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Domestic Electrification.

IT is somewhat singular that, despite the torrent of eloquence, oral and written, that has been poured forth in recent years, and notwithstanding the statistical evidence which is abundantly available, on the subject of the domestic load, there are still some electricity supply managers who are more or less frankly sceptical as to the value and possible development of that outlet for electricity supply—a class of business which stands to benefit not only the suppliers of electricity, but also the manufacturers of almost every class of electrical machinery and apparatus, as well as the electrical contractors throughout the whole country, and the consumers themselves, who will certainly derive advantage from the increased use of electricity. Doubtless progress is slower in some towns than in others; "fashion" has great influence in every grade of society, and the popular taste differs from place to place—but of the eventual outcome we have no doubt whatever: the domestic load is bound to increase in importance almost without limit, and the far-sighted engineer-manager will both provide for it and foster its development. Only a few weeks ago Dr. S. L. Pearce pointed out that in the Manchester area the number of domestic consumers had quadrupled in the past five years; in the same time the sale of energy had doubled, and as there has been no such growth in the demand for industrial power during that period, it is a plausible inference that the doubling of the output was largely due to the increase in the domestic load. In the Tyneside area, the Newcastle-on-Tyne Electric Supply Co. connected 12,600 new consumers last year.

As an example of a successful domestic policy, we have obtained permission from Mr. A. E. McKenzie to explain the system which he has adopted in Wimbledon, where the load is rapidly increasing and extensions have become necessary, which are described on a later page. "Simplicity" and "Service" are the fundamental principles on which the system is built up. Every facility is afforded to the would-be consumer, to help him to secure connection and to ensure his subsequent satisfaction. To begin with, the tariff is cheap and simple: 3½d. for lighting, 1d. to ¾d. for cooking and heating, ½d. for water heating; and the application form is reduced almost to a formality. Apparatus of all kinds (except lighting) is provided on hire or hire-pur-

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chase, and is installed by the Consumers' Department. Once apparatus is installed, it is not forgotten; the Department stands ready—even on Sundays—to attend to a faulty part or appliance at call, free of charge (except in the case of kettles), and no repairs are done on the consumer's premises, the faulty part being at once replaced by a sound one. Every effort is made to *please the consumer*—a phrase which ought to be inscribed in letters of gold on the heart of every official. Consequently dissatisfaction is rarely met with, and there is a steady increase in the load, without any sensational effort to develop it. As an instance of the flexibility of the service and the desire to please, we may cite the fact that no fewer than 13 types of cooker are hired-out by the Corporation. In this connection we may draw attention to the report of the E.D.A. Conference on hire and hire-purchase schemes which appears in this issue. Also, in view of the growing importance of the domestic load, we have thought it desirable to group together under a common head various classes of domestic appliances which have hitherto been noticed in our "New Devices," or "Notes" columns, to facilitate reference and to mark our appreciation of the potentialities of this thriving branch of the electrical industry.

British and Foreign Instruments.

THE reputation of British-made switchboard instruments for accuracy and reliability deservedly stands so high that an inquiry into their merits as compared with instruments of foreign manufacture might be thought superfluous; however, apparently the tradition that British instruments are inferior still lingers in some quarters, although it has long ceased to be well-founded. Possibly it is supported to some extent by the tendency, characteristic of the race, to adopt a simple and sober finish, free from the meretricious glitter that marks some foreign products; appearance counts for a good deal, though in fact it is the least important criterion of value. Thirty years ago, no doubt, certain foreign makes of instrument took the lead for accuracy and legibility, as well as other valuable qualities, but nowadays some of our instrument makers turn out work which for exquisite workmanship and technical excellence is unexcelled throughout the world.

However, the British Scientific Instrument Research Association thought there was sufficient vitality in the aforesaid tradition to justify a detailed investigation into its truth or falsity, which at the same time might lead to improvements in design; the inquiry has now been completed, and a summary of the very interesting report appears elsewhere in this issue. It is very satisfactory to learn, as a result of the examination of many makes, "that the instruments made by certain of the principal manufacturers in this country are not inferior to any comparable instruments of foreign manufacture; and that in what may be termed the general 'balance' of design some of the British instruments take a leading place."

A careful perusal of the report leaves the impression on one's mind that the examination has been conducted with a high degree of impartiality; credit is given where it is due, whether to British or foreign work, and adverse criticism is expressed with equal fairness. From some of the general statements which appear in the complete report, we gather that there is room for improvement in certain features, such as the choice of steel for the magnetic system, the mode of mounting the movement, the marking of the scales, and the design of the pointers; apparently no instrument combined all the best elements of design. Some of the suggested improvements would cost little or nothing to adopt. The fact that the "torque/weight" quotient varies over the wide range from 0.044 to 0.46 strikes us as remarkable, indicating fundamental divergencies in design.

The information contained in the report should prove of great value to British manufacturers, who will know how to apply it to advantage in their designs; and to the purchasers of switchboard instruments, whose confidence in the British product should be fortified by the results of the critical comparison with foreign instruments which have been placed on record.

A Business Book.

READERS who are prepared to give sympathetic study to a very human document dealing in an attractive manner with problems regarding business efficiency, management, control and cognate matters might spend a profitable evening with "Letters to an Absentee Director," which was issued a few months ago by Messrs. Pitman (5s.). We direct attention to this small book this week for two reasons. First, because in the early days of the New Year, as we try to draw aside the veil of the future with its unknown duties and responsibilities, there is greater susceptibility to suggestions and new ideas, in both of which the book abounds. Our second reason is that it is our sad duty to record elsewhere the death of the author—Mr. John Lee, C.B.E., M.A., M.Com.Sc.—who passed away suddenly a few days ago while returning from New York. A crowded life full of public and private service has come to an end all too soon, as it seems to us, but the influence of this truly remarkable man, like that of all who devote themselves with soberness and enthusiasm to the critical problems of their day, will live after him. The series of "Letters" was written originally for *The Times Trade Supplement*, signed by "The Junior" and addressed to "My Friend, E. A. Mellinger," and they are brought together in what is described as an unconventional book on the proper functions of boards of directors and their relation to executive management. The main theme running through all the notes is the problems of industry, emphasis being laid repeatedly upon the need for us all to remember that conditions have greatly changed in recent years. It is useless to attempt to face the new situations that are constantly confronting us unless we are prepared to change with the times. The book contains some frank remarks on a wide range of topics, including: directors and their training, associations in industry, profits, shilling shares, industrial combination, employé shareholding, leadership, executive control, trade unionism, American methods, works councils and reorganisation—all subjects of interest to-day.

Barton Power Station Libelled.

THE recent judgment of the Court of Appeal in the case of Farnworth *v.* Manchester Corporation (ELEC. REV., December 21st, 1928, p. 1068), throws back upon the latter the liability for damage resulting from the emission of sulphurous fumes from the chimneys of Barton power station; Lords Justices Scrutton and Sankey held that the Corporation had not proved that all reasonable precautions had been taken, and gave it a year to mitigate the nuisance. Lord Justice Lawrence dissented, and it is obvious that the question presents difficulties from the legal as well as the technical point of view. Alderman Dagnall, chairman of the Electricity Committee, in an interview stated that the Corporation had spent thousands on trying to find some way to prevent the nuisance, and might spend thousands more with no better result.

However that may be, the Corporation was justly aggrieved when the *Manchester Guardian* in a leaderette accused Barton of producing "a streaming banner of smoke as black as ever poured from a group of giant chimneys over a pastoral scene!" It was admitted in a later issue that a mistake had been made, for the smoke emitted from the Barton chimneys is hardly visible: the trouble is due not to "smoke," but to colourless fumes. Apparently the writer of the article had mistaken a local steel works for the Barton station.

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Electricity Supply at Wimbledon.

The recent plant extensions at the Wimbledon Corporation Electricity Works have been rendered necessary by the growth of the domestic supply, in connection with which some excellent results are shown.

Plant Extensions.

FOR the year ended March, 1927, the maximum load on the electricity works of the Wimbledon Corporation was 7,450 kW. In the next year the maximum load recorded was 9,650 kW, representing an increase of about 30 per cent. The plant capacity at the end of the second period was 11,500 kW.

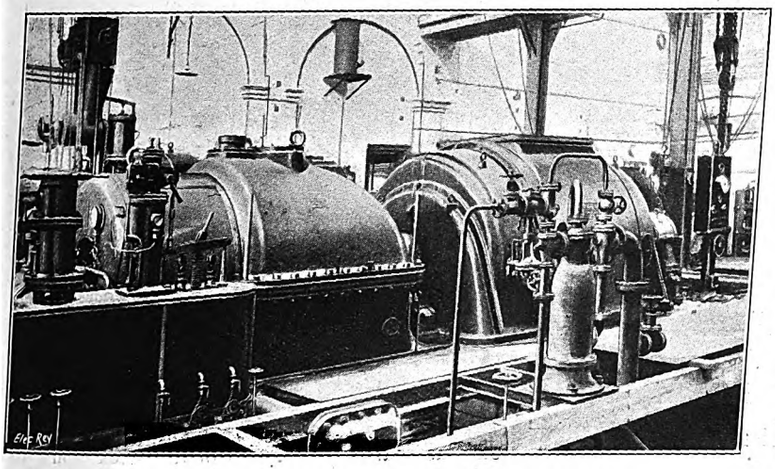

Fig. 1.—Turbo-alternator; Single-phase, 3,750 kW.

The above is sufficient explanation for the extensions which have recently been installed at the generating station. The new plant includes a 3,750-kW turbo-alternator set, fig. 1, with the necessary condensing plant and auxiliaries, and a 50,000-lb. boiler unit, fig. 2. The turbo set was supplied by the Metropolitan - Vickers Electrical Co., Ltd., and the boiler by Messrs. Babcock & Wilcox, Ltd. It is interesting to note that the generator, and the others of the same size in the station, are believed to be the largest single - phase machines in the country. The new alternator generates at 2,000 V, 50 cycles, and runs at 3,000 r.p.m. It is air-cooled on the enclosed system, the air itself being passed through water coolers. The turbine is of the impulse reaction type, and is designed for steam stop-valve conditions of 250 lb. per sq. in. and 650 deg. F. The steam consumption at $1\frac{1}{4}$ times full load, 0.8 p.f., is 11.64 lb. per kWh, and at full load 11.40 lb. per kWh. The condensing plant was supplied by Messrs. Hick, Hargreaves, Ltd.

The boiler unit consists of a B. & W. boiler, Green tri-tube economiser, B. & W. superheater, Sirocco induced-draught plant, and a steel chimney and the necessary bunkers and grates. The plant is designed to run continuously on a 25 per cent. overload. The working pressure and superheat temperature are 250 lb. per sq. in. and 700 deg. F. The total heating surface for the boiler, superheater and economiser is 17,463 sq. ft. An interesting feature in connection with the boiler equipment is that the proportion of the economiser heating surface to the boiler heating surface is considerably greater than that usually adopted, being of the order of 86 per cent., as against 60 per cent. The scheme, by reason of the lower exit gas temperature obtained, is believed to be a commercial proposition. The height of the chimney from the firing floor is 95 ft., and the makers guarantee an output from the boiler of 40,000 lb. per hour with natural draught only. The capacity of the bunkers feeding the boiler is 100 tons.

The chain-grate stokers employed with the boiler are of the "L" type, supplied by the Underfeed Stoker Co., Ltd., and designed for working on balanced draught. It required some confidence to put in such a plant for working on induced draught only, but the undertaking appears to have been rewarded by the satisfactory results obtained. The furnace arch is of the double-suspension "Liptak" type. The guaranteed efficiency of the boiler at normal full-load evaporation, based on gross calorific value for the fuel, is 82 per cent.

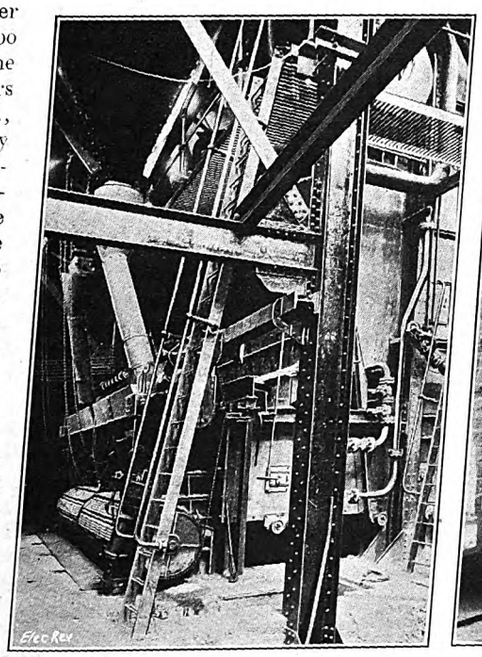

Fig. 2.—50,000-lb. Boiler Unit.

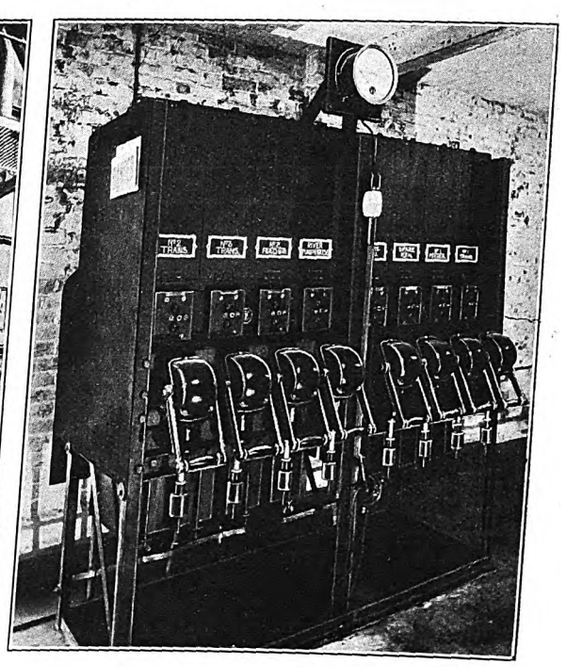

Fig. 3.—Standard Sub-station h.p. Switchgear.

It is interesting to note that a second boiler unit of the same size and type is to be installed, and that in order to accommodate the new plant, the existing boiler house had to be increased in height by about 45 ft. This has been effected by means of a steel structure sheeted with Trafford tiles. A new ash-handling plant installed by the Underfeed Stoker Co., works on the

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water-sluice system. The ashes fall from the boiler hoppers into a trough, and a water stream carries them into a "whirlpool" from which the mixture is pumped to overhead ash bunkers by means of 24-h.p. electrically-driven Gwynn pumps against a head of 40 ft. The water is drained off and returned to the trough by gravity, and the ashes are dropped into trucks and taken away. The water stream flows at from 6 to 7 ft. per second. There are two ash bunkers, each with a capacity of 750 cu. ft.; these are of reinforced-concrete structure. In connection with the extensions, a new 22-in. pipe line to the river has been installed by the Brightside Engineering & Foundry Co., Ltd.

To meet the increased demand from the "outlying" districts, such as Malden, Raynes Park and Coombe, three 2,000-kVA transformers by the Metropolitan Vickers Co., Ltd., and one of 1,155 kVA capacity by the British Electric Transformer Co., Ltd., have recently been installed at the station. These are of the outdoor, oil-cooled type, and step up to 11,000 V for transmission. All transmission and distribution is single-phase.

About 20 transformer sub-stations have recently been added to the system, bringing the total up to about 100. It is considered advisable to put down new "subs" rather than increase the size of the feeders. A new sub-station at the works is fairly representative of the standard design adopted for the area. An interesting feature in connection with this is the switchgear, to which the undertaking contributed a good deal in the design. Fig. 3 shows the h.p. (2,000 V) equipment installed by the English Electric Co., Ltd. It is a simple angle-iron structure equipped with eight s.p. switches (earth return) in a total length of 6 ft. In the l.p. switchgear six units are accommodated in a total length of 2 ft. 3 in.

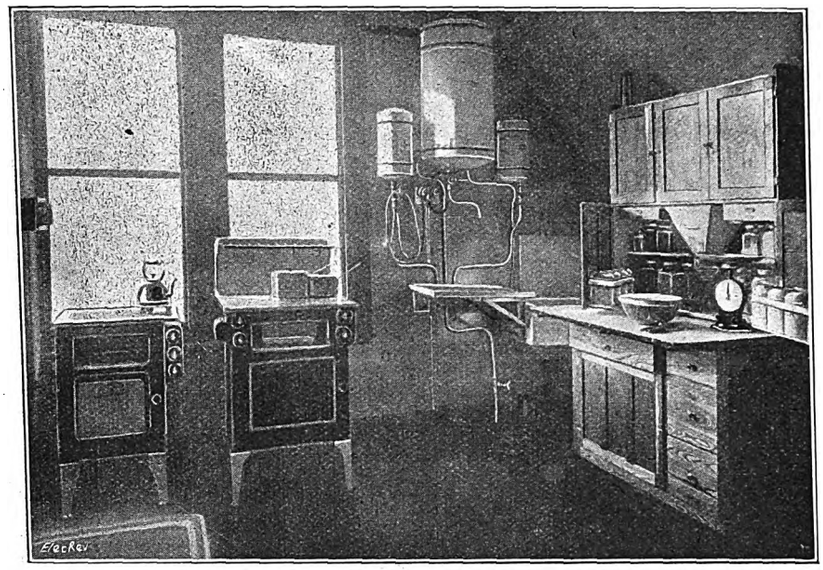

Fig. 4.—Cooking Demonstration Room.

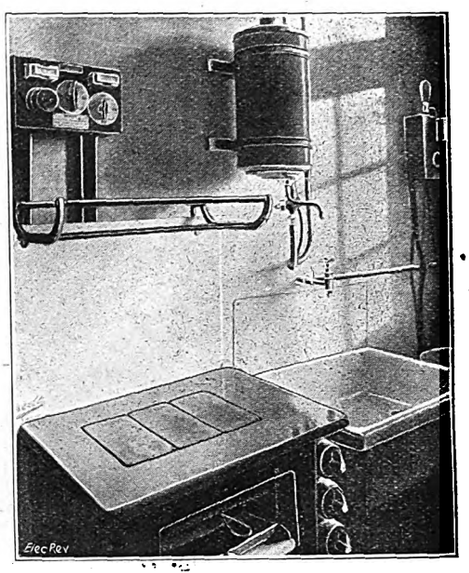

Fig. 5.—Part of All-Electric Kitchen.

Domestic Supply Service.

In these days of rapid development of domestic electricity supply many undertakings must have found it necessary to reorganise their systems of accepting applications for supply, issuing appliances and materials, carrying out repairs, and so on, particularly the smaller undertakings in which, in the past, the mains or distribution departments have dealt with all work pertaining to the consumers—actual and prospective.

The Wimbledon electricity undertaking has produced some particularly interesting results in connection with its domestic supply service, and it is believed that the following notes on the system and methods adopted for dealing with the domestic supply will be of interest to many of our readers. It will be readily agreed that the results obtained are excellent for a comparatively small undertaking, especially so when it is noted that the showroom and administrative costs relative to the domestic service amount to something like £100 for the capital outlay, and £400 per annum working expenses.

During the first six months of 1928 the undertaking installed 240 cookers, 123 water heaters, 60 wash boilers, 340 irons and 250 kettles. Already this heating season over 500 radiators have been installed. The bulk of the apparatus is put out on hire, and, with the exception of lighting equipment, the department undertakes to hire out any obtainable class of domestic electrical apparatus. A considerable amount of hire-purchase business is also done by the undertaking, and in this connection well over 200 agreements for all sorts of appliances have been signed since March last.

In the light of the above statistics it is interesting to note the charges that are in vogue for domestic electricity supply in the area. There is no two-part tariff, and plain flat rates are charged for all services. For cooking and ordinary heating the supply is charged for at 1d. and ¾d. per kWh for the winter and summer quarters, respectively. Water-heating supply is rated

Date Received..... Application No.....

BOROUGH OF WIMBLEDON ELECTRICITY DEPARTMENT.

Application for a Supply of Electricity.

Full Name of Applicant. IN BLOCK LETTERS. (*State, Mr. Mrs. or Miss*)		For Official use only.
Address where supply is required.		Date Recon.....
Description of Premises.		L.....
Date supply required.		R.....
		P.....

PARTICULARS OF INSTALLATION.

(The supply is alternating, single phase, 50 periods per second, 220 volts.)

LIGHTING.		HEATING AND COOKING APPLIANCES, ETC.			MOTORS.	
No. of Lamps.	Size in Watts.	Actual No. of Appliances.	DESCRIPTION	Total Amperes at 220 Volts.	No.	Total H.P.
						P.T.O.

THE ABOVE INFORMATION MUST BE GIVEN BEFORE APPLICATIONS CAN BE ACCEPTED.

Fig. 6.—Application Card; Front.

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at 0.5d. per unit, and lighting at 3½d. per unit. The main feature of the whole scheme is its simplicity. All the work, including meter fixing, is done by the consumers' department, which is entirely separate from the "mains." The relation between the two sections is similar to that usually observed between the distribution engineer and the contractors, and there is no friction whatever between the two branches of the undertaking. One important advantage of the consumers' work being kept strictly separate is that it avoids sending two or three lots of men to one house during the progress of any one job—a procedure which is often annoying to the consumer.

I/We hereby give notice to the Corporation of Wimbledon that I/we wish to have, and hereby agree with the Corporation to take, a supply of Electrical Energy at the premises mentioned hereon, and to pay for such supply at the rate or rates of charge for the time being charged by the Corporation therefor until such time as I/we may desire to discontinue the use of such supply, of which discontinuance I/we will give the Corporation 24 hours' notice in writing. I/We further agree to observe the Terms and Conditions of Supply made by the Corporation from time to time, all of which shall be deemed to be incorporated in and form part of this agreement.

Signature of Applicant	
Occupation	
Present Address	
Previous Address	
Date of Application	
Name and Address of Wiring Contractor	
	P.T.O.

Fig. 7.—Application Card; Back.

Little is done in the way of propaganda, and for new business the undertaking relies chiefly on its attractive charges and its simple and straightforward methods. Considerable business, however, is obtained as the result of cooking demonstrations, one of which is given every week in a specially equipped room, fig. 4.

A very interesting point to the credit of the undertaking is the real and successful effort that has been made to do away with the usual long and irksome application form. Figs. 6 and 7 show the two sides of a card which, filled in, is accepted as an orthodox application. The terms and conditions of supply are contained separately in a small pamphlet.

At the commencement of a new job a simple voucher is issued to the foreman wireman. This is in three portions, one in the form of instructions to the foreman, a second for giving notice to the office of the completion of the work, and a small "chit" advising the mains department that the job is ready for testing. There are 7 wiremen and their mates constantly employed on new work. In connection with the hiring-out contracts for cookers and wash boilers, the wiring is installed free up to 30 ft.

No doubt the most vital point in connection with any maintenance scheme is that of carrying out repairs with a minimum of delay, and in this matter the work of the department shows great initiative and foresight. Practically all the repair work is in connection with the cooking equipment, and 90 per cent. of the cooker repairs are on the boiling plates. All ordinary repairs are carried out on the same day as the notification of the trouble is received—up to a reasonable time, of course. Less than half a dozen cookers are returned per annum through dissatisfaction.

There are two separate gangs of repairs men—one for the heavier apparatus, cookers, wash-boilers and water heaters—and one for radiators, kettles and irons. A considerable number of the faults are reported on the telephone, and the operator books all the calls and endeavours—usually successfully—to ascertain what part of the apparatus has failed. The bulk of the remaining jobs are notified through the post. The repairs men ring up the office from various points in the area at stated times during the day, and receive instructions concerning the latest notifications of troubles in their allotted areas. Every repair job is entered on a voucher in triplicate, two copies of which are issued to the repairs foreman. These are returned to the office on completion of the work for the necessary booking of the time, materials, and so on.

With the exception of the kettles, the cost of repairs to the appliances is borne by the undertaking. All the kettles hired out by the department are fitted with safety devices, and it is found that 9 out of 10 failures are brought about by negligence. In the main repair workshop is up-to-date equipment for dealing with the returned kettles. These appliances are all put through a "mass-production" process, including re-polishing outside and re-tinning inside, and it is interesting to note that the repairs bill amounts to about 2s. or 3s. per kettle, against about 12s. charged by the makers.

A careful record of all the repair work carried out on the large appliances is made in the office, and the record is so analysed as to show the maintenance costs over given periods for the different makes and classes of apparatus installed, and the various parts of the appliances. There are at present 13 different types of cookers handled by the Corporation. At the end of September last, 1,897 cookers were connected to the mains, and the average number in use for the previous 12 months was 1,798. The average maintenance cost per cooker for that period was 15s. 4d.; for the previous year the figure was 19s. 8d.; while for the year ended September, 1926, the amount spent per cooker was 21s. 9d. It is particularly interesting to note that the drop is attributed, not to the increase in the number of cookers installed, but to the change-over which the undertaking is effecting to closed-type boiling plates. Another point of interest is that the make of boiling plate adopted is not necessarily the same as that of the cooker. An important feature in connection with the record keeping of the department is the entry of all the particulars concerning every appliance during its life

VOUCHER NO.....

ORDER FOR APPLIANCES ON HIRE.

TO THE CORPORATION OF WIMBLEDON, ELECTRICITY DEPARTMENT.

Please supply the following Appliances on hire for use at:

The minimum hiring period to be .....years. Subject to fair usage, such appliance(s), (except kettle(s)) to be maintained free of cost to me:—

APPLIANCE	RENTAL

SIGNATURE OF HIRER:

DATE.....192 | ORDER BOOKED BY:

Fig. 8.—Order Card; Large Appliances.

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in a "history" book; separate books are kept for the large and small appliances.

There are several repair shops and stores situated in various parts of the area, and when the men are advised of a job, they go and see what is wanted, if necessary, and then journey to the nearest store to get the necessary spare parts. An important point is that the men are not allowed to attempt to carry out the actual repair work on the consumer's premises, but merely change the part that is faulty—boiling plate, oven element, and so on.

With regard to the ordering of apparatus for hire by consumers, figs. 8 and 9 show two cards which, filled in, are accepted by the undertaking as official orders for the large and small appliances, respectively. The large-appliance cards are filed away in road order, and in that way serve as a useful record. A time-saving scheme is the issue of vouchers in triplicate for the small appliances, one copy being given to the storekeeper as his order for the issue of the materials.

POST CARD.

1d STAMP

Please send me an Electric Iron on hire (with 2-way connector)* at a rental of {1/- per quarter, 1/3 per quarter,* the minimum hiring period to be two years.

Name.....

Address.....

.....

Date.....

* Please strike out if not required.

To The Chief Engineer & Manager,
Corporation Electricity Works,
Durnsford Road,
Wimbledon,
S.W 19.

Fig. 9.—Order Card; Small Appliances.

The latest development of the department is the equipping of 200 houses on a new estate at Malden. These are all-electric, except for one coal fire. A 10-gal. "Inventum" water heater is installed in the bathroom, and a similar 1½-gal. water heater is fixed in the kitchen, fig. 5, as part of the cooker equipment; the hire charge for the small water heater is included with that of the cooker.

One of the simple details to which attention has been given by the department in its vigorous policy of "pleasing the consumer," is the provision with each cooker of a standard control board. In addition to the necessary equipment for the cooker itself, this board, fig. 5, is fitted with a multiple 10-A plug, which amounts actually to one or more power points ready for the use of other domestic appliances. This has proved to be a considerable saving to both consumer and department, and a valuable business-getting scheme.

Another point designed to please the consumer is an arrangement for giving attention to faulty apparatus on Sundays and holidays, when there is a stand-by man at the office during cooking hours.

In conclusion, it may be as well to stress the fact that the department makes a particular point of not making exaggerated claims for the electrical apparatus, and its policy of "no fairy tales" has proved, beyond doubt, the correct one.

We have perused recent annual accounts of the undertaking, and they afford ample proof that the bold policy of developing the domestic load adopted at Wimbledon has been fully justified.

We are indebted to Mr. A. E. McKenzie, M.I.E.E., M.I.Mech.E., chief engineer and manager, for permission to publish the above details, and to Messrs. W. J. Oswald, A.M.I.E.E., chief assistant engineer, and B. A. Larney, commercial assistant, who is directly responsible to the chief engineer and manager for the development of the domestic supply service, for their assistance in the collection of the information.

Electrical Development in British Columbia.

The Work of the Electrical Service League.

By FREDERICK H. FULLERTON.

SOLUTION of many of the problems which confront the electrical industry in the United States and Canada has been found in the organisation of Electrical Service Leagues throughout various parts of the territory of these two countries. The Electrical Service Leagues are organised under the auspices of the Society for Electrical Development, which has its headquarters in the United States, but the leagues themselves are particularly active in both eastern and western Canada. It is an interesting fact that in the actual number of private houses which have been granted "Red Seal" certificates, which are the approved symbols of correct electric wiring, the cities of Toronto and Vancouver are to be found within the first three places in the list of all the cities in which Electrical Service League work is being carried on throughout the North American continent.

There are now in the city of Vancouver a total of 1,258 "Red Seal" homes. These figures are in accordance with the publication of regulations by the Society for Electrical Development, in which each suite in Red Seal apartment blocks is counted as a home.

During the past year the Electrical Service League of British Columbia has carried on considerable educational work along the lines of better wiring and illumination in offices, stores and factories. Owing to lack of capital, it was found impossible to employ salesmen to follow up the work which was done by correspondence and advertising, but as the League is composed of electrical contractors, retailers, manufacturers, and the central station, the salesmen from several of these concerns co-operated with the League in following up the circulars which were sent out, with the result that considerable business was secured. The supply undertaking, the B.C. Electric Railway Co., accepts the responsibility for the major portion of the expense of operation, and supplies an office at its headquarters for the secretary of the League. The manufac-

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turers then assume the next largest proportion of the expense, while the balance of the expenses involved in connection with the operations is paid for by the contractors and the electrical dealers in proportion to the connection of the League with their particular business.

The programme of publicity and propaganda which was carried out by the Vancouver organisation during 1928 included the issuing of 15,000 circulars. These circulars were mailed to factories, stores and offices throughout the Greater Vancouver area, and offered free of charge the services of the illumination engineer of the League for the purpose of making a survey of the lighting equipment of the office, factory or store to which the communication was addressed.

In addition to the actual circulars which were sent out, a certain amount of literature is issued by the Electrical Service League. This is sent to every permit taker in the city of Vancouver or in the surrounding municipalities of South Vancouver, Point Grey and Burnaby, and in the city of North Vancouver and the North Vancouver municipal district. This literature is also sent to the associations of the various industries and to the general contractors, electrical contractors, master builders and architects throughout the province of British Columbia, and all members of the Property Owners' Association and the Real Estate Exchange. The figures for 1928 have not yet been completed, but it is interesting to note that during the year 1927 the League sent out over 16,958 circular letters and well over 10,000 pieces of printed matter.

It is impossible to arrive at definite figures as to the results obtained from the general propaganda. Ninety-five per cent. of the wiring of residences and Red Seal homes was done by residence wiring contractors who are not members of the League, but from the number of inquiries and calls received during the year, the League is proving that the general lighting propaganda is achieving excellent results. Data were supplied and electrical lay-outs made for 83 residences. Lay-outs, advice, and specifications were supplied to 64 stores in Vancouver, South Vancouver, and Point Grey districts. The League dealt with a total of 17 apartment houses during the year. While it was only possible to grant certificates to eleven of these, the wiring of the others was approved, but owing to no electric ranges being installed, certificates could not be awarded. The League also laid out and revised lighting specifications for seventeen offices, two Vancouver docks, three hotels, four garages and petrol stations, three theatres, three restaurants and cafés, five stores, a recreation park, two warehouses, four churches, two auditoriums, and the Vancouver public library and museum.

In the school-lighting campaign circulars were sent to all school boards and school trustees on the Lower Mainland. The League collaborated with the trustees of Burnaby and South Vancouver in the new schools erected by them, and both of these municipalities are carrying out suggestions made and are installing modern lighting in the schools. In the matter of street lighting, the League has always supported the City Electrical Department in its effort to install new standards in the principal business and residential streets with great success.

In addition to results from the intensive campaigns, inquiries were received all through the year; the League received requests from 64 stores for advice on revising the existing lighting equipment or planning new systems. It is estimated that the store and factory lighting campaign in the autumn of 1926 and spring of 1927 resulted in some $20,000 worth of business being secured for the industry. In 1927 the League also received requests from 21 factories, and the illumination engineer of the League revised or laid out lighting for them.

The directors of the League felt that such success had been obtained in the store and factory lighting campaign that an effort should be made to procure better illumination in the offices of Vancouver. In 1927 a campaign was therefore made as an experiment, and a total of 6,961 office lighting circulars were issued in a series of three. The campaign, while disappointing through not being followed up, showed that there is a large field open for canvass, and it is the intention of the League to continue the work this year.

Owing to the number of new apartment houses being erected in Vancouver, the League felt it was opportune to press on the owners of the old apartment houses the necessity for bringing their wiring up to modern requirements. A total of 1,730 circulars were sent out to apartment house owners and to tenants. This work was not followed up by a personal canvass, but a number of the large apartment houses have remodelled, or are remodelling their wiring, and there is no question that a greater proportion of the others will very shortly follow suit.

A considerable portion of the year was devoted to promoting better wiring in the homes of Vancouver and district through Red Seal literature. It is gratifying to note that, while considerable success was secured with this campaign in 1926, the results were more than trebled in 1927. The method of procedure was as follows:—1. Circular to all permit takers on general residential lighting. 2. Circular on Red Seal wiring, enclosing Red Seal pamphlet. 3. Circular offering the service of the League to lay out lighting or check plans, and enclosing specifications. 4. Arrangements with Inspection Departments of Point Grey and Vancouver for notifications when applications for electrical permits were made for new homes. 5. Inspection of all applications for Red Seal wiring.

During 1927 the League inspected a total of 848 houses, and for the purpose of record divided them into six classes. In Vancouver and surrounding districts there were a total of 3,322 new houses built. Of these, 15 per cent. were for small additions, and 20 per cent. for four-room bungalows and under, leaving a total of 2,160 houses over six rooms; the League actually got into touch with 1,940 of these. From the circulars sent out, 848 applications were received and houses inspected during the year, while 55 applications were pending at the end of 1927. During the year the League granted 283 residential certificates and certificates to eleven apartment houses and two "duplex" houses. These apartment houses comprised 164 suites and contained a total of 3,440 outlets. Altogether in 1927 there were 449 units awarded Red Seal certificates in Vancouver and district. In Greater Vancouver at the end of the year there were 614 Red Seal homes and apartments.

The League approached the Architectural Institute in British Columbia to endorse the Red Seal specifications, and while official endorsement has not yet been received, all architects are practically meeting the League in any new building which they design. The Small House Service Bureau, subsidiary of the Architectural Institute, through its secretary, Mr. E. W. Turnquist, has worked in close co-operation with the League in all plans sold through its service in British Columbia.

Electric signs have also been receiving attention. During the year there were installed in Vancouver 54 new electric signs. These signs required 13,633 outlets, and with the necessary lamps and renewals made an estimated total sale of 26,000 lamps during the year.

The work of the League in Vancouver and district is undoubtedly arousing more interest each year in the greater use of electricity, in better wiring, and in the use of electrical appliances. 1927 has shown the greatest results the League has yet obtained, so far as residential wiring and lighting is concerned, and it can be safely said that the work of the League in this connection has increased the wiring of Vancouver homes by at least 50 per cent.

The president of the League during the current year is Mr. George Kidd, president of the British Columbia Electric Railway Co.

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Modern Stone Quarry Equipment.

An electrical installation which provides convincing evidence of the large output and saving of labour made possible by the use of modern machinery.

WITH the gradual growth of the City of Edinburgh and the expansion of small towns within the County of Midlothian, many of the main arteries to the outlying districts have been reconstructed on modern lines. That work, coupled with increased road repairs consequent upon the ever-increasing traffic, called for a greater output of stone from the quarries of the Midlothian County Council and, as the machinery with which they were originally equipped was not of sufficient capacity to meet the increased demand, it has been reorganised and extended considerably, the two gas engines of 80 and 40 h.p. with which the plant was originally driven having now been discarded and electric induction motors installed throughout.

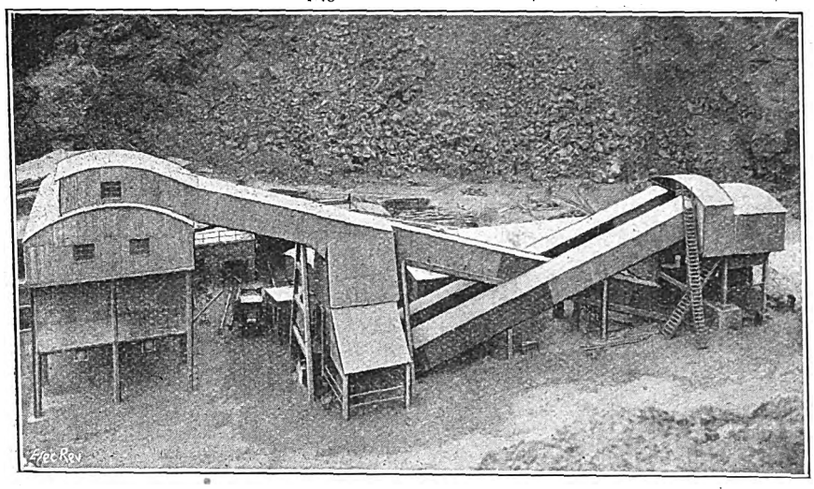

Fig. 1.—General View of Blackford Quarry Plant.

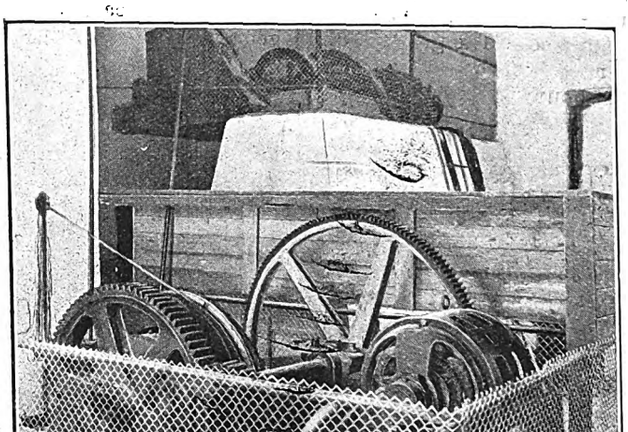

Fig. 2.—Rope Haulage and Shaker Feed Driving Motors.

A bulk supply of electricity is purchased from the Edinburgh Corporation at 6,600 volts, 3-phase, 50 cycles, a static sub-station within the quarry reducing the pressure to 400 volts by means of a 400-kVA transformer which was manufactured by Messrs. Bruce Peebles & Co., Ltd., to the order of the Edinburgh Corporation. The contract for the motors was placed with the same Company through its agents, Messrs. Mitchell Graham & Son, Ltd., who carried out the whole of the electrical installation work. The complete quarry plant was designed and supplied by Messrs. H. R. Marsden, Ltd.

The first operation in quarrying road material is the breaking up of rock by drilling and blasting, which is then roughly separated by hand and graded into two sizes of over and under 5 in. and transferred to light narrow-gauge rail wagons; these transport it to the inclined endless-rope haulage road serving the feeding platform, which is driven by a 16-b.h.p., 712-r.p.m. protected squirrel-cage motor (fig. 2). Two hoppers are situated at the side of the track on the feeding platform, and when the wagons come abreast of these their contents are tipped into them, the large material going to the primary crusher and the small to the shaker feed. The empty wagons are then run on to return rails and automatically return to the quarry face.

The reciprocating shaker, its function being to receive the small material in bulk from the wagons and evenly feed it to No. 1 conveyor, is driven by a 10-b.h.p., 945-r.p.m. enclosed-ventilated slip-ring motor, the whole equipment being mounted on an elevated platform in the same house as that in which the haulage gear is installed (fig. 2). The Blake-Marsden 36 in. by 24 in. F-type primary crusher has jaws and side plates constructed of manganese steel, and it is capable of reducing the material to 5 in. at the rate of 85 tons per hour when running at a speed of 300 r.p.m. Two heavy flywheels ensure steady operation of the crusher, which is driven by a Peebles 85-b.h.p., 972-r.p.m. enclosed-ventilated slip-ring motor similar to that illustrated in fig. 3. The No. 1 belt conveyor collects the output of the primary crusher and shaker feed and transports it to the secondary crushing plant.

In order to prevent "tramp iron" reaching the secondary crushers, a "high-duty" magnetic pulley has been installed in place of the ordinary conveyor head pulley; it is energised at 220 volts by a Peebles 3.5-kW squirrel-cage induction motor-generator set, which is situated in the same house as the motor (fig. 3) that operates No. 1 conveyor and the four Blake-Marsden 20 in. by 12 in. "X"-type stone breakers which form the secondary crushing plant, each machine having an out-

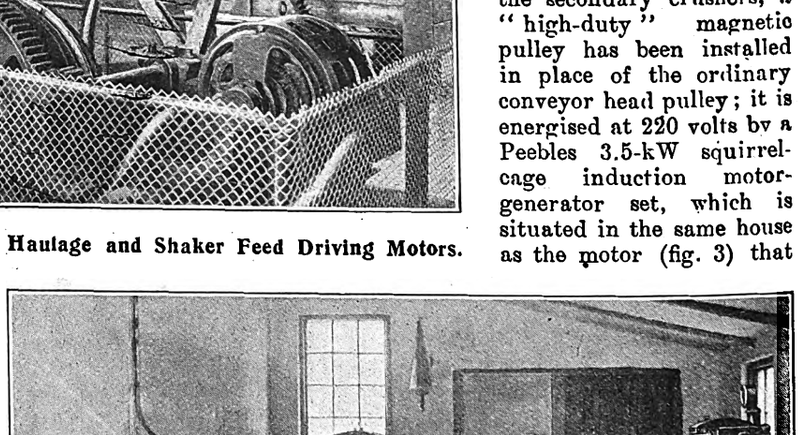

Fig. 3.—Crushing Plant Motor and Motor-Generator.

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put of 12 tons per hour, reducing the material to 2½ in. and under. The output from each pair is collected by two belt conveyors (Nos. 2 and 3), each 18 in. wide, with 105-ft. centres, and transported to the chippings plant, consisting of two cylindrical primary screens and two crushers. Each screen is 4 ft. in diameter and 15 ft. 3 in. in length, made up of several sections perforated with different sizes of holes for suitably grading the stone. The graded material automatically passes through collecting hoppers into the crushers, the rejects being fed to a 30 in. by 6 in. Blake-Marsden granulator and the smaller material either to a disk crusher, or to No. 4 conveyor, or both as required. The granulator when set to crush to 1 in. and under has an output of approximately 10 tons per hour when running at 280 r.p.m. The complete chippings plant and Nos. 2 and 3 conveyors are driven by an 85-b.h.p. motor similar to than shown in fig. 3.

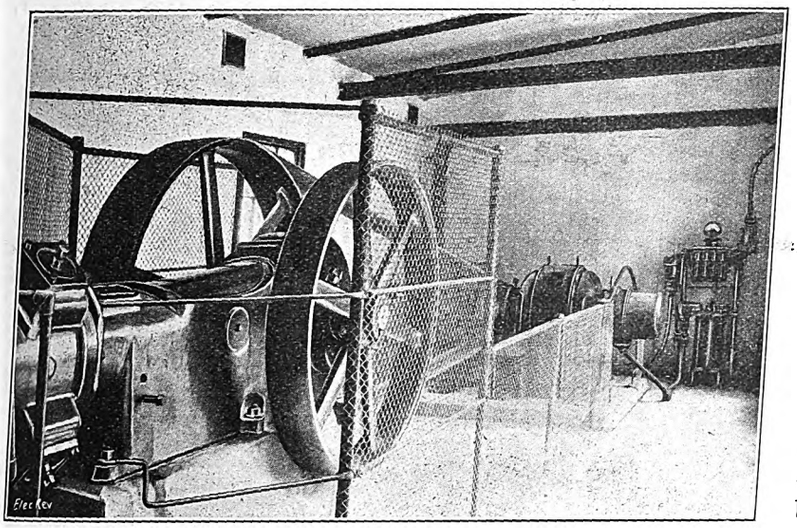

Fig. 4.—Air Compressor and its Driving Motor.

The crushed material from both machines is collected by the conveyor just mentioned, which is 24 in. wide with 170-ft. centres, and carried to the feed hopper situated over the main grading and tar macadam plant. On reaching the former, the material passes through two cylindrical screens, each 4 ft. in diameter and 35½ ft. in length. The screens and the No. 4 conveyor are driven by a 50-b.h.p., 967-r.p.m. enclosed-ventilated slip-ring motor. The screens are above two ferro-concrete storage bunkers of a total capacity of 800 tons, divided into compartments so that any size of material can thus be transferred direct to wagons.

The tar macadam plant is fed by means of belt conveyors running longitudinally under each bunker. It consists of two Blake-Marsden mixers of the double-paddle type, each with eight paddle arms, at a suitable height over the roadway, so that the "batches" may be dropped straight into wagons. This plant and the machine tools in the fitting shop are driven by a 25-b.h.p., 965-r.p.m. enclosed-ventilated slip-ring motor, and fig. 4 illustrates a 60-b.h.p., 970-r.p.m. enclosed-ventilated slip-ring motor driving an Ingersoll-Rand air compressor for operating the rock drills.

A central electricity distribution station situated adjacent to the transformer house contains an oil-immersed unit-type Geo. Ellison distribution switchboard to which the low-voltage side of the transformer is directly connected. As will be seen from fig. 5, the switchboard controls the incoming supply from the transformer, and the three smaller switches the feeder circuits. The former panel consists of a 450-amp. triple-pole, oil-immersed circuit breaker provided with three overload releases, time lags, no-voltage release, ammeter, and leakage indicator. The three outgoing feeders are each controlled by a 200-amp., triple-pole, oil-immersed circuit breaker surmounted by an ammeter and fitted with three overload and one no-voltage releases with time lags. The overload releases are provided with padlocked dust-proof covers, whilst 3-core, paper-insulated, lead-covered and wire-armoured cable is used throughout, all switchboards and control gear being provided with the necessary cable boxes for its accommodation. The feeder cables leading from the distribution station are laid in trenches where necessary, and cleated on wood grounds attached to the walls of the buildings where convenient. The cables terminate in unit mining-type distribution panels, each of which consists of three single-pole, Home Office pattern fuses with "unbreakable" handles, triple-pole, quick-break isolating switches, and busbar chamber, the fuses and switches being interlocked so that the doors cannot be opened when the switches are closed. The motor circuits are controlled by triple-pole, oil-immersed circuit breakers mechanically interlocked with oil-cooled rotor starters. Spare "ways" have been left on the boards where possible extensions are contemplated, and the distribution boards are arranged to facilitate future extensions. All the switchgear is electrically bonded to the earth system, and the general system of distribution has been to group the motors in sections and to feed each section with one cable, this arrangement being the most convenient in view of the lay-out of the buildings. All the motors are of Peebles manufacture and, with their control gear, are housed in separate chambers, so as to protect them from stone dust, driving through the walls by means of belts. The complete electrical installation complies fully with the Coal Mines Regulations.

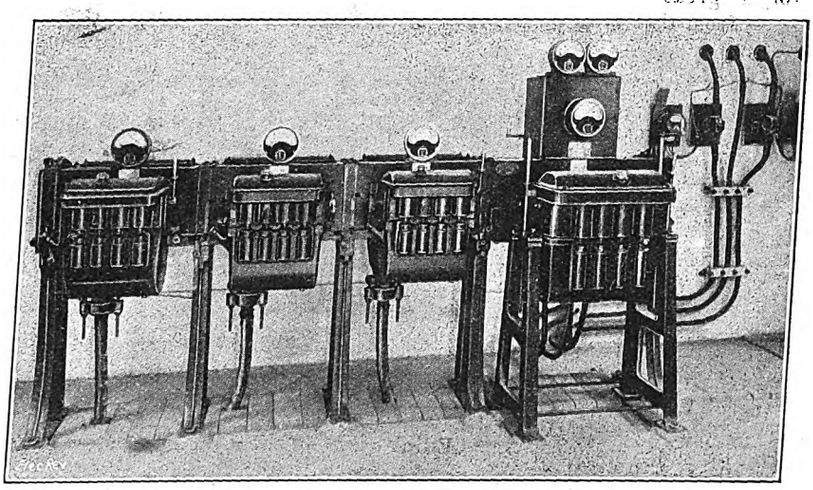

Fig. 5.—Central Distribution Switchboard.

Wiring the Homes of the United States.

According to estimates prepared by the Statistical Department of the National Electric Light Association, U.S.A., 842,000 new homes and farms were wired for electricity during the first nine months of 1928. If the last quarter of the year shows the same increase as the third quarter, the number of wired homes added during the year will approximate to 1,150,000, and the grand total on December 31st will exceed 19 millions.

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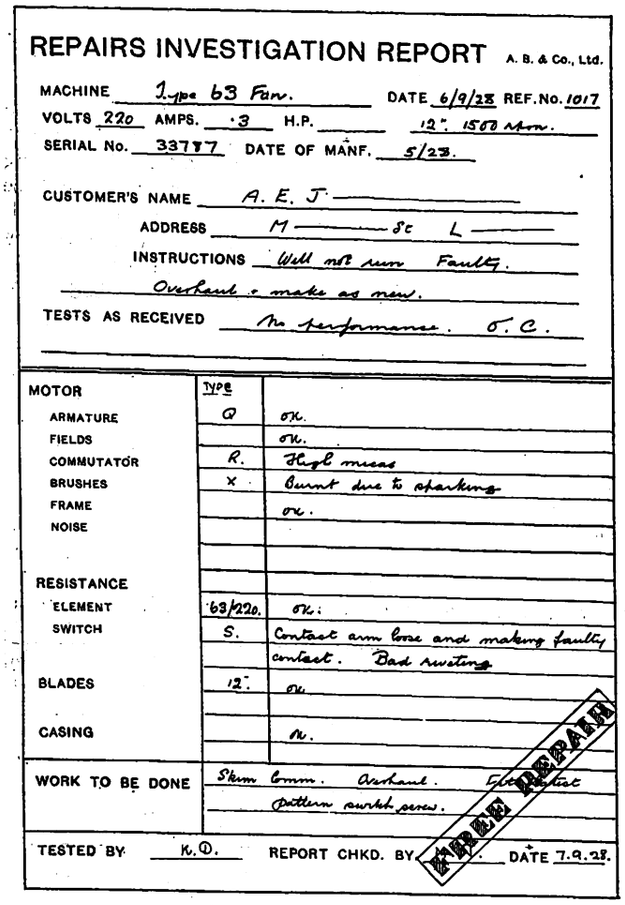
Repairs Investigations.

Details of a successful scheme adopted for the collaboration of the repairs and designs departments of a manufacturing works.

By STUART F. PHILPOTT.

THE potentialities of the repairs department as an aid to the design office are very often neglected in engineering works in this country, repairs being considered rather as a necessary evil than anything else. The criterion of an article's worth is its performance *in service*, and whilst laboratory tests are very essential in the early stages of a product, it is only from machines returned for repair that its performance under actual working conditions can be gauged; but unless some scheme of collaboration exists between the two departments, much valuable information concerning the article is bound to be lost.



REPAIRS INVESTIGATION REPORT A. B. & Co., Ltd.

MACHINE Type 63 Fan. DATE 6/9/28 REF. No. 1017
VOLTS 220 AMPS. ·3 H.P. 12" 1500 r.p.m.
SERIAL No. 33777 DATE OF MANF. 5/28.

CUSTOMER'S NAME A. E. J.
ADDRESS M — St L
INSTRUCTIONS Will not run Faulty. Overhaul & make as new.
TESTS AS RECEIVED No performance. S. C.

	Type	
MOTOR		
ARMATURE	Q	ok.
FIELDS		ok.
COMMUTATOR	R.	High micas
BRUSHES	X	Burnt due to sparking
FRAME		ok.
NOISE		
RESISTANCE		
ELEMENT	63/220.	ok.
SWITCH	S.	Contact arm loose and making faulty contact. Bad riveting
BLADES	12".	ok.
CASING		ok.
WORK TO BE DONE		Skim comm. Overhaul. Fit latest pattern switch arm.

TESTED BY K.D. REPORT CHKD. BY [illegible] DATE 7.9.28.

MERRY & PRAM

Fig. 1.—Examination and Test Report.

Of course, major troubles and interesting defects get more or less reported to the design and research departments of the works, but usually no attempt is made to keep these sections *systematically* informed of the general run of repairs being executed, nor does the design office keep the repairs staff informed of progress and alteration in design of the various products.

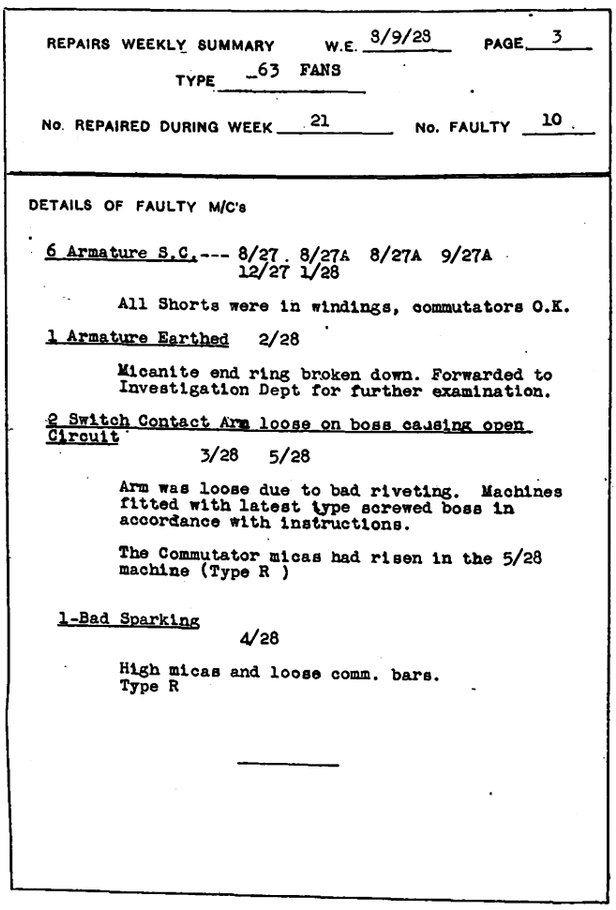
The scheme outlined here was evolved to overcome this difficulty; it has been very successful in operation, and is eminently suitable for works manufacturing small apparatus, such as fractional-horse-power motors, fans, telephone and radio equipment, domestic appliances, and so on.

Each machine or piece of apparatus coming in for repair is examined and tested, and a report is made out on the form shown in fig. 1, giving the date of manufacture, faults, and other details. The machine is then labelled to correspond with the number on the report form and passed on for repair, unless it has an unusual or special fault, when it is put aside for further investigation. The report is passed to the repairs technical department for examination.

Reports on apparatus having a date of manufacture over a predetermined limit, *e.g.*, eighteen months, are disregarded, as a fault which takes that time to develop is not considered serious. The remaining reports are carefully examined, checked where necessary, and the faults are tabulated on a special form, as shown in fig. 2, all the essential details being briefly noted.

Production arrangements are such that machines having any special feature, for instance, a new kind of insulating material, are marked with a suitable sign, usually a letter. These details are, of course, noted on the report sheet, and go into the summarised report, so it is easy for the designs staff to determine from the latter the result of any change in material or in design. It is, of course, up to the designs office to keep the repairs people acquainted with all changes.

In addition to the report going through in the ordinary manner, any machine or apparatus returned for repair having special trouble, or a modification mark of recent issue, is held up pending decision as to whether laboratory examination is desirable or not. The personnel required depends on the class and amount of repairs handled. For a moderate-sized plant, one or two intelligent youths on examining and reporting, and one senior technical man examining reports and investigating troubles on the spot should be sufficient.



REPAIRS WEEKLY SUMMARY W.E. 8/9/28 PAGE 3
TYPE 63 FANS
No. REPAIRED DURING WEEK 21 No. FAULTY 10

DETAILS OF FAULTY M/C's

6 Armature S.C. --- 8/27. 8/27A 8/27A 9/27A 12/27 1/28

All Shorts were in windings, commutators O.K.

1 Armature Earthed 2/28

Micanite end ring broken down. Forwarded to Investigation Dept for further examination.

2 Switch Contact Arm loose on boss causing open Circuit

3/28 5/28

Arm was loose due to bad riveting. Machines fitted with latest type screwed boss in accordance with instructions.

The Commutator micas had risen in the 5/28 machine (Type R)

1-Bad Sparking

4/28

High micas and loose comm. bars. Type R

Fig. 2.—Summarised Fault Reports.

The success of the scheme depends on the care and intelligence used in making the reports, and on the hand-in-hand working of the departments.

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Fault Indication.

A scheme has been adopted at the main Manchester City sub-station for indicating on a central board faults on the station plant and feeders.

By A. PHILIP, B.Sc., A.M.I.E.E.

MODERN switchgear and protective appliances have been brought to such an efficient state that any faults which may occur on a supply system are cleared quickly, and in many cases with practically no general disturbance, so that in large sub-stations with many important connections it is essential that any fault should at once be brought to notice in order that steps may be taken to resume an interrupted supply immediately, or to prevent any further spreading of trouble which might be caused, for example, by the failure of one supply overloading others in parallel.

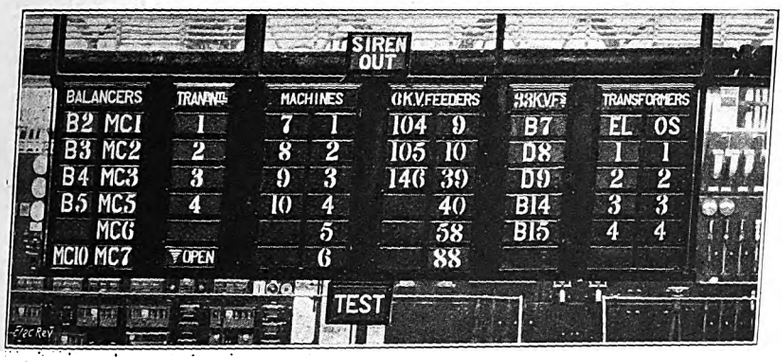

Fig. 1.—General View of Indicator Board.

In the case of the main sub-station feeding the Manchester city network, the types of plant involved cover a wide ground, including both incoming and outgoing high-pressure feeders, transformers, d.c. power and lighting supplies, and traction feeders, and the importance of the station is indicated by the fact that the winter load attains a figure of some 16,000 kW for the d.c. output alone. In the event of any local fault or of a system disturbance occurring, it is very desirable that the charge engineer should be at once acquainted with the position, so far as the plant under his care and the feeders connected to the station are concerned, and with this object in view an alarm signal system has been designed and installed, so that any fault occurring on the main items of plant can be at once signalled and an alarm sounded.

The plant covered by the indicator system falls into the following groups: (1) 33,000-V feeders; (2) 6,600-V feeders; (3) 33,000/6,600-V transformers: and (4) converting plant.

In the case of groups 1, 2, and 4 an indication is given if the switch for the item concerned is tripped automatically, whatever the cause, but in the case of the transformers, if an earth fault occurs it is signalled separately. In addition, indication is given of fault current flowing in the neutral earthing connection of the transformers, and of the opening of this connection if such fault current is maintained. the transformers being connected delta-star. The alarm is also given if large out-of-balance currents flow on the d.c. side.

The general scheme of operation is that for each piece of equipment an indicator relay, when energised simultaneously with the tripping of the oil switch, or with the occurrence of the incident to be signalled, lights a lamp behind a stencilled plate on an indicator board, and at the same time an audible warning is given by means of a motor-driven siren. Fig. 1 is a general view of the indicator board mounted in position, from which it will be seen that, in addition to the individual signs, there are group signs at the head of each section. A method of illuminating the group title would be, of course, to have lamps in parallel with the item lamps, but owing to the large number of lamps required, it was decided to illuminate the group signs by means of auxiliary relays energised by current flowing in the common return lead from each group of lamps. The auxiliary relays are shown in fig. 2. Additional contacts are fitted to these relays for the purpose of energising the siren.

A typical schematic diagram of connections for the oil switch indicators is given in fig. 3. It will be noticed that the relay winding is inserted in a branch of the oil-switch trip circuit which is not energised during manual opening of the switch. The type of indicator relay used for the great majority of circuits is shown in fig. 4. These relays are of the attracted-armature pattern, with a locking device and an indicator flag. Resetting the relay is accomplished by means of a spring-loaded push rod, which unlocks the armature. A small window is cut in the centre of the front cover, in which a flag appears when the relay operates.

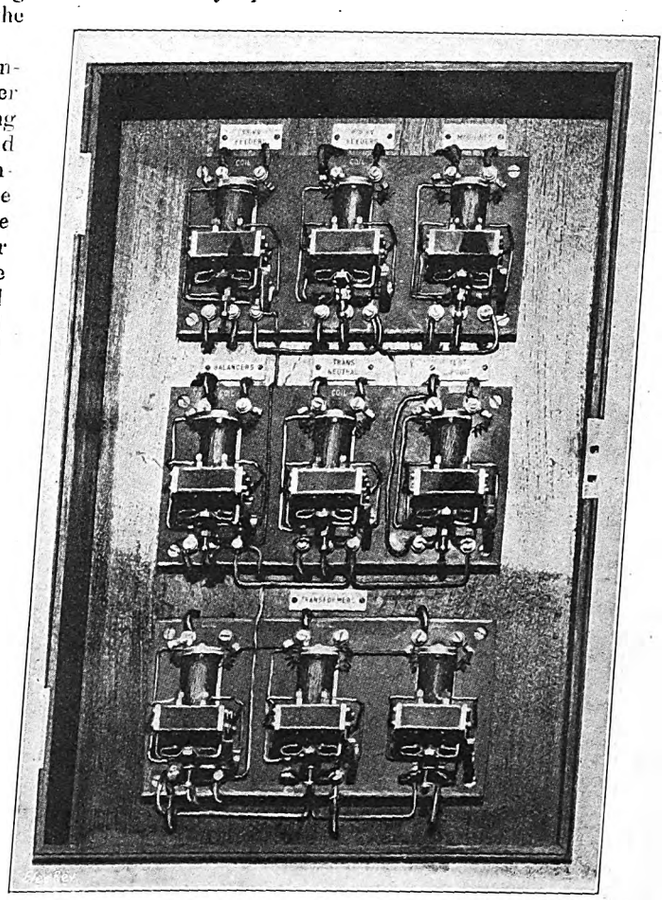

Fig. 2.—Auxiliary Relays for Group Titles.

The signals headed "transformers, earth leakage," shown in fig. 1, are fed by means of relays supplied from current transformers arranged in the earthing

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connections of the transformer cases, the cases being elsewhere insulated from earth, so that any earth-fault current has to flow by this path. The current transformers are ring-type in order that the earthing connection may be maintained as a continuous straight copper bar.

The out-of-balance indicators are operated by means of centre-zero moving-coil relays fed by shunts in the middle wire of the d.c. supplies. These relays are scaled in amperes and can be set to any desired value, but they have, of course, no tripping function. They are provided with hold-on coils and are reset by means of a common push-button. No large out-of-balance on any of the machines thus occurs unnoticed.

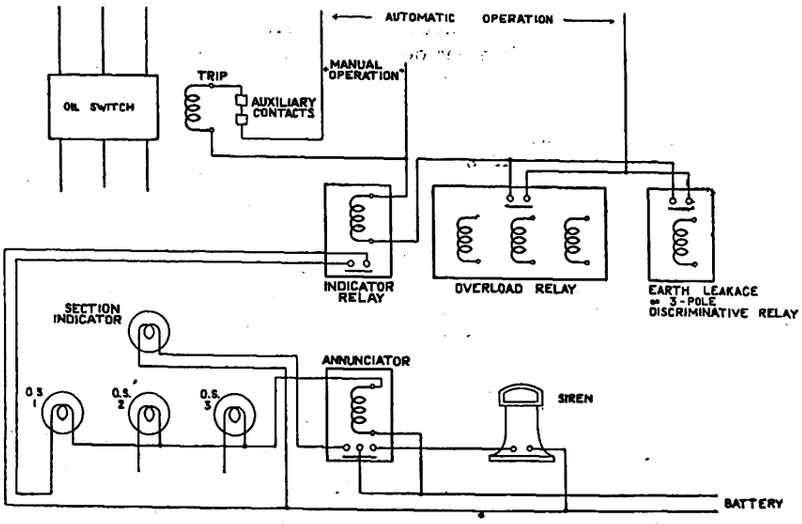


Fig. 3.—Connections for Oil-switch Indicator.

A feature of the equipment is that, after the alarm has been given, the siren can be silenced by means of a throw-over switch, leaving the indicating lamps lighted. Thus, the extent and nature of any disturbance are left on record until all concerned have become acquainted with the facts. This information would not be available visually after the indicator relays had been reset. The throw-over switch lights an addiitonal signal, indicating that the siren has been cut out of circuit.

Signals on somewhat similar lines are also installed in the undertaking's generating stations, but the equipment described is unique in covering such a large amount of plant by one centralised indicator. With the exception of the out-of-balance relays, the whole of the equipment has been constructed in the department's workshops. The amount of wiring involved is somewhat large, but the method employed is considered to give greater reliability than one using less wiring and employing selector switches.

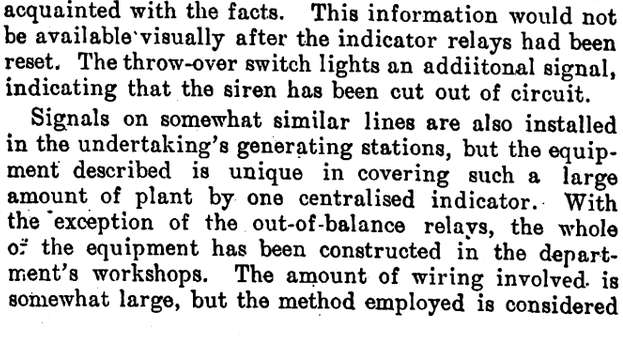


Fig. 4.—Indicator Relay.

The above description of the scheme has been written by permission of Mr. H. C. Lamb, M.I.E.E., Chief Engineer and Manager of the Manchester Corporation Electricity Department.

A Young Engineer Takes Stock.

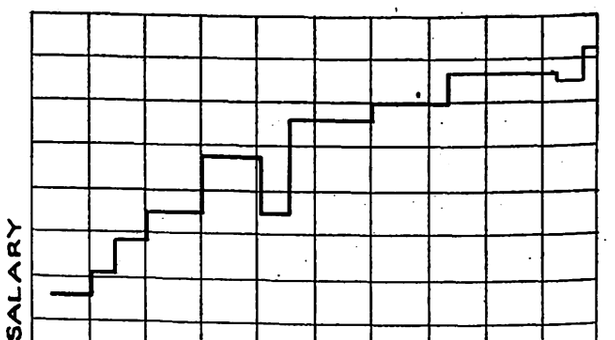
(COMMUNICATED).

ABOUT this season of the year a subdued murmuring and a faint rustling indicate the making of good resolutions and the turning of new leaves. Within a few weeks, of course, sharp cracking sounds will mark the breaking of the resolutions, and the leaves will be clean no longer, but these facts hardly call for comment. At this time, too, the daily Press is full of helpful articles under such titles as "Where are we going?" and "What is success?" It seems to be a good time for a young engineer to take stock of his position.

I call myself young, but at twenty-nine, perhaps, I ought to be in sight of a fairly profitable position offering some sort of future. Well, my job certainly affords experience, and perhaps has a future, but the future is a long way off and is slightly nebulous. My other jobs were like that, and I want to know whether I am justified in feeling a little bit discouraged.

I took the usual technical college training, but couldn't go through a works as I was wanted to make a tour of inspection of half the camps in England. When that little job was finished I was lucky enough to dodge a holiday on the Rhine, and got my first billet as a very junior assistant engineer at a power station. Thus I started to gain experience and look for prospects, an occupation which has engaged me ever since.

All told I have held six jobs, two for a few months only. I have never been sacked, have had fairly regular rises in the positions I have held for any length of time, and have three useful testimonials.



A Young Engineer's Salary Curve.

I have to leave every job when the prospects fail to come along, although twice I have taken new situations at a lower salary on the strength of a rosy future.

In one section of electrical engineering I have had experience in the shops, test room, estimating and contract departments, on the road, and on the publicity side. My college diploma exempts from the examination for Associate Membership of the I.E.E., but how I am ever to get those necessary years of superior responsibility I don't know. I am not a clock watcher and have at least the ordinary amount of common sense. Am I doing as well as I can expect by getting about 30 per cent. more than a London 'bus driver? Shall I stick in my present job until somebody dies, or shall I get on the move again? It's all very difficult.

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Of one thing I am very sure. It does pay to acquire knowledge, even if only in the satisfaction of knowing more than the other fellow. Of course, it is rather bad for one to know more than one's chief, but if that happens there is the obvious remedy—get another chief!

I suppose there are openings for young men in electrical engineering?—for young men who aren't brilliant scientists, but have a sound knowledge of their job and are prepared to work hard? In the other department, perhaps; but then it is very difficult to get a transfer from one department to another—the policy is to get in a new man so as to avoid any jealousy.

My last position was very comfortable, but the prospects came to an end. So I left that firm for another, and now have a very slightly more comfortable position, but have not yet seen any of the promised developments which were going to lead to a nice little job for me.

Where do I go from here? After ruling out a couple of organisations in which I don't think I should be happy, there remain about five which might have a use for me. I have worked for two of the five, so unless I throw away some years of specialised experience and start in a new line at less money, my scope is somewhat cramped. If I stop where I am I shall become still more of a specialist, and may or may not increase my salary cheque.

Herewith is given my salary curve. Am I too impatient, or ought there to be a more decided upward slope? I shall feel a little happier if some other young engineer writes to say that his salary curve is even flatter, but I should much prefer to be told how to give mine a more decided incline in the right direction. If there is anything wrong with me, I am quite prepared to try to put it right, but somehow I cannot help thinking that I should have done better in the soft-goods trade, or in some other industry not in its infancy.

The Operation of Rotary Convertors.

An analytical study of the causes of flash-over, and a *résumé* of the chief methods adopted in practice to minimise the danger of flash-over.

By WALLACE FORD, Wh.Sc., A.C.G.I., B.Sc., D.I.C.

TWO of the chief problems in connection with large rotary convertors for heavy traction sub-stations for d.c. railway electrification are to increase the capacity of the convertor to deal with heavy load fluctuations without flash-over at the commutator, and secondly, in the event of flash-over occurring, to prevent the arc spreading to the armature and field coils and to the framework of the machine. The main cause of flash-over at the commutator is the unstable voltage distribution round the commutator, which is brought about by sudden and oscillatory changes in the armature magneto-motive force, and any arcing which starts at the trailing edges of the brushes when the voltage between adjacent commutator segments exceeds a critical value, is assisted to spread by the movement of the commutator and by any accumulation of ionised gases between the brush arms. An analytical study of the action of a rotary convertor when the load is suddenly thrown off, shows the root causes of flash-over, *i.e.*, it reveals the conditions which produce the unstable commutator conditions. Any experimental work could comprise a study of the oscillatory transient voltages produced round the commutator when a sudden load-change occurs; the practicability and use of such investigation will be discussed later.

When a rotary convertor is in synchronism, but not loaded, *i.e.*, when the d.c. side is open-circuited, the machine can be considered as an unloaded synchronous motor, with the one modification that the brushes on the commutator short-circuit some of the armature coils. The short-circuited armature coils have the effect of reducing the effect of the synchronising current, or conversely, cause the convertor to take a bigger current from the supply to produce the necessary synchronising forces. The alternating current taken from the supply transformer or a.c. bus-bars is the synchronising current (the wattless component of the synchronising current depending upon the amount of excitation of the field), together with the power component required to cover iron, friction and windage losses. The armature poles are locked-on to the field poles, and the angular displacement between the armature and field poles is very small.

When the d.c. circuit is closed and direct current is taken from the commutator, two separate effects may be considered as being produced. The first is similar to that due to the mechanical loading of a synchronous motor; as the load increases the armature poles lag farther and farther behind the field poles, and due to this displacement the synchronising current changes, and an additional a.c. is taken from the a.c. mains (or transformer) to supply the load current. The second effect is due to the fact that the load on the machine is not "mechanical," but "electrical"; the d.c. output from the commutator is collected from the armature winding, and the current in the armature coils due to the d.c. is in the opposite direction to that due to the a.c. supply. The actual current in any armature winding is, therefore, the difference between the a.c. and d.c. load currents, plus the a.c. synchronising current. The armature reaction m.m.f. is, therefore, a combination of the m.m.f.'s due to the a.c. and d.c.

The difference between load and no-load conditions comprises the following: a difference in angular displacement between armature and field poles; a difference in synchronising current; a difference in armature m.m.f. due to the fact that the no-load m.m.f. is produced entirely by the a.c., whereas the m.m.f. of the loaded convertor is due to the combined a.c. and d.c.; and finally, since at no-load there is no direct current, the commutating poles are not energised, while there is a large m.m.f. due to the commutating poles when the convertor is loaded. When the a.c. load is suddenly thrown off the convertor returns to no-load conditions, but the change produces unstable voltage-distribution at the commutator.

First, consider the relative positions of armature and field poles. With removal of the load the armature speeds up until its poles reach their new position of equilibrium relative to the field poles. The energy for this acceleration must be drawn from the a.c. supply, so that the drop of the supply current, a.c., from the load to the no-load value is retarded. Further, the armature poles are liable to hunt considerably before settling down to their new position relative to the field—this oscillation can be clearly seen by painting a de

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sign on the end of the armature shaft and illuminating it by a neon lamp; the lamp should be supplied with a.c. from the supply to the convertor (with any necessary stepping-down of voltage to the order of 100 V) with a superposed d.c. supply at about 100 V. When the load is thrown off the design will be seen to move forward in the direction of rotation of the armature, oscillate slightly and then settle down to a new steady position. It is practically needless to emphasise that any such observation should be carried out on the end of the shaft remote from the commutator, in case any flashing occurs.

It is difficult to separate-out the three other effects due to the change from the loaded to the non-loaded condition, but the only effect which occurs at once, provided there is no flash-over at the commutator, is the total removal of all direct current and the m.m.f.'s due to it. If flash-over occurs the problem is further complicated; this will be dealt with later. Directly the d.c. is removed the full a.c. load current appears in the armature windings. The sudden changes in the m.m.f. distribution due to this change of current-distribution must affect the commutator voltage-distribution. Due to the reactance of the armature there is a transient rise of voltage across the opening d.c. circuit-breaker contacts, and it appears at the brushes.

Due to the sudden removal of the commutating-pole flux, which links the coils short-circuited by the brushes circulating currents are set up which cause sparking at the brushes. Due to the fact that the armature is rotating, the coil short-circuited at the moment the commutating flux disappears is almost immediately open-circuited, but the effect of the commutating m.m.f. is felt over several coils and induced voltages will appear in the armature windings; these will also affect the commutator voltage-distribution. This effect will probably be small, since the d.c. load disappears at the same time as the commutating flux, and the effects of the two tend to neutralise each other; but due to the changes in the a.c. distribution, the effect will appear as slight sparking at the brushes. The synchronising current depends upon the relative positions of the armature poles and field poles, so that the synchronising current changes from its load to its no-load value in an "oscillating" manner due to the armature-position oscillation described above. The effect of this oscillation will affect the commutator voltage-distribution.

It will be seen, therefore, that four effects appear at the commutator, when the d.c. load is thrown off, as follows: (i) a transient voltage-rise between the brushes due to the armature reactance; (ii) oscillatory transient voltage changes due to the re-distribution of armature m.m.f.; (iii) oscillatory transient voltage changes due to the speeding-up of the armature and the oscillation about its no-load position; and (iv) sparking at the brushes due to the removal of the commutating flux and also due to the above three conditions.

These conditions may start flashing or a flash-over round the commutator if the load-change is of sufficient magnitude, *i.e.*, if the change is brought about by the opening of the d.c. circuit breakers on overload. When a rotary convertor is working on heavy load, there is a tendency to form large quantities of ionised gases between successive brushes round the commutator, and these gases assist arcing to the machine frames or to the armature windings when such arcing is set up by the voltage-rise at the brushes (see (i) above).

The term "flashing" implies rather a different meaning from "flash-over." Flashing generally means arcing from the brush-arms to the machine-frames, armature windings, field windings, or to parts of the commutator, whereas flash-over means the setting-up of a continuous arc from brush-arm to brush-arm, a condition which may spread right round the commutator and ring the machine in flame until the a.c. circuit breakers operate. Flash-over occurs only when the convertor is subjected to short-circuit, or to a heavy overload approaching short-circuit value. Flashing is liable to occur under steady overload conditions—and it is generally considered that flashing is helped by accumulations of ionised gases, although some engineers tend to look for other causes, and to discountenance the fact that conducting gases alone produce flashing conditions.

The principal methods of preventing flashing and of protecting the commutator and windings when flashing occurs are as follows:—Fire-proof insulating covers and barricades between brush-arms and at the back end of the commutator (between commutator and windings); fans incorporated in the convertor (or the equipment) which direct a stream of air from back to front of the commutator, and so blow the ionised gases off the commutator and away from the machine; and magnetic blow-outs to quench arcs.

The above methods are suitable for dealing with flashing due to sustained overload conditions, *i.e.*, arcing mainly assisted by accumulations of conducting vapours, but they will not give proper protection against flash-overs at the commutator when heavy overloads or short-circuits are suddenly removed, and the machine is required to remain in synchronism and connected to the a.c. supply, *i.e.*, when the d.c. circuit breakers operate before the a.c. breakers.

Suppose a rotary convertor to be short-circuited: the d.c. terminal voltage drops practically to zero, but if the d.c. circuit is opened by the circuit breakers, the d.c. voltage is almost immediately restored and, due to armature reactance, reaches a transient value of about twice the normal terminal voltage. This condition is an aggravation of the conditions described previously for sudden load change. It is this effect which transforms flashing into flash-over. If a flash-over is set up it is, of course, practically equivalent to short-circuiting the d.c. side without the provision of overload circuit-breakers. Flash-over is not complete until the arc has been drawn from one brush-arm to another, and this needs an appreciable time, although it is not necessarily dependent upon the time taken for a commutator segment to travel from one brush-arm to the next.

There are two methods of dealing with flash-over: one is by installing high-speed circuit breakers on the a.c. side, and the other by using flash-barriers between the brush-arms, so designed as to prevent an arc spreading round the commutator after it has started at the trailing edges of the brushes.

The second method is not the same as a simple flash barrier between the brush-arms, but consists of a contrivance for attenuating the arc, "scooping" it off the commutator and throwing it out radially. A device of this nature is much favoured for traction rotary convertors in the U.S.A. The high-speed circuit breaker is adopted so that, in the event of flash-over occurring, the power may be cut off from the convertor in the shortest possible time. Generally, the d.c. circuit breakers are arranged to operate before the a.c. breakers, since, if the a.c. circuit were opened first, power would tend to flow back into the convertor from the d.c. system. In the event of a short-circuit, therefore, the d.c. circuit is opened, and if the resultant internal effects produce flash-over, this is equivalent to a second short-circuit, and the a.c. breakers must cut off the a.c. power before the flash-over becomes serious. This means that, from the time when the a.c. current due to flash-over reaches the tripping value of the a.c. circuit breakers, the tripping, opening and arc quenching of the breaker must be accomplished in the shortest possible time. As a matter of fact, the high-speed a.c. circuit breaker was developed for, and has its greatest application in, the protection of rotary convertors for electric traction.

A further consideration arises out of the fact that the energy in the flash-over is taken principally from the kinetic energy of the convertor armature. With the heavy load on the armature due to the initial setting-up of the flash-over, the armature slows down and its poles take up a new position relative to the field poles. The kinetic energy given up in this deceleration

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appears as electrical and heat energy in the flash-over. The angular displacement increases as the flash-over persists, the commutating conditions get worse, and the production of conducting vapour is increased. The flash-over effect is therefore cumulative. About 80 to 90 per cent. of the energy in the flash-over is supplied from the kinetic energy of the armature, and only quite a small proportion from the a.c. mains. Of course, as the angular displacement of the armature increases the synchronising current from the a.c. mains also increases. It is obvious, therefore, that the a.c. high-speed circuit breakers must be designed to operate at a lower current value when the current-rise is rapid.

The following arrangement is in use on a large railway traction system in which d.c. is supplied to the traction motors at 1,500 V.; the system has given satisfaction up-to-date. On the d.c. side, a high-speed circuit breaker is situated in the main negative connection to the convertor, and a load-limiting resistor is connected across its terminals. This breaker is arranged to trip only on a pre-determined value of steady overload. The breaker in the main positive connection is arranged to trip on sudden current-rise, but only when such current is in the direction opposite to normal, *i.e.*, when d.c. power is flowing into the convertor. The positive and negative breakers are interlocked so that when the negative breaker opens on overload the load-limiting resistor is inserted across the opening and limits the current to twice rated full-load current; almost immediately afterwards the positive breaker opens and isolates the machine from the d.c. bus-bars. Hence the d.c. load is removed in two steps and the convertor has more chance of remaining in synchronism, connected to the a.c. side, than if the load were removed suddenly, when flash-over would probably be inevitable.

If, however, there is a sudden short-circuit on the d.c. side, the a.c. high-speed breakers, being set to operate on the "rate-of-current-rise" principle, open before the d.c. breakers. Thus there is a reversal of power from the d.c. side, the convertor tending to keep running as a motor taking power from the d.c. system. This operates the positive breaker and completes the isolation of the convertor. This is only one method, applicable to large machines, for protection against flash-over. In smaller machines the overload may be removed in one step, any tendency of flashing being taken care of by devices on the brush rigging.

Since heavy load fluctuations are the cause of flashing, and, perhaps, flash-over, the practical requirements are definite and satisfactory methods of dealing with flashing and flash-over, and of increasing the power of the convertor to deal with heavy load changes without being susceptible to either. The principal methods of achieving the latter end comprise limitations of the rate of change in m.m.f.'s in the convertor consequent upon changes in load demand, and limitations of the rate of load change. These limitations are effected by using a big air-gap for the commutator pole, by using high-reluctance commutating poles, or by introducing external reactances into the d.c. load circuit. The resistance to flash-over can also be increased by making the path between the brush arms as long as possible; this can be achieved by increasing the diameter of the commutator, and also by enclosing the brushes in special "radial" brush-holder units fitted with insulated covers. With modern methods of construction, safe peripheral speeds of commutators can be increased, and it is not unusual to find the commutator with a diameter equal to that of the armature. Such a design allows better facilities for getting rid of ionised gases from the commutator.

A practical study of the root causes of flashing and flash-over would probably serve no really important purpose. Designers have long been occupied and much research has been carried out in connection with methods of reducing the susceptibility of rotary convertors to flash-over. Manufacturers have realised that the conditions set up in the convertor when the load changes suddenly are inherent to the type of machine, and attention has been directed to the prevention of the phenomenon, and to the limitation of its effects.

Reviews.

A Course in Electrical Engineering. Volume II. Alternating Currents. By CHESTER L. DAWES, S.B., M.A.I.E.E., Assistant Professor of Electrical Engineering in the Harvard Engineering School. Pp. xvii+618; figs. 483. London: McGraw-Hill Publishing Co., Ltd. Price 20s. net.

The volume under notice is the second edition of this work, and while, for the most part, retaining the form of the first edition, it has been amplified in several important respects. The author states, in the preface to the second edition, that the book was originally primarily intended for the use of students taking courses, the fundamental subjects of which were non-electrical, and that one object of the additions in the second edition is to make the book more suitable for students taking courses which are mainly electrical.

As regards evening and other part-time students this object has probably been achieved, but the treatment hardly seems sufficiently complete as to permit of its use as a text book for full-time university courses, unless its perusal is followed by the reading of more specialised and detailed books. On the other hand, the book appears excellently suited for the use of full-time students whose main interest lies in non-electrical subjects.

As regards contents, the book is chiefly concerned with a study of the problems of alternating-current circuits and of alternating-current machines, but chapters are also devoted to such subjects as measuring instruments, transmission of power, electron tubes and illumination. The most interesting addition is a chapter dealing with the application of complex quantities to electrical problems. Rectangular and polar notations are both employed, and the use of the method in later portions of the book is pleasing.

The book is very accurately written and few criticisms are possible, though we note that the natural frequency of a circuit is given as $1/2\pi\sqrt{LC}$. This is only true if the resistance is negligibly small, and though the effect on the frequency of taking the resistance into account is not considerable, it should be pointed out.

Again, when dealing with the starting of squirrel-cage induction motors, attention is devoted to the relative starting currents resulting from the several methods, but the question of the relative starting torques per ampere of line current, an important matter, is not raised.

In connection with the starting of synchronous motors some interesting methods, of a mechanical nature, for starting up against heavy loads, are described.

Special commendation may be given to the diagrams, particularly the half-tone reproductions. These are more instructive than is often the case and are well reproduced; indeed, two of them, one dealing with an arc over a string of insulators and another showing an example of flood lighting, are really works of art.

Electrical Engineering Economics. By D. J. BOLTON. Pp. xi+305; figs. 27. London: Chapman & Hall, Ltd. Price 21s. net.

Really good and useful books on engineering economics are so few and far between that the present volume may almost be regarded as unique. In the preface the author rightly emphasises the sheer necessity for co-ordinating economy of manufacture with that of performance, as the overall value of a piece of apparatus can only truly be assessed when these two aspects are taken into account. The present volume makes a very creditable attempt to explain the principles of the monetary values of the performance of electrical plant and the application of these to the important question of deriving maximum economy of operation. The subject is considered under three headings, namely, General Principles, Choice of Plant, and finally Supply Problems. The first part, namely, General Principles, covers the field of consideration of capital, interest and sinking funds, total depreciation, annual depreciation, productivity and the basis and method of engineering applications. The treatment of these subjects follows the fairly well defined lines which have in some cases been laid down elsewhere, and which in any case are generally understood. It is, however, of the utmost value to the manufacturing, purchasing, and supply engineer to have the different data available in a single volume in so concise and orderly a manner. In the second part, which is concerned with the choice of plant, the author deals with Kelvin's law for cables and with the economical selection of motors, transformers and lamps. In this section, particularly that part of it dealing with motors and transformers, the author appears to advocate the under-running of plant both from the point of view of current and voltage, although he throws the onus upon the dictates of the intending purchaser's economic conscience. We can hardly imagine a purchaser ordering a transformer, for instance, of a higher output *and voltage* than is really required (having in mind, of course, the necessity or not, as the case may be, for additional spare output) for the sake of the paper economy that might be calculated by under-rating the iron and copper circuits when running the plant at the normal service conditions. The illustrations are, however, useful if only to serve as an indication of the extremes to which so-called economy calculations can be taken. The third part of the book, which discusses the problems of electricity supply, deals

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with tariffs, load and diversity factors, two-part tariffs, power factor, and the choice of static and synchronous condensers. So far as it goes one cannot reasonably dissent from the author's views as expressed in this portion of the book, but we think the subjects of tariffs and load and diversity factors have been accorded all too scanty consideration. Appendices are included giving equations and tables for interest and sinking funds, the estimated useful life of engineering assets and the efficiency of electrical machinery when under-run, and finally questions on the subject matter of the volume.

It will be appreciated that in an economical study of the kind covered by this volume it is quite impracticable to assign a definite commercial value to all the factors which contribute towards the finished article. Nevertheless, those factors have a very important bearing upon the ultimate life of the plant or apparatus and upon its freedom from premature failure. Those calculations of the kind described by this volume give results which can only be regarded as a partial solution to the selection of electrical plant for a given service, and the results of such calculations should not be regarded as the sole criterion for the ultimate selection of any given plant which may be required.

The volume is one which we have no hesitation whatever in recommending for the closest attention of all branches of the profession and as being one, the study of which will well repay whatever time may be spent upon it. The publisher's name is sufficient indication of the excellence of the production of the volume.

Electrical Sub-stations. By H. BRAZIL, M.I.E.E. Pp. vii+215; figs. 92. London: Edward Arnold & Co. Price 12s. 6d. net.

In this book the author gives an account of present-day practice in the design, maintenance and operation of sub-stations; he also deals in a practical way with the matters of converting plant, switchgear, and protective gear with reference to his main subject.

As may be expected, Mr. Brazil is of the opinion that there is still a distinct future for direct current distribution, and he has written some useful notes on the peculiar difficulties in developing a d.c. distributing system, arising from the necessarily smaller number of sub-stations as compared with an a.c. system. The author describes his method of using resistances in the distributors fed direct from the sub-station, but we imagine that many engineers would prefer to regulate the load on these feeds by suitably sectionising the network. The notes on the design of large direct-current sub-stations are also very useful.

The chapter dealing with static transformer sub-stations is somewhat superficial in character. Illustrations such as figs. 7 and 8 are hardly called for in a work of this kind, whilst the paragraph on the induction regulator only describes the single-phase type. The chapter dealing with switchgear contains many shrewd and practical notes on this important subject, and the author's regulations for the repair, testing, or cleaning of extra-high-pressure gear are very sound. Armour-clad gear is now supplied by so many manufacturers of switchgear that it is hardly correct to associate this type of gear with the name of one firm.

In the chapter on protective gear the author's outlook appears to be somewhat narrow, for we find no reference to the systems employing the biasing principle. The self-balance system described on p. 59 refers to the protection of an alternator, and is somewhat out of place in a work on sub-stations. The analogous method applicable to transformers might have been described.

The chapter on converting plant gives a good general description of the usual type in use. We think that the reference to the glass bulb type of rectifier is somewhat scanty, as there is every prospect that this plant will find extensive use in residential areas where it is decided to retain direct-current distribution. Although the author implies that this type of rectifier is suitable only for small outputs, it may be recalled that there is a glass bulb rectifier sub-station designed for a 3,000-kW rating in the London area.

The author gives a good account of modern automatic switchgear for non-attended sub-stations. There is a useful chapter on the prevention of noise, whilst we are not surprised that the subject of limiting resistances receives due prominence.

The final chapter on continuity of supply is one deserving of special study, and we endorse the importance which the author attaches to this subject. It would have been well if greater stress had been here laid on the periodical testing of protective gear, and some practical notes on the carrying out of these tests would have been useful.

We can recommend this book as a practical and very readable account of modern sub-station practice.

Electric Circuits, Theory and Applications. Vol. I. "Short Circuit Calculations and Steady State Theory." By O. G. C. DAHL, S.B., S.M. Pp. x+390; figs. 228. London: McGraw Hill Publishing Co. Price 25s. net.

In this book the author has carried the subject of the arithmetic of alternating currents a stage further than is found in the usual textbook of alternating current theory. The work is intended to be a textbook for the use of post-graduate electrical engineering students in the Massachusetts Institute of Technology. Although the subject of alternating current calculations has been taken, in this book, to a stage well beyond that required by the average engineer, a study of some of the problems dealt with by the author will be well repaid, not only for the clearer insight into fundamentals which will be so gained, but also by the light which will be thrown on many matters of real every-day practical interest.

The book commences with a chapter dealing with the calculation of network impedances for the evaluation of short-circuit currents. The convenient method of using the equivalent star for a delta combination of impedances is explained and illustrated, and some useful notes are appended on the experimental solution of impedance problems by the use of calculating tables.

Considerable space is devoted to the subject of unbalanced polyphase circuits, and the author outlines the two usual methods of solving problems of this kind, the one by the use of Kirchhoff's laws, and the other by the resolution of an unsymmetrical system into two symmetrical systems of opposite phase sequence.

In spite of the apparently artificial character of the conceptions involved in the latter system, it has proved itself to be a most potent method for the solution of problems dealing with unbalanced three-phase circuits. The symmetrical co-ordinate method is, in our opinion, best developed by the use of a vector operator, which represents a rotation through 120 degrees, and which is algebraically equal to one of the complex cube roots of unity. The use of this operator not only enables the fundamentals of the system clearly to be visualised, but also enables the various geometrical methods of resolution easily to be proved. The author's method of establishing the basis of the system, in which the operator in question is not specifically used, is, we find, somewhat difficult to follow. The author deals with the operation of transformers when delivering unsymmetrical loads, and with the more important and more interesting question of the operation of alternating current motors on three-phase systems in which the voltages are unbalanced. This chapter is worthy of study by all electrical engineers.

The remaining portion of the book deals mainly with transmission line problems. Short transmission lines are first considered, and the several approximate methods of calculation are explained. The author then passes on to exact calculations for lines of unlimited length, and shows clearly the application of the hyperbolic functions to problems of this character. An important chapter is devoted to harmonics, their genesis, and their effect on the operation of transmission lines. Further chapters deal with the construction of transmission line and synchronous machine charts, and the concluding chapter is devoted to the consideration and detailed solution of specific steady-state transmission-line problems.

This book is the most penetrating we have yet seen of those dealing in a practical way with alternating current circuit calculations. It abounds in fully worked examples for the guidance of the student. Although it will not appeal to the average engineer, it should be of the greatest interest and use to those who are concerned with technical problems relating to the transmission of electric power over long distances.

The Spectroscopy of the Extreme Ultra-Violet. By T. LYMAN, Ph.D. Second edition. Pp. vii+160; figs. 7. London: Longmans, Green & Co.

No research worker whose investigations take him into the region below 2,000 A can dispense with Prof. Lyman's book. The author, as is well known, has devoted himself almost exclusively to the study of the extreme ultra-violet, having made over twenty contributions to the literature of the subject, and the usual designation of the fundamental series of hydrogen by his name is a fitting tribute to his pioneer work, second only to that of Schümann himself. This edition follows the same general lines as the first, but the large amount of work done in the last fourteen years in this field has necessitated the re-writing of certain sections of it. The stimulus for this work has, of course, come from the simultaneous development of the Bohr theory of the atom, with its recognition of the fact that electron energies corresponding to the ionization potentials of many elements also correpond to spectra in the Schümann region, and particular interest thus attaches to Section III (Part II), on emission spectra, where we note that the line spectra of over sixty elements have now been at least partially described in this region, quite apart from molecular bands. The other parts of the book are very largely concerned with matters of technique, and do not call for detailed comment here. There is a good bibliography as an appendix, which appears to be complete up to about the middle of 1927, but at the same time considerable work has been done even since then, including the description by Prof. K. T. Compton and Dr. Boyce of their beautiful method of exciting gas spectra in this region by controlled electron impacts, and Dr. Rupp's very recent production of electron spectra by a ruled grating, and this monograph must thus be regarded as marking a stage in the growth of a rapidly developing subject, and not as indicating the attainment of any degree of finality.

K. G. E.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

E.D.A. Activities.

We have received from the British Electrical Development Association a supplementary programme of its activities for January. Efforts during this month are being directed particularly to domestic lighting and colour lighting. To this end the month's newspaper advertising will put forward the beauty, convenience, and cleanliness of electric light, and many attractive "lay-outs" have been prepared for the purpose. Two simple but effective window displays have been designed for the use of the trade, and a special poster (E.D.A. 729) has been printed in seven colours bearing the slogan "For Health's Sake Use Electricity." February is to be devoted to the subjects of wiring and spring cleaning, and local Circles are asked to discuss the arrangements for this part of the campaign at their January meetings. Two new illustrated lectures are available: For January, "Electric Lighting in the Home"; and for February, "Transforming the Homes of Britain."

The G.E.C. in 1928.

Some details of its work during the past year which we have received from the GENERAL ELECTRIC CO., LTD., prove that the company is in the forefront of electrical development. Among the outstanding items included in the list brief mention may be made of the following. In the field of turbo-alternator manufacture progress has been made in increasing the output of 3,000-r.p.m. machines. A set of 40,000 kVA capacity is in hand for the Battersea Corporation and two others of 18,750 kVA are being made for Poplar and Southampton. Two 40,000-kVA sets running at 1,500 r.p.m. are being erected in the new Hams Hall station, Birmingham, and several large machines have been dispatched to various parts of the Empire. An automatic sub-station at Aldwych House was completed for the Charing Cross Electricity Supply Co. during the year. This station, which houses four 750-kW motor-convertors and the necessary control equipment, is claimed to be the largest in the country. An interesting example of automatic control applied to a synchronous condenser was recently undertaken by the company in connection with the power-factor regulation in an ironworks. In this a 400-kVA machine is switched in at times when the load approaches the maximum demand, and out again at light-load periods. Plant and switchgear is being produced at the Witton Works for the Palestine hydro-electric scheme. The main plant comprises two 7,500-kVA vertical-spindle alternators driven by Boving turbines. High-pressure outdoor switchgear has been supplied to Australia and New Zealand. The traction work carried out during the year included a 2,250-h.p. electric locomotive for the Great Indian Peninsula Railway and two 340-h.p. Diesel-electric locomotives for the North-Western Railway of India. An order is in hand for 920 240-h.p. traction motors, &c., for the London Underground Railways. In the direction of industrial electrification, the company has nearly completed a contract for the electrical equipment of a large artificial silk spinning mill with 3,500 spindles directly operated by small high-speed vertical motors. One of the most important contracts received during the year was, of course, the £500,000 order placed by the Central Electricity Board for a 132,000-V transmission line under the South-East England Scheme.

In many other directions—lighting, heating, cooking, radio work, &c., the company has made progress and improvement. Among the orders for materials-handling equipment received by Fraser & Chalmers Engineering Works (one of the company's branches) is one for complete self-unloading equipment for two coal-carrying steamers.

The B.E.A.M.A. and Industrial Credit.

Just before Christmas at the final meeting of the Sound Currency Association, a brief reference was made to the British Electrical and Allied Manufacturers' Association's recent "survey" concerning trade credit. The Sound Currency Association was formed in 1919 with the object of pressing upon the Government the need for the restoration of the gold standard in this country and that object having been achieved there was no further need for the existence of the Association, and it has accordingly been wound up. The whole of the work was of a voluntary nature, but it was strongly supported by the leading bankers, economists, and others in this country. Mr. D. M. Mason, who has acted as chairman of the Association since its formation, referred to the B.E.A.M.A.'s manifesto and said there seemed to be a feeling in certain circles that there was a lack of credit to-day. He contended, however, that there was no such lack and that everybody with good security had no difficulty in obtaining any credit that they desired. At the same time it was impossible to force credit into the country because the only result was inflation and the very evils which the Association had endeavoured to prevent. The British Electrical and Allied Manufacturers' Association had suggested that the depression during recent years had been due to the monetary policy of the Bank of England, but the system of the Bank of England was, in a sense, governed by the trade of the country. It did not provide the trade but existed for the purpose of circulating trade and the function of the gold standard was to enable exports and imports to develop to the greatest extent. That system enabled this country to build up a foreign trade before the war second to none in the history of the world, and it was a satisfaction to know that we had now got a currency which was convertible into gold, was elastic, and absolutely free from any political influence whatever.

Cookery Exhibition Results.

We are informed that a leading manufacturer of electric equipment reports that his orders and inquiries at the recent Cookery and Food Exhibition amounted to over £6,000. A competing firm mentions the figure of £7,200. Another firm claims to have sold, among other equipment, 100 electric hand-dryers. A manufacturer of electrical refrigerators and other plant estimates his business transacted at Olympia at £700 per day.

Simplification in an American Lamp Works.

A striking illustration of the fact that reduction of types often stimulates sales is found in the simplification undertaken by a large lamp manufacturing concern in the United States, as reported in a recent issue of *Manufacturing Industries*. General lighting types were reduced by this company from 1,260 to 180 and general lighting voltages to three, which accounted for 95 per cent. of the demand. Types of lamp bases were reduced from 179 to three. The company reports that, as a result, it was able to reduce prices by 50 per cent. in a period of 12 years, and that sales increased by 74 per cent. in four years. Freight and warehousing expenses were reduced, floor space was more efficiently utilised, and the efficiency of the employés increased.

Indian Electrical Imports.

The *Board of Trade Journal* gives details of Indian import trade during the first half of the fiscal year (April-September, 1928). It is stated that the improvement in the import trade of machinery and millwork continued. The value of imports of electrical machinery rose from Rs. 97 lakhs in April-September, 1927, to Rs. 108 lakhs. The United Kingdom's share rose from Rs. 80 to Rs. 83 lakhs, that of the United States from Rs. 6 to Rs. 14 lakhs, and Germany's from Rs. 5 to Rs. 7 lakhs. The imports of electrical instruments, apparatus, &c., rose from Rs. 139 to Rs. 147 lakhs. The British share advanced from Rs. 91 to Rs. 94 lakhs, that of Germany from Rs. 13½ to Rs. 14½ lakhs, Holland from Rs. 6 to Rs. 7½ lakhs, Italy from Rs. 4 to Rs. 6 lakhs, and Japan from Rs. 1½ to Rs. 2½ lakhs. On the other hand, American shipments were slightly reduced from Rs. 18 to Rs. 17 lakhs. "Other countries" supplied Rs. 5½ lakhs' worth. Analysing the above total, it is found that the imports of electric wires and cables fell from Rs. 46 to Rs. 45 lakhs. The share of the United Kingdom, however, advanced from Rs. 39 to Rs. 41 lakhs. That of Germany remained stationary at about Rs. 2 lakhs, and Holland's at Rs. 1 lakh, while imports from the United States fell from Rs. 2½ lakhs to Rs. 64,000. The trade in electric glow lamps and parts thereof rose from Rs. 12½ to Rs. 15 lakhs. The British share advanced slightly from Rs. 3½ to Rs. 4 lakhs, that of Holland from Rs. 4 to Rs. 5½ lakhs, and "other countries" from Rs. 3½ to Rs. 4 lakhs. The German share fell from over to just under one lakh. Electric lamps of other kinds amounting to Rs. 7 lakhs were obtained from the United Kingdom (Rs. 4 lakhs), Germany (Rs. 1 lakh), the United Kingdom (Rs. ½ lakh), and "other countries" (Rs. 1 lakh). Electric fans to the total value of nearly Rs. 17 lakhs were obtained from the United Kingdom (Rs. 10 lakhs), Italy (Rs. 5 lakhs), the United States (Rs. ½ lakh), and "other countries" (Rs. 1½ lakhs). Of a total of Rs. 23 lakhs' worth of unenumerated electrical apparatus the United Kingdom supplied Rs. 14 lakhs, the United States Rs. 4½ lakhs, and Germany Rs. 3½ lakhs.

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Accumulators were imported to a total of Rs. 8½ lakhs, of which the United Kingdom supplied over Rs. 7½ lakhs and the United States Rs. ¾ lakh. Meters and switchboards were entirely obtained from the United Kingdom, but of the Rs. 6½ lakhs' worth of batteries imported the United States supplied nearly Rs. 4 lakhs, the United Kingdom only Rs. 91,000, and "other countries" Rs. 1½ lakhs. Imports of wireless apparatus expanded from Rs. 6½ to Rs. 7½ lakhs. The British share rose from Rs. 5½ to Rs. 5¾ lakhs, that of the United States from Rs. ⅓ to Rs. ½ lakh, and "other countries" from Rs. 1 to Rs. 1¼ lakhs.

Local Exhibitions.

TAMWORTH.—Since, four years ago, the Pooley Hall Colliery Co., Ltd., Polesworth, near Tamworth, undertook the public supply of electricity through its Electric Supply Department (manager: Mr. J. C. Chaytor) considerable progress has been made in the district, which includes about a dozen villages. There are now about 5,000 consumers. To stimulate this progress an exhibition was held recently at the Assembly Hall, Tamworth; it included a competition for housewives who do their cooking by electricity. There were 348 entries and many prizes were awarded. The premier prize, a silver challenge trophy, was presented by the Credenda Conduits Co., Ltd., whose cookers are used throughout the company's supply area. Colonel Darcy Chaytor, C.M.G., C.B., presided at the opening ceremony, at which Councillor G. H. Jones, chairman of the Tamworth Electric Supply Committee, introduced Lady Brooks, of the Birmingham and Midlands Branch of the W.E.A., who spoke of the advantages of electricity.

MANCHESTER.—An exhibition of industrial electrical equipment will be held at Belle Vue, Manchester, from January 7th to 12th, under the auspices of E.D.A., the Manchester and Salford Corporation Electricity Departments, and the Lancashire Electric Power Co. Among the exhibits will be electric furnaces, baking ovens, electric welding plant and tools, soldering irons, boilers and coffee-making machines, and heating elements. Admission to the exhibition will be free by tickets, obtainable from E.D.A., or the Corporations named, which will have an inquiry bureau for the benefit of visitors. The organisers hope to secure a good attendance of operatives, as well as employers. The exhibition will not be of interest to the general public.

SHEFFIELD.—During the annual congress of the Royal Sanitary Institute next July at Sheffield, the Electric Supply Department is to hold an exhibition of electric heating, lighting and power appliances in the Cutlers' Hall.

Canadian Order for Sweden.

It is reported from Stockholm that the Allmänna Svenska Elektriska A.B. has secured in competition with other firms an order from the city of Winnipeg for the supply of two generators, each of 10,000 h.p., valued at 1,430,000 kr.

Central Electricity Board Contracts.

In this issue the Central Electricity Board calls for tenders for the supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England Scheme and the North-West England and North Wales Scheme.

New Catalogues and Lists.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—A pamphlet describing B.T.H. thermostatic metal and its applications.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Lists M.F. 30 and 30/1, dealing with the company's Type F.C.c. a.c. watt-hour meter. Illustrated and priced.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflet No. 452/1-1, containing illustrated notes upon "Metrovick" self-contained turbo-generator sets.

THE WHOLESALE FITTINGS CO., LTD., 23, Commercial Street, E.1.—Supplement No. 225, containing particulars and prices of "Altolite" glassware.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A well-illustrated pamphlet containing a full description of the construction and employment of a new "Universal" electric washer and dryer. Priced.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—Pamphlet S.P. 126, illustrating and describing the "Little Giant" pneumatic coal pick.

METROPOLITAN-VICKERS AUSTRALIA PTY., LTD., Auburn (N.S.W.) and South Melbourne (Vic.).—A series of illustrated pamphlets advertising the company's truck-type switchgear, oil circuit-breakers, and switchboards.

LIGHTING TRADES, LTD., 30-31, Farringdon Street, E.C.4.—Catalogue No. 422, containing illustrations, details and prices of "Eltee" bakelite electrical accessories.

Calendar blotters for January have been received from MESSRS. MAVOR & COULSON, LTD., 47, Mile End, Glasgow; POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, W.C.2; MESSRS. H. J. BALDWIN & CO., Nottingham; and MESSRS. WARREN BROS. (MIDDLESBROUGH), LTD.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A folder containing particulars of the company's ozone-proof cables; and a well-illustrated brochure dealing with the "Prescot" wiring system.

Chinese Reconstruction.

The Chinese National Commission of Reconstruction, Nanking, recently offered prizes for papers setting forth practical and useful construction schemes falling under any of the following headings:—Communications; navigation and hydro-electric enterprises; agriculture; commerce; mining; harbour and port development; industries; and capital city building. Authors of constructive projects which are adopted by the Commission may be appointed to direct the schemes which they put forward or be employed as advisors.

Calendars and Diaries.

The 1929 calendar of the GENERAL ACCESSORIES CO., LTD., 125, High Holborn, W.C.1, has neat monthly date slips and bears illustrations of the company's switches, plugs and sockets, fuses, &c.

We have received a very neat wall calendar from the CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1. A set of monthly slips is suspended beneath a picture of a power station.

The 1929 calendar of MESSRS. FRANCIS POLDEN & CO., LTD., 56, Cannon Street, E.C.4, consists, as usual, of neat monthly sheets provided with a date-indicating device.

A plain calendar with boldly-figured daily slips has been received from ROTUNDA, LTD., Manchester Road, Denton, Manchester.

A view of a battery of cooling towers and a block of salmon-coloured date slips comprise the 1929 calendar of the DAVENPORT ENGINEERING CO., LTD., Bradford.

The LIVERPOOL ELECTRIC CABLE CO., LTD., Bootle, again employs a view of the Mersey for its calendar, which has monthly date slips.

Ample memorandum space is given in an appointments calendar sent us by the LEA RECORDER CO., LTD., 28, Deansgate, Manchester.

MESSRS. ROPER BROS., 5, South Anne Street, Dublin, have altered the character of their calendar this year; it consists of a neat card upon which a block of large daily slips is mounted.

Refills for their "moving ring" calendar have been received from MESSRS. HOPKINSONS, LTD., Huddersfield.

From the IRON & NICKEL BATTERY CO., 17-19, Cockspur Street, London, S.W., we have received a handy ten-inch rule with English and metric measure marks; and a calendar for the complete year 1929 is compactly arranged from end to end.

Monthly sheets bearing illustrations of the goods supplied by the company form the calendar of MESSRS. W. H. WILLCOX AND CO., LTD., 38, Southwark Street, S.E.1.

MR. FERNAND ESPIR, 86-88, Queen Victoria Street, E.C.4, has sent us a new set of daily slips for his calendar.

A girl with a smile forms the subject of the calendar received from MESSRS. DOWNES & DAVIES, Stanley Street, Liverpool, which is a very pretty production.

An engagement calendar with monthly sheets comes from MESSRS. W. H. SUGDEN & CO., LTD., Glenny Road, Barking, E.

Each of the four quarterly sheets which form the 1929 calendar of MESSRS. CROMPTON PARKINSON, LTD., Chelmsford, bears an excellent drawing in colour of a scene in which electric motors play a part.

The LANCASHIRE UNITED TRANSPORT & POWER CO., LTD., Atherton, Lancs., has sent us a little wall calendar with a view of some Scotch firs and monthly date slips.

A pocket diary has been issued by the STANTON IRONWORKS CO., LTD., of Stanton-by-Dale, near Nottingham.

MESSRS. B. S. & W. WHITELEY, LTD., of Leeds, have again sent us a wall calendar with daily date slips, each bearing a more or less interesting literary quotation.

A representation of a "Mullard" valve with a picture of a fair lady and a block of daily slips again form the calendar of the MULLARD WIRELESS SERVICE CO., LTD.

Russian Electrical Production.

It is calculated that the State Electrical Trust (High Pressure) will be able to turn out products of the value of 210,000,000 roubles in the current financial year, provided that a sufficient supply of copper is available. In the case of the Low-Pressure Trust the works are at present fully occupied, and are working two shifts daily.

Unemployment in Australia.

In a recent article contributed to the *Industrial Australian and Mining Standard*, Mr. P. J. Pringle (chief engineer of the Electric Supply Co. of Victoria, Ltd.) compares unemployment in the Commonwealth of Australia and its constituent states with conditions in Great Britain, and draws certain conclusions. By means of curves he shows that while the proportion of unemployed in the individual states has shown wide variations during the past eight or nine years the fluctuations for the Commonwealth as a whole have been similar in nature to those of Great Britain. For instance, the lowest level was reached in both cases in 1920, while in the succeeding year the curves sprang up to their maxima. The cyclical nature of Australian unemployment is very evident from the curve. Dealing with causes, Mr. Pringle states that when world prices slumped in 1921 Australia refused to undertake a gradual deflation or readjustment of production costs, with the result that high internal costs of production make it impossible to export profitably all primary products, with the exception of wool. The economic position has been ignored. The engi-

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neering trade has nearly 11,000, or 17 per cent., of its members unemployed. The Federal Arbitration Court, instead of helping to lower production costs in keeping with those of other countries, did the reverse by imposing a 44-hour week. Mr. Pringle concludes by stating: "The education of Capital and Labour must progress so that they can appreciate the dictum that capital, profits and wages are only limited by production. When this sound fact is realised, we shall do much to ease the satisfactory solution of our long-delayed readjustment problem, which during its progression must necessarily be accompanied by much adversity."

Scope for Development.

Mr. Henry A. Porter, research editor of the *Magazine of Western Finance*, lists the reasons advanced by competent authorities as to the certainty of continuous growth and prosperity in the electric light and power field as follows:—

1. Less than two-thirds of the population of the United States lives in homes which use electricity.
2. Less than 50 per cent. of the homes wired for electricity use any domestic electrical appliance except the flatiron.
3. The use of electricity in the home would be increased more than 1,000 per cent. if homes were equipped electrically throughout.
4. Less than 10 per cent. of the farms in the United States use electricity in any form.
5. Less than 1 per cent. of the entire railroad mileage of the United States is electrified.
6. The lighting of the nation's great network of highways and airways will prove a large source of new revenue.
7. Radio broadcasting, and the radio with an electric socket, have opened up a new field for consumption of energy.
8. Present use of electric power by industries is less than 50 per cent. of their actual power requirements.

The Anglo-Chinese Treaty.

Last week the text was issued of the treaty between Great Britain and China, which was signed at Nanking on December 29th. This provides, *inter alia*, for the complete national tariff autonomy of China. Each country agrees to accord most-favoured-nation treatment to the other and in the case of Great Britain this applies also to the Dominions and Colonies. The signatories also promise equality of treatment with each other's nationals for imported goods. China undertakes to procure the abolition of *likin*, or internal dues and taxes, as soon as possible.

A Radio Trade "Understanding."

A reciprocal understanding has been arrived at between the Radio Wholesalers' Federation and the Wireless Retailers' Association of Great Britain, embodying the following points, which the councils of both organisations recommend their members to observe:—(1) The W.R.A. recommends its members to give preference in purchasing to firms and companies that are members of the R.W.F. (2) The W.R.A. deprecates its members purchasing from firms and companies acting as wholesalers, but who compete with them either openly or otherwise, by selling retail as well as wholesale. (3) The W.R.A. recommends its members to communicate to the R.W.F. the name of any wholesaler or manufacturer offering radio goods at prices or on conditions other than manufacturers' listed prices and/or terms. (4) The R.W.F. agrees to circulate amongst its members, after verification, the names of applicants for trade terms who in its view do not comply with recognised trading requirements. (5) The R.W.F. recommends its members to use their influence with their retail customers to induce them to become members of the W.R.A.

The Radio Wholesalers' Federation has sent us a list of its members arranged according to towns.

Inspection of Companies in Spain.

A decree of the Spanish Finance Ministry appeared in the Official Gazette of December 30th, by virtue of which the State will have the right of inspection of all undertakings and companies established in Spain.—*Reuter* (Madrid).

For Sale.

Gillingham Corporation has for sale one Diesel engine and alternator, and the Weald Electricity Supply Co., Ltd., two gas engines, one oil engine, &c. Derby Corporation has for sale one 2,000-kW set with auxiliaries, and one 750-kW set. Mr. H. J. Shaw will offer by auction on January 9th, at 13, High Holborn, W.C.1, stocks of wireless sets, electrical goods, lamps, &c. (See our advertisement pages to-day.)

Electric-Furnace Agreement.

The Metropolitan-Vickers Electrical Co., Ltd., and the Electric Furnace Co., Ltd. (who are sole licensees for the British Ajax-Northrup patents) have entered into an agreement whereby each company has the right to manufacture and supply coreless induction furnaces incorporating the Ajax-Northrup and Metropolitan-Vickers patents.

Wages in the Cable-making Industry.

The stabilisation of wages in the electricity supply industry for the whole of the current year applies equally to plumber-jointers, jointers and jointers' mates in the electric cable-making industry. Two areas are excepted from this stabilisation, *viz.*, Area No. 1, North-East Coast, and Area No. 10, Greater London (for plumber-jointers and their mates).

The D.O.T. and Standard Fittings.

The Department of Overseas Trade is compiling a list of British firms which are at present manufacturing lampholders, conduits, and conduit fittings in accordance with B.E.S.A. specifications. The Department wishes to obtain particulars from British manufacturers of any of the above goods. Reference B.X. 4961 should be quoted in any communication.

Book Notices.

The "Practical Engineer" Electrical Pocket Book and Diary, 1929. Edited by Conrad Arnold, A.M.I.E.E. Pp. cxx +651; illustrated. London: Humphrey Milford. Price 2s. 6d. net.—While the 30th edition of this useful pocket book has been carefully revised as a whole, the sections on "Electric photometry and illumination" and "Electric lamps" have been recast and largely rewritten with a view to emphasising more strongly the practical aspect of illumination under modern conditions and requirements.

The "Argus" group of South African newspapers recently issued a special 48-page British Supplement. This, a copy of which we have received, contains many illustrated articles by leading public men on several phases of British activities—engineering, industry, sport, music, literature, &c. Copies can be obtained free of charge from Argus South African Newspapers, Ltd., 72-78, Fleet Street, E.C.4.

"Science Abstracts (A and B)." Vol. XXXI. Part 12. London: E. & F. N. Spon, Ltd. Price 3s. each.

Unemployment.

During the week ended December 17th there was a decrease of 49,810 in the number of registered unemployed. The total at that date was 1,271,100, as compared with 1,320,910 on December 10th and 1,100,050 on December 19th, 1927.

The British Mission in Australia.

In the month of November, according to the *Industrial Australian and Mining Standard*, the members of the British Economic Delegation conferred in Melbourne with representatives of the Chamber of Commerce, associated banks, Chamber of Manufactures, and other commercial institutions. They also had a conference with representatives of primary producers. The conference with the associated banking interests was attended by the general managers from the head offices of banks in Melbourne. A full and frank discussion took place with representatives of the manufacturing interests. Sir Arthur Duckham said he found the discussions very interesting, and they were characterised by an atmosphere of helpful frankness.

Trade Announcements.

As Mr. J. SCRIVENER's future business activities make it impossible for him to carry on Volta, Ltd., in its present form, the company is being voluntarily liquidated as at December 31st. Arrangements have been made for the liquidator, Mr. Norman Smith (Smith & Earle, 80, Finsbury Pavement, E.C.2), to carry on for at least twelve months, and he is retaining several of the staff of the company, as well as the warehouse at Eagle Street, where stocks of "Volta" vacuum cleaners are available. Mr. Smith will be in a position to deal with all questions of repairs, new business, and so on until other arrangements are made. For the present all correspondence should be addressed to Volta, Ltd., Kern House, 36-38, Kingsway, London, W.C.2.

Mr. L. E. HEMBER, electrical engineer, has opened new showroom premises at 4, Pepper Street, Lymm, Cheshire.

The Liverpool branch of PHILIPS LAMPS, LTD., has been removed to 25, Stanley Street, Liverpool.

Mr. W. S. JOHNSON, Edinburgh, has discontinued business on his own account and has joined Messrs. SINCLAIR, CAMPBELL AND KINGHORN, who are opening an electrical department and fittings showroom at 59-61, George Street, Edinburgh.

Mr. ERIC MARX, who has commenced business as a wholesale electrical supplier at 34-36, Oxford Street, London, W.1, wishes to receive manufacturers' catalogues.

Mr. CHRISTOPHER WADE, of Messrs, Gabriel Wade & English, Ltd., has removed from Ashburnham Road to 32, Linden Road, Bedford. His telephone number, Bedford 3187, is unchanged.

A "Venner" Gift.

We have received from VENNER TIME SWITCHES, LTD., a very serviceable thermometer. It is accompanied by a card bearing greetings conveyed in verse and epigram which, we regret to say, contain one or two rather unforgiveable—if not venerable—puns.

Company Liquidation.

RADIO MAINTENANCE, LTD.—A meeting of creditors was held on December 28th, at 15, King Street, St. James, S.W.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, December 31st:—Copper (electrolytic) bars, £77 10s., £2 5s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £87 10s., £2 5s. inc.; ditto ditto h.c. wire, 10 13/16d., ½d. inc.; Silicium bronze wire, 11¾d., ½d. inc.

Messrs. James & Shakespeare report, December 31st:—Copper bars (best selected), sheet and rod, £100, £2 inc.; English pig lead, £23 5s., 15s. inc.

Messrs. Edward Till & Co. report, December 31st:—No change in the price of india rubber, Para fine.

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Lighting and Power Notes.

Afghanistan.—WATER POWER.—One of *Reuter's* correspondents in India reports, in connection with the fighting now proceeding between Afghan Government troops and insurgents, that the Salang River, which is used to provide hydro-electric power for Kabul, has been diverted by the rebels into another channel, and the consequent failure of electricity has caused much inconvenience in the Government factories.

Aylesbury.—ELECTRICITY IN BULK.—The Town Council has accepted an offer of a temporary bulk supply of electricity from the Central Electricity Board. The Council is to provide a demand of not less than 1,000 kW. The Council has adopted a scheme for carrying out within the next twelve months h.p. and l.p. lines and works in the rural areas at a cost of £16,000.

Birkenhead.—LOANS.—The Corporation Electricity Committee has obtained sanction to the borrowing of £3,582 for mains, £11,200 for rotary convertor equipment, £666 for transformers, and £2,730 for switchgear.

Brampton.—ELECTRICITY SUPPLY.—The Rural District Council has received from the Carlisle Corporation a letter with regard to the proposed extension of the electricity supply to the area, asking whether the Council is desirous of taking a bulk supply and acting as distributors, or whether it would be willing for the Corporation, or, as an alternative, for a private company to carry out the distribution. A deputation has been formed to discuss the matter with the City Electricity Committee and report.

Canada.—QUEENSTON-CHIPPAWA EXTENSION.—The Hydro-Electric Power Commission of Ontario has decided to add a tenth unit to its power plant at Queenston, Ontario. This will add 65,000 h.p. to the capacity of this power plant, bringing the total installed capacity up to 625,000 h.p. The cost of the addition will be approximately $4,000,000. Although originally designed for nine sets, it has been demonstrated that there is a sufficient flow of water in the canal from Chippawa creek to operate the extra set. While no additional work will be required on the canal itself, it will probably be necessary to enlarge the forebay on the north side and put in an additional penstock.

NEW WINNIPEG HYDRO-ELECTRIC PLANT.—With the completion of a 14-mile railroad from Whitemouth, Manitoba, to Seven Sisters Falls, on the Winnipeg River, work will begin at once on the 135,000-h.p. plant that the Winnipeg Electric Company is to build there on its leased site. The company states that the sale of the entire output of the plant is already assured, that it will be completed in two or three years at a cost of approximately $20,000,000, and that its capacity will ultimately be raised to 230,000 h.p.

Continental.—FRANCE.—An amalgamation of rural electricity supply undertakings is being effected by the Société L'Union Electrique Rurale which is acquiring the undertakings of the Société Centrale de Distribution d'Energie, the Société Française d'Electrification Rurale, the Société le Morivan Electriques, and the Société d'Eclairage et de Force Motrice de la Region du Vernet-la-Varenne. The capital of the Rurale Co. is being increased from 10 to 32 million francs.

GERMANY.—Up to 1916 the largest power station in Germany was that at Golpa, with a capacity of 128,000 kW, but since the war this has been passed by the Goldenburg plant of the Rhenish-Westphalian Electricity Co., with a capacity of 290,000 kW. The Golpa station, however, is to be further extended, and the capacity of the plant increased to 430,000 kW. It is claimed that when the extensions are completed it will be the largest power station in the world. The new plant will be noteworthy for the size of the generating units. The original plant comprised turbo-generators of 16,000 kW capacity, whereas for the latest extension a contract has been placed with the Allgemeine Elektricitäts Gesellschaft of Berlin, for a 85,000-kW turbo-generator set.

Dereham.—INAUGURATION OF SUPPLY.—An electricity supply for the district was recently formally inaugurated by the chairman of the Urban District Council. The supply is obtained from Norwich Corporation and distributed by the Council.

Derby.—INQUIRY.—A Ministry of Transport inquiry was held recently by Mr. A. D. Erskine, respecting the application of the Leicestershire and Warwickshire Electric Power Co., to erect 13 poles at Melbourne for the supply of electricity. For the company it was urged that it would be uneconomical to place the line underground, and although it was admitted that in Melbourne itself a large proportion of the existing lines were underground, it was explained that when the company took over the undertaking from a local private company the ducts had already been laid. The County Council opposed on the ground that for the safety of the public it was undesirable to have additional poles put up on the highways. The assistant chief constable said that during the last five years there had been 279 accidents in the county to motor vehicles through collisions with telegraph poles, lamp standards and other obstructions. It was also urged that poles would not add to the beauty of the district.

Douglas (I. of M.).—EXTENSION OF SUPPLY.—The Town Council, on December 18th, presented to the Tynwald a petition for leave to extend the optional area for the supply of electricity to certain districts outside the borough. The area which the Council wishes to include is that in which the Howstrake Estate Co. is empowered to lay mains, an area vested in the Manx Electric Railway Co. The application is being opposed, and the Tynwald has referred the matter to a committee.

Droxford.—ELECTRICITY SUPPLY.—The Rural District Council has received from the West Hampshire Electricity Co., Ltd., an intimation that it proposes to apply for a Special Order to distribute electricity in an area including the Droxford rural district, with the exception of the parish of Hambledon, and that it is proposed to obtain a supply of electricity in bulk from the Southampton Corporation.

Godalming. — PRICE REDUCTIONS. — The Urban Electric Supply Co. has reduced the charge for electricity for lighting from 10d. to 9d. per kWh, and has made a flat rate of 3½d. per kWh for power and heating.

Guildford.—INQUIRY.—The Electricity Commissioners have appointed Colonel T. C. Ekin to hold an inquiry at the Ayers' Hall on January 15th into the following orders: Aldershot District Electricity (Extension) No. 1, No. 2, and No. 3 Special Orders; Petersfield Electricity (Extension) Special Order; West Sussex Electricity Special Order; Steyning Electricity (Extension) Special Order; and Alton Electricity (Extension) Special Order.

Holbeach.—INQUIRY.—Colonel F. Gordon Tucker held a Ministry of Transport inquiry on December 20th respecting objections to the erection of poles for h.p. cables to the Holbeach, Long Sutton, and Sutton Bridge districts, by the Boston Electricity Supply Co., Ltd. The line is to carry a pressure of 11,000 V, and as it was to traverse rich arable land it had been designed at considerable additional expense to follow hedge-lines as far as possible. Originally there were eight objectors, but these had been reduced to six. In one case it was suggested that the line might be diverted *via* a roadway, but Colonel Tucker said the Ministry would not agree to h.p. cable on a roadway. It was also asked why the cables could not be placed underground. Colonel Tucker explained that the cost would be three times as much, and the company could not supply Sutton Bridge with electricity at a low cost. As a result of the inquiry several objections were disposed of.

Ilford.—LOAN.—The Corporation Electricity Committee is to apply for sanction to a loan of £5,000 for the free wiring scheme.

Japan.—ELECTRICAL DEVELOPMENT.—The capacity of electrical plant to be installed in Japan during the current year is 340,000 kW, of which 230,000 kW will be installed in hydro-electric power stations and 110,000 kW in steam power stations. At the end of the year the plant installed will total 4,020,000 kW.

Keighley.—NEW PLANT.—The Corporation Electricity Committee has recommended the installation of a new water-tube boiler, &c., and that application be made for sanction to a loan of £8,000 for this purpose.

Kingston.—LOANS SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing by the Town Council of £4,695 for mains, £2,401 for plant, and £7,251 for works consequent upon change of system.

Lichfield.—LOANS.—The Town Council has received sanction to loans of £4,100 in connection with the extension of the mains to Whittington, and £4,407 for excess expenditure. A loan of £2,850 has been applied for for extending the mains to Shenstone.

London.—BATTERSEA.—The Borough Council Electricity Committee is to install electricity services in 125 premises, at a cost of £1,171, extend mains for private services at a cost of £866, and extend mains for public lighting at a cost of £344.

Morocco. — HYDRO-ELECTRIC DEVELOPMENT. — The hydro-electric station which is under construction at Sidi-Said-Machou, about 53 miles from Casablanca, is nearing completion. The works consist of a dam, a tunnel of 4,675 ft., cutting off a loop of eight miles from the Oum-er-Rebia river, and a power station at the mouth of the tunnel. It is estimated that the dam will utilise a head of 11½ ft. of water and allow a maximum flow through the sluicegates and over the spillway of 1,188,799 gal. per sec. The installation should have been finished by the end of 1928, but owing to difficulties in obtaining the necessary labour, the station will not be put into operation until about the beginning of March next. Two turbines will then be in operation, and the other two are expected to be completed by the end of January, 1930. Three turbines will function normally, a fourth will be used as a reserve only, and the average power developed will be 20,000 h.p.

Newton Abbot.—NEW SUB-STATION.—The erection of the new 2,000-V sub-station was completed on December 22nd, and the station was put into commission the following day. The station will supply the growing suburb of Milber, on the outskirts of the town.

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Norwich.—LOANS.—The Corporation Electricity Committee has recommended that application be made for sanction to the following loans: £12,264 for excess expenditure on Thorpe power station; £100,000 for prospective unspecified expenditure on mains and services; £10,000 for transformers; and £5,000 for extensions to offices and workshops at Duke Street.

Pontefract.—INQUIRY.—At the request of the Town Council and the Chamber of Commerce, the Electricity Commissioners have appointed Col. T. C. Ekin to hold an inquiry at Pontefract on January 8th into the alleged excessive charges made by the West Riding Tramways Co., Ltd., for electricity within the borough.

Preston.—LOANS SANCTIONED.—The Corporation has received sanction to a loan of £46,000 for the modification of certain generating plant already installed or under construction, so as to increase the capacity of the Ribble station from 50,000 kW to 60,000 kW. The Electricity Commissioners have also sanctioned a loan of £3,500 for the purchase of property adjoining the Crown Street works.

Réunion.—HYDRO-ELECTRIC INVESTIGATION.—A commission of French electrical engineers is at present in Réunion reporting on the project for the utilisation of the water power available on the island. It is stated that the River Marsouins can furnish power to the extent of 25,000 kW at low water and 40,000 kW in flood periods. The necessary plant for the hydro-electric power station is to be supplied by Germany on war reparations account.

Shoeburyness.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £6,644 for carrying out an electric lighting scheme for the town.

Stoke-on-Trent.—ELECTRICITY SUPPLY.—At a recent meeting of the Corporation Electricity Committee a letter was received from Messrs. Alfred Meakin (Tunstall), Ltd., stating that they had in contemplation the erection of an electrical kiln at their Newfield factory. It was decided that the three-phase e.h.p. main be extended to Newfield Pottery, and that application should be made for sanction to borrow £2,400 for this purpose.

Taunton.—LOAN.—The Town Council has applied for sanction to a loan of £3,000 for meters for the next three years. A scheme for wiring houses on the hire system has been adopted.

United States.—ELECTRICAL DEVELOPMENT.—According to the *Electrical World*, the Utilities Power and Light Corporation of Chicago announces that it will immediately build a steam-electric generating station at Sayreville, N.J., to be owned and operated by its subsidiary, the Eastern New Jersey Power Company. The plant will cost $6,000,000 and will have an initial capacity of 60,000 kW, derived from two 30,000-kW turbo-generators. This capacity will be increased to 180,000 kW in steps of 30,000 kW as the demands for power require its expansion. There will be a coal storage capacity of 60,000 tons. The site adjoins the main channel of the Raritan River, which there has a depth of 15 ft. at low water, permitting coal to be delivered either by water or rail.

West Ham.—LOAN.—The Town Council is to apply for sanction to a loan of £69,300 for the laying of h.p. feeder cables direct from the generating station to the London County Council pumping station, and sub-station equipment.

Tramway and Railway Notes.

Bradford.—RAILLESS CARS.—The Corporation Tramways Committee has recommended the purchase of eleven single-deck and six double-deck railless cars.

Glasgow.—INQUIRY.—The Electricity Commission inquiry into the application by the Corporation for power to install new plant at Pinkston power station will take place on January 29th. It was to have been held on December 18th last, but was delayed owing to the illness of one of the counsel.

Japan.—ELECTRIC RAILWAYS.—The Railway Department reports that on October 1st last there were 92 electric railways in operation in Japan, with an aggregate mileage of 1,218, and 40 others in course of construction, with a total mileage of 134. In addition, 51 charters had been granted for the construction of electric railways, totalling 356 miles, one elevated railway with a length of 20 miles, and two underground railways with an aggregate mileage of 15.

London.—COLLISION.—Traffic was delayed on the Southern Railway on December 27th due to the derailing of one coach of an electric train which came into collision with an empty van train. The Southern Railway issued the following official statement:—"An empty van train slightly touched an electric train, and one of the coaches of the electric train was derailed. It knocked down an overhead girder on the electric system, and another train collided with the girder. The result was that the central section of London Bridge station was closed for about 1½ hours, and electric trains on the central section (the Brighton side) were terminated at New Cross and Peckham Rye. Some trains were diverted to Victoria and others to Charing Cross. The eastern side of London Bridge was not affected. No one was hurt, and no serious damage done."

United States.—RAILWAY ELECTRIFICATION.—The *Electrical World* reports that on December 4th the Great Northern Railway began electrical operation of the entire 80-mile stretch of its main line between Skykomish and Wenatchee, Wash., with the exception of about 10 miles through the new tunnel in the Cascade Mountains. This tunnel is to be opened about January 12th, and after that date the whole 80 miles will be operated by electricity. For eighteen months the Great Northern has been working upon the conversion of the Skykomish-Wenatchee line, and in recent months it has hauled its trains over about 30 miles with electric locomotives.

Telegraph and Telephone Notes.

Australia.—RADIO STATION FIRE.—The costly equipment of the "beam" wireless-telegraph station at Ballan, about 50 miles from Melbourne, narrowly escaped destruction on December 28th, when the roof of the engine-room was destroyed by fire. The fire-fighting equipment of the station proved inadequate, and until the arrival of the fire-engine from Ballarat, two hours after the fire broke out, little could be done to check the blaze, says *The Times*. The fire burned for three or four hours and damaged the generators. It is understood that the transmitter at Ballan was severely damaged by fire and water, and that it will not be available for service for some days. The service is being maintained through the international broadcasting transmitter at Pennant Hills, Sydney, which is being controlled by a land line, 500 miles long, from Melbourne. This station only maintains one circuit, so that simultaneous transmission to Canada and Great Britain is impossible, but the cables will assist to relieve the congestion. The British Broadcasting Corporation's proposed attempt to relay New Year greetings from Australia to listeners in the British Isles had to be abandoned because of the dislocation of the service caused by the fire.

RADIO STATIONS SALE.—The Governor-General, in Council, has approved of the sale to Amalgamated Wireless (Australasia), Ltd., for £39,574 of 25 Government wireless-telegraph stations, which have been operated for the Commonwealth by the company for some time past.

Isle of Man.—RADIO COMMUNICATION.—Wireless communication with the Isle of Man was established on December 29th by the Post Office authorities on two routes between the mainland and Douglas. The service was organised to supplant the submarine telegraph cable, which, for some time, has been yielding unsatisfactory results, culminating in serious difficulty during the Christmas holidays. A wireless-telegraph station at Fleetwood, to establish temporary communication with Douglas, was housed in the hutment barracks on land belonging to the War Office. Direct wireless communication with Douglas was also instituted from the R.E. barracks in Mason Street, Liverpool.

Marine Radio-Telegraphy.—LEGISLATION POSTPONED.—The Merchant Shipping (Convention) Act, which was passed by Parliament in 1914, but has never come into force, has been postponed for another year by an Order in Council. It is now due to come into force on January 1st, 1930, but in view of the fact that many of its provisions are obsolete, and of the International Conference on Safety of Life at Sea which is to be held in London in the spring, it is unlikely that it will ever operate.

Spain.—MADRID-HAVANA WIRELESS SERVICE.—The Council of Ministers approved on December 21st of a scheme for the provision of a wireless service between Madrid and Cuba.—*Reuter* (Madrid).

Transoceanic Telephony.—HOLLAND-EAST INDIES.—A public telephone service between Holland and the Dutch East Indies will be opened on January 8th between Amsterdam, Rotterdam, Utrecht, The Hague and the four leading towns in the East Indies. Dutch Post Office officials have recently been experimentally telephoning all over the world: in addition to conversation with Sydney, New South Wales, says *The Times*, they have lately held successful conversations with South America. The incoming conversations from Sydney were transmitted *via* the Dutch East Indies, and the outgoing calls from Holland were direct from a short-wave sending station at Kootwijk. The South American station worked on 28½ metres, and the transmission from Holland on 18 2/5 metres. The new service will be the third long-distance wireless-telephone link to be established in two years. It was on January 7th, 1927, that the transatlantic service between London and New York was opened to the public. The London trunk exchange acts as the European focus of the

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whole service, and that between Germany and Argentina, opened on December 10th, was at first conducted through British stations, but the service is now operated at the German end from the Nauen wireless station.

United States.—RADIO-TELEPHONY.—The construction of a $100,000 wireless transmitting station has been started at Scobeyville, N.J., by the Universal Wireless Communication Co. for commercial telephony.

Radio Notes.

Australia. — REORGANISATION.—Preliminary recommendations for the reorganisation of the broadcasting services in Australia have been submitted to the Federal Ministry by the Broadcasting Committee. The Ministry will in future provide all stations and equipment, and will lease the right to provide programmes to a single organisation. Class A station leases will be for three years, and it is unlikely that Class B stations will be increased in number, they being auxiliary and obtaining their revenue mainly from advertisement. The scheme is not expected to become effective for some months.

France.—PRIVATE STATION TRANSFER.—Owing to its unfortunate financial position, the Montpellier Radio Club's transmitter has been taken over by the P.O. authorities, says *World-Radio*. It is being installed in the post office, will have an input of 2 kW, and should re-commence operation about the middle of January, its wave-length of 253.1 m. remaining unchanged.

Oscillation.—DECLINE.—The oscillator has been rather forgotten of late, but the British Broadcasting Corporation has been on the watch, and some surprising statistics have been prepared, says the *Wireless World*, showing that oscillation has diminished considerably. From December 1st, 1927, to November 30th, 1928, some 2,037 cases of oscillation were referred by the B.B.C. to the Post Office. Of that number, 1,445 were dealt with by the Post Office engineers, and in nearly 17 per cent. of the cases the fault was found to lie in the complainant's own receiver. During the previous year the proportion was 35 per cent., but at that time only meagre details of each complaint were available. Nowadays every correspondent who complains of local oscillation receives a questionnaire in which every available detail can be tabulated. The total number of complaints dealt with by the B.B.C. during the past year was 9,006. The "curve" was at its highest in January and February, which suggests that new listeners were experiencing difficulty in operating their sets. The lowest mark was reached at holiday time in July and August. The number of anti-oscillation pamphlets issued up to the present is 822,529.

Receiving Licences.—LARGE INCREASE.—An increase of 34,706 receiving licences was registered in November, 1928, in Great Britain, the total being 2,564,516. The increase noted in November, 1927, was 18,000.

Wavelengths.—REVISION.—The allocation of the 113 available wave-lengths among European stations according to the 1925 *plan de Geneve*, framed by the Technical Committee of the Union Internationale de Radiophonie, has not been satisfactory. A new *plan de Bruxelles*, arrived at by majority agreement between the European nations and involving sacrifices by all those unduly favoured by priority in the old plan, will become effective on January 13th, 1929, and British station wave-lengths will accordingly be readjusted as follows:—

PRESENT.			NEW.		
Kilo-hertz.	Metres.	Station.	Kilo-hertz.	Metres.	Station.
192	1,562.5	Daventry 5XX	192	1,562.5	Daventry 5XX
610	491.8	,, 5GB	622	482.3	,, 5GB
740	405.4	Glasgow	748	401.1	Glasgow
780	384.6	Manchester	793	378.3	Manchester
830	361.4	London	838	358	London
850	353	Cardiff	—	—	—
920	326.1	Bournemouth	928	323.2	Cardiff
960	312.5	Newcastle	964	311.2	Aberdeen
980	306.1	Belfast	991	302.7	Belfast
1,040	288.5	Edinburgh	1,040	288.5	Relays and Bournemouth
—	—	—	1,230	243.9	Newcastle

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Army Contracts.—Manufacturers who are not already on any War Office list of tenderers, and who wish to be invited to tender for Army requirements of electrical and wireless stores, cables, electrical plant, scientific instruments, &c., should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, S.W.1, for Form 1, on which formal application for inclusion on the list of tenderers may be made.

Ashford.—January 14th. Electricity Department. One heavy-oil engine to drive a 600-kW alternator, &c. (December 21st.)

Australia.—NEW SOUTH WALES.—February 11th. Department of Public Works. Supply, delivery, erection and maintenance of hydro-electric plant in connection with the Hume Reservoir hydro-electric development. (B.X. 4989.)*

January 21st. Static transformers for Young-Wyangala section of the Burrinjuck hydro-electric development. (B.X. 4995.)

Belgium.—January 8th. Municipal authorities of Saint Gilles, Brussels. 3,320/4,150-kW steam turbo-generator for the St. Gilles power station. Particulars for 5 francs from Service de l'Electricité, 40, Rue de Bethléem, St. Gilles, Brussels.

Brentford.—BOARD OF GUARDIANS.—Installation of electric lift at the West Middlesex Hospital, Isleworth. (See this issue.)

Brentwood.—January 21st. Essex and Colchester Mental Hospital Committee. Wiring Brentwood Mental Hospital. (December 14th.)

Edinburgh.—January 14th. Electricity Supply Department. Boiler feed water de-aerating plant. (December 21st.)

January 18th. District Board of Control. Electric power and lighting installation at Gogarburn, Edinburgh. Specifications from Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

Egypt.—CAIRO.—January 31st. Ministry of the Interior. Diesel engine-driven d.c. generator set. d.c. rotary balancer and accessories for the Kafr El Zayat power station. (B.X. 4931.)*

January 27th. Transformer kiosks, cables and accessories for the extension of electricity supply from Mit-Ghamr power station. (B.X. 4893.)*

Glass Houghton (Yorks.).—January 14th. West Riding Education Committee. Electric lighting installation at Ashton Road Council school and caretaker's house. Specifications, &c., from Education Department, County Hall, Wakefield.

India.—NEW DELHI.—January 8th. Indian Stores Department. Three 12½-kW oil-engine-driven generator sets. (B.X. 4956.)*

January 23rd. Bombay, Baroda, and Central India Railway Co. 400-kW heavy oil engine driven generating set. Specifications from the offices, White Mansion, 91, Petty France, S.W.1 (deposit £1). (See this issue.)

February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

Keighley.—January 17th. Electricity Department. One water-tube boiler (30,000 lb. per hour) with mechanical stoker and superheater. (December 28th.)

Kettering.—January 14th. Electricity Department. Supply and delivery of h.p. and l.p. cables, and transformers. (See this issue.)

Liverpool.—January 31st. Corporation. Supply of various electrical materials. (See this issue.)

London.—ISLINGTON.—January 18th. Electricity Department. Materials for 12 months, including cables, meters, transformers, &c. (December 14th.)

BETHNAL GREEN.—January 14th. Borough Council. Electric lighting and power installations and telephone installation for the public baths and washhouses at Old Ford Road. (December 21st.)

February 18th. Central Electricity Board. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England, and North-West England and North Wales Electricity Schemes. (See this issue.)

New Zealand.—WELLINGTON.—January 29th. Public Works Department. Single core, paper-insulated, lead-covered cable (B.X. 4954.)* 15 sets of earth leakage protection equipment. (B.X. 4950.)*

March 18th. 110,000-V transformers (B.X. 4952)*, 11,000-V switchgear (B.X. 4953.)*

January 15th. Posts and Telegraph Department. Telephone cords. (B.X. 4847.)* Vitreous-enamel phase-indicating plates (B.X. 4927.)*

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February 12th. V.i.r. wire. (B.X. 4951.)*
February 19th. 120,000 galvanised steel spindles for insulators. (B.X. 4948.)*
February 12th. Dry cells for telephone work. (B.X. 4991.)*
February 28th. Telephone cordage. (B.X. 4990.)*
February 28th. Whangarei Harbour Board. One 15-ton electrically-operated level luffing gantry crane. (A.X. 7263.)*
January 31st. Manawatu-Orona Electric Power Board. Automatic reclosing switchgear for pole platform mounting. (B.X. 4988.)*

Norton.—January 14th. West Riding Education Committee. Electric lighting installation at the new school. Specifications, &c., from Education Department, County Hall, Wakefield.

Ripon.—February 1st. Corporation. Works in connection with the proposed electricity supply undertaking as follows:—Contract No. 2: Overhead 11,000-V transmission line. (See this issue.)

Rumania.—January 10th. Ministry of Communications. 17,000 insulators, iron, steel, copper and bronze wire and 11,000 copper coupling rings. (A.X. 7289.)*

South Africa. — JOHANNESBURG. — January 24th. South African Railways and Harbours. Two small d.c. crude-oil generating sets for Maguassi. (B.X. 4943.)*
February 14th. One 15-ton electrically-driven portal titan crane. (A.X. 7272.)*
January 24th. Town Council. Electric cable. (B.X. 4977.)*
January 24th. Oil switches. (B.X. 4994.)*
CAPE TOWN.—January 23rd. City Council. Electric cable. (B.X. 4978.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bolton.—Tramways Committee. Accepted:—
Special crossings, &c.—Hadfields, Ltd.

Brentford.—Board of Guardians. Accepted:—
Intercommunication telephone installation at Warkworth House, Toolands House, and West Middlesex Hospital (£1,115); rewiring the radio installation at the hospital (£100).—Reliance Telephone Co., Ltd.

Chelmsford.—Watch Committee. Recommended:—
Street signal fire alarm system (£257).—Carter & Co.

Ilford.—Electricity Committee. Accepted:—
1,000-kW convertor (£3,235).—Crompton Parkinson, Ltd.
200-kVA transformer (£144).—Foster Engineering Co., Ltd.
Tramways Committee. Recommended:—
New cells for electric tower wagon (£147).—A.F.A. Accumulators, Ltd.
Trolley wire (10 5/8d. per lb.).—British Insulated Cables, Ltd.

Dover.—Electricity Committee. Accepted:—
Switchgear (£640).—Switchgear & Cowans, Ltd.
6,600-V feeder cable (£2,232).—Pirelli-General Cable Works, Ltd.

Essex.—County Health Committee. Recommended:—
Wireless installation at Harold Court Sanatorium (£107).—Chelmsford Radio Co.

Leeds.—Electricity Committee. Accepted:—
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£865); Enfield Cable Works, Ltd. (£1,553); Macintosh Cable Co., Ltd. (£1,178); Greenwich Cable Works, Ltd. (£2,315).
Terra-cotta work for work at Kirkstall power station.—Leeds Fireclay Co., Ltd. (£18,942).
Extension of tram depôt in Swinegate.—Lift and enclosure.—A. P. Steven, Ltd. (£703).

Manchester.—Cleansing Committee. Accepted:—
Electric lighting, Oldham Road depôt.—E. M. Evans and Son, Ltd.
Education Committee. Accepted:—
Electric lighting installation at Johnson Street clinic.—A. Louden.
Electric lighting installation at Plymouth Grove centre and Princes Street Buildings, and alterations to electric lighting installation at Cambrian Street school.—R. Seddon & Sons.

Rugby.—Urban District Council. Accepted:—
Cables (£332).—W. T. Henley's Telegraph Works Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
Concrete tank foundations, retaining wall, pipework, &c., for new cooling tower at Neepsend power station.—James Laver & Sons, Ltd. (£3,524).
Tramways Committee. Accepted:—
500 tramcar tires (£3 6s. 3d. each).—Cammell, Laird and Co., Ltd.

Smethwick.—Education Committee. Accepted:—
Electric fittings at open air school.—Walker & Co. (£96).

Wimbledon.—Electricity Committee. Recommended:—
Pipework for boiler.—Babcock & Wilcox, Ltd. (£374).
Two 4-circuit equipments.—English Electric Co., Ltd. (£202).
Twenty-eight 400/500-amp. l.p. equipments.—George Ellison (£412).
Two 100-kVA transformers.—Foster Engineering Co., Ltd. (£158).
Two 200-kVA transformers.—Hackbridge Electric Construction Co., Ltd. (£237).

Forthcoming Events.

Institution of Mechanical Engineers (Informal Meeting).—Friday, January 4th. Institution, Storey's Gate, S.W. 7 p.m. "The Engineer Salesman Abroad." Major A. W. Farrer.

Royal Institution of Great Britain.—Saturday, January 5th, and Tuesday, January 8th. Institution of Electrical Engineers, Savoy Place, W.C.1. 3 p.m. "Sound Waves and their Uses." Mr. A. Wood.

Exhibition of Industrial Electric Heating Apparatus.—January 7th to 12th. Belle Vue, Longsight, Manchester.

Electrical Power Engineers' Association (London Local Group).—Tuesday, January 8th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Domestic Electrical Appliances, Design, Construction and Efficiency."

Physical Society and Optical Society.—Annual Exhibition of Electrical, Optical and other Physical Apparatus. January 8th to 10th. Imperial College of Science, South Kensington, S.W.

Institute of Wireless Technology.—Wednesday, January 9th. Engineers' Club, Coventry Street, W. 7 p.m. "Picture Transmission." Mr. J. Priechenfried.

Institution of Electrical Engineers.—Thursday, January 10th. Institution, London, W.C. 6 p.m. "A Study of the Future Development of Demand and the Economic Selection, Provision and Lay-out of Plant, as Illustrated by Telephone Systems on the one hand and Power Stations on the other." Capt. J. M. Donaldson and Capt. J. G. Hines.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 7th. University, Liverpool. 7 p.m. "Overhead Electric Lines." Mr. W. B. Woodhouse.

(North-Western Centre).—Tuesday, January 8th. Engineers' Club, Manchester. 7 p.m. "Recent Developments in Electricity Meters, with particular reference to those for special purposes." Mr. J. L. Carr.

(Scottish Centre).—Tuesday, January 8th. Royal Technical College, Glasgow. 7.30 p.m. "The Electrical Equipment of X-ray Apparatus." Mr. L. G. H. Sarsfield.

(Dundee Local Section).—Thursday, January 10th. University College, Dundee. 7.30 p.m. "Static Rectifiers." Mr. W. M. Mackay.

(Meter and Instrument Section).—Friday, January 4th. Institution, London, W.C. 7 p.m. "Precautions in the Use of Standard Instruments." Mr. W. H. Lawes.

(London Students' Section).—Friday, January 11th. Institution, London, W.C. 6.15 p.m. "Telephone Repeaters." Mr. J. A. H. Lloyd.

(North-Eastern Students' Section).—Friday, January 11th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Some Problems in the Design of Pilot Wire Protective Systems." Mr. E. W. M. Scott.

Association of Mining Electrical Engineers (Western Sub-Branch).—Saturday, January 12th. 60, Wind Street, Swansea. "Cables and Control Gear for use Underground." Mr. G. Rutter.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

CRESCENT meters.
PELLEN radiators.
UNIVERSAL imitation glow fires.
UNIVERSAL battery charging clips.

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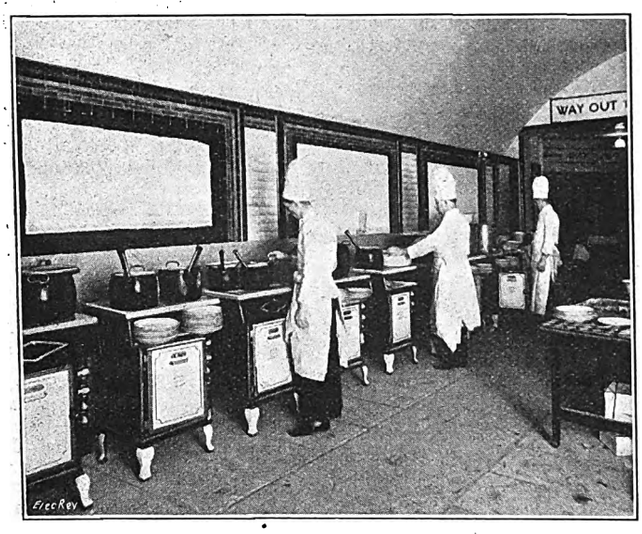
Notes.

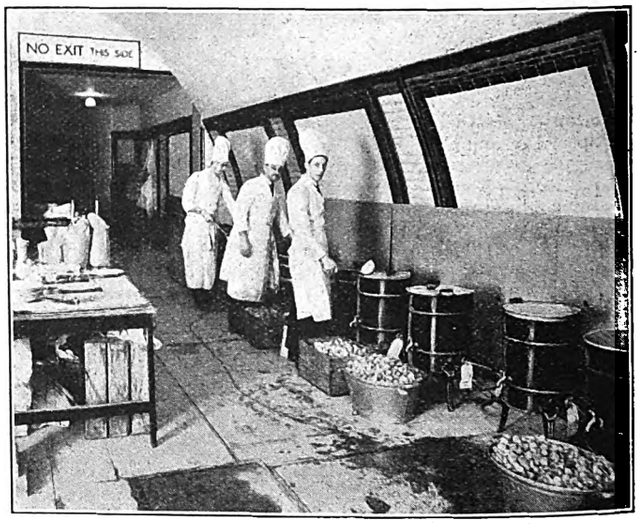
Traffic Control.

Coventry Corporation is giving a trial to an electrical system for the control of traffic by means of automatically operated coloured lights. An installation has been made where the main Birmingham-London road crosses one of the principal thoroughfares of the city. The lamps are placed on posts at each of the four corners, and show a red light for "stop," amber for "caution," and green for "go on." When the red light stops traffic in one direction the green light gives the signal for the crossing traffic to proceed, with a short amber light display before each change. The object of the system is to relieve police constables of point duty, it being claimed that the service can be maintained at a cost of £10 per annum, whereas a point-duty constable costs £400. The trial was begun on December 17th, when it was found that the 20 seconds' period for the red and green lights was too short, and this was doubled with more satisfactory results.

An Emergency Cooking Installation.

Just before the recent opening of the new Piccadilly Station of the London Underground Railways (ELECTRICAL REVIEW, December 14th, 1928), it was decided to give a dinner to all the men engaged upon the work. Electric cooking was decided on for obvious reasons, and Messrs. BELLING & Co. supplied the necessary cookers. Ten of the No. 6 cookers were used, as shown below, each being equipped with an oven 14½ in. high by 13½ in. wide by 14 in. deep, and two enclosed-type fireclay boiling plates, each 8 in. square. The meal consisted of fried fish and fried potatoes, roast beef, boiled potatoes and brussels sprouts, and Christmas pudding. In addition to the cookers a number of electric boilers were employed. They were supplied by the METRO-VICK SUPPLIES, LTD. Two hundred and eighty-seven persons sat down to the meal, and we understand that the excellent quality of the food was commented upon and largely attributed to the cookers.





Belling Cookers and Met-Vick Boilers at Piccadilly Station.

French Rural Electrification.

Great interest has been taken since the 1914-18 European war in the electrification of rural districts in France, and it is not perhaps generally realised what great efforts have been made and how much work has been accomplished in this direction. The French Government has realised to the full the importance of the work and has not been niggardly with the subventions and long-term loans it has granted: in 1920 it granted subventions to the amount of 3½ million francs; in every succeeding year the amount increased until in 1927 it was 150 millions, and in 1928 it reached 180 million francs; long-term loans granted in accordance with the law of August, 1923, total 172 million francs. Taking subventions and loans together, no less than nearly 700 million francs has been granted by the Government, the rest of the total of 2,000 million francs spent on electrification work having been supplied by the departments, communes, farmers interested, and companies holding concessions. At the end of the war in 1918 only 7,000 communes were supplied with electricity: on December 31st, 1927, out of 37,981 communes no fewer than 21,234 were electrified, which represents 55 per cent. of the total number of communes with a population of 32,784,365, or 80 per cent. of the total population of France; in 1927 power systems were installed in over 3,000 communes. Mr. Tardieu, Minister of Public Works, was apparently not exaggerating when he said at the opening of the Puyvalador barrage that if this pace continued, at the end of six years every French village would be electrified.—*Reuter's Trade Service* (Paris).

The Whitworth Society.

The sixth annual commemoration dinner was held at the Holborn Restaurant, London, on Friday, December 21st, with the president, Mr. F. H. Livens, J.P., in the chair. Mr. W. H. Fowler, M.Inst.C.E., Manchester, was elected president for 1929, and will take office at the summer meeting to be held in Manchester next July, during the meeting of the Institution of Mechanical Engineers. It was decided that the date for holding the annual commemoration dinner should be altered, and the next dinner will be held in March, 1930. Six of the scholars of the current year were present as guests, and each was presented with a copy of "The Whitworth Book." Further particulars may be obtained from the hon. secretary, the Whitworth Society, c/o the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1.

Submarine Power Cables in the United States.

A correspondent of *The Times Trade and Engineering Supplement* states that the Interstate Public Service Company recently completed the laying and putting into service of two 15,000-volt submarine cables across the Ohio River, interconnecting the systems of that company and the Louisville Gas and Electric Company. Each cable is a three-conductor 250,000-cir. mil cable, and has the usual lead covering, jute filler, and galvanised steel armour, the over-all diameter of the cable being 2.92 in. and the weight, approximately, 14 lb. per foot. Each was made up and shipped in two 1,400-ft. lengths, and the splices were made while the barge upon which the cable reels were mounted was anchored in mid-stream.

Hackney Technical Institute.

ELECTRICAL ENGINEERING DEPARTMENT.—A short course of about 12 lectures commencing on Thursday, January 10th, will be given at the Hackney Technical Institute on the following subjects: on "Modern Developments in Protective Apparatus," at 6.30 p.m., on "Automatic Control Gear," at 8.10 p.m. Full particulars can be obtained from the Principal at the Institute.

The Boulder Canyon Project, U.S.A.

Commenting on a report of a board of engineers and geologists appointed by the Secretary of the Interior, U.S.A., to examine the proposed site of a dam on the Colorado River at Black Canyon, or Boulder Canyon, *Electrical News Items* quotes the Board as stating that the proposed dam would be by far the highest yet constructed, and would impound 26,000,000 acre-feet of water. If it should fail, the flood created would probably destroy several townships and the levees of the Imperial District, creating a channel into Salton Sea which would probably be so deep that it would be impracticable to re-establish the Colorado River in its normal course. To avoid such possibilities the proposed dam should be constructed on conservative lines. The estimates of the cost of the project as made by the United States Reclamation Service, amounting to $125,000,000, have been revised by the Board as follows:—

Dam and reservoir	$70,600,000
1,000,000 h.p. development	38,200,000
The All-American Canal	38,500,000
Interest during construction	17,700,000
Total	$165,000,000

It is believed that under present conditions of irrigation a continuous output of 550,000 h.p., or one million h.p. on a 55 per cent. load factor, could be maintained even during the years of normal low flow. A fairly rapid irrigation development is, however, to be expected in the entire Colorado River basin, and as the use of water for irrigation increases, the amount of water available for power will decrease. The Board is of the opinion that if the Boulder Canyon project is completed and put in operation, carrying as it does the costs of

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flood protection works and the All-American Canal, it will be impossible to meet operation, maintenance, interest, and a sufficient sinking fund to retire the cost of the project within a 50-year period.

The British Association.

According to *Nature*, members of the British Association who are attending this year's meeting in South Africa will leave Southampton on July 5th, arriving at Capetown on the 22nd. The inaugural meeting will be held on the evening of that day in the City Hall, when the Association will receive an official welcome from the Mayor. The sections will meet in Capetown from July 23rd to 26th and, later, the members will proceed in two parties to Johannesburg, arriving on July 30th and 31st. The Johannesburg section will continue until August 3rd. Some of the addresses of the presidents of sections will be delivered in Capetown and the others, including that of the president of Section G.—Engineering, will be given in Johannesburg. An excellent series of tours has been arranged. Members will leave Capetown on August 7th, arriving at Southampton on the 26th.

The Resistivity of Aluminium.

A meeting was held at the Laboratoire Central d'Electricité, Paris, on November 16th, to consider proposals for the values of the electrical and other qualities of aluminium for transmission lines for recommendation to the International Electrotechnical Commission for adoption. Professor Paul Janet, Director of the Laboratoire Central d'Electricité, presided, and twelve delegates were present, Great Britain being represented by Dr. E. H. Rayner (National Physical Laboratory) and Mr. E. T. Painton (British Aluminium Co.).

The subject has been under consideration for some years, information having been interchanged on a large number of experimental determinations made at the chief national laboratories of the resistivity, density, and other qualities of both hard-drawn and annealed material.

The type of aluminium considered was restricted to hard-drawn material in the form of wire. Annealing usually results in a lowering of resistance of more than 1 per cent. It was decided that it was of first importance to prescribe an upper limit of resistivity with which all commercial supplies of aluminium should comply, as the presence of impurities, if they exceed about 0.5 per cent., is liable to increase the tendency to corrosion; since increase in impurity is accompanied by an increase of resistivity, a limit to the resistivity permissible serves as a limit to the risk of corrosion. It is also necessary to define "hard-drawn" since resistivity increases with increased strength such as would be obtained by cold working, and in consequence resistivity standards must refer to a well-defined range of tensile strength. Agreement was reached on the following lines:—

The resistivity of commercial hard-drawn aluminium wire at 20 deg. C. is not to exceed 2,873 microhm-centimetres. This is to apply to wire before being stranded into a cable; if the wire is tested after having been stranded, an increase of 1 per cent. of the above value is permitted. The wire is required to withstand for one minute a stress of 16 kilograms per square millimetre. The density of aluminium is assumed to be 2.768 at 20 deg. C. The temperature coefficient of linear expansion is 23×10^{-6}. The temperature coefficient of resistance is 0.004.

It was considered desirable to adopt a definite nominal value for the resistance of commercial aluminium, which could be used in designing transmission lines; it would naturally be less than the maximum mentioned above. It was thought that this should be the average value of good material as at present manufactured. In order to obtain information on which such a value might be founded, it was decided to postpone a decision on the subject until after March, 1929, and that in the meantime the countries interested should send the necessary information to the Central Office of the International Electrotechnical Commission.

A Swiss-German Complication.

The erection of the new hydro-electric station at Klingau, in Argovie, has been the subject of much controversy, not only between the Canton and the Confederation, but also between the Swiss themselves. The Canton of Argovie had taken up negotiations with a Westphalian electric company, whereby it was agreed that the latter should aid in the setting-up of the power-station at the junction of the Aar and the Rhine. At first it was stipulated that the Germans should pay half the expenses of installing the plant, and that in return the Forces Motrices of the Rhine and Westphalia should use all the current. But before the protests of other Argovians the authorities were forced to modify their plans, all the more because permission to export Swiss energy must be obtained from the Federal Council, and the Argovian State Council shrewdly suspected that the Government would refuse a permit under the form first conceived. A new arrangement was therefore proposed to the German company. The F.M.R.W. was only to supply 40 per cent. of the cash necessary to set up the works at Klingau, Argovie would find 50 per cent., and a Swiss bank would furnish 10 per cent. Even this, however, did not altogether please, as it appeared that the bank in question was also lending the German company the capital necessary for its participation in the work, and that, once the latter was in full blast, the Westphalians were to have all the electric energy of Klingau, for a period of forty years, at cost price! At this point the Federal Council intervened, recommending the Canton to try and find a more national solution of the problem. Meanwhile the Government had been approaching some of the big electric concerns in Switzerland to see if they could not collaborate and undertake the construction and operation of the Klingau works. But even this arrangement raises difficulties because of the guarantees already given by the Argovian authorities to the Westphalian company. A second scheme has been brought forward whereby the latter would be allowed to join the united collaboration of certain Swiss concerns, but at a much reduced share in both construction and use of current.

Electrical Treatment of Seeds.

In a recent issue of *Electro Farming* are given some interesting notes on the Carr Bennett process of treating seeds electrically, by means of which, it is claimed, extraordinary results have been obtained. The seeds are first steamed or soaked in either warm or cold water to soften the cuticle or outer skin. The time required for this varies according to the size, nature and condition of the seed, and the exact time at which the seeds should be taken out of soak is largely a matter of experience, though 15 minutes is quite a usual time. As a general rule, soft seeds take less time than hard, big seeds. The important point is that the damping of the seeds should extend to the germs or eyes, but not necessarily into the centre of the core of the substance. The seeds are next drained to remove superfluous moisture, and are spread in a single layer on a sheet of zinc or other rustproof conducting metal, so that each seed is earthed by contact with the plate. Next, high-frequency current is applied. The terminal of the high-frequency machine is connected to that of an evacuated glass cylindrical roller. While the discharge is in progress, this roller glows with a red-violet light. It is rolled to and fro over the layer of seeds for from five to fifteen minutes, and when this treatment is over, it only remains for the treated seeds to be air-dried to restore them to their natural condition. The vitality and germination capacity of the seeds is somehow very considerably improved, and in poor soils, without the aid of any manuring, plants have yielded heavy crops. An experiment on peas was arranged. Three plots were marked off for this purpose; the first was horse manured and planted with ordinary seed; the second was cow manured and planted with ordinary seed; the third was left without manure, but was planted with electrified seed. Three-quarters of the total crop came from this third plot.

Fatalities.

An inquest was held at Church Village, near Pontypridd, Glam., on December 27th, on Oswald Morris and his wife, who received fatal electric shocks whilst erecting a wireless aerial. It was stated that Morris was putting the aerial above the roof when the wire came into contact with a 230-V cable. In returning a verdict of "Accidental death," the jury expressed the opinion that "live" wires near a house should be insulated.

A similar fatality occurred at Langwith on December 29th, when Thomas Frederick Bradbury Martin was erecting a wireless pole in his garden. Fastened to the pole was a wire intended to form a stay to support the pole. The wire touched an electric cable serving Langwith and Shirebrook collieries, and Martin received a shock at 6,000 V. He was conveyed to the Mansfield Hospital and died shortly after admission from burns and shock.

Lecture.

At a meeting of the Paisley Association of Electrical Engineers on December 18th, Mr. A. W. Johnston gave a lecture on "Pulverised Fuel," in which he outlined the difficulties which had to be overcome in the development of the new method of firing.

The Lighting Problem in Factories.

A timely article in the December issue of *Industrial Welfare*—the organ of the Industrial Welfare Society (Incorporated) deals with the subject of adequate illumination in factories and workshops. It is pointed out that bad lighting not only injures eyesight, but also reacts on the spirits and the nervous system, besides increasing the risk of accident. A case is cited of an annual record of over 400 accidents being reduced to 150 by the increase of the lighting allowance from 40 to 100 watts per employé, at a cost very far below the amount of compensation saved. The effect of good lighting on the output of work is also shown to be worth many times the cost incurred. The importance of scientific design as regards reflectors, lamps, and spacing is emphasised, and an ingenious fitting which is said to reflect all the light of a gasfilled lamp whilst hiding the brilliant filament is described.

Illumination of Traffic Points in Edinburgh.

A lighting experiment at traffic points where policemen are on duty is to be carried out by the Edinburgh Corporation. It has been found possible to project beams of light from underground of sufficient intensity to produce a form of flood lighting which brings the constable and his movements into the required prominence. The device incorporates four electric lamps, which are secured underneath a manhole cover, measuring, say, 25 inches square, the lamps being protected by sections of thick glass to withstand ordinary traffic. The type of lamp recommended has a maximum voltage of 12 V, so that, when run off the city mains, resistances would have to be interposed, and it is suggested that the resistances should be so disposed as to produce the effect of a foot-warmer for the constable. The Corporation is to give the system a trial.

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Mine Signalling Bells in Parallel.

In a report issued by the Mines Department "On an investigation at the Mines Department Testing Station, Sheffield, of the safety of certified mine signalling bells when connected in parallel," by Capt. C. B. Platt, M.B.E., superintending testing officer, and Mr. R. A. Bailey, Ph.D., investigator (H.M. Stationery Office, price 6d. net) an account is given of further experimental work by which it has been shown that, under certain limiting conditions, certified bells may safely be connected in parallel on a bare-wire circuit. Three methods to diminish the energy of the break-flash at the signal wires to less than that which will cause ignition of the most readily ignitable firedamp-air mixture were investigated, namely, by reducing the battery voltage, by increasing the safety factor of the individual bells, and by limiting the current in the main circuit. The first method is ruled out as very unreliable on account of the differing characteristics obtaining for bells of different makes. The second method is also objected to because, to ensure the safety of a circuit containing several bells in parallel, it is necessary to reduce the resistance of the shunt to a figure comparable with the resistance of the magnet coils themselves. In the third case, the results of the investigation show that, whatever the number of bells connected in parallel (of equal resistances), the added resistance necessary to ensure the safety of the circuit need not exceed one quarter of the resistance of the magnet coils of an individual bell. The only sure way of including the necessary resistance in the main circuit, and of being certain that it will always remain there and function, seems to be to include it as "internal resistance" of the battery. Experiments have shown that a type of battery of sufficiently high internal resistance to ensure the safety of nearly all types of certified bells when used in parallel is the porous-pot Leclanché battery, consisting of cells of three-pint size connected in simple series, provided that not more than one battery of this type is connected in the system. There are one or two types of certified bells which are not safe for use in parallel in indefinite numbers, even with the battery in question, but they require only slight modification to make them so. It should be clearly understood that modifications of the ordinary Leclanché cell, having a relatively low internal resistance, such as the "Carsac" and the "Carporous," as well as so-called dry batteries, are not safe for use with certified bells in parallel when operated from bare-wire signal circuits. The characteristics of certified relays were also examined during the course of the investigation, and it was found that in most instances relays have a safety factor considerably greater than that of certified bells, particularly in those instances where the relay has a high resistance. Nevertheless, it is advised that the same precautions as those recommended for bells should be adopted when relays are connected in parallel in a bare-wire circuit.

Co-ordinating Electricity Supply in Australia.

The Australian Commonwealth Engineering Standards Association has compiled a list of voltages which have been adopted as Australian standards. The eastern and south-eastern coastal area of Australia contains some 90 per cent. of the population of the entire continent, and this area also contains most of the coal and water-power resources. In the course of time there will be a series of generating stations, both steam and water power, extending throughout this area, each one interconnected with those on each side of it. In order that the utmost economy and convenience may result from this arrangement, it has been decided that all such stations shall generate 3-phase alternating current having a frequency of 50 cycles per second, and it has also been decided that wherever practicable the transmission voltage shall be 66,000 V. At present the railways, both in New South Wales and Victoria, are using 25 cycles, a fairly large installation in Queensland has adopted 60 cycles, and the Western Australian Government is using 40 cycles. Fortunately, however, none of these installations will seriously affect the situation, and for industrial purposes 50 cycles is practically the universal standard for the western and south-eastern portions of the Commonwealth.—*Industrial Australian and Mining Standard.*

"A Little Knowledge . . ."

The following consecutive items appeared recently in the "Personal" column of a Kentish paper:—

The relatives of the late ——— wish to thank all kind friends for sympathy and flowers sent.

Accident compensation claims. Advice free and assistance given in genuine cases.—Write ———.

Amateur with very little knowledge of electricity has successfully wired his small house and installed electric lighting set.—He would be pleased to give information to anyone writing to ———, Sevenoaks.

We have, of course, suppressed the identification marks, but otherwise the reproduction is a faithful copy of the original text. We suggest that the notes should be read in the reverse order; then they would aptly serve to point a moral, the trend of which is obvious.

It is bad enough to have amateurs "with very little knowledge" messing about with electric lighting installations, but when they offer to impart their ignorance to others—surely the limit is reached. No doubt the offer is not wholly altruistic; in other words, the advertiser seeks to do the professional contractor out of a job, or jobs. If any doubt has remained in a reader's mind as to the propriety of supporting the registration of contractors—and wiremen—this incident should settle it.

Electricity in Mines.

A report by Mr. Ilsley, electrical engineer of the United States Bureau of Mines, shows that the British regulations covering the installation, inspection, and maintenance of electrical equipment in gassy coalmines provide safer conditions for the mine worker than those in America. Mr. Ilsley declares, however, that in connection with strictly safe equipment in gassy sections there is much yet to be done in both countries. In British coalmines there are no trolley locomotives, whereas statistics recently compiled indicate 11,986 in the United States. Every piece of apparatus and practically every conductor in British mines is earthed by conductor to a plate on the surface; practically no earthing is resorted to in American mines, except to connect the frames of stationary motors to a pipe or rail return within the mine. Alternating current is not used extensively in American mines, but in British mines it prevails, and direct-current circuits are being replaced by alternating-current circuits in a number of mines. The natural conditions in British mines as to grades, faults, thinness of seams, extreme depth of shafts, and the difficulty of properly supporting the over-burden render the installation of electrical equipment much more difficult than in American mines, says the *Manchester Guardian Commercial.*

Institution of Electrical Engineers.

ANNUAL DINNER.—The annual dinner of the Institution will be held on Thursday, February 7th, at the Hotel Cecil, London, at 7 p.m.

Appointments Vacant.

Junior distribution assistant for the Aldershot Gas, Water and District Lighting Co. Station superintendent (£672) for the City of Bristol Electricity Department. Shift engineer for East Grinstead Urban District Council. Resident engineer and chief accountant for Electric Development and Securities Trust, Ltd. (See our advertisement pages to-day.)

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Major J. R. WATSON, O.B.E., who, since the war, has been assistant works manager at Crompton's, Chelmsford, has been appointed accountant with the Crittall Manufacturing Co., Ltd.

Mr. CHAS. HARBON, of Stoke-on-Trent, for eight years chief of the electrical staff of the Lilleshall Coal Distillation Co., Shropshire, has been appointed engineer and manager of the electricity supply undertaking at Budleigh Salterton, Devon.

Mr. R. WILSON EDWARDS has been appointed chief engineer to the New Hucknall Colliery Co., Ltd., Mansfield, Notts., and has consequently resigned his position on the staff of Messrs. D. Selby Bigge & Co., Glasgow, with whom he has been connected for the past 29 years.

Mr. H. C. PARSONS, sales engineer with Messrs. Newtons of Taunton, is leaving after over 20 years' service to take up an appointment with the British Electrical and Allied Manufacturers' Association. He has been presented by the staffs at Taunton and the London office, to which he was recently transferred, with an eight-day clock.

Lady LODGE, wife of Sir Oliver Lodge, F.R.S., has been ill for some time at Normanton House, Lake Salisbury, and toward the end of last week her condition was causing anxiety. Later reports record improvement.

As a token of esteem Mr. H. P. STOKES, transport manager to the Plymouth City Council, has been presented by the management committee of the Tramways Social and Benefit Fund with a case of pipes and a tobacco pouch.

Congratulations to Capt. J. COXON, M.I.E.E., of the Post Office Engineering Department, who was transferred from London to Birmingham in December, 1926, as power engineer for the North Wales District, on his promotion to the position of executive engineer, Technical Section; he will be stationed at Shrewsbury.

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Mr. J. R. MORRIS, for many years sole representative in the British Isles for "Columbia" carbon products, is visiting the various factories in the United States of the National Carbon Co. during January and February. The National Carbon Co., Inc., is an important unit of the Union Carbide Corporation, and it specialises in the production of dry-cell batteries, brushes, and all types of carbons.

Mr. T. W. DAVENPORT has retired from the position of superintendent of the Edinburgh and Leith department of the Eastern Telegraph Co.

Mr. W. J. JONES, M.Sc. (Eng.), A.M.I.E.E., who has been on the staff of the E.L.M.A. Lighting Service Bureau for some years, has now been appointed manager of that Bureau in succession to Mr. W. E. Bush, who, as already announced, has taken up other work. Mr. Jones received his training under the late Dr. S. P. Thompson at Finsbury Technical College; subsequently he had experience in the X-ray and Appliances Department, also in the Electric Lamp Department, of Messrs. Siemens Bros. & Co., Ltd. Later he was in charge of the works of A. C. Cossor, Ltd., which post he vacated to join the Lighting Service Bureau staff. He is a member of the Council of the Illuminating Engineering Society.

Obituary.—MR. JOHN LEE.—The death of Mr. John Lee, O.B.E., M.A., &c., occurred suddenly on December 24th while on board the *Laconia* on his return journey from New York, where he had been on a visit connected with the business of the Automatic Telephone Co., of which he became a director when he retired last year from the post of Controller of the Central Telegraph Office. Mr. Lee was born in 1867, and as a boy he entered the Post Office service at Liverpool, subsequently rising from the position of telegraphist to assistant superintendent, assistant traffic manager for telephones (1907), and in 1916 being promoted to the post of Inspector of Telegraph and Telephone Traffic. Three years later, after a brief period as Postmaster at Belfast, he came back to London as controller of the Central Telegraph Office. He had a very full, varied and efficient life in the service. A mere list of the matters in which he was called to figure more or less prominently emphasises the valuable work which an enthusiastic and able man can render during 40 to 45 years. His record comprises the reorganisation of the Indian Railway Telegraph system, membership of the Committee on High Speed Telegraphy, and membership of various delegations to the U.S.A. and to the Continent, including the International Telegraph Conference in Paris over which he presided. He wrote a number of books on telegraph and telephone practice and other subjects, was interested in the principles of scientific management, was profoundly concerned with religious questions and modern movements connected therewith, attended many industrial conferences, was a most acceptable speaker and lecturer and a writer for the Press, while administrative and organising ability and a striking personality also form parts of the outline record of the interests and achievements of one who, according to those who knew him best, was a remarkable man, whose ceaseless industry unfortunately permanently impaired his health, so that he has passed away as a result of a heart attack at the age of 61 years. A Memorial Service was to be held yesterday (Thursday) at Christ Church, Newgate Street.

MR. T. H. MORRIS.—We regret to record the death of Mr. Thomas Harold Morris, of Stretford, Manchester, secretary of Messrs. Ferranti, Ltd. Mr. Morris, who was 45 years of age, was in London on business on Wednesday, December 19th, but after leaving his luggage at his hotel he was not seen again until his body was recovered from the Thames two days later. At the inquest on December 24th, Mr. Morris's brother said that the deceased gentleman suffered from headaches and illness after long journeys. He might have become unwell and after taking his usual remedy, have gone to seek fresh air on the Embankment and somehow fallen into the water. A director of the company testified to the high esteem in which Mr. Morris was held. A verdict of "Found Drowned" was returned, the coroner remarking that there was nothing to suggest either assault or suicide.

DR. DAWSON TURNER.—We regret to record the death of Dr. Dawson Turner, on Christmas Day, at the age of 71; since 1896 he had specialised in X-ray work, at the Edinburgh Royal Infirmary, and like so many other pioneers he paid the penalty, losing several fingers and an eye. Dr. Turner carried out much valuable research work, and developed means for protecting operators and patients from injury by X-rays; he was also an inventor and the author of works on medical electricity and allied subjects.

MR. A. T. HOLLINGSWORTH.—We regret to record the death, in his 82nd year, of Mr. Alexander T. Hollingsworth, who well back in the nineteenth century bought the journal *Engineering* from the late Mr. Zerah Colbourn, and took into partnership Messrs. W. H. Maw and James Dredge, who were conducting the paper. Mr. Hollingsworth had outlived both of these gentlemen, who, along with him, had witnessed and were responsible for, the growth and rise of our esteemed contemporary, which has long occupied a position in the front rank of British technical journalism. Mr. Hollingsworth died on December 31st at his residence at 2, Belsize Grove, Hampstead.

MR. F. R. EDWARDS.—The sudden death is announced, at the age of 50 years, of Mr. Frederick Richard Edwards, electrical engineer, who was in business in St. Albans as the Herts. Electrical Co.

MR. D. FULTON.—The death has taken place at Montevideo, where he was supervising the installation of telephones, of Mr. David Fulton, who took a prominent part in the transfer of the undertaking of the National Telephone Co. to the Government.

Will.—The late Sir HORACE DARWIN, F.R.S., a director of the Cambridge Scientific Instrument Co., Ltd., left £100,919 gross and £91,886 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

W. M. Syndicate, Ltd.—Private company. Registered December 24th. Capital, £2,500 in 1s. shares. Objects: To adopt an agreement with Capt. M. Trouton for the purpose of acquiring his interests relating to royalties under an agreement dated March 5th, 1928, between him and Wireless Music, Ltd., and to carry on the business of manufacturers of and dealers in wireless, loud speakers, and other apparatus, motor horns, gramophones, &c. The subscribers (each with one share) are: F. H. Rover, 31, Alloa Road, Goodmayes, Essex, company secretary; G. Warner, 4, Talbot Road, Alexandra Park, N.22, accountant. Solicitors: Lawrence, Messer & Co., 14, Old Jewry Chambers, E.C.2.

Rogers-Jenkins & Company (Proprietary), Ltd.—Particulars of this company were filed on December 14th pursuant to Section 274 of the Companies (Consolidation) Act. The capital is £100,000 in £1 shares. The company was incorporated in South Africa to acquire the goodwill and other assets of the business of a mechanical, electrical, and contracting engineer carried on by A. Rogers-Jenkins as Rogers-Jenkins & Company, Durban. The registered office is in Natal. The British address is at 21, Chiswell Street, E.C.1, where H. F. Adams is authorised to accept service of process and notices on behalf of the company. The directors are: A. Rogers-Jenkins, 409, Musgrave Road, Durban, merchant; I. H. Pierce, Kubuta, Swaziland, farmer; G. H. Cotton, 64, Cotswold Drive, Johannesburg; G. A. F. Brett, 338, St. Thomas Road, Durban, solicitor; and H. F. Adams, 35, Manor View, London, N.3.

Simpson, Baker & Co., Ltd.—Private company. Registered December 27th. Capital, £20,000 in £1 shares. Objects: To acquire the business of electrical suppliers, factors and agents, carried on by C. M. Simpson and A. C. Baker at 2-5, Nelson Street, Bristol, and at 32, Newman Street, Marylebone, London, as "Simpson, Baker & Co.," also to carry on the business of manufacturers of and dealers in telegraphic, telephonic, and radio apparatus, &c. The subscribers (each with one share) are: C. P. Dawes, East View, Hillcrest Avenue, Edgware, company secretary; V. E. T. Daniel, 183, Lauderdale Mansions, W.9, clerk. Solicitor: C. E. Edwards, 16, St. Andrews Crescent, Cardiff.

Stotts Wire-Covering Machines, Ltd.—Private company. Registered December 24th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with Lottie Stott and N. Stott, to develop and turn to account the business of an inventor and producer of wire-covering machines carried on by Lottie Stott at Sorrel Bank Works, Pendleton, Manchester, and to carry on the business of manufacturers of machines, mechanical contrivances and apparatus, manufacturers of and dealers in metal, wire and materials for the insulation of wires or other electrical conductors, &c. The first directors are:

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Mrs. L. Stott, "Sunnyside," Cavendish Road, Eccles, near Manchester; H. N. Allott, 20, Cromwell Road, Stretford, near Manchester, consulting civil engineer; S. A. N. Deluce, 1, Duffield Road, Irlams-o'-th'-Height, near Manchester, engineer. Registered office: 323, Bolton Road, Irlams-o'-th'-Height, near Manchester.

Fromray Parent Co., Ltd.—Private company. Registered December 22nd. Capital, £120 in 20 "A" and 100 "B" shares of £1 each. Objects:—To acquire from V. C. From the benefit of certain existing inventions and discoveries relating to the use of electricity, &c. The directors are:—C. D. Rowley (chairman), 15, St. James's Place, S.W.1; V. C. From, address not stated. Solicitors: Boyce, Evans & Sheppard, 14, Stratford Place, W.1.

Rotor Electric, Ltd.—Private company. Registered December 22nd. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers, importers and exporters of, and dealers in gramophones, phonographs, and other sound-producing or musical instruments and radio, television and electrical apparatus, &c. The directors are:—M. Holzman, 16, Queen's Road, Hendon Central, N.W.4; Madeline B. Holzman, 24, Parkfields, Hendon Central, N.W.4. Registered office: 34, Kingsway, W.C.2.

Dual Motors, Ltd.—Private company. Registered December 19th. Capital, £20,000 in £1 shares. Objects:—To carry on the business of manufacturers, repairers, importers and exporters of or dealers in electrical, clockwork, and other motors, engines, springs and articles for gramophones, &c. The subscribers (each with one share) are:—R. A. Parkin, 18, Dilston Grove, S.E.16, solicitor's clerk; A. W. Pears, 6, Colchester Avenue, Manor Park, E.13, solicitor's clerk. Registered office: 86, New Bond Street, W.

Phos Development, Ltd.—Private company.—Registered December 18th. Capital, £4,050 in 4,000 preferred shares of £1 each and 1,000 deferred shares of 1s. each. Objects: To undertake and engage in the improvement, development, and exploitation of any inventions, patents, and secret processes relating to "Television," and to carry on the business of importers and manufacturers of, agents for and licencees of gramophone records, television, electrical and wireless apparatus, &c. The directors are: Dr. C. Ruzicka, 3, Hope Terrace, Middle Lane, Hornsey, N.8; J. A. Seddon, 12, Woodbury Gardens, Finchley, N.12; A. J. Harvie, 96, Piccadilly, S.W.: A. J. Clark, The Old Friary, Wraysbury, Bucks.; Capt. H. Pearce, 8, Garway Road, W.2; Capt. J. T. Rees, "Fairlawn," Banstead, Surrey. Secretary, S. O. Garrett. Registered office: 68, Victoria Street, S.W.1.

New Era Wireless and Electrical Co., Ltd.—Private company. Registered December 19th. Capital, £500 in £1 shares. Objects: To acquire as from January 1st, 1929, from Gladys E. Green, the business known as the New Era Wireless and Electrical Company, and to carry on the business of manufacturers, buyers, sellers and hirers of electrical and wireless apparatus of every description, gramophones, musical instruments, &c. The first directors are: C. H. Cohen, engineer, and Mrs. G. Green, both of Ingoldsby, Coventry Road, Sheldon, near Birmingham. Registered office: 3, Hobmoor Road, Small Heath, Birmingham.

Official Returns of Electrical Companies.

Carlisle and District Transport Co., Ltd. (formerly City of Carlisle Electric Tramways Co., Ltd.).—Trust deed dated December 18th, 1928, to secure £60,000 prior lien mortgage debenture stock, constituting a specific charge upon the company's tramways, lands and buildings in Carlisle, and upon all shares held by the company in Richard Percival, Ltd., and a first floating charge upon the company's undertaking and property, present and future, including uncalled capital. Trustees: J. Harrison, Lloyd's Bank Buildings, King Street, Manchester; and A. Maconachie, 2, Dr. Johnson's Buildings, Temple, E.C.4.

Alderley and Wilmslow Electric Supply, Ltd.—Satisfaction in full on July 1st, 1928, of first mortgage debentures dated July 19th, 1900, and May 24th, 1911, securing £15,000. (Notice filed December 20th.)

S. G. Leach & Co., Ltd.—Debenture dated December 3rd, 1928, to secure all moneys not exceeding £3,000, charged on the company's undertaking and property, including uncalled capital. Holders: M. W. Woods, Ltd., Denmark Street, Colchester. (The above charge ranks in priority to debentures already registered.)

British Electrical Reproduction Co., Ltd.—Debenture dated November 29th, 1928, to secure all sums due or to become due not exceeding £500, charged on the company's undertaking and property, including uncalled capital. Holder: G. E. Myers, 88, Kingsway, W.C.2.

Radio Company of Great Britain, Ltd.—Capital, £100 in £1 shares. Return dated September 25th, 1928. All shares taken up. £100 paid. Mortgages and charges, nil.

Epoch Radio Manufacturing Co., Ltd.—Debenture dated November 1st, 1928, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Freda B. Laserson, 88, Woodstock Avenue, Golders Green, N.W.

Hendon Electric Lamp Co., Ltd.—Capital, £1,995 in 1,900 preferred ordinary shares of £1 each and 1,900 deferred founders' shares of 1s. each. Return dated June 26th, 1928. 1,406 preferred ordinary and 1,900 deferred founders' shares taken up. £801 paid, £700 considered as paid. Mortgages and charges, nil.

A. Cunningham & Co. (Manchester), Ltd.—Capital, £4,000 in £1 shares. Return dated September 27th, 1928. 1,057 shares taken up. £586 (£1 on 537 and 2s. on 500) paid. £20 considered as paid. Mortgages and charges, nil.

Western Counties Electrical and Engineering Co., Ltd.—Capital, £6,000 in 3,000 preference and 3,000 ordinary shares of £1 each. Return dated September 27th, 1928. 2,015 preference and 2,026 ordinary shares taken up. £1,211 paid on 611 preference and 600 ordinary shares, £2,830 considered as paid on the remainder. Mortgages and charges, nil.

Delabole Electric Lighting and Supply Co., Ltd.—Satisfaction in full on September 10th, 1928, of mortgage dated September 18th, 1915, securing £200.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the extent of £6,965 on December 11th, 1928, of debenture stock secured by trust deed dated June 28th, 1905, and supplemental deed of acknowledgement dated June 12th, 1907, securing £200,000.

Rushden and District Electric Supply Co., Ltd.—Issue from September 25th to December 11th, 1928, of £2,500 debentures, parts of a series already registered.

Bayliss, March & Newey, Ltd.—Debenture dated December 14th, 1928, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital (subject to prior charge dated July 12th, 1927). Holder: J. S. Cooke, 31, Solihull Lane, Hall Green, Warwickshire.

City Notes.

Foundation Co., Ltd.

The annual meeting was held on December 28th. Mr. J. G. B. Stone (chairman), who presided, reviewed the accounts, and said that although the results had not been quite so good, they could be considered satisfactory. The short-term notes fell due at the end of 1929, and when dealing with their repayment the directors proposed to provide additional funds in a more permanent form, and generally readjust the capital. In their general engineering department they had expanded considerably in connection with the erection of overhead lines under the Government "grid" scheme. The new office building which the company was erecting for the Underground Railway Company was nearing completion. While they had retained and probably improved their position as contractors for the erection of super power stations, the delays inevitable from Government control had made the year disappointing, and in respect of general heavy engineering work competition had increased because of the unexpected reduction in demand, but they had specialised in comprehensive works where mechanical and electrical engineering could be combined with civil engineering, not only in respect of electric generating plant, but also in general factory construction, and to-day they believed that they had an organisation almost unique in that respect, which they hoped to utilise to advantage when industrial development became more general.

Adelaide Electric Supply Co., Ltd.

At the recent annual meeting in Adelaide, the chairman (Mr. J. K. Samuel) said that the changing over of the system of supply was proceeding, but the full effects would not be felt until the completion of the work in about two years' time. Delivery of a new 15,000-kW turbo-alternator was expected early in 1929, and a further 10,000-kW set had been ordered for delivery in April; the latter would replace two old 5,000-kW sets. During the past year their sales of electricity for domestic purposes had increased by 23 per cent. The company was keeping a watchful eye upon the development of the use of pulverised coal and liquid fuel for boilers. He concluded by stating that the board proposed to create 250,000 6½ per cent. "C" cumulative preference shares, raising the company's capital to £3,000,000. These would be offered to existing shareholders in Adelaide and London in the proportion of one to eleven. The accounts were passed and the increasing of the capital was sanctioned.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Atlas Light & Power Co., Ltd.—114,789 ordinary shares of £1 each, fully paid, Nos. 2,635,212 to 2,750,000.

Underground Electric Railways Co. of London, Ltd.—21,239 ordinary shares of £1 each, fully paid, Nos. 6,428,722 to 6,449,960.

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Manx Electric Railway Co.

The directors report a gross profit of £42,007 for the year ended September 30th (against £40,508 in 1926-27). The net working profit rose from £10,867 to £12,515. To this is added £878 brought forward, making £13,393. After deducting debenture interest, &c., there remains £3,641, which it is proposed to carry forward. The number of passengers carried rose from 549,604 to 593,129.

Commonwealth Power Corporation.

The gross earnings of this corporation and its subsidiaries during the year ended November 30th last were $58,066,062 (against $52,837,951), and the amount available for dividends was $16,015,874. Regular quarterly dividends of 1½ per cent. on the 6 per cent. preferred stock and 75 c. per share on the common stock have been declared.

International Telephone and Telegraph Corporation.

To finance the purchase of the United River Plate Telephone Co., Ltd., and for other purposes, the Corporation is making an issue of 10-year convertible 4½ per cent. gold debenture bonds. Holders of the bonds will be able to exchange them for common stock at the rate of $200 per share up to July 1st, 1932, or thereafter at a higher rate.

Marconi International Marine Communication Co., Ltd.

The resolution for the alteration of the company's articles of association to ensure that the British control of the company shall be maintained was duly confirmed at an extraordinary general meeting on December 31st.

Crompton-Parkinson, Ltd.

The directors announce their intention of redeeming the whole of the outstanding first mortgage debentures on June 30th at the rate of 105 per cent.

German Companies.

The accounts of the *Siemens and Halske A.G.* for the year ended September 30th, 1928, show net profits of 18,450,000 marks, as compared with 18,851,000 marks in the previous year; the dividend is increased from 12 per cent. to 14 per cent. The net profits were arrived at after writing off 597,000 marks for depreciation (748,000 marks in 1926-27) and applying 4,550,000 marks to legal social welfare purposes (3.57 millions in 1926-27), and 2.79 millions (2.35 millions) to voluntary social welfare objects.

The accounts of the *Siemens-Schuckert Company* show the following appropriations for the year ended September 30th, 1928: Depreciation, 1,690,000 marks (1,430,000 marks in 1926-27); legal social burdens, 8,000,000 marks (6,120,000 marks); and voluntary social welfare purposes, 5,860,000 marks (5,090,000 marks). The net profits are returned at 16,560,000 marks, as compared with 14,780,000 marks in the previous year, and the dividend rises from 9 per cent. to 10 per cent.

French Companies.

The *Compagnie des Exploitations Electriques* has declared a dividend of 20 fr. per share out of net profits of 3,955,000 fr. for 1927-28.

The *Société Financière Electrique* reports net profits of 11,632,000 fr. for 1927-28 and is paying dividends of 40 fr. on the old preference shares, 15.65 fr. on the new preference shares, and 8.55 fr. on the ordinary capital.

The *Société pour l'Equipement Electrique des Véhicules* reports gross profits of 2,011,000 fr. for the year ended in September as compared with 801,000 fr. in the previous year. The dividend is maintained at 30 fr. per share.

The *Société Industrielle des Téléphones* records net profits of 7,480,000 fr. for 1927-28 (against 10,139,000 fr.); the dividend is 24 fr. per share. Authority has been given to make an issue of bonds up to an amount of 30,000,000 fr.

Stocks and Shares.

MONDAY EVENING.

THE year 1928 will stand out in the chronicles of the Stock Exchange as being one that witnessed very unusual activity in stocks and shares of companies connected with industry and commerce. It is generally the case that a year produces, if not a boom, at all events a semblance of one, in some particular market or a particular group in that market. The twelve months that have just closed brought a remarkable amount of animation and an extraordinary list of rises in the stocks and shares of companies connected with industrials. Money has been tolerably easy during the period, the Bank rate not having varied from 4½ per cent. since April, 1927, and this in spite of the fact that money several times in New York, where gambling reached a point akin to madness, rose well into double figures.

Capital and New Issues.

It may at first sight appear anomalous that during a time when national trade was far from flourishing, and its progress has been disappointingly slow, there should have been this excitement in Stock Exchange markets, though it requires no great perception to see how the mere fact of trade being quiet acts as a stimulus to Stock Exchange investment and speculation. If capital is unable to find profitable outlet for its use in the world of commerce, it is bound to seek such channels as those which the Stock Exchange offers for its employment. Hence it happens that speculative activity may, and probably will, synchronise with sluggishness in the chief national arteries of trade. Luxury, entertainment and amusement, new processes in coal and other branches of industry, have proved so popular amongst capitalists that scores of new companies were formed, during 1928, and their shares secured ready response in most cases.

Strength to Strength.

The year has been one in which the principle of amalgamation, working agreements, and absorption, made giant strides. Some of the older combinations of pre-war days look puny compared with the schemes that are now accepted as being almost commonplace. It is frequently remarked that whereas before the war the ordinary man thought in hundreds, he now thinks in thousands or tens of thousands, this applying to financial operations more particularly. Nevertheless, apart from the check imposed upon confidence by a sharp fall in a specialised group of shares, brought about by the death of Mr. Alfred Loewenstein, the year has suffered comparatively few reactions of any moment. Stock Exchange prices have gone from strength to strength, and the end of 1928 finds extraordinary rises in a number of securities which nobody suspected beforehand enjoyed that speculative flavour which would commend them to the operator in stocks and shares, or would provide their holders with more than a steady income on the money. The unexpected has happened, and, to take one example, the Eastern Telegraph group has appreciated in value to such an extent that people who held the shares this time last year, and who continue to retain them, are very much better off than they were on last New Year's Eve.

Cable Stocks and Shares.

In presenting our usual tables of price comparisons for the twelve months, the Eastern Cable group deserves first consideration, by reason of the increment in value which has occurred in the quotations for the stock and shares. Whereas Eastern ordinary lost 32½ points in the year 1927, this has not only been recovered, but the present price is no less than 127 points higher than it was twelve months ago. Eastern Extensions shed over £3 in 1927: in 1928 the price rose from 15 to 27⅞. We set out the exact comparisons in the following table:—

CABLE STOCKS AND MARCONIS.

Stock or share.	December, 1926.	1927.	Now.	Rise.
Anglo-American pref. ...	101	93½	103½	10
Eastern Extension	17⅞	15	26¾	11¾
Eastern Telegraph	177½	145	267½	122½
Globe ordinary	18½	14¾	25¼	10¾
Great Northern	27	38¼	34¼*	—
Indo-European	47½	40	47½	7½
Marconi	13/9	37/6	78/9	41/3
Western Telegraph	17¼	14	26¾	12¾

* Ex bonus.

It is hardly necessary, except for the sake of future reference, to do more than mention that this advance in cable stocks has been due to the Government's decision to enter into partnership with the cable and wireless companies. A Bill has been promoted in Parliament, and is within easy reach of receiving the Royal Assent, which, under the title of the Imperial Telegraphs Bill, will consolidate the interests of the private companies and of the Government beam system.

The Wireless Whirligig.

The effect upon Marconis has been just as dramatic as in the case of the cable issues. From 37s. 6d., Marconis rose almost without a break to 85s., and, although reaction occurred from the top, the price at 78s. 9d. has more than doubled within the twelve months. Canadian Marconis have undergone yet more extraordinary fluctuations, the price at this time last year being 9s. 9d., and rising, in November, to £6 a share for about half-an-hour one night in Throgmorton Street dealings, when the pressure to buy from America became particularly acute. The boom subsided more quickly than it arose, and the shares went back to 30s. within a few weeks. Marconi Marines have made similar progress, and the current price of 3⅝ compares with 30s. last New Year's Eve. The wireless market, as a whole, has attracted its full share of popular speculative interest, and American buying was very persistent on various occasions.

London Electricity Supply.

The market for electricity supply shares shows moderate rises in the values of the principal London companies, whose tenure under present conditions runs out in 1931 or thereabouts, to be replaced by a fresh set of conditions under the London Electricity Supply Acts. This has the effect of turning the shares into what the Stock Exchange technically calls money stocks. They are perfectly sound investments, but the prospect of appreciation in price holds out so little of promise, having regard to the lowering of the dividends in the fairly near future, that the shares are left to the investor who is content with a useful return upon money invested in sound

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industrial undertakings. The County of London stands in a different position from the others, hence the very considerable rise that has occurred in the price of the ordinary shares. This has been assisted by the advance in Bournemouth and Poole, and in shares of other subsidiary undertakings. Metropolitans have also gone ahead, there being a persistent rumour at one time to the effect that Americans were endeavouring to buy for control purposes. Apart from these two exceptions, it will be noticed that the group, while showing satisfactory increase in capital appreciation, presents no striking points of interest.

ELECTRICITY SUPPLY SHARES.

Ordinary.	December. 1926.	1927.	Now.	Rise.
Brompton	1½	24/6	27/-	2/6
Charing Cross	25/-	26/-	26/6	6d.
Chelsea	25/-	25/6	27/-	1/6
City of London	42/6	30/-	30/9	9d.
County	26/-	28/6	44/6	16/-
Kensington	24/-	25/6	26/6	1/-
London	24/-	25/-	26/-	1/-
Metropolitan	39/6	30/-	46/3	16/3
St. James'	24/-	26/-	27/6	1/6
South London	24/6	25/6	27/6	2/-
Westminster	24/6	25/6	27/-	1/6

Tube Railways.

It has been a bad year for railways as a whole, although a good deal of money has been spent on electrical plant, &c., by the steam companies. The Tube Railways have come out well, Underground Electric Railways of London advancing substantially, both as regards the shares and the income stock, in consequence of the increased dividend paid on the former, and the option which the income stock now has of conversion into the "A" shares at £1 1s. each. The newly-introduced sport of greyhound racing has not made much further progress, and Metropolitan Consolidated, which was expected to benefit by the new amusement, has slipped back some five points, although, on the other hand, Districts have risen 14½. This table shows the net movements of the year :—

RAILWAY STOCKS AND SHARES.

Stock or share.	December, 1926.	1927.	Now.	Rise.
Central London ord. ...	69	71	73	2
Metropolitan	63	70	65	−5
District	53½	66	80½	14½
Underground "A" ...	12/-	19/6	26/6	7/-
Underground Income ...	103	105	126	21

Tramways.

In regard to the tramway shares, a fairly general advance has taken place by reason of the steps taken towards the unification of traffic control in London. London United Tramways 4 per cent. debenture at 61 is 7½ up on the year, and compares with 42½ at the end of 1926. London and Suburban Traction preference at 13s. have gained 5s. Mexico Tramway fives at 79 are 7 points higher, and Mexican issues as a whole show improvement. Brazilian Tractions have been moving in spectacular fashion. The shares were subdivided early in the year, and the present price of 77½ is equal to 310, as against 224 a year ago. Looking back a little further, it may be recalled that Brazilian Tractions stood at 80 in December, 1925. British Electric Traction deferred stock at 615 is 115 points higher on the year.

The Manufacturing Group.

Manufacturing companies' shares have been in fairly steady request throughout the greater part of the year. It is said that in some cases Americans have been endeavouring to acquire control through purchase of shares, but official statements have been made to satisfy the desire that the companies should remain British. The year has made it evident that the principle of co-operation adopted by some of the leading companies is working satisfactorily. Here are half-a-dozen companies for the purpose of comparing twelve months' prices :—

Share.	December, 1926.	1927.	Now.	Rise or fall.
Babcock	2⅝	3⅛	3½	+ ⅜
British Aluminium ...	48/-	45/6	2¼	− 6d.
Callender's	3 7/16	3 15/16	4 1/16	+ ⅛
General Electric ...	31/-	33/6	43/9	+10/9
Henley's	4⅜	5⅛	5¾	+ ⅝
India-Rubber	21/3	13/9	11/3	− 2/6

It may be noticed, by those who are curious in such matters, that in these lists of comparative prices there are 26 rises and only three falls. The quotations were taken as being representative, and with no intention to emphasise advances against declines. The proportion of the former is as striking as it is typical of the general trend of movements during 1928 in most industrial stocks and shares. It is with very cordial wishes that the same pleasant process may be continued in a Happy New Year to readers of these paragraphs that this last line is written in the closing hours of 1928.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1926.	1927.	Price Dec. 31, 1928.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14†	15	8⅜	+1/16	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 8
City of London	1	10	10	30/9	—	4 16 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	38/6	—	4 3 0
County of London	1	7½	7½	44/6	+6d.	3 7 9
do. do. 6% Pref.	1	6	6	23/6	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	50/9	—	4 6 8
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	46/3	+1/16	3 18 0
do 4½% Pref.	1	4½	4½	17/6xd.	+4½d.	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power	1	—	15	2	—	... ..
Newcastle-on-Tyne Ordinary ...	1	5	6	26/3	—	4 11 5
do. 7% Pref. ...	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾xd.	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/6	—	5 1
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	36/9	—	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 3 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	35/-	—	4 11 5

†4% of which was tax free.

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	73	—	5 9 7
Metropolitan	,,	3	3	65	+½	4 12 4
do. District	,,	3½	4	80½	—	4 19 5
Underground Electric	£1	1½	5	26/6	—	3 15 7
do. do. Income ...	Bonds	6	6	126	—	4 15 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	+1	5 16 0
do. Def.	,,	1½	1½	25¼	+⅛	5 18 10
Automatic Telephone	1	10	10	2 1/16	—	4 16 10
Eastern Extension	10	10	10	26¾	+⅝	*3 15 0
Eastern Tel. Ord.	Stock	10	10	267½	+5½	*3 15 0
Globe Tel. and T. Ord.	10	10	10	25½	+¼	*3 18 6
do. do. Pref.	10	6	6	11xd.	—	5 9 1
Great Northern Tel.	10	20	20	34½	+4½	... ...
Indo-European	25	10	10	47½	—	*5 5 8
Marconi	10/-	5	*10	8 13/16	+1/16	... ...
Marconi-Marine	1	8¾	12½	3⅝	+⅛	3 9 1
Oriental Telephone Ord.	1	12	12	3⅛	—	*3 18 0
United R. Plate Tel.	5	8	8	11¾	—	*3 8 1
Western Telegraph	10	10	10	26¾	+¾	3 15 0

*Interim.

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	3 7/16	—	8 14 6
do. do. 5% Deb. ...	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	,,	—	—	615	—	... ...
do. do. Pref. Ord.	,,	8	8	124	—	6 9 1
Brazil Traction	100	6	7	77½	—	2 5 2
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	+1/-	... .
London United Tram Deb. ...	Stock	4	4	61	+1	6 11 4
Mexico Trams. 5% Bonds	—	5	5	79	—	6 6 7
Mexican Light Common	100	Nil	Nil	77½	—	... ..
do. 7% Pref.	100	Nil	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	77	—	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ..

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	13	15	3½	+⅛	*4 5 9
British Aluminium Ord.	1	10	10	2¼	+1/16	*4 9 0
British Elec. Transformer Pref. ...	1	7	7	15/-	−3/-	9 6 8
British Insulated Ord.	1	15	15	4⅛	+⅛	3 12 10
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4 1/16	+1/16	3 14 0
do 6½% Pref.	1	6½	6½	1 3/16	—	5 9 5
Crompton Parkinson Ord.	5/-	—	—	19/6	−6d.	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan	4/-	10	10	12/6	—	3 4 0
do. 5% Deb.	Stock	5	5	86½xd.	—	5 15 7
Electric Construction	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	1	20	20	£⅛	+1/16	3 16 0
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref	1	8	Nil	10/-	—	... ..
Gen. Elec. Pref.	1	6½	6½	23/6xd.	—	5 10 8
do. Ord.	1	7½	10	43 9	—	4 11 4
Henley	1	25	25	5¾	+⅛	4 6 10
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ..
Johnson & Phillips	1	12½	10	36/3	—	5 10 3
Met.-Vickers Ord.	1	8	6	30/-	—	... ...
do. Pref.	2	8	8	2¾	—	5 16 5
Siemens Ord.	1	7½	7½	26/3	—	5 14 2
Telegraph Construction	12	10	10	2½	—	*4 18 6

*Dividends paid free of Income Tax.

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Electrical Manufacturing in Canada.

Production in 1926 and 1927.

THE production of electrical apparatus and supplies in Canada was valued at $78,558,730 in 1927, according to a bulletin recently issued by the Dominion Bureau of Statistics, Ottawa. This figure was 13 per cent. over the value of $69,767,308 for the previous year, 30 per cent. greater than in 1925, and 39 per cent. in excess of the output reported for 1924.

Reports were received from 130 firms in this line of production, with fixed and working capital of $80,475,999, giving employment to 16,813 people. Salaries and wages totalled $20,613,592. By manufacturing processes the sum of $45,823,855 was added to the value of purchased materials, which cost $32,734,875. The following table gives particulars of the production during 1926 and 1927 :—

Product.	Selling value. 1926. $	1927. $	Inc. or dec. $
Batteries—			
Storage	4,352,433	4,280,896	− 71,537
Dry cell	3,291,500	3,315,692	+ 24,192
Parts and supplies ...	123,493	125,423	+ 1,930
Conduit and moulding, interior, and fittings ...	1,047,846	1,249,636	+ 201,790
Cooking and heating apparatus—			
Flatirons	314,690	363,419	+ 48,729
Hotplates and grills ...	126,230	277,904	+ 151,674
Percolators	—	12,423	+ 12,423
Stoves and ranges... ...	493,287	573,370	+ 80,083
Toasters	—	81,517	+ 81,517
Water and air heaters ...	300,200	419,012	+ 118,812
Unspecified	241,893	57,923	− 183,970
Fans	31,525	43,886	+ 12,361
Fuses and fuse wire	287,284	269,801	− 17,483
Generators, a.c. and d.c. ...	3,222,339	2,183,809	−1,038,530
Ignition apparatus	703,146	757,183	+ 54,037
Lamps, incandescent ...	3,979,841	4,561,752	+ 581,911
Bulbs, bases and other parts for incandescent lamps	82,944	58,679	− 24,265
Lighting fixtures	1,312,029	1,450,584	+ 138,455
Lightning arrestors	180,112	161,712	− 18,400
Line material, of all kinds	741,163	146,100	− 595,063
Motors—a.c.	4,235,042	4,500,183	+ 265,141
Parts and supplies... ...	160,630	202,912	+ 42,282
D.c.	717,194	685,996	− 31,198
Parts and supplies... ...	113,677	150,206	+ 36,529
Meters, watt-hour, ammeters, voltmeters, &c., service type, including accessories	970,446	1,185,433	+ 214,987
Panel boards and cabinets ...	384,391	482,969	+ 98,578
Pneumatic tools and parts...	1,930,348	1,898,426	− 31,922
Radio apparatus and supplies (excluding batteries)	3,899,517	6,081,067	+2,181,550
Rectifiers for storage battery charging	127,182	184,481	+ 57,299
Refrigerators, electric ...	85,985	227,103	+ 141,118
Sockets, rosettes, attaching plugs and cutouts ...	880,036	945,234	+ 65,198
Switchboards, light and power	1,729,506	3,285,927	+1,556,421
Switches, of all kinds ...	1,204,247	1,961,397	+ 757,150
Telephone materials (excluding line material) ...	7,508,589	7,925,977	+ 417,388
Transformers—			
Power and service types, 50 kW and over ...	3,628,794	3,457,016	− 171,778
Power and service types, under 50 kW	1,023,768	2,697,136	+1,673,368
All other types	154,558	324,313	+ 169,755
Vacuum cleaners	1,345,427	1,970,714	+ 625,287
Wires and cables	13,791,282	14,091,076	+ 299,794
Wiring material, n.e.s. ...	269,087	369,984	+ 100,897
Apparatus or supplies, n.e.s	2,318,013	1,934,833	− 383,180
Repair parts, n.e.s., and repairs	770,407	961,199	+ 190,792
Products of 1 or 2 firms* ...	1,687,227	2,644,427	+ 957,200
Total ...	$69,767,308	$78,558,730	+$8,791,422

* Production figures are for the electrical supplies industry only and do not necessarily represent the total output in Canada of the commodities listed; there may be also a small production in other industrial groups.

The Import Trade of Siam.

A Comparison of Two Years' Figures.

THE following figures, showing the imports of electrical and allied goods into Siam during the year ended March, 1928, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1927, are included for the purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *via* these two ports :—

	1926-27. Baht. (Thous.)	1927-28. Baht. (Thous.)	Inc. or dec. Baht. (Thous.)
Electrical goods and apparatus—			
Total	1,743	2,391	+648
From United Kingdom ...	315	296	− 19
,, Germany	200	669	+469
,, United States	139	234	+ 95
,, Singapore	27	97	+ 70
,, Sweden	5	2	− 3
,, Italy	10	12	+ 2
,, Holland	33	25	− 8
,, France	57	21	− 36
,, Japan	218	167	− 51
Lamps—			
Total	693	896	+203
From Singapore	62	94	+ 32
,, United Kingdom ...	29	37	+ 8
,, United States	7	2	− 5
,, Japan	104	127	+ 23
,, Germany	358	470	+112
,, Sweden	49	78	+ 29
Scientific instruments and apparatus—			
Total	289	300	+ 11
From United Kingdom ...	47	76	+ 29
,, Germany	90	57	− 33
,, France	13	10	− 3
,, Japan	65	73	+ 8
,, United States	23	45	+ 22
,, Singapore	29	27	− 2
Prime movers, other than locomotives, marine, military, and agricultural machinery—			
Total	909	848	− 61
From United Kingdom ...	328	336	+ 8
,, United States	196	305	+109
,, Germany	199	178	− 21
,, Denmark	10	10	—
,, Sweden	166	6	−160
Machinery, unenumerated, including detached parts, and not including agricultural, textile, or sewing machines—			
Total	1,528	1,896	+368
From United Kingdom ...	453	681	+228
,, Japan	12	3	− 9
,, United States	204	198	− 6
,, France	31	36	+ 5
,, Denmark	28	130	+102
,, Germany	265	313	+ 48
Railway material—			
Total	370	159	−211
From United Kingdom ...	30	12	− 18
,, Belgium	169	102	− 67
,, France	33	5	− 28
Cars or trucks for railways or tramways—			
Total	1,205	536	−669
From United Kingdom ...	495	230	−265
,, United States	61	53	− 8
,, Belgium	324	190	−134
Rubber manufactures, other than tires—			
Total	1,076	1,176	+100
From Singapore	643	685	+ 42
,, United Kingdom ...	99	107	+ 8
,, United States	27	30	+ 3
,, Japan	9	19	+ 10
,, Germany	35	79	+ 44

NOTE.—Tical (or Baht)=1s. 10½d.

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Large Induction Motors.

Some constructional features of heavy-duty equipment produced by the British Thomson-Houston Co., Ltd.

ONE of the most arduous duties for which electric motors can be used is the operation of mine winders or hoists, and, in particular, reference may be made to the electric winding equipments installed at the gold mines of the Rand in South Africa. The mines work day and night for seven days a week, and as every trip of the winder involves the reversal of the direction of rotation of the motor at least twice, the necessity for rugged and reliable design is obvious. In many of the mines the workings are now being carried to such great depths that the winding has to be done in stages, and at the Village Deep Mine there is a 1,100-2,300-h.p. geared a.c. winder installed no less than 6,300 feet below ground, this being, it is claimed, the largest hoist at its depth in the world. At the Crown Mines there is in operation a geared a.c. winder, the motor for which is rated at 2,160-4,010 h.p.; this is claimed to be the largest of its type in the world, and duplicate equipment is being manufactured by the British Thomson-Houston Co., Ltd. This company has manufactured a very large number of electric winding equipments for use on the Rand, and it should be noted that owing to the heavy duties imposed on them, and to the very serious consequences of any delay in winding ore due to shut-downs for repairs or overhaul, the equipments must be designed on generous lines. Among other features of construction mention may be made of a special form of dovetail key which has been evolved by the B.T.H. Co. for securing the rotor and stator laminations to the spider and stator frames respectively. This key is of double dovetail section and divided longitudinally so as to give each half a wedge shape. The amount of taper on the two halves of the key is designed so that when driven in the dovetails are forced tightly against the punchings and spider, thereby eliminating all possibility of tangential or radial movement.

Fig. 1 shows a rotor core being assembled. The keys are laid in the dovetail slots machined in the spider, and the two halves of each key are slightly slacked back. The segmental core is then built up, drifts being temporarily placed in some slots to ensure correct alignment; it will be observed that each segmental punching is held to the spider by two double dovetail keys. As the building-up progresses the core is tightly clamped until, finally, with the end flanges in place, it is pulled up tight by clamping bolts arranged outside the core, but close to its inside periphery. The dovetail keys are then removed and broaches shaped to the dovetails are driven through, after which the keys are replaced and driven tightly together.

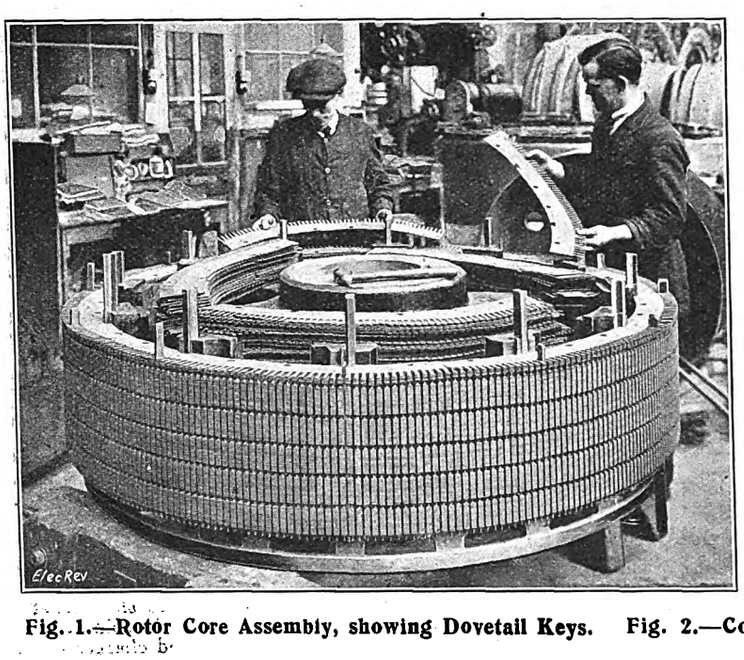

Fig. 1.—Rotor Core Assembly, showing Dovetail Keys.

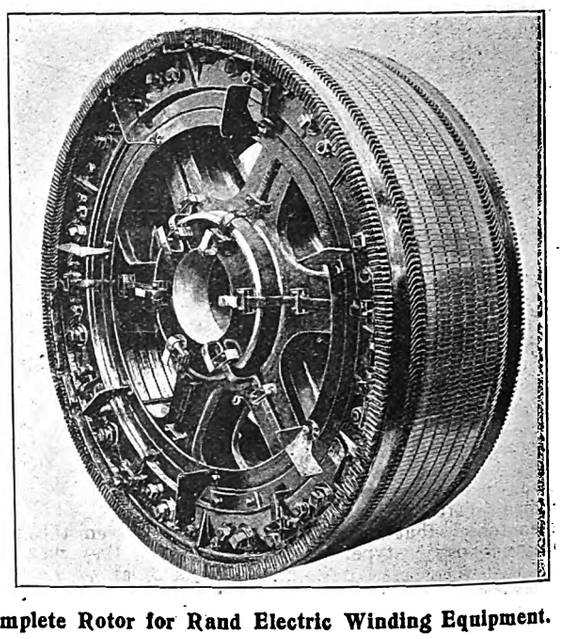

Fig. 2.—Complete Rotor for Rand Electric Winding Equipment.

The length of each half of the key is adjusted so that the thick end projects slightly beyond the thin end within holes provided in the end flanges. Plugs screwed with fine threads are inserted in the holes in the end flanges and bear against the large ends of the keys. The plugs are provided with square shanks and lock nuts, so that should it become necessary at any time they could be screwed further into the flanges, thus tightening up the keys. In addition to the double dovetail keys in the rotor core, pins are tightly driven through holes in both the end flanges and core. A complete rotor with this type of screwed plug is illustrated in fig. 2, and a close-up view of a portion of a rotor with the screw plugs removed is given in fig. 3.

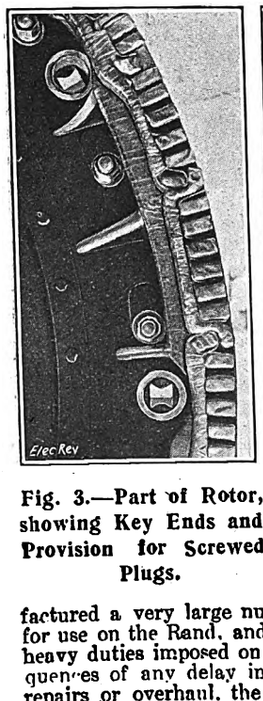

Fig. 3.—Part of Rotor, showing Key Ends and Provision for Screwed Plugs.

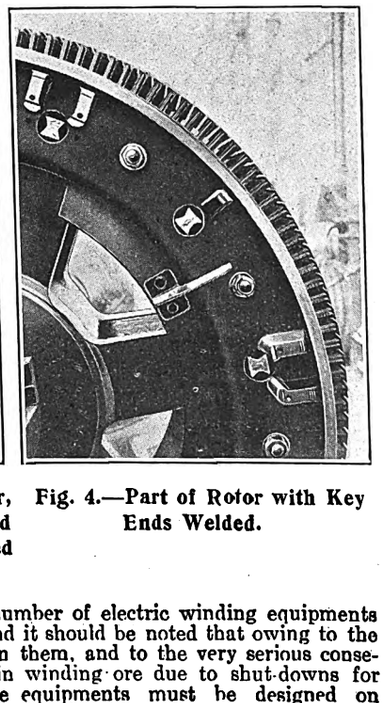

Fig. 4.—Part of Rotor with Key Ends Welded.

The above construction is adopted as standard by the B.T.H. Co. for the rotors of all induction motors having cores built up of segmental punchings. In some cases the design is simplified by the omission of the screwed plugs; the keys, after being driven into position very tightly, are cut off flush and the ends welded, cover plates being fitted over the holes in the end flanges so as to bear against the ends of the keys. Fig. 4 shows a rotor of this type with the cover plates over the holes in the rotor flanges removed. Motors embodying this form of construction are in operation on various duties of the most arduous nature, such as driving rolling mills, mine winding equipments, cement-mill plant, and so on.

Industrial Transport Association.

Mr. P. J. Hannon, M.P., president of the newly formed Industrial Transport Association, an organisation of transport administrators and managers of industrial undertakings, presided on December 4th at the first annual luncheon in London, and stated that in preparation for the Royal Commission on Transport the Federation of British Industries was preparing a memorandum on public life as affected by transport, and at least one expert witness would be received on behalf of the Industrial Transport Association. Mr. J. A. Freeman is chairman of the Manchester branch.

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Hire and Hire-Purchase Schemes.

The Third E.D.A. Conference of the 1928-29 Session.

AT the third E.D.A. Salesmanship Conference on December 21st, at the Royal Society of Arts, Mr. J. E. Tapper (Beckenham) read a paper upon the subject of hire and hire-purchase schemes.

Though recognising the advantages of simple hire schemes, as distinct from hire-purchase, the speaker pointed out that an advantage of hire-purchase to the supplier was that he constantly received a return of his capital, so that a smaller sum was required to finance the business. In addition, he was relieved in most cases of the business of maintenance and liability for accident and breakdown, and the customer became interested in the retention of the article, so that it was unlikely to be thrown back on the hands of the supplier. On the other hand, a consumer who hired apparatus had no inducement to keep it beyond the term of the agreement, probably one year, if some better apparatus was placed on the market, or if he was influenced by some other factor. When apparatus was simply hired the supply authority assumed liability for the whole period of the contract, the liability covering maintenance and third-party accidents due to imperfect design or failure of insulation. This emphasised the necessity for ensuring that only really safe apparatus should be hired, though maintenance could be covered, of course, by fixing suitable hire charges, and accidents could be insured against. With regard to the question of safety, Mr. Tapper emphasised the importance of earthing, and suggested that this matter should receive the attention of the Electrical Apparatus Committee of the I.M.E.A. He appreciated that with much apparatus, such as water heaters and cookers, business could be secured only by hiring schemes, but in other cases, as, for instance, irons and other less expensive apparatus, it was better to sell for cash, or by hire-purchase. In Beckenham 3,200 irons had been installed among 6,200 consumers without the necessity for hire; assuming an average use of three hours per week, they consumed a quarter of a million kWh a year.

Dealing with the necessity for hire-purchase schemes, the speaker said that a man who purchased a house more often than not left the question of electrical fittings to the last and then found that he could hardly afford even those of the plainest possible type. In such cases, and they were legion, the only way to secure the business was by assistance from the supply authority.

Owing to the danger that, if no deposit, or only a small deposit, was asked for, the goods might be returned considerably the worse for wear after three or four months, when an insignificant amount had been paid on them, Mr. Tapper said it was not his practice to enter into a hire-purchase agreement, but to deal with the transaction as a definite sale, allowing the consumer to pay by instalments over an agreed period. Under such a "deferred payment" system the authority could exercise discretion as to the acceptance of the return of goods, and it could refuse the return of badly used apparatus and sue the purchaser for payment in full.

Dealing with the progress made in Beckenham, he said that whereas in 1919 the sales turnover was about £2,000, for the financial year ended March, 1928, it was nearly £13,000, an average of £2 4s. 6d. per consumer, or 6s. 10d. per head of the population. Hire-purchase was responsible for £3,717 of this, or practically 30 per cent. Generally, a deposit of 20 per cent. was asked for, with interest on the outstanding balance at 5 per cent. over one or two years, though the Beckenham Council did not tie itself rigidly in the matter of deposit. Hiring had so far been confined to cookers, and 491 of these had been hired since late in 1925, when the business was commenced. Wiring had been carried out on the hire system for many years, but quite a third of the installations had been sold to the consumers. "Free," or rental, wiring was provided throughout in housing schemes and in small properties up to four lamp points. Various methods of charging were in vogue, but that which was found most advantageous was a fixed charge, based upon the ratable value of the premises, plus wiring and cooker rent, energy being metered and charged at 1d. per kWh. A weekly collection was made in connection with the Council's housing schemes, the amount charged being estimated to cover the fixed charge, cooker rent and energy used. At the end of the quarter the meter was read and the balance drawn or refunded as each separate case required. The wiring was carried out by the Council's staff in grip-joint tubing complete with pendants and lamps at an average cost of £7 for eight points. The wiring and installation of the cooker, including a kettle plug point, cost £3 10s. The weekly charges for a particular class of house were: fixed charge, 1s. 5d.; cooker rent, 9d.; and electricity (23 kWh at 1d.), 1s. 11d., making a total of 4s. 1d. In practice the average weekly charge for energy consumed for all purposes was 2s. 4d., making a total of 4s. 6d. inclusive, so that at the end of the quarter an additional amount equal to 5d. per week had to be collected. The increase was due to the installation of irons and small fires by many consumers. Some 600 consumers were supplied on a "limited" system applicable to lighting only. Four points were installed at a cost of £3 18s. complete with pendants and lamps, the weekly charge varying with the wattage. The average consumption in those houses was 150 kWh per annum, and the average price 4d. per kWh, as compared with the present lighting flat rate of 5d. A similar class of house supplied by meter would demand 100 kWh, so that the limited system resulted in an increased consumption of 50 per cent., although, as the maximum demand was limited, the cost per kWh was less. If a cooker or other apparatus was installed, a meter replaced the limiter; a fixed charge of 1s. per week was made, which covered hire and standing charges, electricity for all purposes being metered through a slot meter at 1d. per kWh.

It had been found that the evening peak load had been affected to a comparatively small extent by superimposing the cooking load upon it. With regard to heating, however, with the introduction of bulk supplies the position was not so clear. A cold snap might occasion a very heavy charge by the bulk supply authority, due to a sudden demand by radiators, without an adequate return from the consumer. Authorities owning capital stations were prepared to accept this load in their own districts. Therefore, Mr. Tapper considered that some method should be devised which would enable that advantage to be passed on to those undertakings accepting a supply from the "grid." A spasmodic heating peak of this nature should be charged for at a lower rate.

Discussion.

Opening the discussion on the paper, the CHAIRMAN (Mr. A. C. Cramb, Croydon), after mentioning that in his experience consumers did not take care of hired apparatus, discussed the possibilities of distributors having to bear a heavy standing charge as the result of a sudden heavy load under the "grid" system, although it might be that that heavy load had been carried for only one night. It seemed to him that under such circumstances it would be cheaper to generate than to buy from the "grid."

Mr. WATT (Woolwich) asked what steps were being taken to standardise cooking apparatus.

Mr. BRYANT (Hackney) criticised the present methods of charging for the hire of cookers, by which the hire rates were cut to a low figure, the supply authority hoping to recoup itself by the surplus revenue resulting from the sale of energy. In a fairly representative case, he said, a standard size cooker would rent at 10s. per quarter and energy would be sold at 1d. per kWh; after allowance was made for overhead charges and maintenance, the price actually received for energy was about 0.6 per kWh. It would be better to charge that price for energy, and increase the rental to, say, £1 per quarter. Although that might hold up the cooker business to some extent, he believed it would go forward again more quickly than before when the consumers appreciated the benefits of the lower price of energy. Under the present system the supply authority lost if the consumers did not use the amount of energy anticipated, and the consumers paid through the nose if they consumed more.

Mr. J. LEADBEATER (Hampstead) said he had found it an advantage to introduce a free maintenance scheme, even for cookers on hire-purchase, for a period of, say, three years. With regard to hire, he said that many engineers in fixing the charge debited the revenue from the consumer first with the cost of maintenance and interest charges, and took what was left for energy, but he regarded it as more correct to debit the consumer with the cost of the energy first and see what was left over for maintenance and interest.

Mr. F. SELLEY (St. Marylebone) emphasised the necessity for an attractive tariff as a first essential to successful hire and hire-purchase schemes. Mr. Tapper had suggested a charge based on ratable value, but he (Mr. Selley) would like to add to that a two-rate tariff, to encourage people to use electricity for water heating during the night. He emphasised the necessity for giving service, and for having a man available at all times to deal with cooker failures.

Mr. BUCKELL (G.E.C.), who also emphasised the importance of maintenance service, expressed the fear that some engineers would not push the sale of electrical apparatus in view of the risk of increased standing charges resulting from high peak loads under the "grid" system, and pointed out that such an attitude would be disastrous at a time when electricity for all purposes was coming into its own.

Mr. W. RITCHIE (Hendon), referring to the author's suggestion that the supply authority had to take responsibility for third party risk in respect of hired apparatus, said that surely the authority could safeguard itself by the terms of the agreements. With regard to hire-purchase apparatus, he suggested that the initial payment on it should on no account be less than the amount of the salesman's commission, and the period of repayment should be within a year, if possible, that being the guarantee period.

Mr. PATMORE asked if users of hired apparatus in Beckenham could buy it at any time if they wished.

Mr. GAIN (Leyton), who said that contractors who had been employed to carry out wiring installations in his district in connection with an assisted wiring scheme had not done any-

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thing to push the sale of electrical apparatus in the houses which they had wired, emphasised the importance of outside representatives being employed by the supply authorities.

Lieut.-Col. W. A. VIGNOLES (director and secretary, E.D.A.) emphasised the immense possibilities of hire and hire-purchase, and pointed out that in Beckenham the marked increase in the number of consumers connected and the amount of energy sold had coincided exactly with the adoption of hire-purchase. He also pointed out that, in view of the decreasing costs of maintenance, there should be a tendency to reduce maintenance charges rather than to keep them up to the charges made earlier, when maintenance costs were higher.

The CHAIRMAN said that supply authorities which did not employ outside staffs should hand over the business of electricity supply to someone else. Emphasising the value of proper service, particularly with regard to cookers, he said he had a man on duty on Sunday mornings ready to go at a moment's notice to any consumer whose cooker had failed.

Mr. TAPPER, replying to the discussion, said he was of opinion that the point had not yet been reached at which cookers could be standardised; the real trouble was with the hot plates, and he believed that if an improved hot plate were introduced, he would be able to charge 10s. per quarter profitably for the hire of cookers without expecting the revenue from the energy sold to bear part of the cost. The only way to carry on the cooking business properly was to maintain the apparatus throughout; that was why he did not consider it advisable to sell cookers by hire-purchase. He saw no reason for hiring irons or radiators, in view of their low price. Apparatus which had been hired originally had been bought subsequently by many of his consumers. The Beckenham Council employed canvassers and had established showrooms.

A Large Lighting Installation.

Some Descriptive Notes on the Electrification of Lancing College.

AMONG the public buildings which are being electrified in ever-increasing numbers, it is interesting to note the large proportion of schools—schools of all types, from our oldest and biggest public institutions to the elementary establishments of the various municipal and county councils.

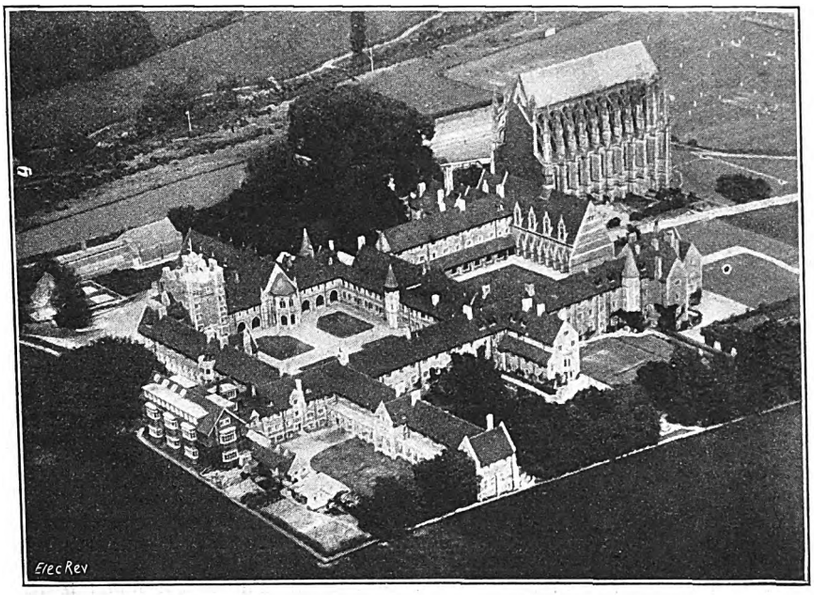

Fig. 1.—Aerial View of Lancing College.

One of the latest to come into line in this respect is Lancing College, which was founded in 1848 by the Rev. Canon Woodard, M.A., the first stone of the central building being laid by the same gentleman in 1854.

Situated on the Downs, near North Lancing, the college, fig. 1, is built of dressed flint, with enrichments of stone; in plan it forms two quadrangles with surrounding cloisters. The east quadrangle is completed by the headmaster's house and dining hall. The foundation stone of the building to complete the west quadrangle was laid by the Marquis of Salisbury in 1910. The chapel, fig. 3, is of dressed freestone in the early English Gothic style, consisting of nave and aisles with an apsidal east end. It was dedicated in 1911, since when numerous improvements and alterations have been made at the college. They include a chantry chapel in memory of the founder, and a new electrically-operated organ, costing £3,000, added in 1914-15; a new wing added and taken into use in 1912; further extensions, including masters' quarters in a 70-ft. tower, with dormitories and studies, forming a sixth house, made in 1913; and finally—most important of all from an electrical viewpoint—the whole of the college buildings were, in 1927, wired throughout for electricity.

The electrical installation was designed and carried out with the Henley Wiring System by Messrs. F. A. Barnes & Son, local contractors, the total number of lighting points being 1,270. The chapel organ is now blown by a 10-h.p. motor manufactured by "Cromptons" and fitted with an automatic contactor-type stator and rotor starter, which is controlled by a start-and-stop switch fitted to the organ manual. For experimental purposes, charging accumulators, &c., a "Hewittic" rectifier with a d.c. output of 15 A at 100 V is installed in one of the laboratories, and the motive installation is completed by a 10-h.p. motor for driving laundry machinery and various small motors for refrigerators and vegetable machines in the kitchens. Some 17,700 yards of twin and triple "Henley" cable—from 3/.029 upwards—was used for the lighting. The main l.p. switchboard was supplied by Messrs. Dorman & Smith, Ltd., and consists of iron-clad switchgear on an angle-iron frame. It is equipped with bus-bar chambers, three ammeters, one voltmeter with a 3-way switch, three 100-A, one 50-A and five 20-A switches and fuses.

The main switches, distribution boards and electric light fittings were supplied by the General Electric Co., Ltd., whilst the lighting switches, switch-plugs, &c., were supplied by Messrs. J. A. Crabtree & Co., Ltd. All the lamps are of from 20 to 300 watts, and special floodlight projectors in the chapel were supplied by the British Thomson-Houston Co., Ltd.

Current is supplied at 8,000 V by the Shoreham & District Electric Lighting & Power Co., Ltd., and is conveyed some 4,000 yards at that pressure by Henley 3-core .04-sq. in. cable from Shoreham sub-station to the college. There it is transformed to l.p. and is distributed all round the college by 1,650 yards of Henley l.p. paper-insulated, lead-sheathed and armoured cable of various sizes.

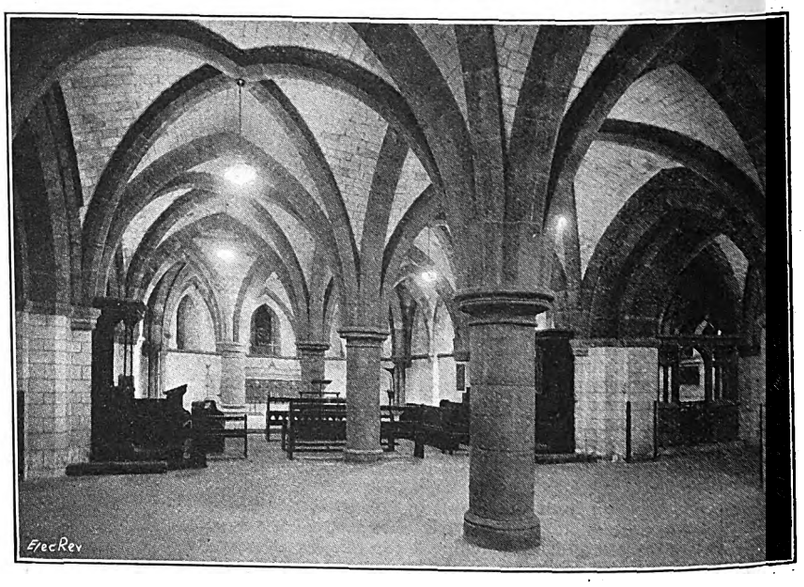

Fig. 2.—The Crypt, Electrically Lighted.

The lighting of the chapel, fig. 3, is carried out similarly to that of Peterborough Cathedral (ELECTRICAL REVIEW, January 1st, 1926, p. 19) by means of silvered-glass projector

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fittings, with 250-W lamps, mounted on adjustable arms fixed in the triforium, and so adjusted that the beams of light are trained towards the bottoms of the piers on the opposite sides of the nave. At the east end of the chapel one projector on either side is directly focused on to the altar. Each projector has a small adjustable mirror on the underside, that throws some of the light upwards, so as to illuminate the upper part of the walls and the roof. The height of the chapel from the floor to the groined roof is 90 ft.; the projector units are fixed 54 ft. from the floor, and well back in the triforium arches, so that by day they are not noticed.

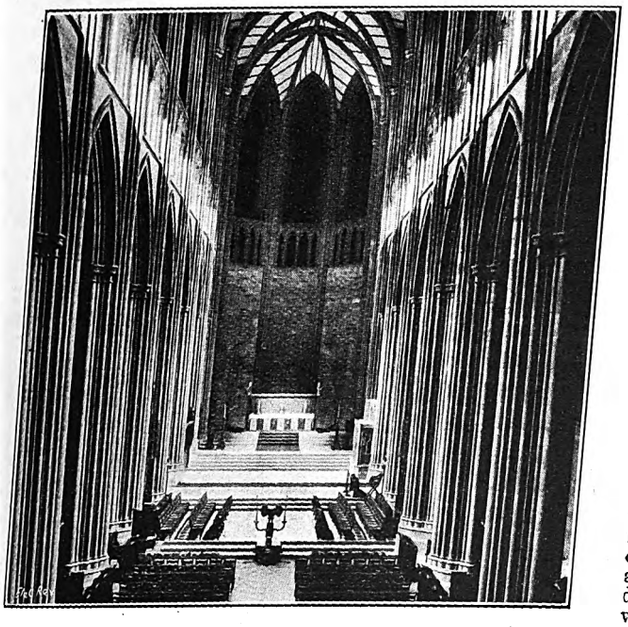

Fig. 3.—The Chapel, by Artificial Light.

The main cables enter the chapel at the west end of the crypt in a portion that is used for the organ motor and "Discus" blowers; the main switches, meter and main distribution board are also fixed in this part. The lighting cable is carried up from the main board into the vergers' store or

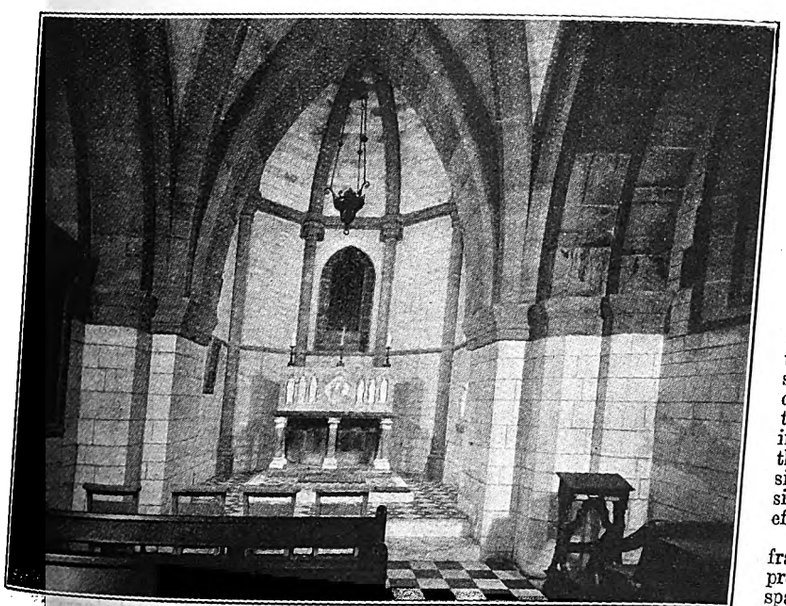

Fig. 4.—Founder's Chapel, Electrically Lit.

cupboard under the organ loft, where are fixed the distribution board and switch panel controlling all the lights. The cables are carried up through the organ loft and into the triforium on either side to the various units, so that they are not visible to the congregation. The crypt, fig. 2, is lighted by enclosed pendants, while the altar and founder's chapel, fig. 4, are lighted by a number of Mirolux reflectors, each having two 40-W lamps, fitted on the capping of the columns, &c., practically out of sight.

Mr. A. M. Willey, engineer and manager of the Shoreham and District Electric Lighting & Power Co., Ltd., acted on behalf of the College authorities as clerk of works during the progress of the installation.

It is of interest to note that in 1926 Messrs. Barnes & Son carried out a complete installation with the same wiring system at the Shoreham Grammar School.

H.P. Direct-Current Generators.

Some particulars of Swiss machines that generate up to 12,500 volts with a single commutator.*

CONSIDERABLE advances have recently been made in the design of high-voltage d.c. generators for energising the anodes of wireless transmitting valves. Since 1912 the S.A. des Ateliers de Sécheron, Geneva, Switzerland, which constructed the first of the well-known Thury generators used for the series transmission of power, had erected some twelve Thury installations, using voltages up to 4,500 V per commutator. Of course, such machines differed considerably from the modern anode generator: for instance, the insulation difficulties were considerably reduced by the large size of the machine (up to 1,000 h.p. each) and none of the refinements for the reduction of ripple had to be incorporated in them. As early as 1916 the firm had constructed a 4-machine set developing 12,500 volts per commutator, the four commutators being used in series to produce 50,000 volts for a radio-telegraph spark transmitter, and it has since been used with a valve transmitter with entirely satisfactory results.

The mechanical construction of the machine is identical with that of normal generators, fixed magnets with rotating slotted armatures being employed and either the slots or the pole edges skewed. Two-polar machines are avoided, chiefly because they do not lend themselves to the easy mounting of former-wound coils, which are almost essential for safe insulation. The whole of the insulation from the frame is concentrated in the slot itself and not partly in the slot and partly between the armature iron and armature spider, as was the case in the earlier Thury machines. The use of two commutators in series on a single armature is also avoided, as the insulation between the two windings offers considerable difficulty. The number of slots and commutator segments is made as large as possible, but the electrical loading (ampere-conductors per inch of periphery) is kept comparatively small with a view to satisfactory commutation and cooling.

One of the most important questions affecting the design of such machines is the break-down voltage to which they are to be subjected during their test. Oscillographic experiments made on a 10,000-volt 2-ampere generator showed that if the full load was rapidly broken by means of an oil switch the voltage at the terminals might rise momentarily to 1.8-2.1 times the normal, but if a horn-break switch was employed the voltage rise was only 1.3 times the normal, so that by the use of a suitable by-pass composed of condensers and resistances it was found possible to reduce the voltage rise (even with oil switches) to only 1.1-1.2 times the normal, but such by-pass circuits are not desirable from the point of view of simplicity.

At one time a test pressure of (2×working voltage+plus 1,000) volts (d.c. voltage) was considered sufficient, but it has been gradually raised and a safe value would now appear to be (2×working voltage+5,000 volts). In practice such high direct-current voltages are not usually available and the test is, therefore, carried out with 50-cycle a.c. voltages obtained from static transformers. Early experiments seemed to show that approximately equal stress was involved if the 50-cycle a.c. test voltage was 50 per cent. of the d.c. test voltage, and later experience has shown that at any rate 60 per cent. is a safe equivalent to use. That is to say, the a.c. test voltage (r.m.s.) should equal (1.2×working voltage+3,000 volts). If much more than this is employed the machine has to be considerably enlarged, with a consequent considerable increase in cost and decrease in efficiency.

The slot insulation between mounting and frame takes the form of micanite tubes pressed round the coils and very low slot space factors have to be allowed for in consequence. For instance, a 12,000-volt, 1-ampere generator will have a slot space factor of (total copper sections in slot divided by gross slot area)=0.035, or 3.5 per cent. approximately for practical purposes.

The shaping and insulation of the coils demands great care and experience, and can only be carried out by highly-skilled workmen trained for the purpose. The insulation outside the slot is less important and simpler. The end windings are supported on metal seatings covered with bakelite cylinders. The thin wires of the armature coils are not carried direct to the commutator, as to do so would involve too much risk of breakage; instead a piece of stronger stranded wire is soldered to the commutator at one end and to the coil ends at the other and bound-in securely to the coil itself.

The commutator segment insulation is provided by micanite

* *E.T.Z.*, October 18th, 1928. Machines for a similar duty are made in England by Newton Brothers (Derby) Ltd., and the British Thomson-Houston Co., Ltd.

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or amberite having a thickness of from 1.5 to 3.5 mm., according to the voltage per segment, the latter thickness being sufficient for a machine carrying as much as 250 volts per segment. Very hard carbon brushes are used and commutating poles are provided, being insulated with micanite tubes from the frame, and half of them are connected in the positive main and half in the negative main. The excitation of the h.p. generator is generally provided by a separate 110-V exciter. The experience gained with the 12,000-volt machines has convinced the makers that similar ones giving 20,000 volts (which covers the highest present requirements for anode supply) are quite feasible, but only in sizes of 20 kW, or over, *i.e.*, if smaller powers were required the same size of machine would still have to be employed.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Heating System.

A system of heating introduced by Messrs. S. G. LEACH AND Co., LTD., 26-30, Artillery Lane, E.1, for which claims of efficiency and economy are made, employs one or more "Modine" units. One of these is shown in fig. 1. It consists essentially of three parts, a condenser, a frame and manifold, and an electric fan. Steam or hot water is fed to the condenser and its heat is given up to air driven over the condenser baffles by the fan. On a steam system the maximum pressure required is 10 lb./sq. in. It is claimed that the units spread the heat without any noticeable draught.

Small Breaker with Time-delay Attachment.

In the "Elimafuse" small circuit breaker marketed by INDUSTRY & COMMERCE ALLIANCE, LTD., 55-59, Kingsway, W.C.2, the difficulty on some circuits of the "starting" current tripping the breaker has been overcome in two appropriate ways. In one the adjustment which determines the tripping current is combined with a bi-metallic thermal element of simple form, which enables the circuit breaker to carry up to about ten times its rated current, for a strictly limited time, after which the tripping value is automatically reduced to one that is safe for the circuit conductors. This feature does not, it is claimed, noticeably diminish the speed of operation in the event of a "short-circuit." Fig 2 shows the thermal time-delay element and its attachment to the spring which controls the tripping current. The thermal element tends to straighten as its temperature rises, thus diminishing the spring tension. The other method employs a button which must be pressed home during the initial period. The pressure permits of increase in the tripping current up to from five to eight times the full-load current. Relieving the pressure on the button restores the circuit breaker to its standard rating. This arrangement thus overcomes in a simple manner the serious risk of short-circuiting the fuses during the starting period. The double- and triple-pole "Elimafuse" circuit breakers are so constructed that if there is excess current sufficient to operate one pole, the circuit is opened on all poles simultaneously. The breaker is supplied in all ratings up to 25 A. It will reliably interrupt, it is claimed, a short-circuit current of 1,500 A at 275 V d.c. The apparatus, without the time-delay device, is similar to that described in the ELECTRICAL REVIEW of June 29th, 1928, p. 1159.

Fig. 1.—"Modine" Heating Unit.

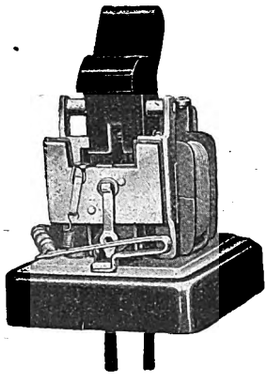

Fig. 2.—"Elimafuse" with Thermal Time-delay Element.

Naval Wireless Transmitters.

A new series of valve transmitters has been designed and introduced by MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2, for use in naval vessels. Types TN1 and TN2 transmitters, with aerial ratings of 2 kW and 1 kW, respectively, are for continuous and interrupted-continuous-wave signalling. Telephony transmission can be provided for if required, without increasing the overall dimensions of the transmitter. Interrupted-continuous-wave signalling can be effected on either one of three selected note frequencies, thus allowing distinctive notes to be used by different ships working on the same wavelength. The provision of a master oscillator, or independent drives, enables constancy of wavelength to be maintained, while the absorber system of keying gives stability of working and eliminates "key clicks," thereby rendering the set particularly suitable for duplex working. The standard transmitter is designed to cover a wave range of from 400 to 3,000 metres, and any wavelength within this range can be quickly brought into use by controls mounted on the front of the transmitter. The whole of the transmitting apparatus is mounted in a steel framework enclosed by metal panels and safety screens, and all tuning circuits are adjustable by handles calibrated in wavelengths and mounted on the face of the panels. Access to the inside of the transmitter is obtained through a safety gate in the front. Fig. 3 shows the TN1 transmitter. Type TN4 transmitter is a fire-control transmitter for destroyers, cruisers and battleships, and is designed to provide an efficient means of communication between the vessels of a flotilla or squadron, and with aircraft operating in conjunction with the fleet. It is suitable for signalling by continuous waves, interrupted-continuous-waves, and telephony, and all adjustments and operating controls are mounted on the front of the transmitter, thereby allowing instantaneous change of wavelength and change from one system of signalling to another to be made. The transmitter is nominally rated as a 500-W set, which is the output of the h.p. d.c. generators to the anodes of the valves. The wave range of this type is from 80 to 180 metres, when used on an aerial approximately 40 ft. long. For short-range telegraph communication over about 50 nautical miles, on wavelengths between 100 and 150 metres, the type TN5 transmitter has been designed. The output of the h.p. d.c. generator used for supplying power to the anodes of the valves is 120 W, which is taken as the nominal rating of the set. Another compact low-power telegraph transmitter is the type TN5a, which forms the main transmitter in such small craft as tugs, naval pickets, and motor boats. The set is designed primarily for interrupted-continuous-wave signalling on an audio frequency of approximately 600, 900 or 1,900 cycles, but it can also be used for continuous wave signalling.

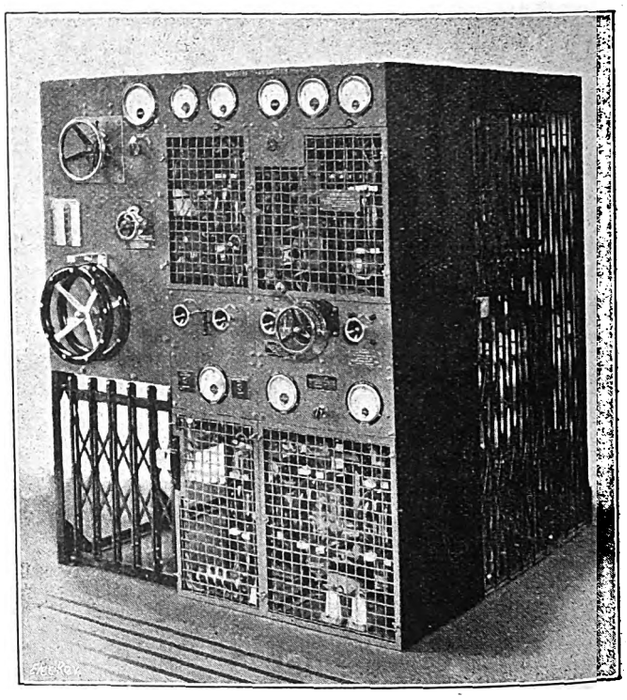

Fig. 3.—TN.1 Naval Radio Valve Transmitter.

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Domestic Electrical Appliances.

New Cooking, Heating, and Cleaning Devices for use in the Home.

New Electric Cookers.

A range of electric cookers has recently been introduced by the MANOR ELECTRIC OVEN & FIRE CO., 303, High Road, Chiswick, W.4, which embody several new features. The oven door, front frame, and drop-down door to the grill chambers of each cooker are fitted with porcelain tiles. The switches and fuses are protected and mounted on a patented vitreous-enamelled splash back, and the hot cupboard or grill chamber is fitted with a vitreous-enamelled mild-steel interior. The hob

Fig. 1.—Small "Manor" Cooker.

is vitreous-enamelled mottled grey, and the hot-plate, grill, and oven elements are of the "plug-in" type.

The boiling plates are new in design, and consist in the 2-kW plate, of twelve non-oxidising metal tubes which run visibly hot. The tubes are so arranged that the utensils rest evenly thereon. The 2-kW plate has an efficiency of 52 per cent., and the combined grill and boiling plate 48 per cent. In a cheaper cooker vitreous-enamelled door panels are used in place of porcelain tiles. Fig. 1 shows one of the smaller "Manor" cookers.

A recent introduction of the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1, is the "Jackson Junior," fig. 2, which has been designed primarily for use in rural areas. It is made of cast-iron and steel, and the exterior black parts are stove enamelled, except the hob, which is "Marblon" mottled enamelled in leadless vitreous enamel.

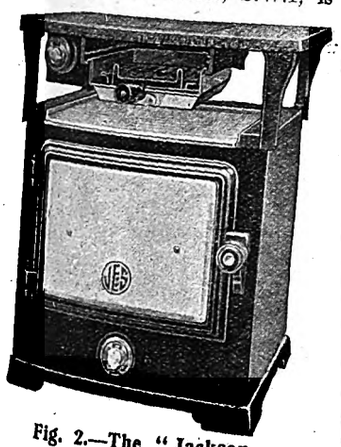

Fig. 2.—The "Jackson Junior" Cooker.

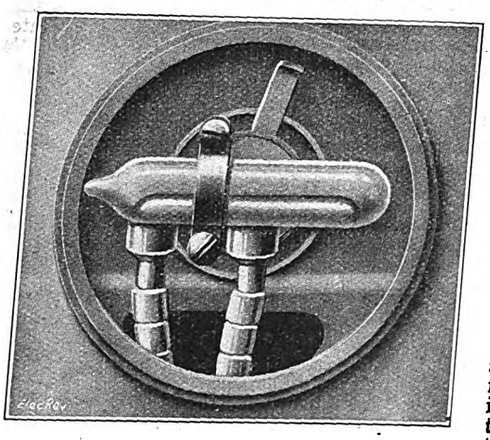

Fig. 4.—Mercury Switch Unit.

The overall dimensions are 22½ in. high by 19½ in. wide by 15½ in. deep, the oven cooking space being 10 in. high by 13 in. by 13 in. The hob contains a 9-in. by 7½-in. grill-boiler plate, with a grill space of 10 in. by 8 in., which, it is claimed, will keep four large saucepans boiling, and toast, or grill, at the same time. An important feature is that the grill-boiler plate is quite independent of the oven, thereby avoiding the difficulties often associated with small cookers in which the grill is incorporated with the oven. The cooker may be stood on a low bench, shelf or table, or a set of cast-iron legs with a pot rack may be provided. It is claimed that this cooker will give all the results obtainable with the larger Jackson models. The loading of the grill-boiler plate is 1,800 W, and of the oven 1,360 W.

A Self-Regulating Safety Kettle.

A new electric kettle recently introduced by METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is equipped with, in addition to the "Met-Vick" automatic "spring-clear" device for preventing damage to the kettle if it is accidentally switched on dry, an arrangement which can be automatically regulated so as to cut down the current at a predetermined temperature of the water to a value which will gently bring the water to the boil and maintain it there, thus preventing splutter or overflow from the lid or spout. The kettle has three heating elements, each of 350 watts. One of them is permanently connected to the terminals of the kettle, while the other two are connected to the main terminals through a small 10-A mercury switch, which makes or breaks the circuit when tilted one way or the other. This switch is mounted by means of a spring clip on a helical spring made of bi-metal strip about ¼ in. wide, which tends to uncoil itself when heat is applied. The mercury switch is so mounted on the free end of the spring that the rotation of that end tilts the switch into the "on" or "off" position. The other end of the spring is fixed in a tube, which is capable of rotation (for adjusting purposes) in an outer tube, the latter projecting into the kettle near the bottom. As the water gets hotter, the spring uncoils itself slightly, the free end rotating in a clockwise direction. The adjusting lever is set so that just before the water boils the mercury switch breaks contact, leaving only one element in circuit, which is sufficient to keep the kettle boiling gently. If the kettle is switched off and allowed to cool down, or is refilled with cold water, the spring coils itself up again, causing the free end to rotate in an anti-clockise direction, thus tilting the switch the other way and making contact again. The device is robust and, it is claimed, absolutely positive in action. The mercury switch is housed in a projection of the kettle case at the back, near the connector plug at the bottom, as shown in fig. 3. Fig. 4 shows the switch unit to a larger scale.

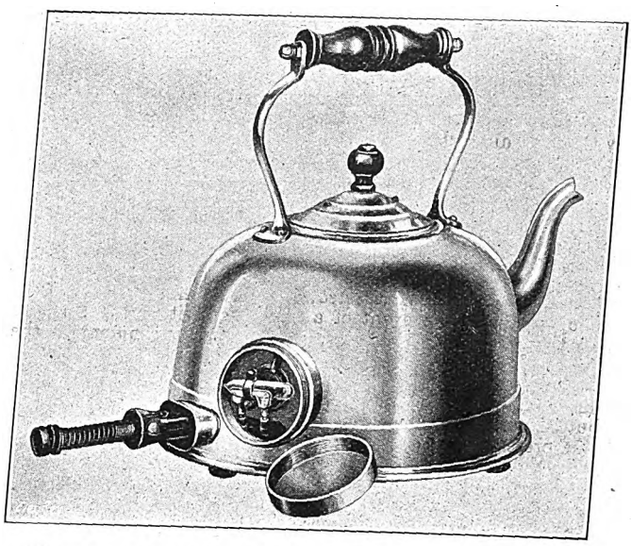

Fig. 3.—"Met-Vick" Self-Regulating Safety Kettle.

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H.P. Distribution Protection.

A descriptive account of the novel protective apparatus that has been devised for use on the high-voltage distribution network of the Lothians Electric Power Co.

By H. C. BABB, M.I.E.E.

(*Extracts from Paper read before the* EDINBURGH ELECTRICAL SOCIETY.)

FOR serving areas of from 800 to 1,000 square miles the present most popular system seems to be a.c., 3-phase. 50-cycle, purchased in bulk through a 33,000-volt main ring line (Edinburgh Corporation) principally overhead, on steel or wooden poles, feeding a number of main transformer sub-stations, the length of the ring being anything up to fifty miles; from the sub-stations, distribution lines at 11,000 volts, generally overhead, radiate over the district to small sub-stations in, or near, the larger towns that reduce the voltage to 10,600 V, 3,000 V, 400 V, and 230 V, necessary to serve as many consumers as possible at the minimum cost. Obviously to extend the low-voltage mains from the distribution points to feed isolated consumers, the cost would be excessive and the loss in the overhead lines, or cables, would be prohibitive; therefore, outlying consumers have to be fed from the high-voltage distribution lines, which are usually at 11,000 volts, through transformers attached to nearby poles.

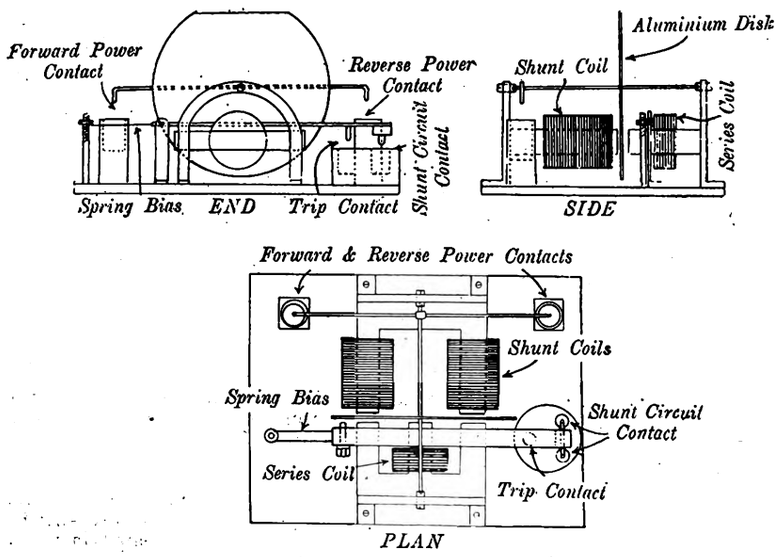

Fig. 1.—Experimental Model Selector.

In the case of a straightforward 11,000-volt line open at one end, if short, an overload switch will protect it satisfactorily, but if it feeds several sub-stations it is not always satisfactory to use more than a 5-amp. time-limit fuse in the protecting switch and with such a small fuse the grading presents great difficulty; morevover, complications are caused by reverse power when a ring main has to be dealt with.

When the Lothians Electric Power Co. met with these problems the several types of then existing protective gear were examined, but none of them would exactly satisfy all our requirements. I decided that it was possible for apparatus to be designed to afford protection under practically every condition, with the added advantage that no pilot wires would be required, which give far more trouble than the whole of the rest of the protection gear, besides their cost of installation amounting to something like £100 per mile. After considerable research and experiment the "Lothians protection gear" was made, and it is claimed that with the exception of impedance relay protection gear, which is to be used on the Central Electricity Board's 132,000-volt rings (and of which I know little) it is the only one which will satisfactorily protect high-voltage lines that are tapped indiscriminately without using a time lag, which holds the fault so long that it becomes dangerous.

For sectionalised ring-main protection there is no alternative but to use apparatus that will discriminate. The "Lothians gear" timing of the various overload relays is entirely independent of the value of the fault current, and is so arranged that each instrument when set in motion at the moment of the occurrence of a fault will run at precisely the same speed, thus giving very close tripping times between each successive sub-station in which it may be fixed, independent of any number of tappings of the line between sub-stations.

Operating Principle.—Timing the operation of the switches is accomplished by arranging the various lag contacts, both forward and reverse power, relative to each other in such a way that on a ring main from the supply point outwards in both directions the forward-power time lag successively decreases and the reverse-power time lag successively increases. Utilising this principle, apparatus consisting of a "selector" (or directional relay of special construction) and an "operator" (or overload time delay instrument) both interconnected electrically, is used.

The Selector.—Purely for discriminating in which direction the power is flowing, it works on the principle of the alternating-current wattmeter (figs. 1 and 2). An aluminium disk mounted on a spindle is arranged to be partially rotated in either direction by the magnetic field produced by a shunt magnet on the one side and a series magnet on the other. On the spindle are two tripping contacts, one "forward" and the other for "reverse" power, so that according to the direction in which power flows so will one or the other, but not both, contacts be closed. In addition, two others are closed when the current exceeds a predetermined value, the common trip contact being connected in series with the former two on the spindle and disk, the fourth completing the shunt circuit; all of which, except the latter, are in the tripping circuit operated by a battery. The function of the common contact is to break the tripping circuit immediately the excessive fault current ceases to flow, the reason for which will be explained later; the fourth contact allows the shunt circuit of the selector to be energised immediately the current, due to a fault, exceeds a predetermined value.

Under normal conditions the shunt coils of the selector are not excited; therefore no current is used and the shunt coils can be designed for a very heavy current rating, so that in the event of a big fall in pressure due to a severe fault the flux of the shunt magnet will still be sufficiently strong, in conjunction with the series flux, to cause the aluminium disk to rotate and so make one, or the other, of its tripping contacts. It should be pointed out that there might not be any serious drop in pressure, except on a three-phase fault, across the shunt coils mounted on the selector, which is in the faulty phase,

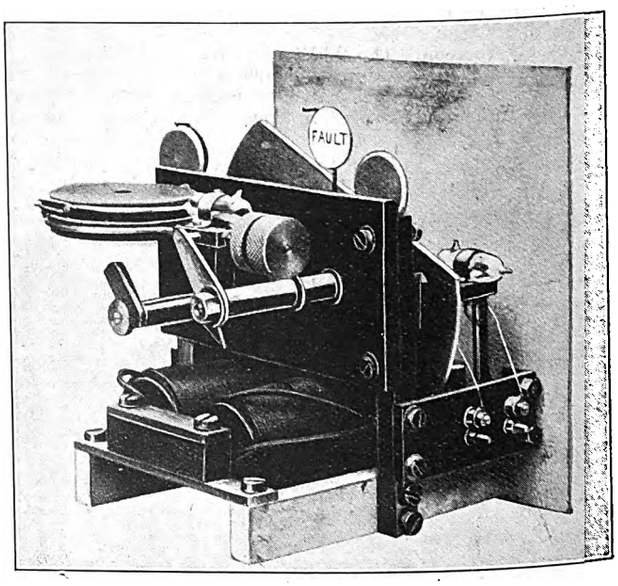

Fig. 2.—Switch Selector.

because while the series coil is in one phase its corresponding shunt coil is connected to one of the other two phases. Another advantage of keeping the shunt coil "dead" is that existing instrument potential transformers can be used without overloading them and possibly upsetting other instruments connected thereto. Where power transformers are already in-

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stalled they can be used to avoid the cost of installing separate potential transformers.

The Operator.—The time-lag device is set in motion when the current exceeds a predetermined value, after a predetermined period of time (which is entirely independent of the value of the fault current) and completes the tripping circuit, or, if the fault is cleared sooner, automatically returns to its normal zero position.

It consists (figs. 3 and 4) of a light metal disk having ratchet-like teeth on its periphery, mounted on a spindle and free to make one complete revolution; two arms, one on each side, which can be adjusted by placing them in any of a series of holes round the disk, are adapted so that each will close a tripping contact, one for "forward" and one for "reverse" power, connected in series with the selector. On the same spindle are two pulleys to which are attached fine cords: from one of them is hung a light plunger in a dashpot containing oil, the viscosity of which is not appreciably affected by changes of temperature, its function being to control the speed of the disk, which is (in our case) about one revolution in two seconds, but can be varied to suit specific requirements; to the other cord is attached an iron core inside a solenoid, which is energised by the tripping battery, its function being to overcome the weight of the plunger and thus cause the disk to rotate in a forward direction when released by the fault current. After the fault has been cleared the solenoid is energised, thus causing the iron core to be lifted; the weight of the plunger in the dashpot then causes the disk to rotate in the reverse direction and so assume its normal position ready for another fault.

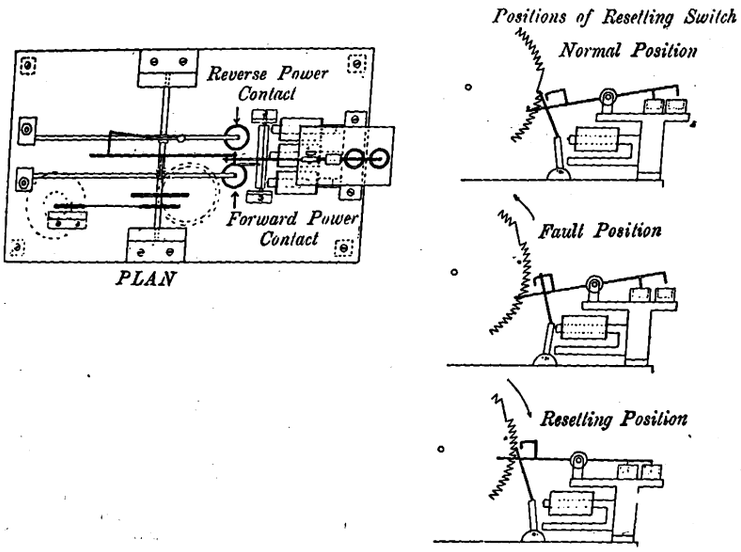

Fig. 3.—Experimental Model Operator.

During normal conditions the disk is held in its zero position by a pawl engaging with the teeth in the disk. Attached to the pawl is an armature controlled by a bias weight, or spring: when a fault occurs the armature is pulled over, thus allowing the disk to rotate until the fault clears itself, or the switches open, when the pawl on the armature again engages and stops further disk rotation in a forward direction. The armature is energised by one, or more, of four coils, three of them connected one in each phase, and the fourth in the neutral to function for "earth" faults only; it is made very sensitive, as normally little current flows in the neutral.

Mounted near the pawl is a contact which is held open by a pin in the disk when the latter is in its normal position. Immediately the pawl is released from the disk by excessive current, the pawl takes over the duty of holding the contact open. When the fault has been cleared the pawl allows the contact to close the solenoid-resetting circuit, which causes the disk to return to its zero position and the contact to be opened again by the pin in the disk.

Action of Selector.—The selector's two contact arms are normally held open by the gravity control of the disk. When the fault current suddenly ceases the disk will tend to swing over and so make the other contact, which may under certain conditions trip the wrong switch; but, since the shunt and tripping circuits are broken simultaneously on the selector, no complications can occur should the disk momentarily swing over. It is due to this contact and the purely mechanical timing, that the "Lothians" system can give such fine time settings between successive instruments.

Use of Protection Gear.—On an open-ended main, since there can be no reversal of power, operators only are required.

On parallel feeders operators only are required at the feeding end, with a very short time-lag setting. At the remote end selectors only are required, set without any time lag, so that they function before the operators.

On a ring main when two switches are installed in each sub-station (incoming and outgoing) one switch would be on the forward setting and the other on the reverse, but only one set of selectors and one operator are required. Only three current transformers are required to operate the apparatus when two switches are to be controlled, except at the supply point, where one operator is fitted to each switch, but without selectors. When there is only one switch in each sub-station the operator can be given two distinct time settings, one for forward and one for reverse power.

The tripping of the switches and resetting of the operator are carried out by direct current supplied from a battery provided for that purpose in each sub-station.

On the selector is an indicator that shows which phase has been, or is still, faulty, and also in which direction the fault lies. On the operator an indicator shows how far the disk has revolved before clearing the fault, and (knowing the settings of the various instruments) it is possible to ascertain which switch has tripped by visiting any one of the sub-stations, because all the indicators will read the same as the one in the sub-station in which the switch has tripped; all indicators have to be reset by hand. Across each tripping contact of the operator is connected a small hand-operated time-lag cut-out switch: when closed, before re-closing a switch which has been tripped by a fault, it causes practically instantaneous tripping should the fault still be on.

When designing the apparatus our aim was to obtain absolute mechanical timing with close setting between each successive instrument: for example, we have had for over 12 months four sets on a ring main eleven miles long, with a maximum time lag at the supply point of 0.64 second; they were made by our staff with the assistance of an outside instrument maker. Out of fourteen faults caused by birds and tree branches, the first four were not cleared in proper sequence, owing to adjustments which could only be carried out after noting practical conditions; the fifth cleared itself before any switches tripped, and the last nine faults have been cleared in proper sequence. When a fault occurs on a ring main fairly near the supply point, the instruments on the long section of the ring do not usually commence to function until the short section has been cleared, due to the fall in pressure being insufficient to cause heavy current to flow round the long section until the pressure rises after the short section has been cleared. This fact, however, does not affect the working of the apparatus.

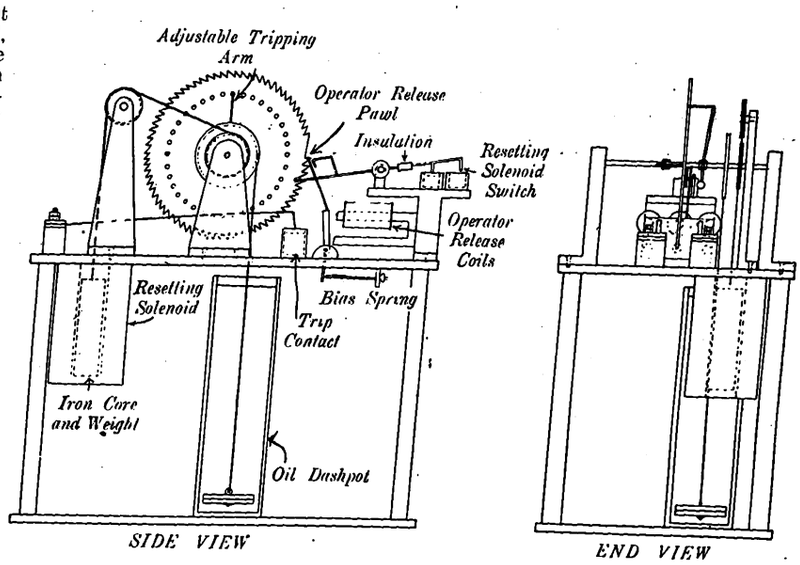

Fig. 3a.—Experimental Model Operator.

Action During a Fault.—The sequence of function is as follows (fig. 5):—Suppose an earth fault on blue phase: corresponding current will be induced in the secondary winding of transformer 36 and flow through selector series coil 6, which will then cause switches 35 and 33 to close; simultaneously coils 24 and 24a will release the operator. The closing of switch 33 will allow the shunt coil 5 to be energised from

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potential transformer 7, the combined effect of coils 5 and 6 causing contact 4 to close. When the time lag of the operator has elapsed, contact 29 will complete the d.c. tripping circuit through trip coil 31 (from battery 30) when the main oil switch 1 will break the fault current induced in the current transformer secondary 36. Switches 35 and 33 will then open the

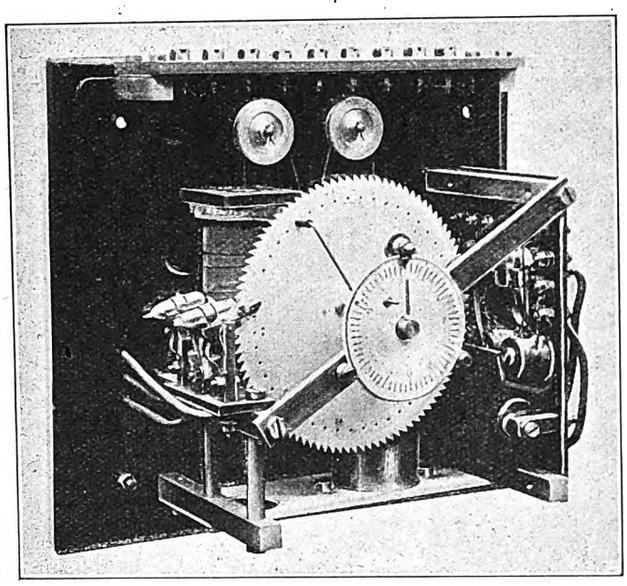

Fig. 4.—Operator Time-lag Device.

trip circuit and shunt coil 5, causing contact 4 to open; simultaneously the operator will stop and resetting contact 26 close, thus energising resetting coil 22 from battery 30. The operator will then return to its normal position and resetting contact 26 open, thus cutting off the current to the resetting solenoid.

Should the power to the fault be in the opposite direction the sequence of operation will be the same, with the exception that contacts 4a on the selector and 29a on the operator will be closed, thus energising trip coil 31a and opening oil switch 2.

If the fault is cleared by another switch on the line the apparatus will return to its normal position for further use should another fault occur.

Commercial Model.—The commercial manufacture of the apparatus has been undertaken by a company in Scotland, which, after thorough investigation and inspection of the original in operation, was satisfied that the apparatus will effectively protect a distribution main against all descriptions of fault and indicate the section on which the fault occurs, without the consumption of power except when functioning; also it will indicate the nature of faults at a cost which is infinitesimal, compared with that of existing apparatus on the market with which pilot wires have to be used; above all it allows load to be taken off at any point of the line, thus allowing transmission lines to be used to their fullest extent.

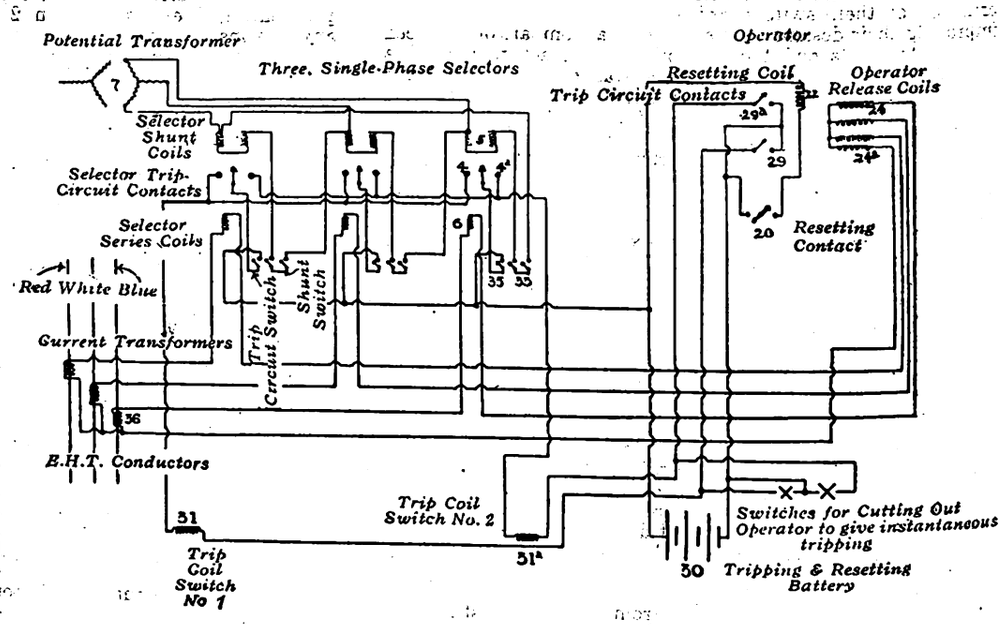

Fig. 5.—Connections for Tripping Two 3-phase Switches.

German Million-Volt Testing Plant.

An open-air million-volt testing plant has recently been established by the Bergmann Electricitätswerke Gesellschaft, at its works in Berlin. The plant is intended for the testing of transformers, insulators, &c., constructed for outdoor use. The installation consists of three transformers connected up on the Dessau system so that at the end terminals a pressure of a million volts is obtained. The Bergmann Co. has already a half-million volt testing plant, which in future is to be used for the testing of insulating and allied materials.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Earth or Insulate?

May I hasten to assure Mr. Crowdy that my letter was written in the same strain as his own, and to grasp his outstretched hand with all good wishes for the coming year? We must have these little bits of fun occasionally, and I am only too happy to withdraw any hard words that are not, perhaps, in the best of taste.

I still think that I should have preferred to see the conductor under discussion enclosed in a flexible metallic tube in the same way as the metal-pot conductors, but no doubt Mr. Crowdy has the best of reasons for not doing so.

May I also thank you, Sirs, for your good wishes, and hope that our REVIEW may prove even more useful to us in the future than it has done in the past—which is, in the language of our American cousins, "saying a mouthful."

T. C. Gilbert.

Folkestone, *December 29th*, 1928.

Lamp Trading.

The trade generally, I venture to believe, would like the E.L.M.A. to define clearly the dividing line between *bona-fide* electrical traders and others: whether, for instance, the line is to be drawn at piano dealers, leather goods merchants, or paper hangers. Representative businesses of these three mentioned trades are trade-graded in this city.

What with shopkeepers *ad lib* being allowed (*sub rosa*) discounts on parcels of one dozen lamps or so, and other "snatch order tactics," the sales, in relation to output, passing through legitimate trade channels get smaller year by year.

Upon asking for lamp orders at their own installation jobs, contractors are often told that their customers buy elsewhere at a discount—a very galling experience for one who merely asks for that which he, naturally, expects.

Is it not time that the whole business was seriously reviewed, and "rules and regulations" adjusted a little more in favour of those looking (perhaps unfortunately) to the trade for a living?

J. H. Noble,
(*Director*) ELECTRO-MECHANICAL SUPPLIES, LTD.

Coventry, *December 28th*, 1928.

Thermal Efficiency.

We hear a good deal about the thermal efficiency of electricity generating stations, and it would be interesting to know just what is intended by that expression. Is there any authoritative formula for it? and is the same formula used by all stations in making their returns? What about the power used in the station itself for the numerous auxiliaries, coal and ash conveyors, pulverisers, pumps, fans, &c.? Is this debited or credited? What is the position in this respect of a station with steam-driven auxiliaries, as compared with one all motor-driven? The power used up by the auxiliaries in a modern supply station must be a considerable percentage of the total.

M.I.Mech.E.

December 29th, 1928.

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Wind Pressures.

Referring to the extracts from a paper by Mr. W. B. Woodhouse on Overhead Lines before the I.E.E., in the ELECTRICAL REVIEW of November 16th, the following data observed here during the hurricane of September 15th-16th, 1928, may be of interest.

The pole line in question was constructed of 33-ft. Bates expanded-steel lattice poles (an American product), with concrete foundations 4 ft. in coral rock, and failed by bending through an angle of 90 deg. about 8 feet from the ground.

From a consideration of the exposed area of the poles and lines and the manufacturers' actual tests at which failure occurs, it was apparent that the wind pressure exceeded 66 lb. per square foot.

The failures were not isolated cases which might have been attributed to faulty poles, but occurred to groups of poles in three different localities.

The anemometer failed when registering 98 m.p.h., but the wind velocity further increased to an estimated anemometer reading of 125 m.p.h., giving an actual wind velocity of approximately 94 m.p.h., accompanied by torrential rain. It appeared that the maximum pressures were due to "eddies" or streaks in the main gale, which caused exceptional conditions in particular localities; while large structures might only be loaded to an average value, small structures are more liable to be wholly loaded at the maximum pressure and consequently suffer greater damage.

While laboratory tests in tunnels with dry air are productive of interesting and useful data, the conditions are hardly comparable with gale conditions when the atmosphere is heavily laden with rain, which, by virtue of its increased mass, must produce considerably greater pressures on exposed structures. It is suggested that more extensive observations of actual wind (and rain) pressures under gale conditions would be of much service to engineers responsible for line construction, as figures of wind velocities convey little information regarding the maximum loading likely to be encountered

C. H. Brazel, A.M.I.E.E.,
Director, Electrical Department.

Nassau, Bahamas, *December 15th*, 1928.

British and Foreign Switchboard Ammeters and Voltmeters.

Extracts from a synopsis of a detailed report by the British Scientific Instrument Research Association.

WE have received from the British Scientific Instrument Research Association a summarised report on an investigation, initiated by the Association at the request of certain of its members, who desired to obtain an impartial criticism of their switchboard instruments, with a view to improving their designs, and an impartial comparison between their instruments and those of other manufacturers, with a view to discovering whether there was any foundation for statements, not infrequently met with, that the instruments made by certain foreign manufacturers were the "best" obtainable.

The inquiry was confined to permanent-magnet moving-coil instruments, new instruments being obtained from the best-known British and foreign manufacturers. The examination has led to slight modifications being made in certain British instruments in respect of the degree of damping provided and the details of scales. The best of the instruments examined, both British and foreign, are stated to be well suited to the purposes for which they are made, and none of them shows an outstanding superiority over all the others in every particular. The instruments made by two British manufacturers are open to criticism in respect of some details of construction, while the instruments made by two foreign manufacturers are distinctly inferior both in design and construction to any of the other instruments examined.

"It can definitely be stated, as the result of the examination, that the instruments made by certain of the principal manufacturers in this country are not inferior to any comparable instruments of foreign manufacture; and that in what may be termed the general 'balance' of design some of the British instruments take a leading place."

The types of instruments selected were the ordinary "Dial Type" switchboard ammeters and voltmeters, of from six to eight inches diameter, obtained from 12 of the best-known British, American, and Continental sources, the number of different instruments being twenty-three.

Some extracts from the report are given below :—

Rapidity of Indication.

The instruments examined differed widely in the extent to which the movement of the pointer was damped, as the result of which there was a wide variation in the time taken for the pointers to come to rest after a current, sufficient to produce a deflection of about 90 per cent. of the full deflection, had been switched on through the instrument. In some of the instruments the pointer struck violently against the stop at the upper end of the scale. In one or two instances, also, there was a tendency for the movement to stick at the upper end of the scale. In other instruments the pointer oscillated several times before coming to rest.

The damping should be almost, but not quite, critical, *i.e.*, it should allow the pointer to swing slightly beyond the position it will finally take up, and to return fairly quickly to (and actually through) that position, after which the movement should be imperceptible. Certain of the instruments, both of British and foreign manufacture, were admirably proportioned in this respect. Two others, of British make, were modified by their makers in order to demonstrate that it was quite a simple matter to adjust the damping to any desired degree.

Accuracy.

Of the instruments examined, about 60 per cent. were accurate to within 1 per cent. at ordinary temperatures, 30 per cent. had errors between 1 per cent. and 2 per cent., 8 per cent. had errors between 2 per cent. and 3 per cent., and one instrument had an error of over 9 per cent.

The general level of accuracy of the British instruments was at least as high as that of the foreign instruments.

Correction for Temperature.

Most of the voltmeters were fairly accurately corrected for temperature variation.

The ammeters were not, in general, provided with compensating coils, but the variation of sensitivity over a range from 10 deg. to 50 deg. C. was not usually greater than 3 per cent. Three ammeters, two British and one foreign, were fitted with compensating coils. In one of the British instruments the compensation was practically perfect from 10 deg. C. to 50 deg. C., the sensitivity of the instrument being constant to within one or two parts in one thousand over this range of temperature. In both of the other instruments the compensation was good between 10 deg. C. and 25 deg. C., but was less perfect between 25 deg. C. and 50 deg. C.

A certain degree of compensation can be provided without the use of compensating coils, by a proper choice of the materials used in the moving-coil circuit, control springs, shunt, &c. In one of the "uncompensated" foreign instruments the variation in sensitivity corresponded almost exactly to that found in the compensated instrument of foreign manufacture already referred to. Another uncompensated instrument, a British one, showed a temperature variation between 12 deg. C. and 30 deg. C., rather less than twice that of the compensated foreign instrument, the total variation in the uncompensated British instrument between 12 deg. C. and 50 deg. C. being only one-third of that of the compensated foreign instrument.

Internal Construction.

(a) *Zero Adjustments.*—In some of the instruments no zero adjustment of any kind was fitted, while in several others the fitting provided was very light and flimsy. In less than half the instruments was the zero adjustment really robust. Zero adjustments were fitted in all the British instruments.

(b) *Coil Mounting.*—In many instruments the coil was supported between bridge-pieces mounted on the pole-pieces in such a way that the movement could not be removed from between the pole-pieces without dismantling it. In other instruments the whole movement was held in a frame, either pressed or die-cast, which could be slipped from between the pole-pieces after one or two screws and connections had been loosened. The latter form of construction, which is adopted by most of the manufacturers whose instruments were examined, would appear for many reasons to possess advantages over the former.

In the instruments made by one foreign manufacturer the frame which carried the coil was of a very flimsy construction, and was held in position between the pole-pieces by shellac; this instrument was rather unusually constructed in almost all respects.

In the instruments made by two British manufacturers the

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jewels were mounted on resilient supports. Two instruments, neither of which was provided with resilient supports, were found to be damaged when they were opened. The practice of fitting resilient supports to the jewels affords considerable protection to the movement against risk of damage.

Springs.

In all the instruments phosphor-bronze springs were used. All the instruments were tested to see if the zero changed temporarily or permanently after the coil had been kept deflected to about 90 per cent. of the maximum deflection possible, for periods up to 72 hours. In only two instruments was the zero unchanged after this period, though the change was only temporary.

The problem of making springs free from the defect in question has not yet been solved by any of the manufacturers whose instruments were examined. The "torque/weight" quotient varied very considerably, ranging between 0.044 and 0.46.

Magnetic System.

The magnets used differed largely in weight, in cross section and in length: the magnet steels also differed considerably in their "coercive force." Of the instruments of normal design, those with the longest and shortest air gaps, respectively, had gap fields which differed by less than 10 per cent., *despite the fact that the magnet in the instrument with the long air gap weighed only half as much as the magnet in the other instrument*: the heavier magnet was 20 per cent. longer than the lighter magnet. The coercive force of the steel which was used in the instrument having the large air gap was some 30 per cent. higher than that of the magnet in the instrument which had the short air gap, and, in addition, the design of the system was such as to minimise the magnetic leakage round and over the gap. It will be seen, therefore, that an instrument cannot be adversely criticised merely because it has a somewhat large air gap. The larger gap greatly reduces the danger of the coil "sticking" if a particle of magnetic dust happens to get into the gap.

Pole-pieces.

Some of the instruments were open to serious criticism as regards the way in which the pole-pieces were supported. They should be mounted in such a way that no strain can be imposed on the movement by the means provided for fixing the pole-pieces in position. Such strain is not likely to arise if the movement is carried by a frame or casting which can be removed from the instrument without dismantling and without disturbing the pole-pieces. In some of the instruments the fit of the components was so bad that the strain thrown on the movement during assembly must have been considerable.

The movements of most of the British and foreign instruments were mounted in separate frames or castings so as to be independent of the mode of fixing the pole-pieces.

Magnetic Shielding.

The instruments were not tested to determine the extent to which their indications were affected by external magnetic fields. The Continental instruments examined were not so completely shielded as the British and American instruments.

External Appearance.

Experience gained during the examination of the instruments has led definitely to a conclusion which favours a type of finish almost severely plain, the only relief being such as would be afforded by a thin raised rim, either nickel-plated or black, the rest of the body having either a plain or unobtrusive matt ground, finished dead black or semi-dead black. The majority, though not all, of the British instruments examined were finished in styles corresponding to that for which preference has just been expressed.

Scales.

The types of scales which were considered to be the most satisfactory were fitted in certain of the British instruments. In two pairs of foreign instruments the scales were fairly satisfactory, though the figures in most of the foreign instruments were much less readily recognised than those in the British instruments just mentioned.

Pointers.

The pointer-heads varied in shape from that of a narrow spearhead to a pear-shape, some of the heads having circular holes punched in the middle. The best type of pointer for accuracy of reading was one of a modified diamond shape, all four sides of the diamond being concave, with the "reading" end of the pointer head very long and finely tapering, the extreme end being about the same width as the graduations of the scale.

Dials.—The dials were all graduated in black lines on a white background. Provided that the paint adheres properly to the metal plate and does not become discoloured or detached when the instrument is in service, the use of a painted dial would appear to be preferable to the fitting of a paper dial cemented to a metal back, though the whiter colour which can be obtained on a first-quality card is a point in favour of the use of card instead of painted metal. The best finished dials were found in the instruments made by certain British manufacturers.

General Statement.

The results of the examination are summed up as follows:—

(*a*) The best of the instruments examined, both British and foreign, are generally well suited to the purposes they are intended to serve, and none among them shows an outstanding superiority over all the others in every particular. Two pairs of instruments of British manufacture were open to criticism in respect of certain details of construction, while two pairs of instruments of foreign origin were distinctly inferior, both in design and construction, to any of the other instruments examined.

(*b*) If the instruments were placed in order of merit as assessed on some particular criterion of excellence, the instrument placed first would in many instances be a British one; certain of the British instruments examined would occupy high positions whatever criterion were chosen.

(*c*) The consistently high positions occupied by certain British instruments has led us to the definite conclusion that the best-known British instruments of the kind dealt with are quite equal to the best-known corresponding products of foreign origin, in the suitability of their design for the purpose to be served, in the consistency of their indications, and in the general lines and details of their construction.

Victoria Embankment Electric Lighting.

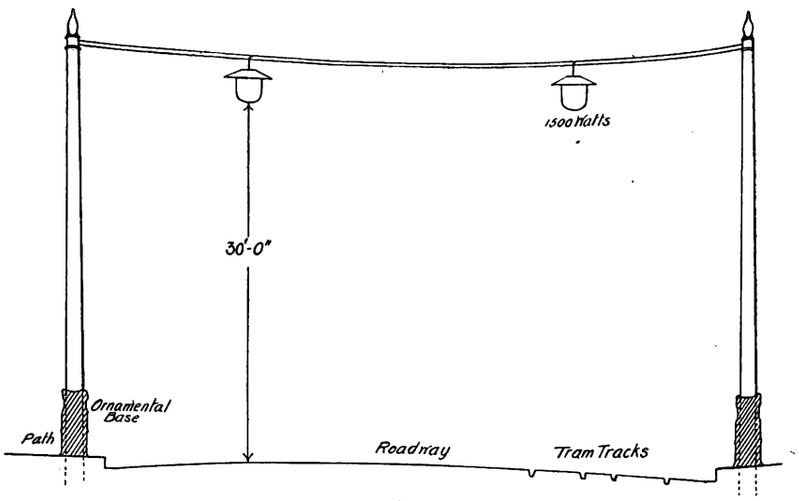
Particulars of the New Scheme.

THE London County Council, at a meeting on December 18th, approved a scheme for replacing the existing electric lighting arrangements of the Embankment with a completely new system.

The report of the Highways Committee, dealing with the matter, states that the Committee has had under consideration, for some time, the question of the steps to be taken to bring the artificial lighting of the Embankment up to the standard now thought necessary, having regard to the greatly increased and rapid traffic along this important highway.

The present installation was designed for series of arc lamps, and the energy was originally generated in the Council's own works; since 1910 the energy has been purchased from the public supply authorities. Gasfilled incandescent lamps were in due course substituted for arc lamps, and at present there are 63 kerb, 69 parapet, and 38 refuge standards, with some few additional fittings under the bridges.

The chief engineer has prepared the new scheme to bring the lighting into conformity with the B.E.S.A. specification for street lighting; both electric lighting and gas companies were invited to submit proposals on this scheme, which has as its main feature the suspension of the lamps over the centre of the road—as shown in the accompanying sketch.



Suspension Arrangements for Embankment Lighting Scheme.

After careful consideration the Committee decided to recommend the acceptance of the tender submitted by the Charing Cross Electric Supply Co., Ltd., at an inclusive cost of £14,184, which includes the provision of ornamental bases for the standards to carry the span wires across the carriageway.

These span wires will carry two 1,500-watt lamps, at a

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height of 30 ft. above the roadway, and will be spaced 140 ft. between spans: the cables to supply this new system of lighting will be laid under the footways.

With regard to the use of centrally suspended lamps over the carriageway, the Highways Committee states that such lanterns were experimented with on the Embankment opposite Hungerford House some years ago, and were found to afford much improved illumination; the Committee is satisfied that this form of illumination is the best method of obtaining uniform and efficient results, and considers that the necessity for putting the lighting into a satisfactory condition justifies any small interference with the amenities of the Embankment that would be caused by the overhead span wires, which, however, at a height of 30 ft., will be inconspicuous.

The annual maintenance charges will be £3,700, exclusive of painting the columns and repairing any parapet lanterns.

The British Industries Fair.

A List of Electrical Exhibitors in the London Section.

THE catalogue of the London Section of the British Industries Fair is again out well in advance of the show, and we have been able to select from it about seventy exhibitors whose displays will be principally of electrical interest (including radio). In our issue of December 21st we printed a list of electrical and allied exhibitors at Birmingham. Ignoring one or two duplications, the Fair as a whole will include about 200 exhibitors of the class mentioned—a very fair showing. The London list follows:—

Accurate Recording Instrument Co., Ltd.
Ajax, Ltd.
Albion Shades, Ltd.
Atkinson, C. Creswick.
"Attracta" Electrical Co.
Axuel Time Switches, Ltd.
Bakelite, Ltd.
Beatty Bros., Ltd.
Belling & Lee, Ltd.
Berry's Electric, Ltd.
Beuttell, A. W., Ltd.
Birkbys, Ltd.
Bower Electric (1926), Ltd.
Brantford Washing Machine Co., Ltd.
Brook, J. A.
Brown, S. G., Ltd.
Brownie Wireless Co. of Gt. Britain, Ltd.
Burovox, Ltd.
Calvete, I., Ltd.
Celebritone, Ltd.
Clarke, H., & Co. (Manchester), Ltd.
Cole, E. K., Ltd.
Cossor, A. C., Ltd.
De La Rue, Thos., & Co., Ltd.
Dowsing Radiant Heat Co., Ltd.
Dubilier Condenser Co. (1925), Ltd.
Dyson, J., & Co., Ltd.
Eastick, J. J., & Sons.
Eastern Telegraph Co., Ltd.
Ever-Ready Co. (Gt. Britain), Ltd.
Federation of British Industries.
Ferranti, Ltd.
Formo Co.
Franco-British Electrical Co.
Fraser & Glass.
Freezone, Ltd.
Fuller Accumulator Co. (1926), Ltd.
Garnett, Whiteley & Co.
Graham, Farish, Ltd.
Hailwood & Ackroyd, Ltd.
Halcyon Wireless Co., Ltd.
Hoover, Ltd.
Ideal Home Electric Appliances, Ltd.
Igranic Electric Co., Ltd.
Johnson, Matthey & Co., Ltd.
Langham Radio.
Lever, Eric J., (Trix), Ltd.
Lissen, Ltd.
Loewe Radio Co., Ltd.
M-L Magneto Syndicate, Ltd.
"M.P.A." Wireless, Ltd.
Marathon, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Mullard Wireless Service Co., Ltd.
Neophone Engineering Co.
Nobbs, George, Ltd.
Northern Aluminium Co., Ltd.
Ormond Engineering Co., Ltd.
Power Engineering Co.
Read Radio, Ltd.
Rees, Mace Mfg. Co., Ltd.
Rialton Radio.
Selectors, Ltd.
Sheringham Daylight Co.
Solidite & Synthetic Mouldings, Ltd.
Spauldings, Ltd.
Telegraph Condenser Co., Ltd.
Thermega, Ltd.
Triotone, Ltd.
Truphonic, Ltd.
Watmel Wireless Co., Ltd.
Westinghouse Brake & Saxby Signal Co., Ltd.
Whittingham, Smith & Co.
Wright & Weaire, Ltd.
Wandle Radio Co.
Zone Wireless Co., Ltd.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1927.

15,168. "Means for driving television or other apparatus at a pre determined speed." J. L. Baird and Baird Television Development Co., Ltd. June 7th, 1927. (301,847.)

17,724. "System of selective remote control by superimposing alternating currents on linked light and power mains." O. Muck. July 4th, 1927. (Patent of addition not granted.) (301,939.)

17,884. "Ventilation of dynamo-electric machinery, transformers, and the like." Sir C. A. Parsons and J. Rosen. July 5th, 1927. (301,771.)

18,054. "Alternating current dynamo-electric machines." General Electric Co., Ltd., and M. Kahn. July 7th, 1927. (301,848.)

22,698. "Circuit arrangements for the operation of electric discharge tubes with direct current." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 29th, 1927. (301,763.)

23,093. "Transformer connections, for example, for rectifiers." British Thomson-Houston Co., Ltd., and J. C. Read. September 2nd, 1927. (301,767.)

23,162. "Control of the load factor in electrical current-supply systems to factory and similar installations, including electrical resistance furnaces." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. September 3rd, 1927. (301,814.)

23,296. "Metallic-vapour rectifiers for alternating currents." Akt. Ges. Brown, Boveri et Cie. October 18th, 1926. (279,045.)

23,306. "Magnet cores." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. September 5th, 1927. (301,784.)

23,307. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. September 5th, 1927. (301,785.)

23,393. "Electric protective devices." British Thomson-Houston Co., Ltd., H. Trencham, and H. S. Petch. September 6th, 1927. (Addition to 268,485.) (301,948.)

23,436. "Valve rectifying and amplifying arrangements." Siemens and Halske Akt.-Ges. September 17th, 1926. (277,650.)

23,558. "Cathode-ray tubes." C. H. F. Muller Akt. Ges. September 7th, 1926. (277,347.)

23,640. "Arrangement for switching off an inductive resistance mounted in a direct current circuit." Siemens-Schuckertwerke Akt. Ges. September 11th, 1926. (277,350.)

23,648. "Automatic regulation of dynamo-electric machines." J. Stone and Co., Ltd., and A. E. Honey. September 8th, 1927. (301,953.)

23,672. "Electric induction furnaces." E. F. Northrup. September 8th, 1927. (301,954.)

23,851. "Loud-speaking telephones and the like." Sterling Telephone and Electric Co., Ltd N. Blades, and J. R. Beard. September 10th, 1927. (301,960.)

24,799. "Electric motor-control systems." General Electric Co., Ltd., and H. G. McClean. September 21st, 1927. (301,977.)

24,860. "Insulating panels." Siemens Bros. & Co., Ltd., and W. E. Goodwin. September 21st, 1927. (301,979.)

25,046. "Electrical condenser units." Dubilier Condenser Co. (1925), Ltd. (W. Dubilier). September 22nd, 1927. (301,980.)

25,272. "Apparatus for testing motor road vehicles." F. W. Highfield and Highfield Electrical Co., Ltd. September 24th, 1927. (301,982.)

25,279. "Manually operated selecting switches for telephone and like systems." A. Graham & Co., Ltd., and A. C. Brockies. September 24th, 1927. (301,983.)

25,496. "Loud-speaking telephones." Sterling Telephone & Electric Co., Ltd., N. Blades, and J. R. Beard. September 27th, 1927. (301,989.)

25,634. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and C. H. Hastings. September 28th, 1927. (301,991.)

27,062. "Arrangement in commutator machines connected in cascade to induction machines." Allmanna Svenska Elektriska Aktiebolaget. October 15th, 1926. (279,086.)

28,142. "Electric locomotives." H. P. Bramah and Metropolitan-Vickers Electrical Co., Ltd. October 22nd, 1927. (302,009.)

28,551. "Electrical plugs." T. Harden and H. A. Mepham. October 27th, 1927. (302,012.)

28,658. "High-voltage system and apparatus for use particularly with X-ray tubes." F. S. Smith. October 27th, 1927. (Convention date not granted.) (282,020.)

29,630. "Sound-reproducing apparatus." H. T. P. Gee (F. W. Paterson). November 5th, 1927. (302,022.)

29,714. "Electric circuit breakers." Electrical Improvements, Ltd., and L. C. Grant. November 7th, 1927. (302,024.)

29,899. "Electric contact breakers." British Thomson-Houston Co., Ltd., and E. G. Parrott. November 8th, 1927. (302,025.)

31,591. "Electric fuses and isolators." V. Hope. November 24th, 1927. (302,039.)

33,476. "Electric circuit breakers." A. B. Field, A. N. Hanworth, and Metropolitan-Vickers Electrical Co., Ltd. December 10th, 1927. (302,048.)

34,352. "Negative electrode for electric accumulators." A. Pouchain. December 20th, 1926. (282,449.)

34,641. "Arrangement for protecting stationary dry surface contact rectifiers from overload." Siemens-Schuckertwerke Akt. Ges. December 22nd, 1926. (282,693.)

35,222. "Clamps or connectors for electric cables." T. Yamanouchi. December 29th, 1927. (302,063.)

35,332. "Temperature-responsive devices." International General Electric Co., Inc. December 30th, 1926. (282,827.)

35,335. "Electrodes for use in arc welding." Imperial Chemical Industries, Ltd., and J. H. Paterson. December 30th, 1927. (302,064.)

1928.

131. "Thermo-electrically operated devices for the protection of rotary dynamo-electric machines." Electrical Improvements, Ltd., and H. B. Poynder. January 3rd, 1928. (302,066.)

1,064. "Couplings for electric conduits." J. Brighouse. January 12th. 1928. (302,068.)

1,584. "Air drying apparatus for oil-immersed electrical transformers." Allmanna Svenska Elektriska Aktiebolaget. January 4th, 1928. (302,071.)

1,828. "Automatic protection and control of electrical installations." S. Schild. February 24th, 1927. (285,870.)

10,750. "Motor train for operating switches." Landis & Gyr Soc. Anon. June 11th, 1927. (292,062.)

11,335. "Shadowless lighting apparatus." Anciens Etablissements Barbier, Benard & Turenne Soc. Anon. February 10th, 1928. (302,105.)

11,519. "Automatic electric cut-in and cut-out switches for battery charging systems." F. Whipp, Whipp & Bourne, Ltd., and Mather and Platt, Ltd. April 19th, 1928. (302,107.)

12,355. "Valve amplifying device combined with a reproducing apparatus for sound films." H. J. Kuchenmeister. November 2nd, 1926. (Divided application on 28,323/27.) (289,448.)

12,367. "Electric sign." J. E. Long. April 27th, 1928. (302,109.)

12,562. "Planet gear drive for electro-mechanical phonographs." W. Rebikoff. September 10th, 1927. (296,975.)

14,744. "Leads for sounding purposes." Electroacustic Ges. June 2nd, 1927. (291,444.)

16,583. "Alternating current motors with short-circuited armatures." Bergmann Elektricitätswerke Akt Ges. June 11th, 1927. (292,071.)

18,195. "Incandescent electric lamps and the like." C. Tourne. June 23rd, 1927. (Addition to 273,293 and 280,496.) (292,616.)

18,660. "Electrically-driven roller ways." B. Quast and F. Lomberg. January 25th, 1928. (302,128.)

19,621. "Resistance elements for electric fires and the like." G. Pate and J. R. Laird. July 6th, 1928. (302,130.)

24,663. "Submersible electric machines." Siemens-Schuckertwerke Akt. Ges. October 20th, 1927. (299,035.)

27,039. "Coupling arrangements for use in high frequency circuits." Marconi's Wireless Telegraph Co., Ltd. September 21st, 1927. (297,434.)

32,126. "Electric control switch constructions." F. Berg. August 6th, 1927. (Divided application on 300,152.) (301,964.)

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ANNAN.—Extensions to Academy (£4,625), for Dumfries-shire E.C.; director of education, Dumfries.

ASHFORD.—Hostel at County School for Girls; Kent Education Committee.

AYRSHIRE.—Entertainment pavilion (£7,000) for Largs Town Council; burgh surveyor.

BARNSLEY.—Development of building estate at Lees Hill, Ardsley; J. K. Micklewait.

BINGLEY.—Housing scheme (24); E. O. Robinson, architect, Town Hall.

BIRKENHEAD.—Extensions, Isolation Hospital; borough engineer. Six wards and sun room, Red Cross Hospital, Manor Hill; governors. Extensions, Maternity Hospital; borough engineer. Shops and houses, Town Lane and Larchwood Drive; Thomas Evans & Co., Rock Ferry.

BRIDLINGTON.—Housing scheme (60), for the T.C.; borough surveyor.

BROMLEY (KENT).—Houses (71), Palace Estate, for H. F. Thoburn.

BURSLEM.—Extensions, Royal Staffs. Pottery Market Place; J. Steventon & Sons. Warehouse, Portland Tile Works, Portland Street; E. Roddy.

CADISHEAD.—School, for Lancs. E.C.; director of education, Preston.

CALNE.—Electric light installation, Town Hall, for the T.C.; borough surveyor.

CARLISLE.—Cinema, Caldewgate, for W. Williams, Workington.

CASTLEFORD.—Electric light installation, Barnes Road Maternity Home, for the U.D.C.; Fred Scatchard, architect, Midland Bank Chambers.

CHESHUNT.—Houses (30), Dewhurst Road, for W. B. Hart.

COLCHESTER.—Housing scheme (60), for the T.C.; Harold Collins, borough engineer.

CROYDON.—Shops and houses, Mitcham Road Housing Estate, for the T.C.; borough surveyor. Reconstruction of baths (£24,000), with electrical work, for the T.C.; borough engineer.

DERBY.—Block of offices for Derbyshire C.C.; G. H. Widdows and G. C. Copestick, architects, St. Mary's Gate (returnable deposit of £1 1s.).

DOUGLAS (ISLE OF MAN).—Additional 100 houses for the T.C.; borough surveyor.

DOVER.—Cinema, for the Dover Theatre Syndicate, 50, Sloane Square, London.

DUDLEY.—500 houses, Priory Estate; borough engineer. Four schools for the Borough E.C.; director of education.

DUNDEE.—Housing scheme (400); city engineer.

EDINBURGH.—Radium Institute (£40,000); secretary, Board of Management, Royal Infirmary.

FALKIRK.—Reconstructing old Falkirk High School to be used as mining centre; clerk, Stirlingshire Education Authority, Stirling.

FENTON.—Housing scheme, Evelyn Street and Marlborough Street; Stoke-on-Trent city engineer. 28 houses, Evelyn Street; Ball & Robinson, Stoke-on-Trent.

FLEETWOOD.—Pavilion, offices, &c., for the U.D.C.; surveyor.

FORT WILLIAM.—School; clerk, Local School Management Committee.

GLASGOW.—Battery house at Port Dundas, for Central Electricity Board; the engineer. Hall at Stirling Road for Salvation Army; officer in command, Salvation Army. School clinic at Springburn for Education Authority; clerk, Education Offices, Bath Street. Warehouse in Hutcheson Street and Garthland Street for John Glen and Co., Ltd., Ingram Street; the manager.

HAMPSHIRE.—Extensions, Park Prewitt Hospital, and nurses' home, Knowle Mental Hospital; Joint Mental Hospital Committee.

HANLEY.—Motor body works for Fishers (Hanley), Ltd., Vale Place; Cotton, Son & Hulme, architects.

HASSOCKS (SUSSEX).—Church; R. Hodgson, architect.

HAWARDEN.—Offices for the R.D.C.; J. H. Davies & Sons, architects, 14, Newgate Street, Chester (returnable deposit of £2 2s.).

HEREFORD.—Public baths for the T.C.; city surveyor (returnable deposit of £2 2s.); extensions, High School, for Herefordshire E.C.; county architect.

HITCHIN.—Additional 50 houses, for the U.D.C.; surveyor.

HUDDERSFIELD.—Public baths, &c., with electrical work, for the T.C.; L. Smith, borough architect, 26, Hamsden Street (January 14th).

HULL.—Two citadels on housing estates; Salvation Army. United Methodist Church, West Hull Estate; Rev. W. Woodhouse.

KEIGHLEY.—Probable reinstatement (after fire) of Trinity Works, for Smith Peace (Keighley), Ltd., engineers.

KIDDERMINSTER.—Works extensions, Anchorfields, for Morris & Co. Fire station (£3,657), for the T.C.; Bridgwater Bros., builders, Cradley Heath.

LEIGH.—School, Manchester Road; director of education.

LONDON (ILFORD, E.).—Cinema, Green Lane; Lewis Solomon and Son. Extensions, Maternity Hospital; Medical Officer of Health. 117 houses, Inglehurst Gardens and Danehurst Gardens; Peachey & Co., Ltd. 67 houses, Chadwell Heath Lane and Herbert Road; A. Purridge and Co. 113 houses, Clifton Road and Malford Gardens; T. B. Goodwin. 35 houses, Park View Gardens and Grangeway Gardens; T. Anders. 88 houses, Perth Road and Middleton Gardens; J. Aldridge. 32 houses, Collingwood Gardens; A. Smith.

(POPLAR, E.).—Wharf additions, West Ferry Road; Aston Grant & Co., Ltd.

(CLAPHAM, S.W.).—Warehouse, Park Hill; Wilton Decorators, Ltd.

(STREATHAM, S.W.).—42 houses, Leigham Court Road and Romeyn Road; F. T. Wooding & Sons.

(WALWORTH, S.E.).—Tenements, Beresford Street; Church Army Housing, Ltd.

MACCLESFIELD.—Silk mill extensions, Chester Road, Poynton, for William Booth, Ltd.

MAIDSTONE.—Extensions, West Kent General Hospital (£50,000); secretary.

MANSFIELD.—School, for the Borough E.C.; borough surveyor.

MERTON AND MORDEN.—School (£20,780), for Surrey E.C.; A. Monk, builder.

MORECAMBE.—Alterations, Morecambe Tower; Denman Picture Houses, Ltd.

NEWCASTLE-UPON-TYNE.—School, High Heaton Estate; City Education Committee.

OXFORD.—Church (£4,500), for Cowley Congregational Trustees; H. W. Smith, architect, George Street.

PENWORTHAM (PRESTON).—Church, Congregational trustees. Fire station (£4,300), for Preston R.D.C.; W. Beetham & Co., builders.

PONTEFRACT.—Colliery developments, Prince of Wales Pit, for Pontefract Collieries, Ltd.

PORTERS PARK.—First section, Mental Hospital (£43,661); John Laing & Son, Ltd., Mill Hill, for Middlesex C.C.

RICHMOND (SURREY).—Re-wiring 15 circuits for electric light, Infirmary, dining hall, and laundry blocks, for the B.G.; Brewer, Smith & Brewer, architects.

SHIPLEY.—New public offices; U.D.C. Special Committee.

STOCKPORT.—Extensions to Infirmary (50 beds), for the governors; Worthington & Son, architects.

SWANSEA.—Industrial centres for mental defectives; Education Committee.

SWINDON (WILTS.).—Educational hall and bakery extensions, for the New Swindon Industrial Co-operative Society, Ltd.; secretary.

WAKEFIELD.—Municipal office extensions; city engineer.

WALSALL.—Additional 450 houses for the T.C.; borough surveyor.

WARRINGTON.—Sunday schools and church hall (£4,500), for St. John's Presbyterian Church; secretary.

WATFORD.—Factory, Bye-Pass Road, for National Filling Factory, Coventry; F. H. Clark.

WELWYN (HERTS.).—Additional 30 houses, for the R.D.C.; surveyor.

WESTON-SUPER-MARE.—Additional 111 houses for the U.D.C.; surveyor.

WILLINGTON (Co. DURHAM).—Additional 20 houses for the U.D.C.; surveyor.

WREXHAM.—Additional 36 houses, Huntroyde Estate, for the T.C.; John England, borough surveyor.

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The

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Materials for Electrical Industry.

THE year just concluded has been a favourable one from the copper producers' point of view, as can be realised when it is remarked that at the close of 1927 the price of electro copper stood at £66 15s. per ton, and had advanced to £77 5s. by the end of 1928. To some extent, no doubt, the cause of the improvement in values is that the Copper Exporters, Inc., the organisation created about a couple of years ago to handle sales of the metal in markets outside of the United States, has got into its stride and, with little serious outside competition to fear, has been able to command its own figure. A further contributory factor, possibly, has been the working of the Copper Institute in America, which has enabled the producers to keep more closely in touch with the position of consumers and their probable requirements. What, however, has been the main cause of the improvement in values has been the large increase in the rate of world consumption of the metal. The deliveries of American refined copper during the period January/November (the latest data available at the time of writing) amounted to 1,523,089 short tons, as compared with 1,342,210 tons in the first eleven months of 1927. From this it will be seen that the world called for nearly 181,000 tons more copper during the first eleven months of last year than it did in the corresponding period of 1927. The American production of refined metal has also expanded, but to a lesser degree than the rate of consumption, the total production during the January/November period last year being 1,479,944 tons, as compared with 1,347,583 tons. In some quarters the impression has prevailed that a lack of sufficient refining capacity prevented the production from showing a greater expansion, but a more likely explanation is that producers were regulating output so as not to overtop requirements, and probably in so doing rather under-estimated the possible takings of consumers. At all events, the net result has been that the stocks of American refined copper have been reduced by something like 43,000 tons since the end of 1927. Latterly the production has been speeded up considerably, the November output being some 6,500 tons greater than the deliveries, so that equilibrium seemed to have been attained for the moment at all events.

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Nevertheless, in the last week or so of the year further heavy buying was seen, which will reflect itself in the statistics later on, and the market closed the year with a firm appearance. In view of the increasing tendency in output, the consumption obviously will require to be sustained at a high level to absorb the metal. At present there is, however, no apparent indication of any slowing down in the rate at which copper is being used.

Lead producers during 1928 did not have a particularly satisfactory time. The highest price touched by prompt metal during the year was that of January 2nd, when it was £22 8s. 9d., while the lowest figure of £19 7s. 6d. on March 1st was the lowest since 1921. Indeed, the concern of producers became such that the question of concerted action for the betterment of the situation was discussed at a meeting of the leading producers held in London in September. At that meeting nothing definite was done, except to organise the collection of statistics, in the light of which the whole position will probably be reviewed at another meeting in March. The possibility of some curtailment of output brought about a temporary rise in values, which received further impetus from the shipping trouble in Australia, which occurred about the same time and resulted in a marked restriction of exports from that country. When the strike was over, however, and the accumulated supplies were being shipped, the market relapsed into a somewhat lethargic state, although it closed the year with a rather better tone. The outlook for 1929 actually does not look particularly bright, however, despite the usual end-of-the-year optimism. Supplies give every indication of being plentiful, while at the moment there is little to warrant the supposition that consumption will expand to any appreciable extent. However, the fact that another meeting of producers is being held in March gives a certain obscurity to the outlook, and prices may be influenced by sentiment.

Aluminium has gradually come to play quite an important part in the electro-technical industries, and some further progress was made in 1928. As, however, the aluminium market is very closely controlled, it is difficult to gain an accurate view of the position, but the reduction of £10 per ton in the price in May last can hardly be interpreted as a sign of strength, and demand has not increased materially since then. As a matter of fact, the European position seems moderately well balanced at the moment, but large stocks are reported to exist in Canada, which constitutes a menace to the general stability. Further increases in production are probable in the near future, and no great optimism can be felt regarding prices, for although consumption seems to be expanding gradually, there does not seem much likelihood of its overtaking production yet awhile.

Early in 1928 renewed dissatisfaction was expressed with the Stevenson restriction of rubber exports scheme, and the Government directed the Committee of Civil Research to investigate the matter. This resulted in an announcement by the Government on April 4th that restriction would be withdrawn as from November 1st. This announcement came as a blow to many, and prices rapidly fell to the lowest level touched since the inception of the scheme, and remained depressed throughout the rest of the year. It became obvious that estates, which under the provisions of the scheme, were only exporting 60 per cent. of "standard" capacity, would employ the six months or so before the scheme was withdrawn in tapping heavily and accumulating stocks. Efforts were made by planters to formulate a scheme, with the co-operation of the Dutch, for regulating supplies, but no satisfactory results were achieved. Owing to the low price of rubber, less reclaimed rubber was used, and with a record output of motor cars in the United States and elsewhere, consumption proceeded on a very good scale and stocks decreased substantially. With the removal of restriction, very heavy shipments began from Malaya, and in December stocks began to increase—a movement that will probably be carried on for some little time yet. The prospects for 1929 are rather mixed. No improvement is looked for in the early months, but if consumption continues to make headway as it is expected to do, the year may close with the market in a much sounder position than it is now.

Birmingham "Fair" Arrangements.

WITHIN about five weeks from the time of writing there will be great activity at Castle Bromwich and at the White City in connection with the British Industries Fair. Electrical men who have not already done so should at once mark off in their 1929 diaries the period commencing with Monday, February 18th, and ending with Friday, March 1st, as a time full of opportunities for the trade. Doubtless, the staffs of many exhibitors have already planned their arrangements so far as stands, goods, and personnel are concerned, and publicity departments are providing for advance advertising and literature appropriate to so outstanding an event. If exhibitors and their staffs who read these notes will give us early particulars of new or special products that the visitor can be on the look-out for, we will endeavour to give such information early publicity. The Fair is now recognised as an important electrical event which must be thoroughly prepared for, if the industry as a whole and in its individual parts is to reap a full reward. The whole of the electrical space available at Birmingham was booked many weeks ago—the space taken by the electrical trade constitutes a record, so that so far as size and variety can affect things success may be regarded as assured. What are needed to make assurance doubly sure, are plenty of visitors—buyers from overseas and buyers from all electricity areas at home; a good body of enthusiastic salesmen and stand attendants as well as technical representatives able to impart information; and a thorough-going optimistic spirit. Already we have published the names of electrical and associated companies and firms who are preparing to exhibit either in Birmingham or in London or at both places (ELEC. REV., December 21st, 1928, and January 4th, 1929). This information we are able to supplement in our "Business Notices" to-day, with a list of the electrical organisations which have as in previous years fixed upon certain days for their joint visits to and tours of the Electrical Section at Castle Bromwich. We would urge the individual members of the institutions and associations which have thus promised their co-operation, many of them being also officially represented on the Advisory Committee of the Section, to back up their leaders and see that these visits and luncheon events are largely and representatively attended. Already readers of the ELECTRICAL REVIEW overseas, however far away, have been apprised of the event in good time for them to make their convenient arrangements for visiting the Fair or for having it visited on their behalf by their agents here. We now urge those who are in the nearer foreign markets to make their plans without further delay. If in addition members of the electrical profession and trade in all parts of the Kingdom recognise that for them as well as for overseas buyers, Castle Bromwich will be the great centre of attraction, where they can see more representative British-made electrical products brought together than at any other place or time during the whole year, there should not be a dull day in all the eleven at Birmingham, while the general variety in London will ensure a continuous run of business there also.

Trade with the East.

THE conclusion of a new treaty between Great Britain and China lends added interest to the report of Mr. H. H. Fox, C.M.G., Commercial Counsellor at Peking, which we review elsewhere in this issue. Under the treaty, China is granted complete tariff autonomy, and in return promises to secure the

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abolition of *likin*, arbitrary taxes and dues extorted by military and local "authorities" of all descriptions. This, if accomplished, will dispose of at least one of the obstacles to trade with China, but many more remain. These can only be surmounted very gradually by a continuance of firm government and a cessation of civil war. A prolonged period of peace, if it comes, will work wonders. First, it will enable the railways and roads to be reconstructed, and thus smooth the path of commerce, and after that it will make possible the vast transport and other developments which have been so long forecast but deferred again and again. Mr. Fox shows that the possibilities of trade with China are boundless, but the present state of the country is not such as to inspire confidence, though past history shows how kaleidoscopic the changes are. It seems that most of our visions of the great electrical advance that will ultimately take place must remain but visions for some time yet. It can only be hoped that the Nationalist Goverrment will be strong enough to keep the forces of disorder in check, and thus justify the hope entertained by the "powers" in relinquishing part of the control which they have exercised over Chinese affairs for so many years.

In our issue of December 28th we dealt with a report upon another great Eastern market—India—by Mr. T. M. Ainscough, Senior Trade Commissioner in India. Here the difficulties with which British manufacturers and merchants have to contend are of an entirely different character. For over a century Great Britain has dominated the market; her relations with India were originally in the hands of a commercial concern—the East India Company, and this trading company ruled a large area of the country. In recent years, however, influences have arisen which threaten to lessen our supremacy. Native industry has become an important factor, while foreign competitors have strengthened their position in many directions. For several years past there has been a tendency for Government Departments and other public authorities to place their orders in India wherever this has been possible. Now definite rules have been drawn up which will compel Government Departments to do this, which means that the purchasing organisation in London will gradually diminish in importance, with a consequent loss to British manufacturers of the advantage which they have enjoyed for so long. Under the rules the orders will go to those concerns with adequate and efficient Indian organisations, whether British or foreign, although it may be expected that British traders will still receive some measure of preference.

Mr. Ainscough says that during the past six years he has been advising British suppliers of Government stores to expand their Indian organisations to meet the Government's requirements. It appears that most British manufacturers of machinery and engineering stores have already taken action in this direction. Those who have not done so stand in serious danger of losing important orders, for the trade is expanding, and they should hasten to attend to this vital matter.

The Indian prospect from the purely electrical point of view appears to be good. The latest figures, those for the period April-September. 1928, record substantial advances in imports of both electrical machinery and electrical apparatus. The total value of imports of both classes increased from Rs. 236 lakhs to Rs. 255 lakhs, and the proportion supplied by the United Kingdom from Rs. 171 lakhs to Rs. 177. While this is satisfactory, the fact remains that the British share did not increase in the same ratio as the total.

Industrial Electric Heating.

THE extent to which electric heating can be profitably used for industrial purposes is still far from being appreciated in this country; we have to live down the tradition that "electricity is dear," which was true enough 20 years ago, but does not hold good in our large industrial centres to-day. We have it on good authority that no less than two-fifths of the output of electrical energy in the United States is actually used in industrial heating processes. "Oh, yes!—Water-power," says the man in the street. We reply that long-hour loads can be supplied as cheaply from steam-driven generating stations as from water-power plant, and many industrial heating processes are essentially of this type of load. Moreover, merely to set off the cost of electrical energy against that of other heating agencies, without taking account of the incidental economies that it makes possible, is a purblind policy; the saving in labour alone often equals the cost of energy.

The development of nickel-chromium alloys for the heating elements of electric furnaces constituted a great forward step, and more recently the mounting of the elements inside the refractory lining fundamentally changed the situation, enabling large furnaces to be built and direct radiation to be employed, instead of passing all the heat through a wall of refractory material. Temperatures up to 1,000 deg. C. at least have become practicable, and new applications of electric heating are rapidly being made. One of great importance is that of heating pottery kilns, which has proved remarkably successful; another is the melting of non-ferrous metals, and the heat-treatment of alloys is constantly increasing in importance. Touching the last point, it is interesting to note that the new magnetic materials which have revolutionised submarine-cable practice depend entirely for the development of their singular properties upon accurate "heat-treatment" following a strictly prescribed cycle. For such a purpose the unique "controllability" of the electric furnace is ideally adapted, and the facility with which materials under treatment can be surrounded with an inert or otherwise suitable atmosphere is often of great importance. The precision with which the furnace acts ensures that "throw-outs" shall be a minimum, whilst the cleanliness and compactness of the electric furnace leave little to be desired. The absence of loss in flue gases is a great factor of economy.

Many of the foregoing remarks apply equally to baking and drying ovens, welding plant, water heaters, &c., and all these are well represented at the exhibition which has been opened at Manchester under the auspices of the British Electrical Development Association, and the local electricity supply authorities, whose enterprise deserves the warmest support—for this is another instance in which consumers, supply authorities, and manufacturers of electrical plant all stand to benefit by the development of the use of electricity.

Unique Electrical Developments.

THE potentialities of the large "store" as a load for the electricity supply undertaking are strikingly illustrated by the description which appears on our later pages of an installation of this type rated at no less than 3,500 kW, and believed to be the largest in the world; what is even more significant is the fact that for the heating, lighting, and ventilating of the establishment, estimates prepared for various systems by the consulting engineer, Mr. A. H. Barker, who is known to have no personal bias in favour of one method rather than another, showed that the all-electric system was the cheapest of all.

Another article in this issue, by Mr. R. E. Hopkins, B.Sc., discloses for the first time an ingenious solution of the problem of operating two-speed lifts on single-phase supply, which has so long been needed, but has hitherto eluded the efforts of inventors. We also give particulars of the remarkable turbo-generator which has been built to carry out the proposal of Mr. Georges Claude, to generate electricity by taking advantage of the difference between the temperatures of sea-water at the surface and at the bottom; that this is a practicable scheme is not open to question, but whether it is commercially practicable is another matter. Whilst wishing Messrs. Claude and Boucherot success in their venture, we fear that, as in the case of tidal power, the high capital charges incurred will prove fatal to it.

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Copper, Lead and Rubber Prices.

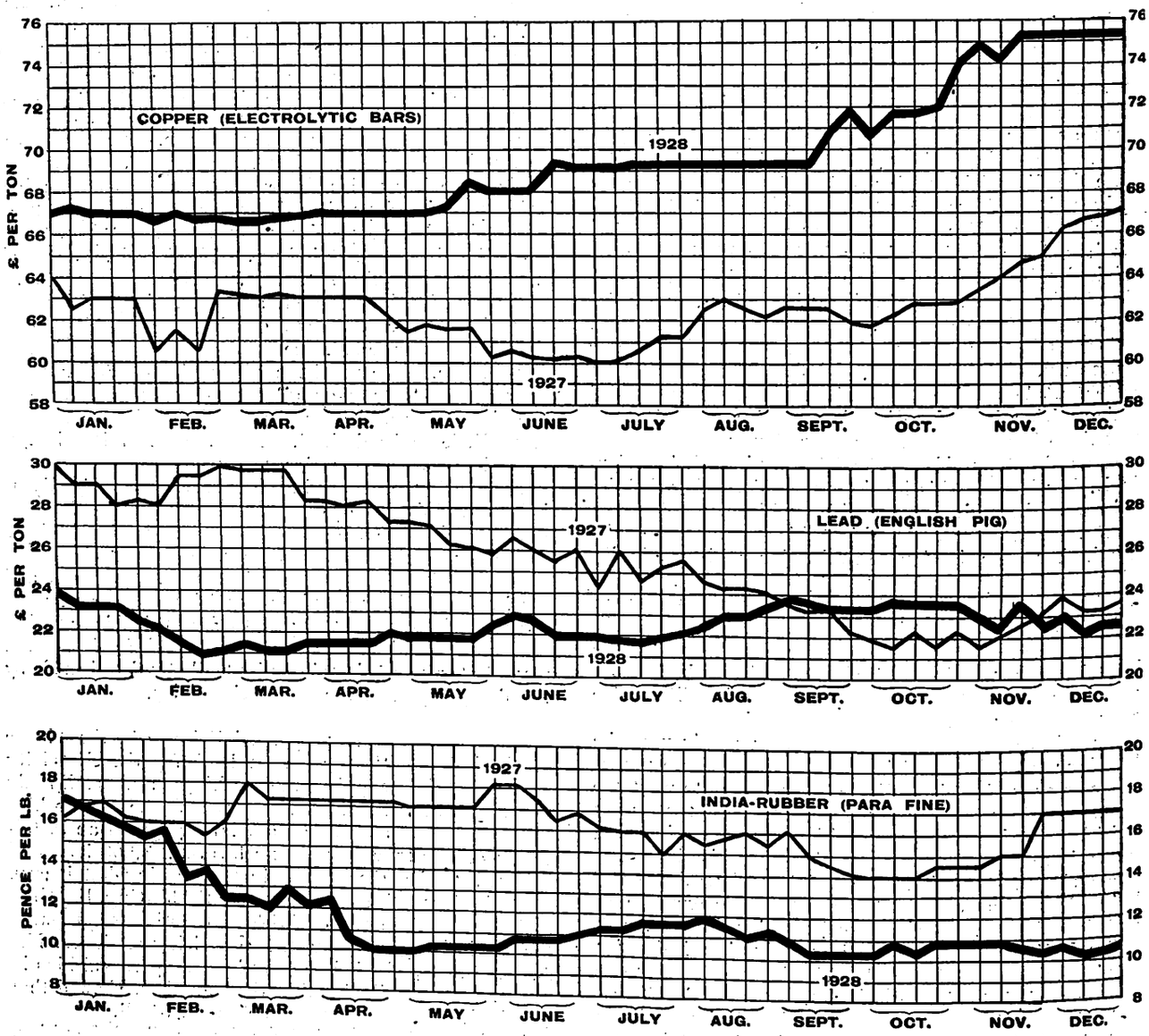
The Past Two Years' Movements Compared.

THE curves which accompany these notes illustrate the course of prices during 1927 and 1928 of three raw materials of importance to the electrical industry—copper, lead, and rubber. They are based upon the information given each week in our "Business Notices" section. Generally speaking, tranquillity characterised all three materials during the past year; copper moving evenly upwards and lead and rubber varying for most of the year between very narrow limits.

The price of copper, it will be observed, remained a few pounds above the corresponding level during 1927 throughout the year. For two clearly-defined quarterly periods the price changed hardly at all, but in September and October there was a substantial rise, which was maintained up to the close of the year. It may be recalled that during 1926 the price of electrolytic bars varied between £64 and £68 per ton. The average price level during 1928 was higher than it had been since 1923, when copper rose to about £84 per ton at one time.

The price of English pig lead was confined to the narrow limits of £20 10s. and £24, and the year closed with the metal at a lower price than in January. In that month the curves for the two years show a difference of £6, but this was reduced to £1 by the end of 1928. The average price, contrary to that of copper, was the lowest for many years.

After a long period of violent activity the price of rubber reached something like stability in 1927. For the first three or four months of 1928 it looked as though the activity was to be renewed; in that period the price fell by 6½d. per lb. Thenceforward, however, there was little change, and the price remained at between 10d. and 1s. per lb., finishing up about 6d. a lb. below the last price of 1927. The average price for 1928 was below that of 1924, when the extraordinary upward movement set in. In that year the price rose to 1s. 7d.; in 1925 there was a sudden rise, succeeded by a fairly considerable fall, after which the price sprang up to 4s. 6d. per lb.; and in 1926 there was a downward swoop, the year closing with rubber at 1s. 4d.



Curves showing the Course of Prices of Copper, Lead, and Rubber during 1927 and 1928.

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A Large Heating, Cooling and Ventilating Scheme.

The electrical installation which is running satisfactorily at the premises of Messrs. Bourne & Hollingsworth, Ltd., Oxford St., London, was adopted because it was estimated to be cheaper in running costs than any other method.

THERE are many features of particular interest in connection with the electric heating, cooling, and ventilating system recently installed at the premises of Messrs. Bourne & Hollingsworth, Ltd., Oxford Street, London; probably the chief among these are the size of the installation—it is designed for an ultimate maximum loading of about 3,500 kW—and the fact that electric heating was decided on as a result of its being estimated to be cheaper in total running costs, including depreciation of equipment and cost of supervision, in the particular scheme in question, of course, than any other method. The installation is also believed to be the largest of its kind in the world.

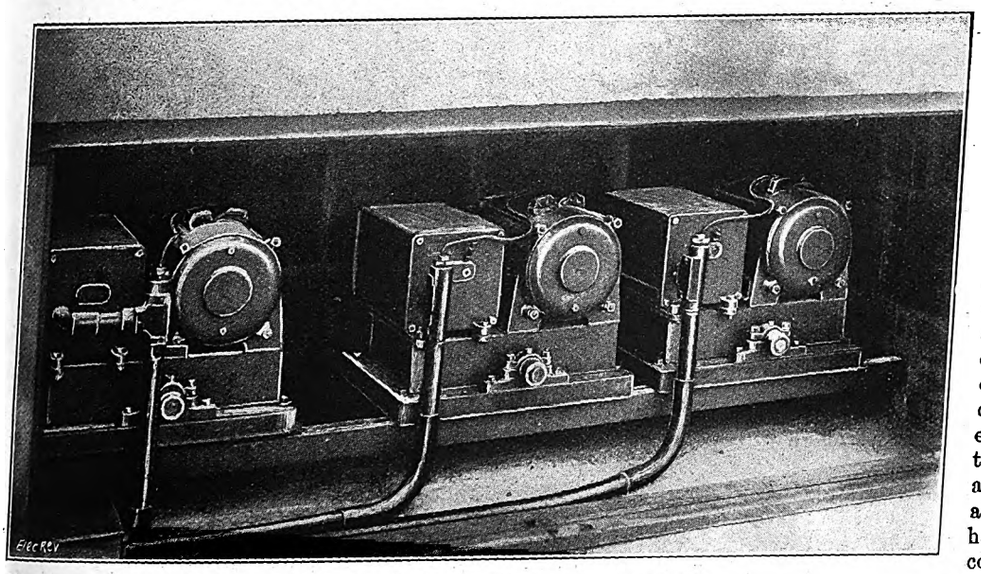

Fig. 1.—Bank of Three Damper-motor Units.

The scheme serves that part of the premises devoted more particularly to the selling side of the business, which has approximately a floor space of 160,000 sq. ft. and a volume of about 2,000,000 cu. ft. It is designed to maintain an average temperature of 62 deg. F. throughout the rooms and floors served, and to effect seven changes of air per hour. The general project was originated by Mr. H. Hollingsworth, and the scheme was designed by Mr. A. H. Barker, B.Sc., M.Inst.C.E., consulting engineer to Messrs. Bourne and Hollingsworth.

The operating principle employed is that of blowing hot or cold air, as required, into the various departments, the temperature and volume of the air admitted at the given points being remotely controlled from a central control room. To permit of such an arrangement it was necessary to incorporate in the design of the building a system of air ducts and sub-ceilings through which the air is conducted and admitted to the rooms. Fig. 7 shows a portion of the sub-ceilings in one of the showrooms on the ground floor.

The actual treatment of the air is effected by means of eight complete and separate heating and cooling equipments, four on the roof of the building housed in two double chambers, and four in the basement in separate chambers. At each of these the main air duct or trunk opens out to a large air heater of rectangular section, containing the heating elements, which presents to an air-inlet chamber an intake measuring about 6 ft. by 6 ft. A hand-operated flap door controls the main volume of air admitted to each system. At the outset the air taken in at each equipment is washed, and for this purpose a network of water sprays is arranged over the mouth of the intake. The cleaning water is taken from a storage tank

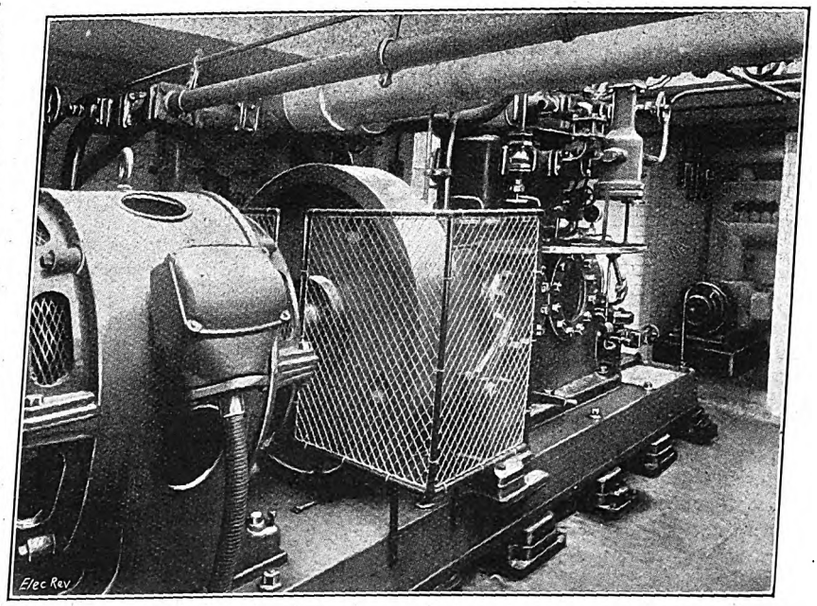

Fig. 2.—60-h.p. Motor-driven Compressor; Brine-circulating Motor at Rear.

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on the roof, and is used over and over again, being itself cleaned every time it has passed through the sprayers. From these the water is collected in a well beneath, from which it is pumped through a filter and back to the storage tank. The two rotary pumps for forcing the water through the sprayers and returning it to the tank are driven by a 6-h.p. motor, one pump on each end of the shaft. Fig. 4 is a view in one of the double-equipment chambers, showing the two sets of pumps; the door-windows on the opposite walls afford access to and inspection of the main trunks at the intakes. In the basement only one water pump is installed per equipment, the water head from the storage tank on the roof providing sufficient pressure to force the water through the sprayers.

The clean air next passes through the elements, and these are arranged in banks sectionally through the heater. The elements are of simple construction, and consist of nichrome ribbon wound on strip mica, the

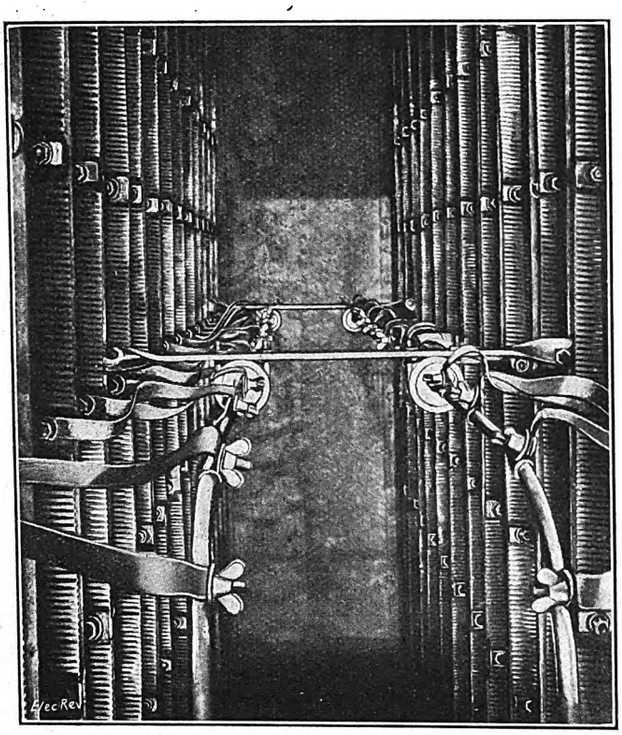

Fig. 3.—Heater Chamber Elements, from Side.

strips being carried on reel-type insulators mounted on iron bars. Fig. 3 is a view looking through one of the element chambers from the side, and showing two of the element banks or grids. There are six equally loaded grids per chamber, with a total loading of 120 kW. These are supplied at 230 V, between phase and neutral, and the whole is balanced up on the three phases. There is provision in each heater for additional elements up to a total of 360 kW. As already indicated, the elements are normally controlled from a distant station by means of push buttons, actual switching being effected by six triple-pole magnetic contactor switches; these are mounted in a street-type pillar. Fig. 5 shows the control equipment in one of the double-set chambers; the front pillars contain the contactor equipment for the heating elements, and others at the rear house the control gear for the pump motors. Local control is also arranged for the heating equipment, and emergency thermostat apparatus is provided to cut off the supply to the elements at a predetermined temperature. The circulation of the air is effected by fans, one 12-h.p. motor-driven unit, fig. 6, being arranged in each main air trunk. The fan motors are contactor controlled, and the contactors are electrically interlocked with those for the heaters, so that any bank or section cannot be switched on without the fan. Each fan will pass about 30,000 cu. ft. of air per min.

No doubt the success of the system is due largely to the efficient means of control of the temperatures in the various rooms, departments, and so on, and in this connection damper stations arranged at different points in the installation, by means of which the volume of air admitted at the various points can be accurately regulated, play an important part. There are 32 of these stations in all, and each consists of a simple flap-type damper driven by a ¼-h.p. motor. In fig. 1 is shown a group of three damper-motor units arranged in a small chamber on the roof of the building. These tiny equipments were specially designed for the job, and each consists of the motor, a very-high-ratio reduction gear, and a drum switch. This drum switch provides for six positions of the damper, and works in conjunction with a 6-way selector switch (through contactors), resembling the stud panel of a face-plate starter or rheostat; the switching-on of the motor is effected by the selector switch, and the drum switch cuts out the motor at the desired position of the damper. This is dependent on the "run" of the motor, which is determined by the length of the drum switch contact and, in turn, by the selector switch position. A group of contactor panels, starter switches, and push buttons for the local control of ten damper stations, and the condenser water pump, are shown in fig. 6.

When the air circulated is required to be at a lower temperature than that of the outside atmosphere, the necessary cooling is effected by means of the spray water, which is cooled by refrigerating plant. Two 60-h.p. motor-driven ammonia compressors, fig. 2, are housed in a separate room on the roof. The main washing-water tanks on the roof contain evaporating coils through which is circulated the cooled compressed ammonia, and which are capable of reducing the temperature of the spray water to 42 deg. F. The refrigerating plant has also more special duties to perform, and at all times of the year; for instance, the cooling of a fur store in the basement and of a number of food chambers. A 2,000-gal. brine tank also works in conjunction with the refrigerating plant for these purposes, the brine being cooled by evaporation coils and circulated where required by suitable motor-driven pumps. The brine can be cooled down to 16 deg. F. Fig. 8 shows a couple of 2-h.p. motors installed in the basement for circulating the brine through coils forming part of the fur-store cooling equipment. Air is blown through the coils by means of two 2-h.p. motors, fig. 9, driving fans. To secure the stability of the system, each fan motor and one of the pump motors are run in parallel on the same flues and brine pipes, but on separate electrical circuits, and each pair of motors is thermostatically controlled by the temperature in the fur store, so as to come "on" or "off" in correct sequence at predetermined temperatures. By means of a change-over switch the thermostat connections can be altered, so that the motors are not always switched on in the same order. An additional thermostat is employed to give warning in the case of current failure. The temperature limits for the thermostat controls are 32 and 34 deg. F. and 36 and 38 deg. F. respectively.

As already indicated, the success of the whole scheme is dependent largely on the system of control employed. From the control room are operated the motors, fans, heaters, and the baffle motors at the damper stations, so that the volumes and temperatures of the air at both the inlets and outlets can be regulated at will. Fig. 10 shows the two distant-control panels employed. The one on the left serves for the water pumps, fans, and heaters, and is equipped with selector switches for controlling the heaters and push-button apparatus for the pump and fan motors. The right-hand panel is equipped with the necessary selector switches for operating the baffle motors. It is, of course, necessary for the operator to be able to ascertain quickly and accurately the temperature at various points of the premises, and also of the air in the main trunk and heater chambers and of the washing and cooling water. To meet these requirements there are 50 thermometers

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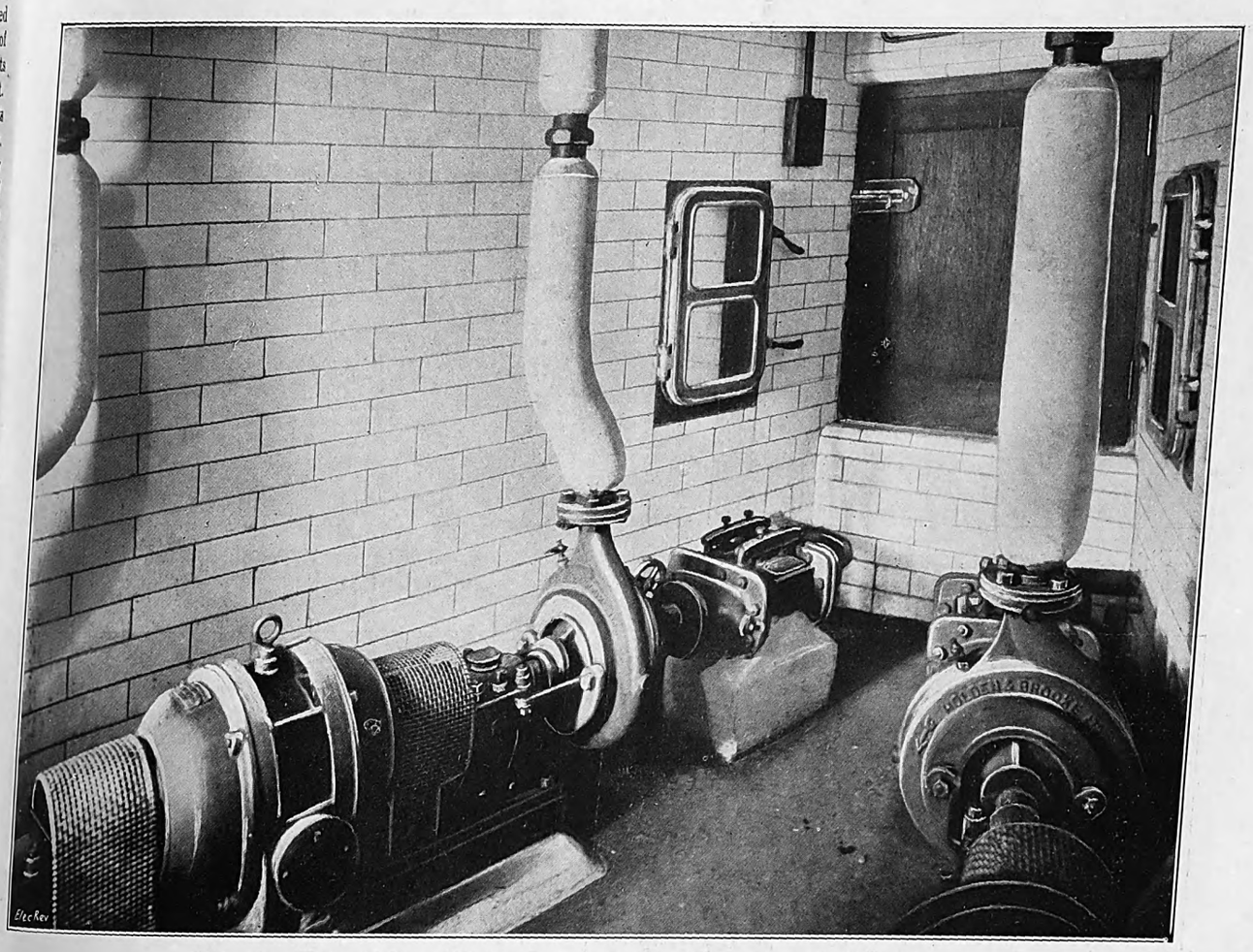

Fig. 4.—Motor-driven Water Pumps in Double-equipment Chamber.

Fig. 5.—Contactor Gear for Heaters, and Switchgear Pillars.

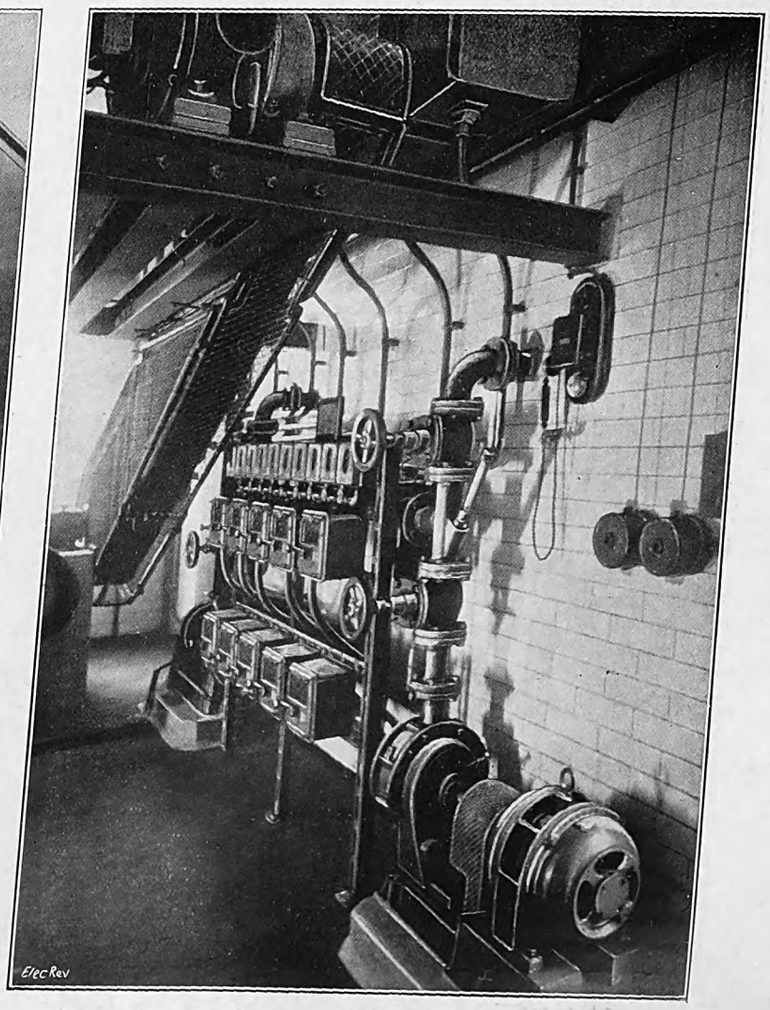

Fig. 6.—Fan Motor, and Control Gear for Baffle Motors.

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at appropriate places throughout the building and installation, arranged for remote indication and recording in the control room. Fig. 11 shows the indicator instrument on the left, complete with the necessary selector switches, and on the right is the recording instrument. Four records can be taken simultaneously by means of the plug-in selector board shown in the centre. The operation of the plant is so effective, it is claimed, that the temperature of the entire building can be maintained within 1 deg. F. of the desired temperature, in spite of the wide variations in the outside temperature and the number of persons in the building.

In addition to the main ventilation effected by the circulation of air generally throughout the building, there are several motor-driven extractor fans included in the installation, with the necessary air ducts, of course, for drawing off fumes from such places as the kitchens. The motors, 7½ h.p., fig. 12, are also arranged for local and distant control.

From the electricity supply point of view, the installation may be said to be divided into two main sections for supplying the roof and basement equipments, respectively, a separate main switchboard serving for each. Fig. 13 shows the main board for the upper section. It is situated in the control room, and is equipped with 1,500-A 3-pole breakers for the incoming supply and 500-A breakers for the outgoing circuits.

The wiring throughout the installation is v.i.r. cable run in galvanised screwed conduit, and the work was carried out by Messrs. Barlows, Ltd., under the supervision of Mr. J. D. C. McLusky, engineer in charge of the installation. The electricity supply is derived from the Marylebone electricity undertaking.

The motors employed throughout the installation were supplied by Messrs. Crompton, Parkinson, Ltd., and the switchgear and baffle-motor units by the Igranic Electric Co., Ltd. Messrs. George Nobbs, Ltd., manufactured the heaters, while Messrs. G. N. Haden & Sons, Ltd., carried out the erection of the plant. The ammonia compressors were supplied by Messrs. J. E. Hall, Ltd., and the equipment was coated by Messrs. Reid Mcfarlane & Co., Ltd.

In conclusion, we are indebted to Mr. Barker for his assistance in the collection of the above information, and to Messrs. Bourne & Hollingsworth for permission to publish the particulars and photographs.

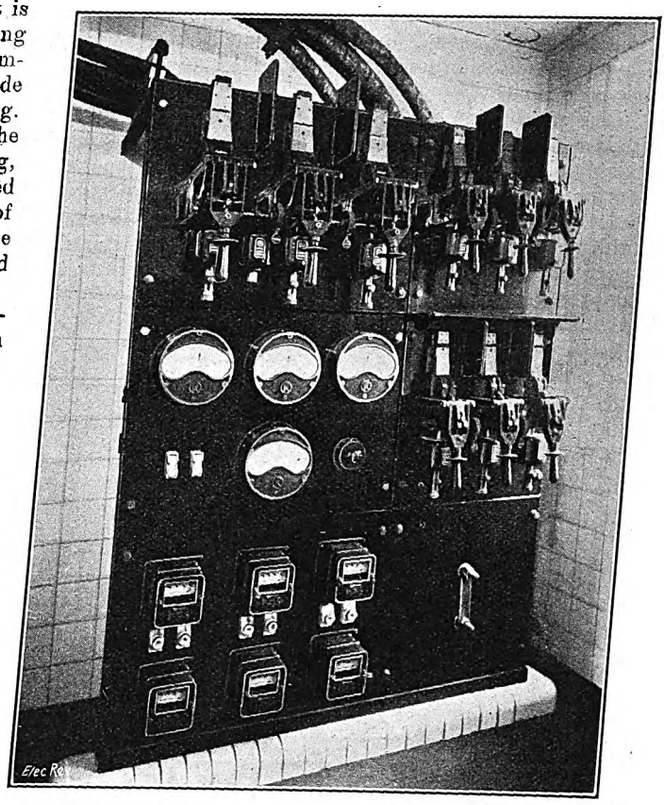

Fig. 13.—Main Switchboard for Roof Equipments.

High-Speed Lifts on Single-Phase Supply.

A descriptive account of a unique two-speed lift equipment, operating on single-phase supply, with a 2:1 speed ratio, built for the G.P.O. by the Keighley Electrical Engineering Co., Ltd.

By R. E. HOPKINS, B.Sc., A.M.I.E.E.

WHILE the operation of two-speed electric lifts on direct-current supply has for a number of years been commonplace lift practice, the application of alternating-current motors to this class of duty has until recently been largely neglected in this country.

The question is to-day receiving much consideration among lift and motor manufacturers—and for a very cogent reason. The increasing height of buildings not only increases the length of travel involved, but also (in virtue of the larger number of landings fed) produces a growing service demand on each lift, and makes high-speed operation essential. To meet this condition some form of two-speed device is necessary if satisfactory stopping conditions are to be secured. Now, this tendency coincides with another, equally pronounced, towards the almost universal adoption of alternating current for all new supplies, and indeed for many of the older direct-current services as well. The production of a satisfactory two-speed a.c. equipment thus becomes daily a matter of more and more importance.

The polyphase problem, although involving many debatable considerations, is inherently simple, and in one form or another is well past its experimental stage. The provision of a satisfactory two-speed drive for a single-phase supply is, however, in a very different category; for, quite apart from any difficulties which may be presented in connection with the method of control, the production of a two-speed single-phase motor satisfactory for lift service has in itself always been the *bête noire* of motor manufacturers, and has therefore set round the lift-maker's neck a mill-stone which practically prohibited excursion into the two-speed, single-phase field.

The lift described in this article has been designed to meet a stringent and definite specification issued by the G.P.O. Engineering Department, involving a dual-controlled lift at 200/100 ft./min. with a capacity of 15 cwt., and for operation on a 440-volt, 40-cycle, single-phase supply. The lift is designed to serve six floors in a busy head post office, and although the necessity for single-phase operation presented known difficulties, it was decided that a reasonably high speed was essential if the lift were to cope adequately with the expected demand. Considerations of floor levelling then made it essential to provide some form of elec-

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trical retardation when stopping, if abrupt action and unduly accurate handling of the car-switch were to be avoided.

The contract has been handled throughout by one firm, all the material being designed and built by the Keighley Electrical Engineering Co., Ltd., which company, in addition to possessing extensive lift experience, has for many years been associated with the single-phase motor problem, and so was in a particularly favourable position for dealing with the many considerations involved.

The production of a suitable electric motor for the driving unit was, of course, the first step. A standard single-phase shunt commutator motor, with power-factor compensation (Keighley Cralft motor) was selected as being the most suitable machine for providing at once a high starting torque, low starting current, flat characteristic, and a running power factor approaching unity. As a single-speed unit, the fundamental connections to such a machine are as indicated in fig. 1a.

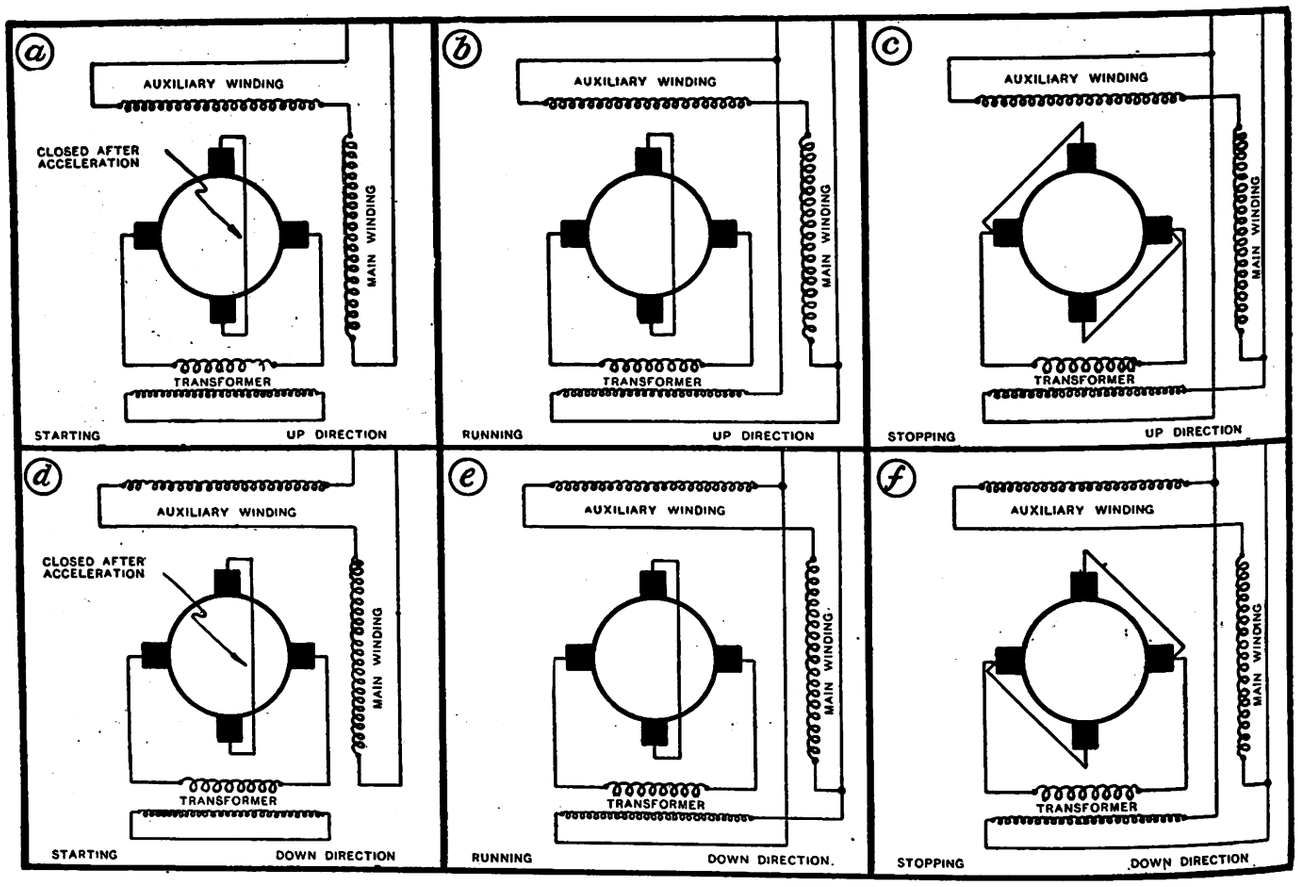

Fig. 1.—Fundamental Connections of 2-speed, Single-phase Motor.

Advantage was then taken of a property peculiar to this motor, whereby it is possible to raise the speed above synchronism by the injection into the brushes YY of a small pressure provided by a speed-controlling transformer of standard construction. The appropriate connections are indicated in fig. 1b. By a fortunate circumstance it is seen that the same pressure can be used to provide the quadrature component necessary for power-factor correction, so making it possible to avoid the necessity for two separate transformer units.

The synchronous speed of the motor used was 800 r.p.m., and when operating under condition 1b, this was raised to 1.000 r.p.m., the sheave and worm gear being then designed to hoist at 200 ft./min.

The next step in the problem was the designing of an inversion to the connections, whereby the speed, instead of being raised to 1,000 r.p.m., would be depressed to 500 r.p.m. and so provide the desired landing speed of 100 ft./min. In theory this merely involved a displacement in the phase angle of the injected rotor pressure through 180 degrees (electrical).

For certain technical reasons, however, such an arrangement would seriously disturb the desirable shape of speed characteristic inherent to the shunt-commutator motor, and this fact made it necessary to introduce a slight complication in the switching and to impose pressure on the brushes XX as well as the brushes YY. The manner in which this was arranged is indicated in fig. 1c, and it is seen that the XX and YY brushes are under this condition linked together instead of remaining separate. In this manner a flat compensated characteristic was obtained just as with the high-speed operation. Figs. 1d, 1e, and 1f represent conditions corresponding with 1a, 1b, and 1c, respectively, but for the opposite direction of rotation.

In a complete journey, the full motor cycle is therefore as follows:—

(1) Under connection 1a the machine develops a powerful starting torque and accelerates to 800 r.p.m. as a normal single-speed Cralft motor, the brush circuit XX being closed when acceleration is complete. This connection is obtained on the first step of the car switch.

(2) Under connection 1b the machine accelerates to 1,000 r.p.m., the transformer providing both the desired hyper-synchronous speed and the high power-factor necessary to a low current consumption. This connection is obtained on the second step of the car switch, and provides the normal operation at 200 ft./min. which obtains for the full-speed portion of the travel.

(3) Under connection 1c the motor decelerates to 500 r.p.m., the same transformer being employed for the purpose, but with its connections arranged to reverse the sign of the impressed rotor voltage. This connection is obtained on returning to the first step of the car-switch, and is preliminary to stopping when the desired landing is approached.

The motor connections defined above were selected as being those most appropriate to the problem in hand, and without reference to the complication of the automatic controller, which would be able to realise them. The controller problem proved to be perhaps more

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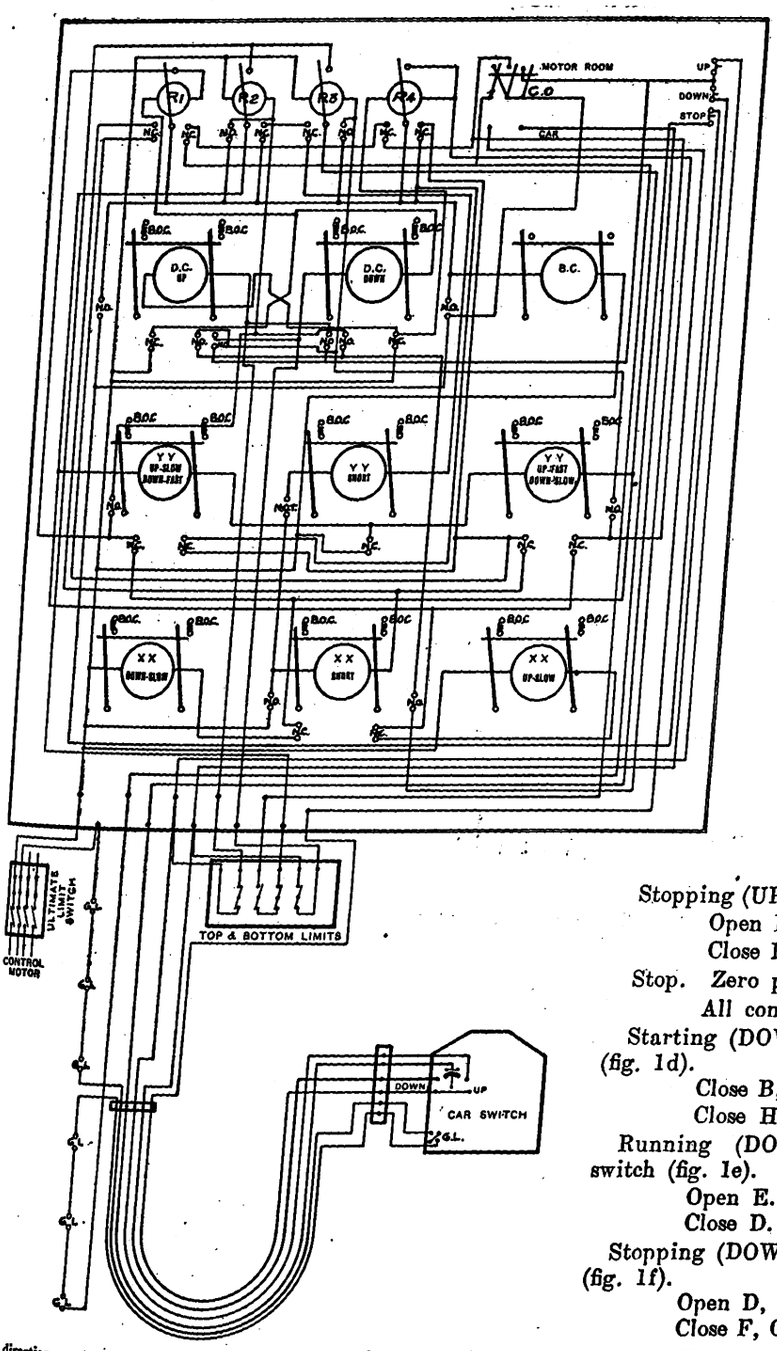
difficult than that of the motor itself, but here, again, the fact that the Keighley Company manufactures its own switchgear proved of tremendous assistance, and enabled a controller to be produced which, though complicated in its wiring, involved nothing but standard double-pole contactors and the usual relay contacts in its construction.

The chief difficulty was the necessity for a comparatively complicated switching sequence (in which many of the contactors operated in more than one capacity), coupled with the necessity for an absolutely complete interlocking system. The latter had to ensure that by no abuse of the car-switch, the control change-over switch, or the motor-room push-buttons, would it be possible to cause anything worse than an unusually heavy current surge, and that by no juggling with the handle could the contactors be made to close in any but the correct sequence.



DC, direction contactor; BC, brake contactor; YY, transformer contactor; XX, rotor contactor; B_1—B_4, sequence relays; BOC, blow-out coils; NC, normally closed interlock; NOT, normally open time-lagged actuating contacts; NO, normally open actuating contacts; GL, gate locks; CO, control changer switch.

Fig. 2.—Diagram of Control Connections for Keighley Car-switch Lift, using 2-speed, 1-phase "Cralft" Equipment.

The practical working-out of the connections required as above involved the use of nine d.p. main contactors, which were allocated to the following duties, and are shown in fig. 2, but with the main connections omitted to simplify the diagram as far as possible for clearness.

Contactor A (marked D.C. UP), connecting the main stator winding for clockwise rotation.

Contactor B (marked D.C. DOWN), connecting the main stator winding for counter-clockwise rotation.

Contactor C (marked B.C.), connecting to the coil of the electro-mechanical brake solenoid.

Contactor D (marked YY UP-SLOW, DOWN-FAST), connecting the primary of the speed-controlling transformer in one direction.

Contactor E (marked YY SHORT), short-circuiting the primary of the speed-controlling transformer.

Contactor F (marked YY UP-FAST, DOWN-SLOW), connecting the primary of the speed-controlling transformer in the opposite direction.

Contactor G (marked XX DOWN-SLOW), linking the XX and YY brushes in one direction.

Contactor H (marked XX SHORT), shorting the XX brushes together.

Contactor I (marked XX UP-SLOW), linking the XX and YY brushes in the opposite direction.

It will be noticed that the contactors are never called upon to handle the low-voltage heavy currents peculiar to the YY brushes, and that all this switching is carried out on the primary side of the transformer, where the currents involved are reduced to approximately one-tenth of those on the secondary side. The sequence and grouping in which the above contactors close had then to be made such as to realise the connections shown in the various parts of fig. 1, namely:—

Starting (UP). First UP notch of car switch (fig. 1a).
Close A, C, E.
Close H (through a time lag).

Running (UP). Second UP notch of car switch (fig. 1b).
Open E.
Close F.

Stopping (UP). First UP notch of car switch (fig. 1c).
Open F, H.
Close D, J.

Stop. Zero position of car switch.
All contactors open.

Starting (DOWN), first DOWN notch of car switch (fig. 1d).
Close B, C, E.
Close H through time lag.

Running (DOWN), second DOWN notch of car switch (fig. 1e).
Open E.
Close D.

Stopping (DOWN), first DOWN notch of car switch (fig. 1f).
Open D, H.
Close F, G.

Stop. Zero position of car switch.
All contactors open.

Remembering the necessity for a complete interlocking system, and noting that the same first notch of the car switch has to cause a contactor grouping that is entirely different when stopping from that when starting, it is evident that no little complication of wiring must be involved for the control circuits. The manner in which it was done is indicated in fig. 2, which is a duplicate of the actual wiring diagram to which the electrical components were wired.

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There are in all, in addition to the nine main contactors, four sequence relays (at the top left-hand corner) and twenty-eight actuating and interlocking contacts. Many of these could have been omitted had it been possible to assume thoughtful driving on the part of the car-switch attendant. In practice, however, this assumption can never safely be made. The car switch is necessarily remote from the machinery which it controls, and unless the sequence is adequately interlocked on the controller, an attendant can wreak considerable havoc in the motor room without being aware of anything more than a slightly eccentric behaviour of the lift car.

The controller was therefore provided with the fullest interlocking system, so that in no circumstances could the switching sequence be disturbed by thoughtless handling of the car switch.

The driving unit, automatic controller, and speed-controlling transformer are all illustrated in fig. 3, the remaining portions of the electrical and mechanical equipment being on normal lines.

On its tests the equipment was found to operate with considerable success. The efficiency and power factor of the motor on full load were found to be 84 per cent. and 0.91, respectively, while the starting consumption was 44 kVA, when developing a maximum of four times full-load torque (equivalent to 60 h.p.). This, of course, represents a performance superior in all respects to that possible even with a single-speed polyphase motor, and amply demonstrates the utility of such an arrangement for general use.

The equipment is believed to be at the moment unique, and to represent the first practical exploration of the full properties of the shunt-commutator machine. Its interest, hitherto academic, therefore now becomes a matter of much more practical politics, and indeed sets single-phase working on a par with any other supply system for high-speed lift work.

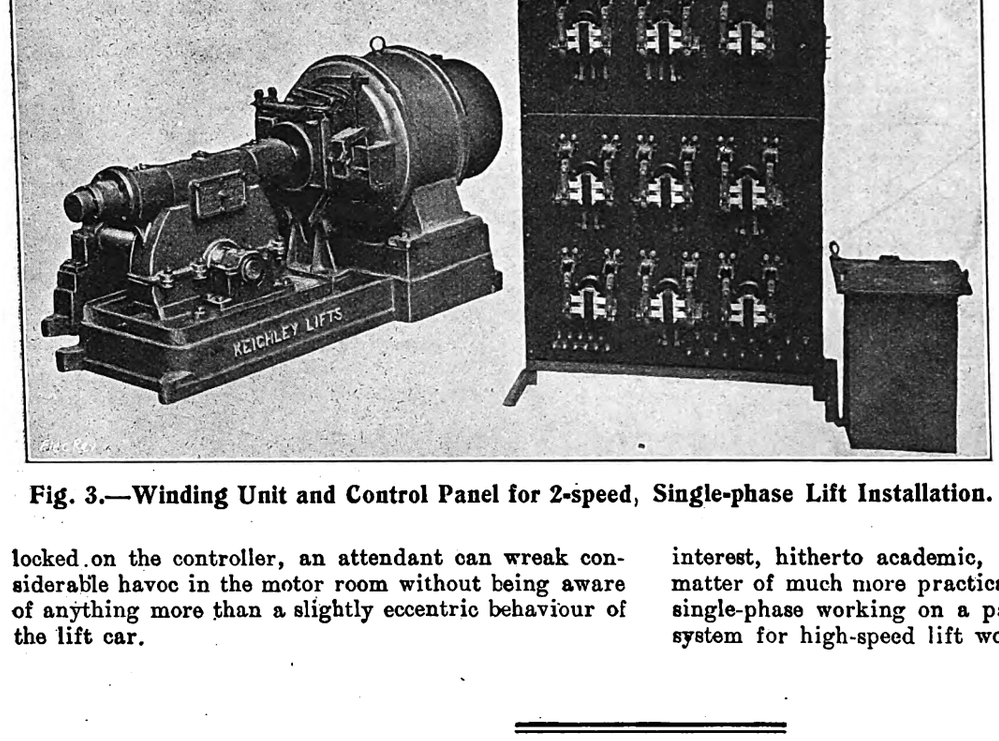

Fig. 3.—Winding Unit and Control Panel for 2-speed, Single-phase Lift Installation.

Rateable Value and Multi-Part Tariffs.

The author discusses whether a "fixed" charge based on the assessment to rates should vary with that figure or remain stationary in spite of variations.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

LEGISLATION is often far more extensive in its effects than legislators anticipate. There is nearly always some unforeseen circumstance which makes the effect of a law somewhat different from what was intended. And this is borne out to some extent in the electrical world by the results which it is quite possible that the new rating legislation may have upon the rates and prices for electricity supplied.

There are all over the country suppliers who base their rates not only upon the amount of electricity consumed, but also upon some other basis, making a fixed charge at the outset to each consumer, and then charging him in addition for the quantity of energy indicated by his meter. Such "multi-part" tariffs are by now quite well established, although they were not foreseen in the original Electricity Acts. Up to 1926 there was no specific mention of such tariffs. The Act of 1899 (Section 31 of the Schedule) provided that suppliers should be able to charge for "energy consumed." The mode of charge was provided by the Act—being calculated either on electrical quantity or some other basis approved by the appropriate Minister. No provision was made, however, for the charging of the consumer with the cost of overhead charges or establishment costs, as it is intended to do by the multi-part tariff. Section 33 of the Act, however, allowed suppliers to make any agreement with their consumers as to the mode of charging. Further, the Act of 1922 repealed Section 31 (Sub-section 2) of the Schedule to the 1899 Act, and empowered the Ministry of Transport to alter or prescribe methods of charging, thus definitely abolishing the consumer's right to insist on being charged a flat rate for energy.

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The fact remains that the practice has grown up of making these multi-part tariffs, and it is evident that they serve a very useful purpose. By the Act of 1926 multi-part tariffs are sanctioned by law expressly. Section 42 says that suppliers may make a periodical fixed or service charge, and in addition a charge for energy supplied. The method of charge must be authorised either by Special Order or some other method.

Apparently the Ministry of Transport or the Electricity Commissioners have not yet made any regulations showing how such a fixed charge is to be made up. For the moment then, the only type of fixed charge that we can consider is that made under private agreement with the consumers. The methods vary: some charge on the basis of the number of lamps or points fitted to the consumer's premises, others on floor area, and others, and this is the most important, on rateable value.

Now, as everyone knows, the rating surveyors are at this very moment engaged on re-valuing all properties of an industrial nature all over the country for the purpose of the new assessments which are to come into force as part and parcel of the pending local government legislation. The question will have to be faced by both suppliers and consumers whether the increase or diminution of the rating assessment will also affect the fixed or service charge for electricity. A principle will have to be sought that will apply to all equally; for in some instances the rateable value will go down, and in others there may be an increase. The question has very properly been asked whether if the rateable value goes up the supplier will be able to claim a proportionate increase in his fixed charge, and whether the consumer will get relief if the rateable value goes down.

At the outset, there appears to be veiled behind this question a slight misunderstanding of the nature of the changes that are now taking place. Strictly there is no re-valuation, although in the consideration of each case the surveyors will no doubt adjust the rateable value where necessary, if it appears to be too low or too high. But the purpose and provisions of the Rating and Valuation (Apportionment) Act are, as its name shows, not to re-value property, but to divide the existing valuation into the part applicable to industrial uses and the part utilised for other purposes, to make it possible to ascertain the proper extent of relief.

The assessment will stand as at present, but instead of a workshop and showroom being included in one assessment at, say, £1,000, that £1,000 will be split up into, say, £600 for the workshop and £400 for the showroom. And the occupier of those premises will get rate relief for the £600 representing the workshop, but will have to pay full rates on the £400 for the showroom.

Accordingly, in a sense, the new valuation, as it is called, will cause in the case of industrial heredita-ments, a substantial reduction in the rates to be paid. For the most part the new rating laws will not affect the actual rateable values. But the amount of the assessment to rates will alter.

Now there are numerous cases apart from this occurring in each year, in which the rateable value increases or decreases, and the valuation is correspondingly adjusted. The question thereupon arises whether such an adjustment of the rateable value will result in a corresponding adjustment of the fixed charge, where this is based on the rateable value. The only answer to this question is that it all depends on the terms of the contract between the supplier and the consumer. Generally, the fixed charge ought to vary in the same way as the water rate does, when the rateable value fluctuates. If the contract states that the fixed charge shall be so much per cent., or so much in the pound of the rateable value, then the charge will rightly vary in each year according to the alterations in the rateable value. But where the contract says that a fixed charge of £x is made, and this is explained as having been arrived at by taking a percentage of the rateable value, then the fixed charge should not vary until a fresh contract is made. In the latter case the use of the rateable value does not form part of the contract, and the mention of it in the agreement is only by way of explanation.

Individual consumers and suppliers can therefore examine their own agreements in the light of this principle. Beyond this no more can be said. The presumption would generally be that the rateable value formed part of the contract, and that the charge would vary, or rather the basis of the charge would vary, the supplier making an alteration in his rates in the same way as the local authorities did when the assessments were raised wholesale a year or two ago. Obviously if the rateable value of an area increases by the raising of the assessments, and not by any enlargement of the district, then the supplier ought not to keep his rate the same, for his production costs do not vary in proportion with the rateable value of the area. Unless suppliers do make some adjustment in this way, the use of the rateable value as a basis for charge becomes absurd. Its use in any event is open to the objection that it does not follow that a man who lives in an expensive house uses more electricity proportionately than a man who lives in an establishment of more moderate size. But this same objection may be used against almost every other method of basing the fixed charge. The area of the floors or the number of lamps fitted do not of themselves give a sure indication of the consumption. But the use of rateable value as a mode of assessing the fixed charge is obviously convenient as it enables the supplier to know at once, by obtaining the total rateable value from the local authority, the potential value of his area, while at the same time the rateable value of each set of premises in the area gives him a definite indication of the quality and relationship of each property with every other property in the area. It saves him the trouble of measuring floors or ascertaining the basis of any other usual mode of assessing the fixed charge.

But the supplier should remember that if he uses rateable value, his moral duty is the same as that of the local authorities and the water companies. He should take his expenditure and divide it out according to the rateable value; not assess each property with an electricity rate and then spend accordingly. If the rateable value of each property in the area is doubled, then the fixed charge ought to be reduced by half, just as the local rates should be. Unless this is done the use of rateable value as a mode of fixing the service charge is open to abuse.

Low-temperature Electric Heating.

Mr. Geo. Wilkinson, M.I.E.E., in a paper before the Institution of Heating and Ventilating Engineers, described the application of electricity for heating purposes by means of his "change-circuit" apparatus, which increased the load factor of electricity supply stations, and so made domestic electric heating a possibility on cost alone. After dealing with cost of supply and practical economies, Mr. Wilkinson said that from Government returns, and assuming an increase in load factor of from 25 per cent. to 75 per cent., it was clear that during the year 1927-8 there was available for heating purposes the enormous total of 19,855,701,260 kWh at 1/3d. per unit. Electrical energy had the enormous advantage that it could be readily delivered at any point where heat was required, also the expense of pipe transmission and heavy heat losses of transmission were saved. Each floor, and, if necessary, each radiator or panel might have its separate storage cylinder which would absorb the constantly varying amount of energy received from the "change-circuits," thus forming a heat reserve to be drawn upon at such times and rates as required to maintain uniform temperature under all weather variations. The absence of combustion and the products of combustion enabled these cylinders to be placed in positions where any radiation loss was usefully employed.

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A Very-Low-Pressure Turbo-Generator.

Some particulars of the steam turbo-generator set designed for use in connection with the Claude-Boucherot water-temperature-difference scheme.

WE give herewith some illustrations and brief particulars of an interesting low-pressure steam turbo-generator set, fig. 1, recently completed by the Société Alsacienne de Constructions Mécaniques, of Belfort, France, for the experimental plant which has been established on the banks of the River Meuse, in Belgium, by the Société d'Ougrée-Marihaye, to try out the system developed by Messrs. Georges Claude and Boucherot to utilise the difference of temperature between the water at the surface and that at the bottom of tropical seas.

The turbine is of an entirely new type, and was designed to meet the requirements laid down by Messrs. Claude and Boucherot, which included the following:—

Load	50 kW.
Steam admission pressure ...	0.0323 kg. (abs.) per sq. cm.
Admission temperature of steam	25 deg. C.
Exhaust steam pressure	0.0125 kg. (abs.) per sq. cm.
Exhaust steam temperature ...	11.5 deg. C.

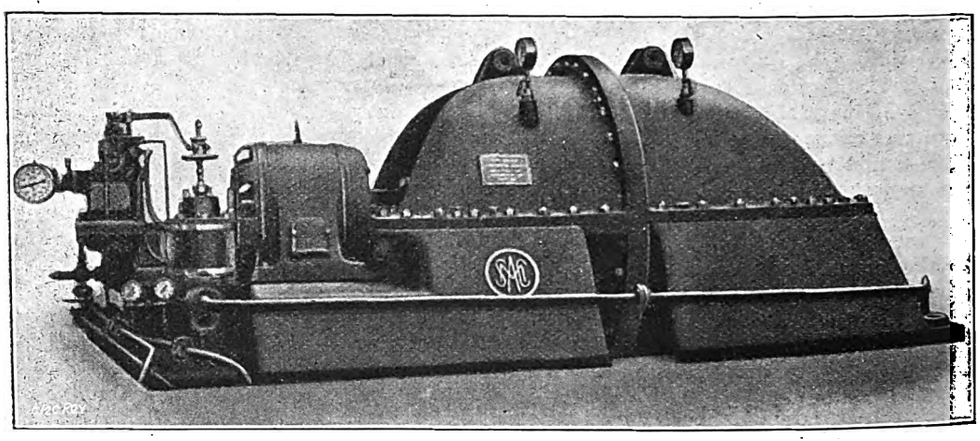

Fig. 1.—50-kW Low-pressure Turbo-generator.

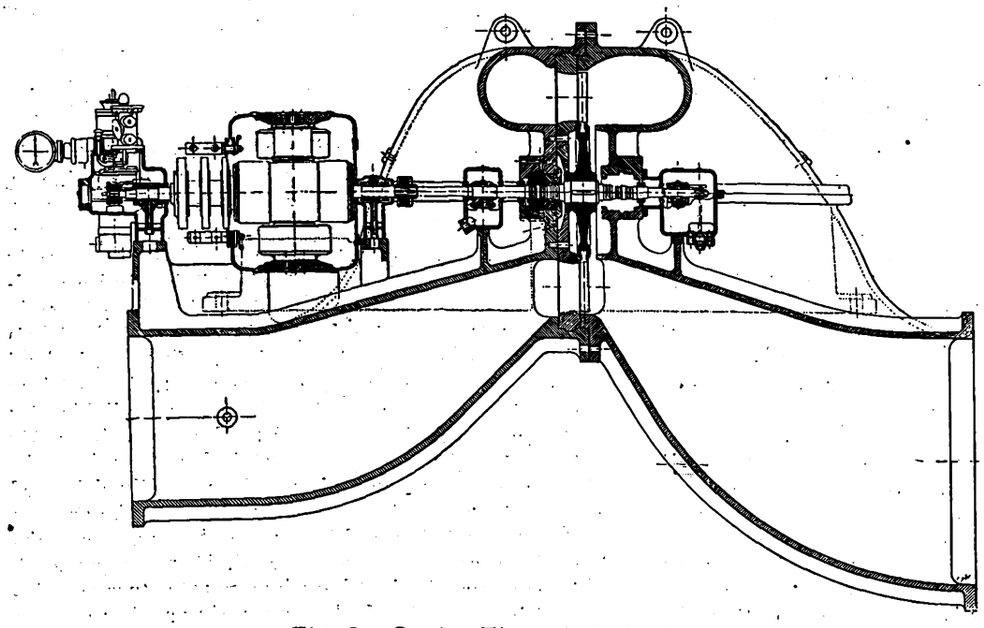

Fig. 2.—Section Through Turbo Set.

The turbine is of the single-stage type, with an average diameter of 2 ft. 7½ in. The special arrangement of the steam admission and exhaust, as shown in fig. 2, results from the necessity of providing very wide passages in order to avoid any load losses in the piping.

The turbine and generator are supported by means of large feet cast with the admission and exhaust port bodies on two longitudinal members located one on each side of the centre line. The dynamo, which is of the company's standard high-speed d.c. type, is of the bipolar pattern, and has an output of 228 A at 220 V, at a speed of 6,000 r.p.m. It is mounted on the admission side of the turbine casing, and is directly connected to the turbine shaft. To the left of the dynamo is the turbine regulator, this position for the latter having been found more convenient than between the turbine and dynamo. The components of the set are therefore in the following order: (1) Bearing supporting the regulator and the oil pump; (2) the dynamo; (3) an intermediate bearing between generator and turbine; and (4) a bearing on the exhaust side of the turbine. A further advantage of the arrangement is that the steam admission and exhaust pipes are located in the centre line of the set, and so have not only a minimum of elbow turns, but a shape best suited to prevent giving rise to local compression zones and eddies, which are always the cause of losses.

The shaft bearing on the exhaust side works in a vacuum, rendering any steam-tight packing at this point unnecessary. It is furnished with an independent circulation of oil maintained by a special gear pump driven by a spiral gear wheel and a worm keyed on the

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turbine shaft, the oil being contained in a small reservoir with a cooling coil formed with the bearing itself.

The steam-tight joint on the admission side, where the shaft passes through the casing, comprises a disk keyed on the shaft and rotating in a circular, vertical recess formed in the turbine casing. A water injector at this point maintains a liquid ring along the periphery of the disk, the ring being maintained in position by centrifugal action, and so forming a hydraulic joint.

The speed of the turbine is controlled by a special regulator made in accordance with a Claude-Boucherot patent which operates by the addition of air to the exhaust steam. A small oil-pressure servo-motor actuates an adjustable valve, the profile of which is such that the steam supply and its corresponding output are proportionate to the stroke of the valve. The control gear comprises the usual components fitted to turbo sets by the Société Alsacienne. In order, however, to obviate the interpolation of valves in the admission piping such as are used in high-pressure turbines, but which in this case might give rise to serious losses, the speed is controlled, as already briefly mentioned, by acting on the exhaust steam, by admitting air between the exhaust piping and the condenser. A safety device located on the regulator cover acts by oil relays on a variable air inlet valve and simultaneously on a safety valve provided in the exhaust. The opening of the adjustable device and the safety valve causes an admission of air sufficient to break the vacuum. In addition, in order to adjust the power of the turbine to the load, means are provided to vary the quantity of water admitted to the boiler and to the condenser.

The turbine wheel, fig. 3, and its blades are of the Company's usual contruction. The distributor is of

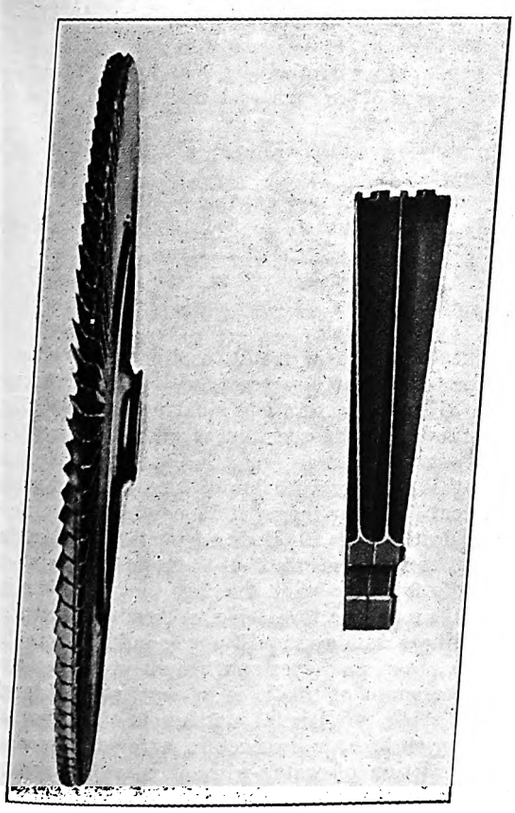

Fig. 3.—Turbine Wheel. **Fig. 4.—Butterfly Blades.**

cast-iron, while the blades are of non-rusting metal. Adjustable blades, to give a variable angle for the steam inlet, are provided, these being of non-rusting chrome heat-treated steel and of a special "butterfly" type (fig. 4). It is to these blades that the closeness of the actual results to the theoretical estimates referred to below is attributed, the shape, it is claimed, enabling the steam to expand to the maximum degree in blades of great length in relation to their average work.

The first tests of the new set were carried out in May last. The results given in the appended table are, however, those of tests conducted in June, when the general temperature of the River Meuse was much higher, 19 deg. C., so that the relation between theo-

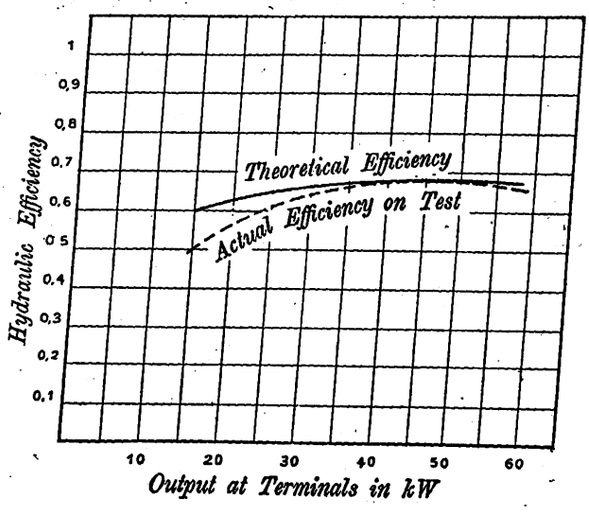

Fig. 5.—Theoretical and Actual Efficiency Curves.

retical and actual results is not so close as in the May tests, despite which, however, they are regarded as interesting and satisfactory.

COMPARISON OF THEORETICAL AND ACTUAL RESULTS.

	Theoretical.	Actual.
Output	50 kW	54.9 kW
Turbine speed, r.p.m. ...	6,000	5,500
Steam admission temperature	25° C.	35.8° C.
Admission steam pressure, kg./cm.²	0.0323	0.06
Exhaust steam temperature	11.5° C.	28° C.
Exhaust steam pressure, kg./cm.²	0.0125	0.0387
Total adiabatic fall in calories	23	13.9
Steam supply per hour in kg.	3,170	6,110
Ratio of steam speed to tangential speed ...	1.75	1.46
Hydraulic efficiency ...	74.5%	68.2%

With regard to the last item of the table, the theoretical hydraulic efficiency based on the actual conditions of the test is 67.1 per cent., so that the results, which are shown diagrammatically in fig. 5, were even better than expected.

Dangerous Occurrences Notification Order.

The Home Office has announced extension of the provisions of the Act requiring notice of accidents in factories and workshops to be given to an inspector, to the following classes of occurrences: I. bursting of a revolving vessel, wheel, grindstone or grinding wheel moved by mechanical power; II. breaking of a rope, chain, or other appliance used in raising or lowering persons or goods by aid of mechanical power; III. explosion or fire causing damage to the structure of any room or place in which persons are employed, or to any machine or plant contained therein, and resulting in the complete suspension of ordinary work in such room or place or stoppage of machinery or plant for not less than five hours, where such explosion or fire is due to (i) the ignition of dust, gas or vapour, or (ii) the ignition of celluloid or substances composed wholly or in part of celluloid, or (iii) electrical short circuit, or failure of electrical apparatus; IV. explosion or fire not included in paragraph III affecting any room in which persons are employed and causing complete suspension of ordinary work therein for not less than 24 hours.

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Boiler-House Operation.

Some Notes for the Assistance of the Combustion Engineer.

By S. ANDERSON.

THIS article is not, and is not intended to be, a technical treatise on the subjects of coal combustion and steam raising. Indeed, such a treatise dealing with plant composition and layout, the choosing of suitable coals by analysis and by boiler test, the analysis of flue gases, &c., and also boiler-house management could not be contained in a large volume. These notes are as non-technical as possible, and are written as an attempt to help the power-station plant operating engineer to a better understanding of the factors he himself can control, and thus enable him to operate the boiler-house at the highest efficiency and therefore lowest cost.

On one occasion the writer had to prepare a comparison of a number of coals tested in a boiler. As the comparison was required by the management only, and not by the engineer, the summary submitted consisted of two items for each coal:—

(1) The price of the amount of coal required to evaporate 10,000 lb. water as from and at 212 deg. F.

(2) The percentage of ash as found from the test.

The importance of the second item is apparent when one realises that ash has to be paid for, in bringing it to the works, in handling at the works, and in most cases in disposing of it. Now if, in the first item, we substitute for the price of the amount of coal the weight of coal required, we have, in these two, the main points for the consideration of the operating engineer. His job therefore is—

(1) to keep the amount of coal required, for a certain heat transference to the steam, at a minimum, and

(2) while he has, of course, no control over the amount of ash brought to the works, he can control the amount in excess of that which is treated in the works as ash, and disposed of as such; at the same time, he ensures that the amount of unburned fuel present in the ash and carried away in the ash is kept at a minimum.

Having thus stated the main points of his job, we will examine the methods he will employ to obtain the desired results.

It is, I think, essential, in the first instance, that the engineer should know something about the working-out of a "heat balance" for the individual boiler in order that he may more fully understand the profit and loss account. For this reason, then, the following typical example is submitted. This was taken on a boiler and economiser fitted with travelling-grate balanced-draught stokers. All details superfluous to the calculations have been omitted.

Data: Coal, c.v. gross as fired, 11,136 B.th.u. Ultimate analysis, carbon 61 per cent., ash 12.65 per cent., moisture 12 per cent., sulphur 1.35 per cent., hydrogen 4.5 per cent., oxygen and nitrogen (balance) 8.5 per cent.

Evaporation: per lb. coal (actual) 7.168 lb. Steam pressure 208 lb. abs., and temperature 635 deg. F., giving a heat content from feed temp. (102 deg. F.) of 1,274.4 B.th.u.

Ash (dry): 13.24 per cent., combustible in ash 10.6 per cent. Flue gases at economiser outlet, temperature 335 deg. F., CO_2 11.9 per cent. O_2 8.07 per cent. CO nil. Nitrogen (by balance) 80.03 per cent.

Boiler-house *air temperature*, 62 *deg. F.*

The heat balance is obtained thus:—

Heat input to steam $= 7.168 \times 1{,}274.4$
$= 9{,}135$ B.t.hu.

Heat lost in unburned carbon in ash $= .1324 \times .106 \times 14{,}600$ (% dry ash × % carbon in ash × c.v. of carbon) $= 205$ B.th.u.

Heat lost to chimney is found by the sum of the following two:—

(1) Heat carried away by dry flue gases per lb. coal.

Now, the weight of dry flue gases per lb. carbon

$$= (44 \times \%CO_2) + (32 \times \%O_2) + (28 \times \%N_2)/12 \times \%CO_2$$

(the flue gas analysis being by volume in the above these volumes are multiplied by the atomic weights of the respective stuffs)

$$= (44 \times 11.9) + (32 \times 8.07) + (28 \times 80.03)/12 \times 11.9$$

$= 21.2$ lb. Therefore the weight of dry flue gases per lb. coal $= 21.2 \times .61 = 12.93$ lb.

Taking the specific heat of these gases at 0.24, and multiplying by the temperature rise, we have the heat loss per lb. of coal in dry flue gases

$$= 0.24 \times [12.93 \times (335 - 62)]$$
$$= 845 \text{ B.th.u.}$$

(2) The heat loss to chimney due to moisture consists of the weight of moisture multiplied by the total heat (sensible, latent, and superheat) given to the water

$$= [0.12 + (9 \times .045)] \times [(212 - 62) + 970.4 + .49(335 - 212)] = 620 \text{ B.th.u.}$$

(The hydrogen is multiplied by 9 as hydrogen unites with eight parts of oxygen and makes nine times its weight in water.)

The total losses to the chimney are then $845 + 620 = 1{,}465$ B.th.u.

Our heat balance is now capable of statement, and is:

Heat input to steam	= 9,135 B.th.u.	= 82.03%.
Heat lost to chimney	= 1,465 B.th.u.	= 13.16%.
Heat lost in ash	= 205 B.th.u.	= 1.84%.
Radiation loss (balance)	= 331 B.th.u.	= 2.97%.
Total ...	= 11,136 B.th.u.	= 100%.

This heat balance is useful, as it not only shows us the boiler losses, but also shows what the effect of varying the different factors contributing to these will be. For instance, on the question of additional wetting of the coal, it will be seen from the foregoing calculations that in this case an addition of 5 per cent. of moisture to the coal (making the total 17 per cent.) would result in an addition of 59 B.th.u. to the chimney losses. This represents ½ per cent. of the total heat value of the coal and, together with the fact that moisture in the coal tends to smoke formation, makes it evident that indiscriminate wetting should not be indulged in. It has, however, been amply established in practice that when a large amount of smalls is present, as in a rough unwashed slack, additional wetting is often necessary to ensure even fires, and therefore more perfect conditions. This addition of water will, of course, vary with the class and condition of the coal, but should at all times be kept at a minimum. The loss due to unburnt carbon in the ash is important, due to the high c.v. of the carbon. This loss, more often than not, is quite serious, especially when high percentages of CO_2 are striven for, and every effort should be made to keep this as low as the figure in the example (*i.e.*, 1.84 per cent. of the c.v. of the coal). This, of course, refers to travelling-grate equipment—where pulverised coal is used, owing to the minuteness of the coal particles and the consequent ease of mixing with the necessary air for combustion, this loss should not be greater than one half of one per cent.

That the chimney losses—the biggest and therefore

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the most important—will vary with the percentage CO_2 in the gases, and the temperature of these gases at the chimney, is also apparent from the calculations.

The maximum CO_2 which can be obtained, if perfect combustion conditions prevail, will depend upon the carbon content of the fuel and, in the average bituminous coal such as in the example, this will vary between 17.5 per cent. and about 19 per cent. These figures are impossible of attainment in practice, the limiting factors being:—

(1) The damage which would result, due to excessive heating, to the stoker equipment and furnace linings.

(2) In all but a very few cases, the inadequate size of the combustion chamber.

(3) The difficulty of air distribution to ensure the correct amount being available at the different stages of combustion.

Modern stokers equipped with balanced draught and furnace refractories should be capable of standing up to the conditions prevailing with 15 per cent. CO_2 present.

In, however, none but the most modern of boilers is the combustion chamber of sufficient size to ensure, with this diminished air supply, the thorough mixture and perfect combustion of the gases. Smoking at the stack is the visible sign of this limitation, which with even the best of balanced-draught equipment necessitates the percentage of CO_2 being kept in the region of 13 per cent. or at the most 14 per cent. Summarising, then, the nearest to perfect combustion conditions will be obtained when the per cent. CO_2 is kept as high as is possible consistent with a clear stack, no CO is present in the flue gases, and the minimum of unburnt carbon is present in the ash. Under these conditions and with a constant feed temperature and boiler loading, the temperature of the exit gases will be an indication of the cleanliness or otherwise of the boiler and economiser.

Leaving now the question of combustion conditions and turning to the transference of the heat to the steam, it will be obvious that if all other conditions remain constant and the water inlet temperature to the economiser is raised, the outlet gas temperature from the economiser will also increase. This will of necessity result in a decrease in the boiler and economiser efficiency, and appears to be an unanswerable argument in favour of cold feed. This is only true where no means of feed heating is available other than by high-pressure steam. The temperature of the feed in this case should be kept as low as possible provided that it does not drop below the dew-point of the gases. This is the point at which there will be condensation of these and the formation in this way of sulphuric acid from the sulphur dioxide present will set up active corrosion of the economiser tubes.

Where, however, hot feed is available, from either heaters where the steam is bled from the main turbines (the best source) or from modern steam-driven auxiliaries, where the whole of the heat in the exhaust steam is recoverable in the feed water, it will certainly pay to feed with water as hot as the feed pumps will deal with. The more the heat units that are added to the feed water before entering the economiser, the less will be the required heat transference in the boiler plant and thus the amount of steam generated per pound of coal will be increased. Again, if the economiser be of a suitable size, the exit gas temperature will not increase by the same amount as the increase in feed inlet temperature. The following figures are the result of six carefully carried out tests of a B. & W. boiler of 9,273 sq. ft. heating surface, with 2,728 sq. ft. superheater heating surface and 4,752 sq. ft. economiser heating surface.

(1) With feed inlet temperature of 96 deg. F., evaporation per lb. of coal (actual)=8.182 lb., steam temperature=597 deg. F. and efficiency=83.4 per cent.

(2) With feed inlet temperature of 152 deg. F., evaporation per lb. of coal (actual)=8.617 lb. of steam temperature=582 deg. F. and efficiency=81.3 per cent.

Thus with a loss of only 15 deg. F. in the final steam temperature the evaporation was increased about 5 per cent. Again, although there is a loss in actual boiler efficiency of 2.1 per cent., it is of interest to note that if the boiler in the "hot-feed" case is credited with the feed temperature of the "cold-feed" case, the efficiency of the former (hot-feed) works out at 85.2 per cent. This is equivalent to assuming that the extra heat units (152-96) in the hot-feed have been given without any cost whatever. Where these heat units are given by steam bled from the main turbines, the saving of coal in this case works out to a figure of about 4 per cent. Of course, where the heat units added are obtained from the exhaust of auxiliaries, the saving will not be so great, and will depend on the type of auxiliary used; but none the less it is clear that there will be a saving.

Considering next the operation of the boiler house as a whole, where the efficiencies are the same, those boilers with the highest superheat should be steamed in preference, wherever possible. This is mainly due to the beneficial effect of the superheat on the consumption of the turbines. In connection with this superheat question the following proposal deserves serious consideration. It is applicable to the land type of B. & W. boiler, and is that some thirty or forty boiler tubes be removed from the bottom rows. These tubes would be removed in groups of six (say), each group consisting of three on the bottom row, the two above these in the second row, and the one above these in the third row. This would leave a staggered and larger heating surface exposed to the radiant heat from the fuel bed. The removal of these tubes will not, I think, reduce much the effective heating surface of the boiler, and will give a greatly increased final steam temperature. If the economiser be of sufficient size, there should be no appreciable rise in outlet gas temperature, and therefore little drop in overall efficiency. This efficiency should further be maintained by the increased combustion chamber rendering it possible to maintain a larger percentage of CO_2 than before. The proposal is, at the least, deserving of consideration where this type of boiler exists.

The next important point is that the regulation necessary for a varying steam demand should be carried out in the minimum of units and wherever possible on one boiler alone. This allows the others to be set as carefully as when on test and at their most efficient loading. This regulating boiler should be the one with the most flexible of draught systems so that the losses due to excess air may be kept at a minimum. Automatic boiler control will, of course, be the solution of the regulating problem, but a great deal can be done where manual control is in use by careful supervision.

The light-load period is, naturally, the worst as far as boiler-house efficiency is concerned, and the system known as "live-banking" has much to recommend it in this respect. Briefly this is, at light loads no boilers, which will be needed again in, say, up to eight hours' time, should be taken off the range and banked; instead they should be kept steaming at the lowest possible rate without the induced-draught fan. In modern boilers with balanced-draught stokers the boiler efficiency at fractional loads can be kept at a remarkably high level. On this type of boiler the CO_2 has been maintained as high as 11 per cent. or even 12 per cent. at one-fifth of the normal rating for hours on end, with no detrimental results whatever.

The boiler-house efficiency over the week is certainly improved with this system; the only drawback is that the temperature of the steam as delivered to the engine room is constantly lowered. Where, however, a high steam temperature is not so important (admittedly in few cases), a surprising gain may be effected by "live banking."

In the generating station the use of the "Parsons line" is helpful where an intelligent check is required on boiler-house performance. This line is, of course, obtained by plotting the total units generated on each shift against the total coal (in lb.) consumed over the same period. The straight line thus obtained is produced until it cuts the "total coal" ordinate. At this point the standing or basic station loss per shift is indicated (in lb. of coal), and the equation to the curve [say C=(1.5 U

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+ 20,000) lb.] gives for any number of units generated the coal consumed. Thus the individual shift performance can be checked and at the same time a watch can be kept on the standing losses. In connection with this Parsons line, the following is an improvement, I think, as it gives greater accuracy. In this it is assumed that if the load (on the station) at the end of a shift is, say, x kW more than at the start of the shift, there is an extra amount of coal, computed at $0.65 \times x$ lb., on the grates at the end of the shift due to this increase in load. This amount of coal is assumed to have been handed over to the next shift, and if this $0.65 \times x$ lb. (whether x be a minus or plus quantity) is allowed for on each shift and the Parsons line is made out on the coal figure thus corrected, this line is, I think, a truer check on the individual shift performance.

In conclusion, it is hoped that these few points will be of some use to the operating engineer, and I would here like to remind him that any falling-off in the efficiency of the operating staff is in any boiler-house immediately and inevitably passed on to the steam-raising plant.

Sir Hugo Hirst in Australia.

Speeches in Melbourne.

SIR HUGO HIRST, Bart., delivered two speeches in Melbourne in November, and reports of both appear in the *Australasian Electrical Times* for November 27th just to hand. The first took place on November 12th at a complimentary dinner given in his honour by business and professional men connected with the Electrical Federation (Victoria). Sir Hugo's "Health" having been proposed by Mr. S. J. Salmon, the chairman, and seconded by Mr. H. P. Brown, Director of Postal Services, he indulged in some reminiscences of his early days in the electrical industry, and stated what had inclined him to remain in England instead of going out to Australia. He said that since the Armistice economics was the politics of the world. The problem of to-day was how to produce economically. How to employ the worker was the problem of the whole world, except perhaps the U.S.A., which was affected differently by the war from all other nations. He had never worked harder in his life than he was doing at present. He was immensely impressed with the possibilities of Australia.

Since coming to Australia, he had found that British manufacturers of motor cars and some electrical lines might possibly find 30 per cent.—not 6 per cent.—of their market in Australia. In Australia, 13,000 miles away from the centre of the Empire, they perhaps did not give enough thought to the economics of the world. They all knew the efficiency of American industry, made possible by its high protection and its 120,000,000 people. Europe had been Balkanised by the Treaty of Versailles, and was saying, "We must make everything in our own country." This was the antithesis of mass production. Things were coming on which might make Europe, economically, a United States. He was one of the people who were expected to make up their minds which way British industry was going—towards Europe or the United States. He felt that either way, they would be left "up in the air." If they did not stand upon their own feet, their dominance would be over. He stood for the Empire.

He thought Australia might steer into a difficult time unless it were fully realised that an efficient standard in industry was necessary, comparable with the standard of living. Otherwise, the country would be living in a fool's paradise, for a fall in values of primary products would bring disaster. He was not criticising, but such a situation must come sooner or later. That could only be avoided by learning the bitter lesson that England had learned, that the two sides must be got together, even while strikes were occurring, and get down to efficiency. He was a protectionist, but he did not believe in protecting everything if there was not efficiency. Inefficient industries might do more towards raising the cost of living than the efficient ones could do to help the country. The electrical industry of Great Britain had every reason to look at itself in the mirror and be proud of its image. They had had artificial protection during the war, and a little protection afterwards. That period of war prohibition was used to put their heads together and create a British school of thought, that in lamps, radio, wires and cables, and other lines, held its own against the world. They had felt the need of rationalisation of industries. The British electrical industry had held its own, and was a good example of that regeneration of industry which had taken place in Great Britain since 1921. He believed that Australia would link up more fully with British industry. In the war it was found that 6-in. guns were no good against 14-in. guns of the enemy, but that was just what was happening in industry in England to-day. He thought that what had been wrested from Nature in 100 years in Australia was beyond everything that he had imagined. He would do the best he could to give information to those at home on the situation in Australia, and he hoped that he would be of use to the Commonwealth as a whole.

Sir Hugo's second Melbourne speech was at the second annual dinner of the Institution of Engineers, on November 22nd, and was delivered in proposing the toast of the "Engineering Profession." He said that the members of the Commission would eventually appear before the Prime Minister and others at Canberra and answer all questions put to them, frankly, truly, and fearlessly, to the best of their ability. From his personal observations, the thing that struck him most was that this great Continent, neglected for centuries by the human race, should have risen to its present position in 125 years. Such development was possible only by the help of engineers. They had great problems for the future. Some of their great factories which he had seen were as efficient as any in other countries. They were living in a world which was fast becoming mechanised. A new vista had been opened up to engineers. In every office and home there were engineering devices, and a great work was before engineers in simplifying these devices and decreasing labour and labour costs. He wished them every success. They had a very great responsibility, but he was sure they would rise to it. British industry had pulled itself together in the last few years. In many directions they were now leading. The thing that was giving them most trouble was the thing that was going to give Australia most trouble—coal! With the coming of oil, coal had been relegated to a secondary position, but he could bring them the message that the best brains in the Old Country were working to remedy the position, and he was satisfied that within comparatively few years that problem would be solved. Whether by low-temperature distillation of coal or by other means, there would be derived from coal enough oil, enough motor fuel, enough fertilisers, enough cheap electricity, for all needs. There were hundreds of thousands of pounds being spent to-day, not in experimental plants, but in large commercial ones, and when their coal problem was solved, Australia's coal problem would be solved also. The need for importing oil from foreign countries would be lessened, and the coal and allied industries would employ more men than ever before. He was full of admiration for the work that had been done by Australian engineers.

The Canberra correspondent of *The Times* says that, taking advantage of the presence of the members of the British Economic Mission, who are paying a farewell visit to the capital, all the State Premiers, with the exception of Mr. Collier, Western Australia, are attending an informal conference with the Prime Minister. The report of the delegation, summarising the results of their Australian tour, was circulated among those present, who were pledged to secrecy as to its contents, pending publication of the report in the Press on January 10th. The report, which is very brief, contains conclusions without stating reasons. A speech by Sir Arthur Duckham, leader of the mission, to Rotarians on January 7th, suggests that the delegation strongly favours a uniform railway gauge from Perth to Brisbane. The realisation that a break of gauge is undesirable for many reasons has lately become widespread, but the cost, estimated at £22 000,000, has been a formidable obstacle hitherto. It is learned from a reliable source that the Economic Mission is prepared to advise that the cost should be borne out of the Imperial grant of £34,000,000 for immigration and development purposes.

Bare-wire Signalling Circuits in Mines.

The Secretary for Mines has issued a circular drawing attention to the Report as to the safety, in the presence of firedamp, of bare-wire signalling circuits in which bells or relays are used in parallel, which was abstracted, on p. 26 of our last issue. The managers of mines in which there may be danger from firedamp are advised to study the report and take such steps as may be necessary.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The "Fair" at Birmingham.

In our leaderette pages to-day we discuss arrangements in connection with the Castle Bromwich Section of the British Industries Fair (February 18th to March 1st). It is not too soon for all concerned to sit down earnestly and make plans. The Advisory Committee of the Electrical Section has been set up, again under the chairmanship of Mr. H. H. Berry, with Mr. T. R. Martin as deputy chairman, and with representatives of various electrical institutions and associations as members, Mr. E. J. Jennings continuing to hold the important office of honorary secretary. By courtesy of Mr. Jennings, we are enabled to publish the programme of visits to the Electrical Section. Readers would do well to keep this at hand for reference.

Friday, February 22nd, at 11.30 o'clock—Conference Hall:—

Conference arranged by the South Midland Area Committee of the British Electrical Development Association.

At 1 o'clock—Luncheon in Royal Dining Room, "C" Building:—

Incorporated Municipal Electrical Association.
Incorporated Association of Electric Power Companies.
Provincial Electric Supply Association.
British Electrical Development Association.
Municipal Tramway and Transport Association, Inc.
Tramways and Light Railways Association.

Saturday, February 23rd, at 1 o'clock—Luncheon in Royal Dining Room, "C" Building:—

Electrical Power Engineers' Association.

Also, in the Conference Hall, for an hour, at termination of Luncheon:—

Electrical Power Engineers' Association.

Saturday, February 23rd, at 4.30 p.m.—Tea in Royal Dining Room, "C" Building:—

South Midland Students' Section of the Institution of Electrical Engineers.

Friday, March 1st, at 1 p.m.—Luncheon in Royal Dining Room, "C" Building:—

Institution of Electrical Engineers.
Association of Consulting Engineers, Inc.
Association of Supervising Electrical Engineers.
Electrical Contractors' Association, Inc.
Electrical Contractors' Association of Scotland.
Electrical Wholesalers' Federation, Ltd.
Electrical Merchants' and Manufacturers' Association.
Illuminating Engineering Society.
Association of Mining Electrical Engineers.

At 4.30 p.m.—Tea in Royal Dining Room, "C" Building:—

Electrical Association for Women (Birmingham and Midlands Branch).

For Sale.

Messrs. Henry W. Figg & Son will offer by auction on January 23rd, at Winchester House, Old Broad Street, E.C., the business and assets of Attaix, Ltd. Norwich Electric Tramways Co. has for disposal a complete power-station plant of 1,000 kW. The Yorkshire Electric Power Co. has for sale rotary convertors, motor generators, circuit breakers, &c. Edinburgh Corporation Electricity Department has for disposal a number of steam generating units, &c. (See our advertisement pages to-day.)

New Australian Companies.

Among the companies recently registered in Australia are the following: The Collie Power Co. (Perth, W.A.), capital £150,000, to carry on in Collie and elsewhere in Western Australia the business of an electricity supply company; the Bowraville Electric Supply Co. (Sydney, N.S.W.), capital £20,000; Austral Batteries Pty., Ltd. (Collingwood, Vic.), capital, £10,000; Hoover (Australia), Ltd. (Melbourne), capital, £5,000; Mouldings, Ltd. (Sydney), capital, £15,000, to acquire the assets of the Electrical Accessories and Engineering Co. of Australia, Ltd., &c.; and the Vickery Engineering Pty., Ltd. (Richmond, Vic.), capital, £10,000, to take over an existing business of electrical engineers, contractors, manufacturers, &c.

New Electrical Trade Association.

We have received from Messrs. McMillan & Henderson, accountants and auditors, of 5, High Holborn, W.C.1, particulars of the formation of the British Electrical Trade Protection Association. We learn that a large and representative gathering of electrical manufacturers and factors was held on November 28th, at Anderton's Hotel, London, for the purpose of forming a Trade Protection Association similar to the Scottish Electrical Manufacturers' and Factors' Association whose secretary, Mr. H. C. McMillan, attended, and explained the scheme in detail, and was interrogated on various points. The meeting unanimously appointed a Committee, consisting of Major Hogan (Messrs. Hogan & Wardrop), Mr. F. Hicks (Welsbach Light Co., Ltd.), and Mr. C. Orgel (Superlamps, Ltd.), to prepare the draft constitution and fix the subscription.

At a later meeting the Committee submitted the following recommendations, and they were unanimously adopted:—

1. That an Association be formed, to be called the British Electrical Trade Protection Association.
2. That the subscription be £5 5s. per annum, together with an entrance fee of £5 5s.
3. That the first 100 members be called founder-members. these to be admitted without payment of entrance fee.

A number of recommendations regarding the internal working of the Association were adopted. The preliminary Committee, with the addition of Mr. F. W. Evans (National Electric Supplies, Ltd.), was given powers to carry on the work of the Association until January 15th, 1929, when the first regular monthly meeting of the Association will be held and office bearers for the year elected. It is stated that the response of the trade has been most encouraging. A large number of applications for membership have been received, and it is confidently anticipated that the Association will supply a long-felt want in providing definite protection against doubtful traders; its basis is such that the members' interests are entirely mutual, and every member is interested in supplying the Association with all requisite information within his power. The registered offices are at present at 5, High Holborn, London, W.C.1, with a Scottish branch at 13, Dundas Street, Glasgow, C.1.

Proposed Industrial Heating Exhibition at Swansea.

At a recent meeting of the Swansea Corporation Electricity Committee the question of organising an industrial heating exhibition, similar to those being held in Glasgow and Manchester, was considered. Mr. J. W. Burr, the borough electrical engineer, recommended the proposal as he thought that a great impetus would be given to the use of electricity in local industry. He estimated that the cost to the Corporation of an exhibition would be about £400; energy would have to be supplied to exhibitors free of charge. There would be difficulty in obtaining accommodation in the earlier part of the year. The Committee decided to postpone further consideration of the matter until it could be ascertained whether accommodation could be found during August.

The Australian Electrical Market.

In an editorial entitled "British Electrical Manufacturers and the Australian Market," the *Industrial Australian and Mining Standard* (November 22nd), in the course of a brief review of the situation in this country remarks:—"We in Australia should, as a natural course, have a deep regard for the electrical production industry carried on in Great Britain, and in order that we may give expression to that regard, it is essential that we as a people should from time to time have placed before us the actual facts of the situation so that we may both formulate policy generally, and take action in particular cases as they arise, with adequate intelligent understanding." In referring to the export trade position our contemporary says:—"It behoves British electrical manufacturers to help their overseas organisations by every means in their power, so that their activities may be characterised by a greater zeal and energy. The home office policy has been to a large extent found wanting in recent years. There is much talk in England at present about the need for introducing greater efficiency and spirit into British salesmanship overseas. Surely it is up to the British electrical manufacturer and trader to act with enterprise in organising to supply this

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country. The present system of tendering in Australia is, we regret to say, very far from satisfactory to all overseas firms. We have had to draw attention to some glaring instances of 'parochialism,' to put it mildly, on more than one occasion in this connection. Competing electrical peoples are only too ready to cater for the requirements of our market. Britain holds a very large share of our electrical business, but can she expect to continue to do so in face of keener foreign competition unless her producers face up to the needs of the situation, so far as publicity and salesmanship are concerned, and show readiness to foot the bill? . . . Link up Australian preferential policy to a policy of wideawake activity on the part of the British trader, giving our buyers an accurate knowledge of the situation of the British industry, and the ability of her works to meet our needs at a reasonable price, with a first-class article, and there need be fewer drops in the trade curve. We commend the wisdom of adopting an aggressive trade policy throughout Australia to the British electrical industry."

Floodlighting in a Church.

We reproduce herewith a photograph taken in the parish church of All Saints, Maidstone, by the light provided by a new installation which has been carried out by Messrs. G. E. WALLIS & SONS, LTD. The floodlighting of the nave, aisles and chancel has been effected by means of 64 "Gecoray" projectors, each fitted with a 200-W gasfilled, white-sprayed "Osram" lamp. The result, as will be judged from the illustration, is extremely good.

Floodlighting in All Saints' Church, Maidstone.

Calendars and Diaries.

The 1929 wall calendar issued by CALLENDER'S CABLE & CONSTRUCTION CO., LTD., presents a large framed portrait in colour of Sir T. O. Callender, the managing director and deputy chairman of the company.

A calendar received from the BRITISH B.A.G., LTD., 23, Farringdon Avenue, E.C.4, bears illustrated instructions for wiring the "Lomax" patent lampholder. It has monthly date slips.

Messrs. BROOK MOTORS, LTD., Empress Works, Huddersfield, have sent us a metal foot rule with British and metric markings.

The calendar received from BRITISH BROWN-BOVERI, LTD., Trafalgar House, Waterloo Place, S.W.1, is a very handsome production consisting of monthly sheets, each of which bears an illustration of the parent company's works and products.

The COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., 46-47, New Broad Street, E.C.2, has again sent us a telephone number card, upon which electric power is symbolised.

Mr. GEORGE P. COSWAY, Coton Road, Nuneaton, has sent us a useful wall calendar with large monthly sheets.

Humorous drawings by Will Owen enliven the two-monthly sheets of a calendar received from the ENGINEERING & LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans.

The "Cosmos" girl appearing on the 1929 calendar of METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is a charming *ingénue* by Bert Wilson. Beneath the picture is a block of daily slips.

The ELECTRICAL TRADES COMMERCIAL TRAVELLERS' ASSOCIATION has sent us a neat pocket diary, a feature of which is a directory of towns giving post times and other useful information, local holidays, &c.

From MESSRS. WM. SANDERS & CO., of Falcon Electrical Works, Wednesbury, we have received a souvenir in the shape of a vest pocket fuse-wire carrier.

On each monthly sheet of a wall calendar sent by MESSRS. PETTERS, LTD., Yeovil, is a photographic reproduction of one of the company's engines or generating sets.

New Zealand's Electrical Imports.

The *Board of Trade Journal* reports that during the September quarter of 1928 electrical apparatus and appliances to the value of £533,886 were imported into New Zealand. The United Kingdom was the principal supplier, with a share valued at £309,576. Then followed the United States (£105,222), Canada (£40,821), and Australia (£7,944).

Customs Tariff Alterations.

In accordance with its usual practice, the first issue of the *Board of Trade Journal* for the year (January 3rd) contained a review of the more important alterations in Customs tariffs made during 1928 by foreign powers and British Dominions. Reference was also made to changes in contemplation.

Recent Contracts.

In our issue of October 12th we gave a list of tenders submitted for the Cairo-Alexandria trunk telephone cable, comprising the names of six British and two German companies. Later, on October 26th, we reported that the offer of the PIRELLI-GENERAL CABLE WORKS, LTD., had been accepted, and it is now stated that the value of the contract is £193,000. The cable will be made at the company's Eastleigh (Hants.) factory, and the work of installation is expected to occupy about eight months.

The Rotterdam Municipality has placed an order with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., for two 42,000-kW turbo-generators. There was keen Continental competition for the contract. The Metropolitan-Vickers Co. has also received a contract for 21 electric locomotives for the Great Indian Peninsula Railway. The value of these two orders is stated to be about £500,000.

BRITISH INSULATED CABLES, LTD., has received orders from the G.P.O. for a telephone cable between Preston and Blackpool, a distance of approximately 21 miles. This is the second cable that has been laid by the company between these two towns. The B.I. has also received an order for approximately 16 miles of telephone cables for the Isle of Man. These cables are to link up Douglas, Castletown, and Port Erin with the mainland through the new submarine cable, which is shortly to be laid between Fleetwood and Douglas.

The ALTON BATTERY CO., LTD., has recently received orders for nine batteries for Sydney, Melbourne and Tasmania. Further recent contracts cover batteries for Mansoura (Egypt), and Lisbon.

ALLOY WELDING PROCESSES, LTD., has secured the contract for the supply of a motor-generator arc-welding plant for two operators for the Assam-Bengal Railway Co. This machine is to be fitted with the company's latest B.P. type dynamo, which is a self-stabilising, drooping-characteristic machine. The special features of the generator are that no separate series resistance, reactors, or transformers are required, nor is separate excitation necessary. The company has supplied similar and special equipment to a number of important railway undertakings, dockyards, &c.

The MEDICAL SUPPLY ASSOCIATION, LTD., has received instructions from the Lord Mayor of Buenos Aires to supply a very large quantity of ultra-violet light, massage, static electrical, high-frequency, radiant-heat, and electro-medical apparatus generally, for the equipment of the Institute de Radiologia, Buenos Aires. The whole of the equipment will be manufactured in the company's London works.

In our "Contracts Closed" section we give a list of sub-contracts in connection with the Hams Hall power station, Birmingham, which have been placed with the GENERAL ELECTRIC CO., LTD. (for the electrical equipment) and other companies.

Important French Amalgamation.

It is announced that the fusion of interests between the two important French electrical engineering undertakings, the Société Alsacienne de Constructions Mécaniques, of Belfort, and the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, which has half a dozen works in different parts of France, has now been completed. The joint business will in future be carried on under the title of La Société Générale de Construction Electrique et Mécanique Alsthom, with headquarters at 146, Avenue des Champs Elysées, Paris. Only the cable and wire, battery and signal manufacturing departments of the Thomson-Houston Co. remain outside the amalgamation.

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Staff for New Bristol Station.

The Bristol Corporation Electricity Committee reports that it is desirable to appoint the preliminary staff for the Portishead generating station, which will be rated as a class "H" station under the salary scale approved by the National Joint Board for the Electricity Supply Industry. It therefore recommends that it be authorised to appoint a station superintendent at a salary of £672 per annum, and a boiler-house superintendent at a salary of £511 per annum.

Bankruptcy Proceedings.

F. PRICE, 9, Gold Street, and C. R. TARVER, 16, Forrest Street, lately trading as Fred Price, Tarver & Co., 15, Working Street, Cardiff, electrical engineers.—The first meeting of creditors was held on December 31st at Cardiff. The debtors returned a statement of affairs showing ranking liabilities of £713, against assets of £88, leaving a deficiency of £625. The debtors attributed their failure to trade depression.

J. W. TURTON, Market Place, Banbury, Oxon., electrical engineer.—The receiving order herein was made recently on the debtor's own petition. The first meeting of creditors was held recently at Oxford, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

W. L. BROWN, trading with another as Sewell & Brown, electrical and radio engineers, 6a, The Exchange, Muswell Hill.—Discharge suspended for six months until May 27th.

W. P. HODGE, wireless salesman, 92, Cannon Street, E.C.4.—Discharge suspended for two years until November 30th, 1928. (?1930).

H. J. BROWNHILL, electrical engineer, back of 48, Whitehouse Street, Walsall.—Order for summary administration made December 20th. First meeting January 11th, at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton. Public examination February 20th, at the Court House, Lichfield Street, Walsall.

B. E. M. POOK, 53a, Albert Road, Southsea, Hants., wireless dealer.—First and final dividend of 3¾d. in the £, payable January 12th at the Official Receiver's office, 87, High Street, Portsmouth.

C. K. WALLIS, electrical engineer, Bedford Street and Longford Road, Bognor.—Application for discharge to be heard February 14th, at the Court House, Brighton.

Company Liquidations.

BURGOYNE MANUFACTURING CO., LTD., 34a, York Road, London, N.1, radio manufacturers, &c.—A meeting of creditors was held on December 28th at the offices of Messrs. W. Meacock & Co., 123, Cannon Street, E.C., when the liquidator, Mr. R. W. Meacock, reported that the company was incorporated on May 29th, 1928, with a nominal capital of £500, divided into 10,000 shares of 1s. each, to adopt and carry into effect an agreement transferring to the company a radio manufacturing, &c., business, in consideration of the allotment of 9,993 ordinary shares, credited as fully paid. Six shares were allotted for cash, in respect of which 5s. had been paid. The trading of the company was not successful, and on August 28th last, Messrs. W. B. Fordham & Sons, Ltd., were granted a debenture for £4,000 as security for an amount due to them. On October 1st last Mr. E. D. Hine was appointed receiver and manager, and carried on the business until November 30th, when all the assets were transferred to a new company formed to continue the business. The assets transferred to the new company consisted of stock at cost approximately £1,500, valued at £1,250; debtors £1,750, valued at £1,050; plant £15, and furniture £26. The small cash balance in the hands of the receiver at that date was insufficient to pay his remuneration. The amount due to W. B. Fordham and Sons, Ltd., was £4,383; and £1,500 was due for debts to other creditors guaranteed. From those amounts had to be deducted £2,250 as the value of the security afforded by the debenture, leaving £3,633. With other creditors' claims the deficiency was £5,308. No accounts had been prepared, and the liquidator said that in view of the state of the books, it would appear that the preparation of any accounts would involve unjustifiable expense. The deficiency was accounted for by trading losses, bad debts, loss on realisation of furniture and plant, costs of formation of the company, remuneration of the Receiver, and costs of liquidation. It appeared that the sales barely covered the cost of materials consumed. No resolutions were passed, and therefore the voluntary liquidation of the company will continue with the present liquidator.

NEW WILSON ELECTRICAL MANUFACTURING CO., LTD., 18, Fitzroy Street, Fitzroy Square, W.1, wireless and electrical factors.—A meeting of the creditors of the above was held on January 2nd at the offices of the liquidator, Mr. R. Y. Rickard, 65, Basinghall Street, E.C. Mr. Rickard reported that the liabilities amounted to £1,569, and the assets totalled £1,134. From that amount had to be deducted £308 for preferential claims, leaving net assets of £826. The company was incorporated in July, 1925, to acquire certain rights in patent articles. The trading was successful for the first two years, but in the third year there was a loss. Since that date, to the time of liquidation, a further loss had been sustained. The sales during the whole time of the company's trading were £29,565, and there was a gross profit of £10,843. After deducting expenses, &c., there was a net profit of £1,820. It was resolved to confirm the voluntary liquidation of the company with the present liquidator.

BELL'S UNITED ASBESTOS CO., LTD.—Winding up voluntarily for the purpose of amalgamating the business with that of Turner & Newall, Ltd. Liquidators, Mr. S. R. Cooper, 14, George Street, E.C.4, and Mr. F. G. Brook, 41, Compton Road, Winchmore Hill, N.21, appointed December 31st. A meeting of creditors will be held on January 18th at Asbestos House, Southwark Street, S.E. (This notice is purely formal; all creditors have been, or will be, paid in full.)

VACUUM POWER, LTD., & VACUUM LIGHT & POWER, LTD.—Particulars of claims to be sent by January 14th to the liquidator, Mr. E. J. Tubbs, Devonshire Chambers, Bishopsgate, E.C.2.

INDUCTION MOTORS (LONDON), LTD.—A meeting is to be held on February 4th, at 19, Leys Avenue, Letchworth, to hear an account of the winding up from the liquidator, Mr. T. Keens, 11, George Street West, Luton.

SHAW & ADAMS, LTD.—Winding up voluntarily. Liquidator, Mr. C. F. J. Taft, Victoria Chambers, St. Peter's Churchyard, Derby, appointed December 28th. A meeting of creditors is called for January 16th at the North Stafford Hotel, Stoke-on-Trent.

VOLTA, LTD.—Winding up voluntarily as already announced. Liquidator, Mr. A. N. D. Smith, 80, Finsbury Pavement, E.C.2, appointed December 31st. A meeting of creditors is called for January 17th at the liquidator's offices.

MOHAWK RADIO, LTD.—Winding up voluntarily. Liquidator, Mr. A. A. Reeves, 2, Tyrrel Street, Bradford, appointed December 27th. A meeting of creditors at 50, Gresham Street, E.C.2, is called for January 15th, and particulars of claims are to be sent to the liquidator on or before that date.

WATERHOUSES (ELECTRICIANS), LTD.—A general meeting of members is called for February 4th at Court Chambers, Jessop Street, Castleford, Yorks., to hear an account of the winding up from the liquidator, Mr. F. W. Hanson.

Dissolutions of Partnership.

MORLEY & BOOTH, Star Buildings, Newcastle-upon-Tyne, electrical engineers and agents.—Messrs. F. H. Morley and H. C. Booth have dissolved partnership. Mr. Morley will continue business at Star Buildings, and Mr. Booth will carry on business at 20, Saville Row, Newcastle.

AIRD & SCOTT, electrical engineers, 1,036, Argyle Street, Glasgow.—Mr. W. Aird and Mr. W. Scott have dissolved partnership. Mr. Scott will attend to debts and continue the business under the style of W. Scott, at 1,036, Argyle Street.

Unemployment in Germany.

The Berlin correspondent of *The Times* reports that German unemployment figures show the sharp rise characteristic of the mid-winter period in several recent years. The total number of persons in receipt of relief at the end of December was 1,417,000, as compared with 647,000 in July, the lowest total of the year. As a contributory cause there has been the shipyard strike, which affected some 50,000 men directly, and has been in progress since October 1st, work having been at a standstill in nearly all the Baltic and North Sea yards.

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports during the nine months ended September 30th last, comparing them with the corresponding period of 1927. From these we have compiled the appended table, showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom, as country of shipment but not necessarily of manufacture:—

	Total imports. Jan. to Sept. 1927. £	Total imports. Jan. to Sept. 1928. £	U.K. share. Jan. to Sept. 1927. £	U.K. share. Jan. to Sept. 1928. £
Electric wires and cables	84,959	147,229	33,980	40,487
Telegraph and telephone instruments and apparatus ...	31,104	7,268	24,320	5,933
Electric lamps and parts	31,990	37,002	26,694	26,119
Batteries and accumulators	25,536	19,365	24,502	17,706
Radio sets and parts	48,554	53,892	47,473	53,077
Other electrical goods and apparatus ...	57,746	73,115	44,284	42,932
Generators	9,283	8,020	8,703	6,758
Motors	14,385	26,091	11,161	14,004
Other electrical machinery	55,476	69,524	49,049	42,348
Totals ...	£359,033	£436,106	£270,166	£249,364

As will be seen, of the total imports, only £249,364, or approximately 57 per cent., as against over 75 per cent. in 1927, came from ports of the United Kingdom, leaving £186,741 for foreign countries, the bulk of which is credited to Germany.

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Trade Announcements.

The ELECTRIC HEATING CO., Croydon, has appointed Bedford Electro Heaters, Howbury Street, Bedford, as sole agents for Lancashire.

The offices and stores of Messrs. HARWELL, LTD., have been removed to the The Sessions House, Clerkenwell Green, E.C.1.

The businesses of Messrs. J. J. GRIFFIN & SONS, LTD., and BAIRD & TATLOCK, LTD., have been combined under the name of GRIFFIN & TATLOCK, LTD. The conduct of the business will be continuous and unchanged.

The REVO ELECTRIC CO., LTD., states that the telegraphic address of its new London depôt, 30, Great Queen Street, W.C.2, is "Revolect, Westcent, London."

This week the WELSBACH LIGHT CO., LTD., opened a new electrical showroom at Welsbach House, 344, Gray's Inn Road, W.C.1. Some particulars of this will appear in our next issue.

With reference to the death of Mr. Clark, reported in a recent issue, it is announced that the business of Messrs. C. O. Clark, electrical engineers and contractors, of London, Deal, and Horsmonden, will be continued by the same staff, and with Mr. M. F. Clark as prinicpal.

For many years past Messrs. V. G. MIDDLETON & CO., LTD., 9, Carteret Street, S.W.1, have worked in close agreement with Messrs. W. J. FURSE & CO., LTD., of Nottingham. To strengthen this connection the name of the company has been altered to W. J. FURSE & CO. (LONDON), LTD. No other alteration will be made; Mr. F. W. Marshall, who has been managing director since the formation of the company, will continue to act in that capacity.

New Showroom at Worksop.

The new showroom of the Worksop Electricity Department (chief engineer and manager, Mr. M. S. Mason) was opened recently. The premises consist of a double-fronted shop, with

A Corner of the New Worksop Showroom.

offices and workshops at the rear, situated in Bridge Street. A view of part of the interior, arranged as a lounge, is reproduced herewith. A dinner to which the staff was invited was held in the evening of the opening day.

The F.B.I. and Penny Postage.

In a recent letter to the Chancellor of the Exchequer, the Federation of British Industries again drew attention to the importance of the early restoration of the Imperial penny post. Reference was made to the recent decision of the Canadian Government to reinstitute penny postage, and the Government was urged not to lag behind the Dominions in such a vitally-important matter.

Social Events.

Following the annual conference of the indoor and outdoor sales staffs of Messrs. John Shaw & Sons (Wolverhampton), Ltd., just before Christmas, the annual staff dinner was held at the Victoria Hotel, Wolverhampton. Mr. V. A. Mattick, the general manager, presided, and Mr. T. W. Simpson, a director, was present. Messages regretting their inability to be present were received from Mr. George Terrell, chairman, who is abroad, and Sir Harry Greer, deputy-chairman.

The Badminton Section of the G.E.C. Social Club held its annual dance in the Lecture Room at Magnet House on December 21st, when there was a large attendance. The arrangements, which were in very capable hands, coupled with the festive spirit prevailing, ensured a very enjoyable evening.

Once a month the employés of Messrs. H. E. Ashdown, Ltd., meet their employers for a jolly evening together. A Social Club was formed twelve months ago, and members invite friends to all the club's social functions. A fancy dress dance was held on December 20th, when over 200 spent a very enjoyable evening. During the evening a presentation was made to Miss G. Claydon, who has been employed with the company for nine years.

The Birmingham City Electric Supply Department's Christmas pantomime was very successful. All the performers were children of the employés, who gave a clever interpretation of "Sinbad the Sailor." The Lord Mayor, Councillor W. B. Kenrick, and Mr. E. J. Jennings (secretary of the Electric Supply Department) attended. The play was written by Mr. G. H. Luke, and the producers were Messrs. R. New and F. J. Tivet. An amateur orchestra, under the direction of Mr. F. A. Wolverson and conducted by Mr. J. Aspin, rendered excellent service.

New Catalogues and Lists.

THE STANDARD WET BATTERY CO., 184-188, Shaftesbury Avenue, W.C.2.—Two illustrated booklets dealing with the use and maintenance of the company's Leclanché batteries for radio work and a leaflet advertising the "Wates" volt-amp. meter. Priced.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—January price list of electrical supplies, fittings, and apparatus. Illustrated.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Three publications, dealing respectively with "Coraline" soldering paste, electric resistance welding, and welding used in the assembly of "Ford" cars.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 172, containing illustrations, details, and prices of the company's shop-window lighting equipment.

MESSRS. J. P. HALL & CO., LTD., Blackriding Iron Works, Oldham.—Booklet No. 64, containing 72 pages of illustrations of motors and generators and numerous applications.

MESSRS. ELLIOTT BROS. (LONDON), LTD., Century Works, Lewisham, S.E.13.—A series of catalogue sheets illustrating and describing the company's meters for laboratory and general use. Priced.

Further January calendar-blotters have been received from the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1; and Messrs. S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A circular letter to dealers containing a special offer in connection with "Universal" vacuum cleaners. Also leaflets advertising other "Universal" appliances.

MR. GEORGE P. COSWAY, Coton Road, Nuneaton.—Two blotters, advertising, respectively, wireless apparatus and service, and the "Drednort" link box.

The VISCO ENGINEERING CO., LTD., 162, Grosvenor Road, S.W.1.—Catalogue No. 283, illustrating and describing the "Visco-Beth" dust-collecting apparatus.

Book Notices.

"Window Display Advertising," by Carl Percy. Pp. xiv+208; figs. 60. London: The Library Press, Ltd. Price 21s. net. In this well-printed and illustrated volume the author, an American publicity expert, makes a study of the various factors which contribute to the success of a window display, and shows how results may be gauged with some degree of certainty. Mr. Percy considers that the retailer should not be expected to do all the work himself; he maintains that the manufacturer should assist and show the retailer how to use his window space to the best advantage.

"The *Wireless Trader* Year Book and Diary, 1929." 390 pp. London: The Trader Publishing Co., Ltd. Price 5s. 6d. post free.—The principal addition to this, the fifth, edition of the Year Book is a section covering the gramophone industry with which the radio trade is entering into closer relationship. This is extended also to the technical data section. All the usual features have been retained and brought up to date, although, in view of the recent Marconi patent royalty litigation, the summary of the "A.2" licence granted to manufacturers has been omitted.

"An Introduction to Electrical Drawing," by E. H. H. Gibbins, B.Sc. (Hons.) (Lond.). Pp. 63; illustrated. London and Glasgow: Blackie & Son, Ltd. 3s. net.

"Broadcasts to Schools," programme and syllabus for the spring term, January to March, together with new series of pamphlets; also syllabus of talks and lectures for the period January to April. London: British Broadcasting Corporation.

German Electrical Contractors' Conference.

The annual congress of the German Association of Electrical Installation Contractors was recently held in Munich, when it was announced that the body now has 400 centres and 9,500 members. The association has for some time been endeavouring to discover a better word than the French one at present used, "*installateur*," to denote the profession. The matter was eventually referred to one of the German philological institutes, which, however, has reported that it has not been able to decide upon a more suitable German word.

New Argentine Company.

The Fabrica Argentine de Lamparas Electricas, S.A., recently formed in Buenos Aires with a capital of $250,000 (paper) is to manufacture electric incandescent lamps, sell electrical materials, &c.

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Asbestos Companies' Amalgamation.

An amalgamation of the undertakings of Bell's United Asbestos Co., Ltd., and Turner & Newall, Ltd., has been completed. An independent company styled Bell's Asbestos and Engineering Supplies, Ltd., has been formed to take over a branch of Turner & Newall, Ltd., and to deal directly with users of packings, jointing and general engineering supplies.

Central Electricity Board Contracts.

In this issue the Central Electricity Board calls for tenders for the supply, delivery, and erection of 132-kV outdoor switchgear for the transformer stations in the area covered by the Central England Electricity Scheme; also for the supply, delivery and erection of 132,000-V transformers for the above scheme. The Board also invites tenders in this issue for the supply, delivery, and laying of 66,000-V cables (London area) for the South-East England Electricity Scheme.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price Jan. 8th.	Fortnight's inc or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	"	£52	...
a Bisulphide of Carbon	"	...	...
a Borax	"	£25	...
a Copper Sulphate	"	£25 10s.	...
a Potash, Chlorate	per lb.	8½d. to 4d.	...
a " Perchlorate	"	5½d.	...
a Shellac	per cwt.	£13 10s.	...
a Sulphur, Commercial	"	£11	...
a " Roll	"	£11	...
a Soda, Chlorate	per lb.	3d.	...
a " Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	3¾d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£95 to £100	...
b " Wire	per lb.	1/1 to 1/9	...
b " Sheet	"	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metal—			
Grade I	per ton net.	£202	£1 dec.
Grade II	" "	£141	...
Grade III	" "	£76	£2 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	10⅜d.	¼d. inc.
c " Tubes (solid drawn)	"	1,0½ to 1/0¾d.	¼d. inc.
c " Wire, basis	"	10⅝d.	¼d. inc.
c Copper Tubes (solid drawn) ...	"	1/2¼	¾d. inc.
c " Bars (best selected) ...	per ton.	£102	£4 inc.
c " Sheet	"	£102	£4 inc.
c " Rod	"	£102	£4 inc.
d " (Electrolytic) Bars ...	"	£75 5s.	...
d " " Sheets ...	"	£148 10s.	...
d " " Wire Rods	"	£85 5s.	...
d " " H.C. Wire	per lb.	1/[illegible]¾d.	...
f Ebonite Rod	"	2/8 to 2/6	...
f " Sheet	"	2/8 to 2/6	...
n German Silver Wire	"	2/2	...
h Gutta-percha, fine	"	nom.	...
h India-rubber, Para fine	"	10¾d.	...
i Iron Pig (Cleveland No. 3.) ...	per ton.	75/-	...
l " Wire, galv. No. 8, P.O. qual.	"	£21	
g Lead, English pig	"	£23 10s.	£1 inc.
g Mercury	per bot.	£22 5s. to £22 15s.	...
c Mica (in original cases) small ...	per lb.	3d. to 8/-	...
c " " medium	"	4/- to 8/-	...
c " " large ...	"	10/- to 20/- & up	...
p Phosphor Bronze, plane castings	"	1/8½	...
p " " drawn bars & rods	"	1/8½	...
p " " rolled strip & sheet	"	1/8½	...
p " " wire...	"	1/4½	½d. inc.
c Platinum	per oz.	£16 5s.	£1 inc.
d Silicium Bronze Wire	per lb.	11½d.	...
r Steel, Magnet, in bars	"	7½d.	
n Tin, Block (English)	per ton.	£225 5s. to £225 10s.	30/- to 35/- inc.
n " Wire, Nos. 1 to 16	per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

c G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated January 5th, Messrs. James Forster and Co. stated that a rise in lead prices occurred last week, but they receded later. The rise was probably initiated, in the first place, by sentiment owing to the better tone in other metals, but the firm conditions brought about a fair amount of buying by home consumers for early delivery. As soon as that buying had spent itself, prices dropped back. Supplies of lead are ample, while it is expected that arrivals this month will be pretty full; in fact, declarations of "Burma" refined lead have already made their appearance. December shipments from Australia are reported as 12,362 tons, so that for the next two months there will be no shortage of lead from that quarter. "Although we consider the intrinsic position of lead sound, we think that under present conditions the price is quite high enough. Should, however, demand on the Continent revive, higher prices may be seen in the near future."

Lighting and Power Notes.

Alresford.—ELECTRICITY SUPPLY.—It was recently reported to the Rural District Council that the Hampshire Electricity Co. proposes to apply for powers to supply electricity to the district. A similar order is being applied for by the Alton Electricity Co.

Birmingham.—CHANGE OF FREQUENCY.—The Birmingham Electric Supply Committee, in a report to the City Council (at its meeting on January 8th) referred to the Central England Electricity Scheme, and the Committee reported that on September 28th the Central Electricity Board formally called upon the Corporation to make the necessary arrangements for changing the frequency of supply from 25 to 50 cycles. It had been arranged for the Board to finance this work in such a manner that no expense would fall on the Corporation. A local engineer had been appointed by the Board, and local offices established.

It had been agreed that the Board should install two 18,750-kW frequency changers at Nechells (Prince's) Station, which would enable the Corporation to supply 50-cycle current from the 25-cycle machines as a temporary measure, and for one of the large generating sets at Hams Hall power station to be rewound for 50-cycle supply. It would take twelve months to install the frequency changers referred to.

ASSISTED WIRING SCHEME.—The Committee gave particulars of a scheme which it had just brought into operation for wiring premises. The work would be done by registered contractors to a specification prepared by the Department. Contracts had been entered into with all registered contractors who were prepared to carry out the wiring at schedule prices, and the work would be spread as evenly as possible amongst the contractors on the rota.

EMISSION OF GRIT.—The grit catchers which are operating successfully where ordinary slack is being consumed are not found to be so successful in the case of pulverised fuel. In order to cope with this new problem, the experiment has been tried of fitting a second catcher behind the first on one of the chimneys, resulting in a marked improvement. Similar additions will be made to the other chimneys over the pulverised fuel furnaces. Meanwhile, in order to reduce the total quantity of ash that has to be dealt with in the pulverised fuel boilers, only fuel having a low ash content is being burnt in them at a considerably increased cost. The Committee has already spent £61,000 upon the problem, apart from the extra cost of fuel.

Carnarvon.—ELECTRICITY SUPPLY.—Attention is being given to the situation that will arise when the Corporation's agreement with the National Electric Construction Co. expires this year. A committee, which has been investigating the matter, has presented a report to the Chamber of Commerce which states that up to six years ago the company had been carrying on at a loss. Since then, however, there had been a profit of £1,700. The Committee is unable to come to any conclusion as to whether the time is opportune for the Corporation to take over the whole responsibility for giving an electricity supply, but is of the opinion that the company should be asked to state its terms for the renewal of the existing agreement.

Canada.—NIAGARA FALLS TREATY.—The Ottawa correspondent of *The Times* reports that on January 2nd Mr. Mackenzie King, the Prime Minister, and Mr. Phillips, the United States Minister, signed a treaty embodying the recommendations of the joint board of engineers which studied the problems connected with Niagara Falls. Its terms will authorise the construction of new works which will reduce the process of erosion and preserve the scenic beauties of the Falls, at the same time making an additional 10,000 h.p. of electricity available for distribution in each country.

HYDRO-ELECTRIC DEVELOPMENT.—The Gatineau Power Company has commenced construction on another storage dam on the Gatineau River, in Quebec Province. The new dam storing the waters of Lake Cabonga, and the present Mercier storage dam will form reservoirs ranking with the largest storage systems of the world. The new structure, known as the Cabonga dam, will create a reservoir of 45,000,000,000 cu. ft. capacity, and will be situated 46 miles above the Mercier dam, the two having a combined storage of 145,000,000,000 cu. ft. Work will be carried on throughout the winter, and it is expected that the dam will be completed and ready for operation next summer. Its construction will materially assist in regulating the flow of the Gatineau River, on which the Gatineau Power Company has completed three hydro-electric plants within the last two years. Two of the stations are within six miles of Ottawa, and designed for a combined capacity of 290,000 h.p., of which 232,000 h.p. is installed or being installed. The third station, known as the Paugan, 35 miles north of Ottawa, which came into operation on October 1st with a delivery of 80,000 h.p., has an installed capacity of 204,000 h.p.

The Vancouver correspondent of the *Financial Times* reports that the construction of another hydro-electric project at

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Ruskin at an expenditure of £1,450,000, and an enlargement of the Bridge River plant, at a cost of £200,000, are announced by the British Columbia Power Corporation. The additional development is planned in the belief that all previous estimates of Vancouver's growth will be exceeded.

Chester.—ELECTRICITY IN BULK.—The Electricity Distribution of North Wales & District, Ltd., has applied to the City Council for a supply of electricity in bulk in order to give a supply to Holt, Bunbury and district. The Electricity Committee is to communicate with the Electricity Commissioners with regard to the request.

Colchester.—EXTENSION OF SUPPLY.—The Corporation Electricity Committee has considered revised estimates of the cost of the proposed double transmission line for the supply of electricity to Wivenhoe urban district, and ultimately to Rowhedge, and has decided to apply for sanction to a loan of £8,536 (in lieu of £6,500), made up as follows: Purchase price of undertaking belonging to the Wivenhoe Electricity Company, £2,150; cost of application for Special Order by the Wivenhoe Council, £275; estimated cost of transmission line from the Hythe (Colchester) generating station to Wivenhoe, £4,776; mains services, &c., in Wivenhoe, £1,260; and contingencies, £75.

Continental.—RUSSIA.—The Glavelektro, headed by M. Korostashevski, has completed its work of investigating the electricity supply and the electrical industry of Leningrad. As regards the supply of electricity to the town, the Commission's investigations showed that the situation would still be difficult in spite of the imminent extensions of steam power works and the building of the Svir station. It therefore considers it necessary to equip a steam power house of 100,000 to 150,000 kW. The fuel used would be peat. Negotiations are proceeding for the use of American credits amounting to $25,000,000, and the *Commercial and Industrial Gazette* says that possibly the Americans will help in the scheme, not only by supplying the electrical machinery, but also by taking part in the construction of the station.—*Reuter's Trade Service* (Moscow).

Crawley (Sussex).—INQUIRY RESULT.—In connection with the local inquiry held recently by the Ministry of Transport into the application by certain consumers for a revision of the maximum charges for electricity supply by the Sussex Electricity Supply Co., Ltd., the company has received a communication from the Ministry stating that after consideration of the evidence given at the inquiry, of the inspector's report and other circumstances of the case, the Minister of Transport has decided not to make an Order in the matter.

Dover.—LOANS SANCTIONED.—The Corporation has received sanction to the borrowing of £2,280 for mains, and £1,520 for switchgear.

Forfar.—INAUGURATION OF SUPPLY.—An electricity supply for the district was inaugurated on January 1st. The supply is given from the Arbroath power station.

Hoylake and West Kirby.—NEW TARIFF FOR OUT-DISTRICTS.—In view of the arrangements that are being made to give a supply of electricity to Frankby and Grange, the Urban District Council has drawn up a special tariff, details of which are as follows: (*a*) A fixed charge equal to 25 per cent. per annum of the ratable value of premises, plus ⅝d. per kWh for all electricity consumed (accounts payable quarterly); (*b*) a fixed charge equal to 12½ per cent. per annum of the annual ratable value of the premises, plus 1¼d. per kWh for electricity consumed (accounts payable quarterly), minimum ratable value assessment £18 per annum.

Hull.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £46,375 for the supply of electricity to the western outskirts of the city.

Lancaster.—ELECTRICITY SCHEME.—Messrs. Thomas Wilkinson, Ltd., of Arnside, have prepared a scheme for the supply of electricity from the waste gases of the Carnforth Ironworks, and their proposals were recently examined at a special meeting of the Rural District Council. The firm proposes to supply the parishes of Silverdale and Warton-with-Lindeth in the scheme for the whole of Westmorland, and sets out its plan in a letter to the Council which states that even if the furnaces at Carnforth were closed down temporarily, it would be able to use the Government's grid and thus be able to maintain a continuous supply. It had already had an interview with the Central Electricity Board and the Electricity Commissioners, which was satisfactory. It was proposed to supply electricity in the parishes at a rate of 1½d. per kWh for power and 8d. per kWh for lighting. The station to be erected was to be 12,000 kW, and the firm hoped to be in a position to make an early start as all the necessary capital for the undertaking had already been found. The Council has decided to refer the matter to the parishes concerned and then to further review the situation.

Leeds.—ELECTRICITY CHARGES.—The Corporation Electricity Committee has recommended the following alternative charge for the supply of electricity to consumers requiring large quantities for lighting purposes. A fixed charge at the rate of £10 per kW of maximum demand plus a "unit" charge of 0.5d., provided that the annual requirements for lighting shall not be less than 100,000 kWh, and that suitable accommodation for the necessary transformers and switchgear shall be provided by the consumer, which plant may also be used by the Corporation for supplying other consumers. The consumer is to have the option of bulking all requirements, whether for lighting, heating or power, and be charged on the above tariff.

ASSISTED WIRING SCHEME.—The Corporation Electricity Committee is to apply for sanction to a loan of £50,000 for the assisted wiring scheme.

Newcastle-on-Tyne.—ELECTRICITY CHARGES.—The *Yorkshire Post* reports that the cost of electricity in Newcastle and district, where the two supply companies charge 6d. per kWh for domestic supplies, was discussed at a meeting at Newcastle on January 2nd of a committee appointed from a joint conference of Tyneside authorities and representatives of the electricity companies. The meeting was private, and no official statement was made. It is understood, however, that the municipalities put their case for a reduction on the ground that various towns in the northern counties were able to obtain electricity at less than 6d. per kWh. The representatives of the companies, in reply, referred to the capital which had been sunk in their industry, on which there had not been an adequate return, owing to the depressed state of industry in the area. They also pointed out that the Newcastle Corporation supplied its own power for trams and street lighting. A promise was given that the companies would go into the matter, and a further meeting of the conference is to take place in a fortnight.

Newport.—ELECTRICITY SUPPLY.—The Borough Electrical Engineer has reported to the Electricity Committee that the new pumping station has been successfully put into commission, and that the execution of the contract is proceeding satisfactorily. He states that the frequency-lowering scheme has been completed and the Llanarth Street works was shut down on December 31st last as a steam generating station. The Electricity Commissioners have sanctioned £141,000 on account of mains and services, meters, &c.

Nottingham.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has decided upon further important extensions of electricity supply, and has recommended that application be made for sanction to borrow an additional £150,000, supplementing a loan of a similar amount granted in 1927, for a general extension of mains, for transformers and switchgear in connection with h.p. supply for outside service, the erection of sub-stations and meters and for work in relation to an assisted wiring scheme.

Plymouth.—MAINS EXTENSIONS.—The Corporation Electricity Committee, at its meeting on January 2nd, sanctioned mains extensions to a number of streets at an estimated cost of over £4,000.

Preston.—NEW PLANT.—The fourth generating set at the Ribble power station has been completed, although its final test has not been made. During December 7,000,000 kWh was generated, an increase of 60 per cent. over the corresponding month of last year. The number of consumers also showed an increase of 190. Formal sanction has been received to the borrowing of £3,500 for the purchase of property adjoining the works in Crown Street.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee has authorised mains extensions at a cost of £12,560.

Skipton.—YEAR'S WORKING.—The Urban District Council's electricity undertaking last year yielded a profit of £2,124, after providing for all charges, against a loss of nearly £1,000 in the three years 1924-6. The year's income was £7,786, and the number of consumers increased to 645. The returns presented to the Council show a fall in the consumption of gas of 5,000,000 cu. ft.

Special Order.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Peacehaven Electric Light & Power Co., Ltd., to supply electricity in part of the parish of Piddinghoe.

Taunton.—ASSISTED WIRING SCHEME.—The Electricity Committee has presented a report to the Taunton Town Council on the question of free wiring, and the Council has accepted a recommendation that wiring for lighting only should be done by charging a slightly increased price for electricity extending over a period of three years.

Worcester.—LOANS.—The City Council is to institute a system of hire-purchase for wiring and to sell apparatus on direct cash or hire-purchase terms. Application is to be made for sanction to borrow £4,000 for assisted wiring work, and £4,000 for electric cookers, radiators, &c.

NEW SHOWROOMS.—The Council is to open showrooms for the display of electrical apparatus.

Worthing.—LOANS.—The Corporation has applied for sanction to loans of £8,405 for cables, and £2,500 for the purchase of additional cookers and heaters to be let out on hire.

York.—"ALL-ELECTRIC" HOUSES.—The Corporation Housing Committee has decided that the new houses to be erected in Burton Stone Lane shall be of the "all-electric" type.

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Tramway and Railway Notes.

Argentina.—BUENOS AIRES.—According to the *Review of the River Plate*, the chairman of the Local Committee of the Buenos Aires Great Southern Railway has presented to the Ministry of Public Works the plans relative to the forthcoming electrification of the company's suburban services. Electric locomotives will be used, and it is expected that the first of these units will be available for trial shortly.

Burnley.—DOUBLING OF TRACK.—The Corporation is to double the tramway track between Gainsborough Avenue and Manchester Road summit terminus loop, at a cost of £1,500.

Continental.—FRANCE.—An amalgamation is being effected of the two Paris electric underground railways—the Metro and the Nord-Sud. The lines of the two concerns represent a length of about 97 miles, of which 70 miles is in operation. As a result of the amalgamation it is proposed to extend four of the principal lines in order to meet the requirements of people who are now living further out from the centre of Paris than before the war.

SWITZERLAND.—With the recent inauguration of an electric train service on the line between Zurich and Schaffhausen, the first schedule of the electrification of the Swiss Federal Railways has been completed. Out of a total length of nearly 1,840 miles, just over 1,000 miles is now electrified. The second schedule of work only provides for the electrification of 265 miles of line, and this is now in process of execution.

GERMANY.—Work is at present in hand on the construction of an electric railway from Eibsee to the summit of the Zugspitz, in the Bavarian Alps. In the first section of the 39-in. gauge railway from Garmisch to Obergrainau, the ordinary adhesion system is used, but from the latter place to Platt, 8,750 ft. above sea level, the line will be on the rack system, while the last 660 yards of the line will consist of an electrically-operated aerial ropeway. The entire length of the line will be 11½ miles, of which about 3 miles will consist of tunnels at a height of about 5,000 ft. above the sea. The contract for the construction of the line, including the whole of the electrical equipment, is in the hands of the A.E.G., of Berlin.

BELGIUM.—The electrification work on the Anderlecht-Cité Bon Air section of the Société Nationale local railways has been completed, and an electric train service was inaugurated on December 23rd.

Hull.—TRANSPORT IMPROVEMENTS.—The general manager has submitted to the Corporation Tramways Committee a proposal for extending the Anlaby Road track along Boothferry Road for a distance of about 500 yards, at an estimated cost of roughly £6,000, which would enable a seven-minutes' service to be run. The Committee has decided that as a temporary measure the general manager shall arrange for a 'bus service to be run from the Newington level crossing to the Pickering Park tramway terminus, along Boothferry Road, to form a connecting link between the Hessle Road and Anlaby Road tram services.

London.—"UNDERGROUND" IMPROVEMENTS.—The Underground Electric Railway Companies have drawn up a programme of works to be carried out during the current year. Escalators are to be installed at Highgate and Camden Town stations, Ealing Common, Notting Hill Gate, and Hounslow West stations are to be rebuilt, and improvements are to be made at St. James' Park, Post Office, and Mansion House stations. New rolling stock to be put into commission will include 372 more cars on the Hampstead and City, Bakerloo and Piccadilly tubes, and 91 new motor-cars on the District Railway. Improvements at Lots Road power station will include the installation of a sixth 15,000-kW set, with new boilers and switchgear. On the tramway section two new model tramcars of modern type will be introduced, uncovered-top tramcars will be converted into "covered tops," and more cars on the South Metropolitan Electric Tramway will be remodelled on up-to-date lines.

Telegraph and Telephone Notes.

Argentina.—TELEPHONY.—The United River Plate Telephone Co. has at last obtained the necessary Government authorisation to lay an underground telephone cable between Buenos Aires and Rosario to replace the present overhead lines; it will be repeatered and loaded, and not be affected by atmospheric conditions. In accordance with the contract the cable must be completed within two years, and it is expected that the work will cost nearly £500,000. An Argentine company holding concessions in San Luis has applied for extended facilities, offering in exchange to link up San Luis with Mendoza and Buenos Aires. The company concerned is probably the Sociedad Anonima Andina, a comparatively small undertaking operating systems in Mercedes, San Luis, and elsewhere in the province of San Luis. *Reuter's* agency states that it has been decided to install a series of complete telephone circuits, partly subterranean and partly aerial multi-conductors, in the northern territory of Missiones. As much of the country is dense forest and tropical jungle the work will prove difficult. The installation will unite Posadas with several small villages, Concepción-del-Uruguay and St. Javier, and a number of adjacent townships.

Brazil.—RADIO-TELEGRAPHY.—Brazil and Peru signed a three-year radio-telegraph treaty on December 31st, 1928, by which a service will be established between the stations at Iquitos (Peru) and Cruceiro Desulk (Brazil).

Isle of Man.—TELEGRAPHY.—Submarine cable telegraph communication between the mainland and the island, which was interrupted on December 24th, 1928, was restored at 9 p.m. on January 2nd.

Russia.—PHOTOTELEGRAPHY.—Apparatus for the transmission of photographs by wireless has been received from Germany and installed in the Central Telegraph Office at Leningrad, to enable pictures and writing to be transmitted from Leningrad to Moscow by the telegraph wire and wireless systems.—*Reuter* (Leningrad).

Telephone Service.—BRITAIN'S POSITION.—It is estimated by the *Telephone and Telegraph Journal* that there were 32,500,000 telephones in use in all parts of the world at the end of 1928, an increase of almost 1,500,000 on the figures for 1927. North America, with approximately 20,000,000 telephones, leads the world, Europe occupying second place with over 8,500,000. The number of telephones per 100 inhabitants in the principal telephone-using countries is:—

United States	16	Germany	4.4
Canada	12.7	Great Britain	3.6
New Zealand	9.9	Netherlands	3.2
Denmark	9.2	Finland	3.1
Sweden	7.6	Austria	2.4
Australia	7.4	Belgium	2.4
Norway	6.3	France	2.1
Switzerland	5.5	Argentina	2.1

Great Britain is thus tenth on the list, but there was an increase of 122,217 telephones in this country during 1927, only 4,000 below the increase in Germany, and much greater than the growth in any other European country. The total number of telephones in Great Britain on December 31st was 1,633,802.

AUTOMATIC AINSDALE EXCHANGE.—Another stage in the automatic telephoning of the Southport area was completed by the cut-over on December 15th of Ainsdale to the Southport multi-office network. The installation of the Strowger equipment has been carried out by the Automatic Telephone Manufacturing Co., Ltd., the contractors for the original installations at Southport main exchange, Churchtown, and Birkdale. The new exchange is a satellite to the Southport main exchange, the system being four and five digit with booster-battery metering. The switchroom contains eight rotary lineswitch units; a composite trunk board, which carries the switching selector repeaters and group selectors; a 3-bay meter rack; a traffic-meter rack, mounting congestion, overflow, total traffic, and traffic unit meters; a repeater rack, and a rack for outgoing secondary line switches. All the supervisory alarms terminate at the supervisory rack, and provision is made for classifying them under one of two grades of urgency by means of straps on a tag-block. Facilities are also provided for extending the supervisory circuits to Southport so that Ainsdale can be supervised from that point during slack periods. The present capacity of the Ainsdale automatic exchange is 800 lines, with provision for ultimate extension to 1,300 lines.

Radio Notes.

Australia.—ROYALTIES.—An agreement has been reached between the Commonwealth Government and Amalgamated Wireless (Australasia), Ltd., that the company's patent rights shall be made available free of charge to all wireless trade broadcasting companies and listeners for a period of five years, dating from November, 1927. To carry out the arrangement the company has made heavy sacrifices, says the *Wireless World*, including an estimated sum of £62,500 on listeners' licences and a similar amount on valve royalties, in consideration of which the company will receive from the Government 3d. per month, or an average of 3s. per annum, in respect of every receiving licence issued. On a basis of 250,000 licences, the amount received by the company will be £37,500, or £88,000 less than was originally claimed.

British Broadcasting.—1928 ACCOMPLISHMENTS.—Apart from programme features, a review of the British Broadcasting Corporation's achievements during the past year shows that one of the most outstanding was the start made in May with the erection of the new regional transmitter at Brookman's Park, which twin wavelength high-power station for serving London is intended to be the first of its kind in the world; it is to be ready next summer, and ultimately will give to all South-East

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England an alternative programme, and several sites were being examined in other parts of Britain with a view to the erection of similar stations. After several months' experiment, a new aerial was put into service at the Daventry experimental station (5 GB) in January, with the result that the quality of reception in the north, north-east, and south of England was distinctly improved. "Outside broadcasts" which owed their success largely to engineering skill included the relay of a nightingale's song from Pangbourne in May, reception reports being received from as far afield as New Zealand; the relay of a running commentary on the University boat race in March with the aid of a floating transmitter; with telephone land lines and submarine cable relays from Belgium and Germany in March, and from France in August; and with a short-wave transatlantic radio link from America in July and October.

The Kent Report in July and an Interim Committee for Schools Broadcasting prepared the way for the formation of a Central Council for Schools Broadcasting, which will come into existence early in 1929 and supersede the old Education Advisory Committee on the schools' side; the Kent Education Committee decided to regularly subsidise its schools for wireless reception. Receiving sets were installed in a number of reformatory and industrial schools under the Home Office, and the London County Council relaxed its restrictions of the hours in which the schools under its direction may listen. Some of the recommendations of the Hadow Committee were already in process of being carried out, and the Central Council for Broadcast Adult Education, under the chairmanship of Lord Justice Sankey, held its first meeting on November 8th. The number of listening groups increased from 60 to 160, and experiments in broadcast adult education were initiated in prisons, in the R.A.F., and in the British Legion, while sanction was given by the War Office for similar experiments in the Army.

The first transmission of "still" pictures took place in October. Pending the introduction of the regional scheme, rather than withdraw the relay stations, an attempt was made to overcome interference and revive their usefulness by the expedient of single-wave working; as a step towards the development of regional programmes, the Nottingham transmitter was taken out of service in November, and Nottingham listeners have since taken their place along with Birmingham listeners in the service area of Daventry (5 GB). A system of group programmes was also developed, material for the projected regional centres (Manchester, Glasgow and Cardiff) being contributed by the various stations within the regional areas. During the year an aggregate of 68,000 hours comprised the programme transmissions from the twenty-one stations of the B.B.C., and the total period of breakdown was less than twenty hours. The licences in force at November 30th numbered 2,580,342, including 13,826 free licences issued to blind persons.

Canada.—STATIONS.—The Minister of Marine has licensed 68 broadcasting stations, 32 of which provide intermittent services at low power and of purely local interest. Some 60 per cent. of the receiving sets in use are classed as urban and 40 per cent. as rural.

Fultography.—B.B.C. SERVICE.—The British Broadcasting Corporation announces that an agreement has been arrived at between it and Wireless Pictures (1928), Ltd., under which the company will continue to transmit pictures by wireless until October 30th, 1929, instead of ceasing at the end of 1928.

TALKING KINEMATOGRAPHY.—Talking films for the home and the reception of still photographs on the same apparatus are made possible, it is claimed, by an invention of Mr. G. V. Dowding, which *The Times* understands is shortly to be demonstrated to the B.B.C. A projector is run at the broadcasting station, and synchronisation of all the listeners' projectors is achieved in an extremely simple manner. At the broadcasting station the play is spoken by artists watching the film, and effects and music are arranged in a similar manner.

North Africa.—TUNIS STATION.—It is understood by *World-Radio* that the 10-kW transmitter constructed near the old town of Carthage, 50 km. from Tunis, will soon commence operation on a wavelength between 300 and 400 m. It is connected by means of a special land line with the studio, which is in Tunis itself. Tests on a wavelength of 1,825 m. were recently carried out.

United States.—MONOPOLY DISPUTE.—A dispute which has been exercising the American radio industry for some time has been won by the General Electric, Radio Corporation, American Telephone and Telegraph, the Western Electric, the Westinghouse Electric, the International Radio Telegraph and the United Fruit and Wireless Specialities Apparatus Companies, whose opponents are the Radio Protective Association, representing independent concerns, which claims that the firms mentioned are monopolising the manufacture and sale of radio equipment. The Federal Trade Commission has dismissed the complaint, deciding that it is without jurisdiction to prosecute The *Wireless World* reports that the Radio Protective Association will resume the attack by pressing the Department of Justice to take the case into Court.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—NEW SOUTH WALES.—February 11th. Department of Public Works. Supply, delivery, erection and maintenance of hydro-electric plant in connection with the Hume Reservoir hydro-electric development. (B.X. 4989.)*

January 21st. Static transformers for Young-Wyangala section of the Burrinjuck hydro-electric development. (B.X. 4995.)

Belfast.—January 29th. Public Health Committee. Installation of automatic telephones in the Infectious Diseases Hospital, Purdysburn. (See this issue.)

Belgium.—January 22nd. Municipal authorities of Saint Gilles, Brussels. 400 3-amp., 220-V and 1,600 5-amp., 222-V ampere-hour meters. Particulars (5 francs) from Service de l'Electricité, Hotel Communal, Saint Gilles.

Brentford.—BOARD OF GUARDIANS.—Installation of electric lift at the West Middlesex Hospital, Isleworth. (January 4th.)

Edinburgh.—January 18th. District Board of Control. Electric power and lighting installation at Gogarburn, Edinburgh. Specifications from Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

Egypt.—CAIRO.—January 31st. Ministry of the Interior. January 27th. Transformer kiosks, cables and accessories for the extension of electricity supply from Mit-Ghamr power station. (B.X. 4893.)*

Glass Houghton (Yorks.).—January 14th. West Riding Education Committee. Electric lighting installation at Ashton Road Council school and caretaker's house. Specifications, &c., from Education Department, County Hall, Wakefield.

India.—January 23rd. Bombay, Baroda, and Central India Railway Co. 400-kW heavy oil engine driven generating set. Specifications from the offices, White Mansion, 91, Petty France, S.W.1 (deposit £1). (January 4th.)

February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

Keighley.—January 17th. Electricity Department. One water-tube boiler (30,000 lb. per hour) with mechanical stoker and superheater. (December 28th.)

Kettering.—January 14th. Electricity Department. Supply and delivery of h.p. and l.p. cables, and transformers. (January 4th.)

Liverpool.—January 31st. Corporation. Supply of various electrical materials. (January 4th.)

London.—CENTRAL ELECTRICITY BOARD.—February 15th 66,000-V cables (London area) in connection with the South-East England Electricity Scheme. (See this issue.)

February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (See this issue.)

Newry.—January 25th. Urban District Council. Supply of single- and three-phase meters. (See this issue.)

New Zealand.—WELLINGTON.—February 12th. Posts and Telegraph Department. Dry cells for telephone work. (B.X. 4991.)*

February 28th. Telephone cordage. (B.X. 4990.)*

January 31st. Manawatu-Orona Electric Power Board. Automatic reclosing switchgear for pole platform mounting. (B.X. 4988.)*

Norton.—January 14th. West Riding Education Committee. Electric lighting installation at the new school. Specifications, &c., from Education Department, County Hall, Wakefield.

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Ripon.—February 1st. Corporation. Works in connection with the proposed electricity supply undertaking as follows:—Contract No. 2: Overhead 11,000-V transmission line. (January 4th.)

Sheffield.—February 14th. Electricity Supply Department. Turbo-alternator, condensing plant, evaporating and steam preheating plant, water-tube boilers, chimneys, superheaters, stokers, or pulverised fuel firing equipment, economisers, &c., wagon tippers, conveyors and elevators, cooling towers, electrically and hand-operated travelling cranes. (See this issue.)

South Africa.—JOHANNESBURG.—January 24th. Town Council. Electric cable. (B.X. 4977.)* Oil switches. (B.X. 4994.)*

CAPE TOWN.—January 23rd. City Council. Electric cable. (B.X. 4978.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—The Corporation Electric Supply Committee reports that in connection with the erection of Hams Hall power station, a contract for which was entered into with International Combustion, Ltd., in July, 1927, all sub-contractors have to be approved, and the chief of these are as follows:—

Electrical equipment of the station, including the steam turbines.—General Electric Co., Ltd.
Condensing plant.—Hick, Hargreaves & Co., Ltd.
Boiler plant.—Babcock & Wilcox, Ltd.
Foundations, buildings, ferro-concrete cooling towers, all civil engineering work, and the coal and ash handling plant.—Mitchell Conveyor & Transporter Co., Ltd.
Structural steelwork of the buildings.—Braithwaite & Co. (Engineers), Ltd.

Chelmsford.—Town Council. Accepted:—
Electric fire-alarm system (£280).—Carter & Co.

Cheltenham.—Electricity Committee. Recommended:—
Rewinding remainder of motors in connection with change-over scheme.—Brook Motors, Ltd.

Colchester.—Electricity Committee. Accepted:—
Supply, delivery and laying or erection of underground and overhead cables and supports, &c. (£3,779).—W. T. Henley's Telegraph Works Co., Ltd.

Earby.—Urban District Council. Accepted:—
Electric wiring of Council offices and adjoining house (£70).—A. Dodgson & Son.

Liverpool.—BOOTH STEAMSHIP CO., LTD.
Contract for 12 months' supply of electric lamps.—Siemens Electric Lamps & Supplies, Ltd.
Tramways Electric Power and Lighting Committee. Recommended:—
Six 500-kVA transformers (£1,344).—General Electric Co., Ltd.
450 pairs fishplates.—Titan Trackwork Co., Ltd.

Reigate.—Town Council. Accepted:—
Wiring small houses under the hire-purchase scheme for 12 months.—T. S. Marriage & Co.

Salford.—Electricity Committee. Recommended:—
Two 1,500-kVA step-down transformers for Agecroft power station (£1,528).—Metropolitan-Vickers Electrical Co., Ltd.; and one 1,000-kVA ditto (£474).—General Electric Co., Ltd.
Merz-Price gear for 1,500-kVA auxiliary transformer (£75); 6,600-V banking cubicle on No. 4 alternator terminals (£140); 33,000-V banking isolators for the 12,000-kVA step-up transformers (£90).—Metropolitan-Vickers Electrical Co., Ltd.

Worthing.—Corporation. Accepted:—
Provision and laying of e.h.p. cable and distributing cables (£8,405).—Callender's Cable & Construction Co., Ltd.

York.—Electricity Committee. Recommended:—
Cable (£4,770).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, January 18th. 39, Victoria Street, S.W. 7.30 p.m. "Notes on the Fitting and Operation of Michell Bearings." Mr. J. F. Petree.

Chemical Engineering Group.—Friday, January 11th. Royal Society of Arts, Adelphi, W.C. 8 p.m. "The Relative Safeties of Mild and High Tensile Alloyed Steels under Alternating and Pulsating Stresses." Prof. B. P. Haigh.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, January 14th. Institution, London, W.C. 7 p.m. Discussion on "Electric Trolley Omnibuses."

(Western Centre).—Monday, January 14th. Grand Hotel, Bristol. 6.30 p.m. for 7 p.m. Annual dinner.

(North Midland Centre).—Tuesday, January 15th. Hotel Metropole, Leeds. 7 p.m. "Recent Developments in Electricity Meters, with particular reference to those for special purposes." Mr. J. L. Carr.

(East Midland Sub-Centre).—Tuesday, January 15th. Technical College, Derby. 6.45 p.m. "Practice and Progress in Combustion of Coal as Applied to Steam Generation." Mr. F. H. Rosencrants.

(Sheffield Sub-Centre).—Wednesday, January 16th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "The Electrical Engineer and Medical Science." T. W. Sampson.

(North-Eastern Centre).—Monday, January 14th. Armstrong College, Newcastle-on-Tyne. 7 p.m. General discussion on "The Anticipation of Demand and the Economic Selection, Provision, and Lay-out of Plant." Introductory papers: Capt. J. M. Donaldson, M.C. (power systems), and Mr. J. G. Hines (telephone systems).

(Tees-Side Sub-Centre).—Wednesday, January 16th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Informal discussion: "The I.E.E. Wiring Regulations," opened by Messrs. S. G. Marston and D. G. F. Drummond.

Electrical Society of Glasgow.—Tuesday, January 15th. Reid's Smoke Room, Glasgow. 7.30 p.m. "Notes on Electrical Maintenance." Mr. W. Macfarlane.

Institute of Fuel.—Wednesday, January 16th. Chemical Society's Rooms. 6 p.m. "Continental Experience in Pulverised Fuel Practice." Messrs. Berg and Vogt.

Overhead Lines Association.—Wednesday, January 16th. Institution of Electrical Engineers, London, W.C. 5.30 p.m. "British Climate and Overhead Lines."

Institution of Civil Engineers.—INFORMAL MEETING.—Wednesday, January 16th. At the Institution, Great George Street, S.W.1. 6 p.m. "Merits and Demerits of Alternative Methods of Taking Water for Modern Power Stations from Tidal Waters." Mr. H. H. Dalrymple-Hay.

Royal Society of Arts.—Wednesday, January 16th. John Street, Adelphi, W.C. 8 p.m. "The Domestic Smoke Problem: A Practical Solution." Prof. C. R. Darling.

Royal Institution of Great Britain.—Friday, January 18th. At the Institution, W.1. 9 p.m. "Further Progress in Crystal Analysis." Sir William Bragg.

British Electrical Development Association, Inc.—Friday, January 18th. Royal Society of Arts, Adelphi, W.C. 7.30 p.m. "Electric Heating and Cooking Development."

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

SANS wash boiler.
LUCETTE fittings.
AJAX insulated staples.
ROCHESTER electric coffee pot.

Notes.

Inspiration.

Mr. Theodore Stevens, M.Inst.C.E., writes:—Last Saturday *Reuter's Service* gave Europe the information that the residue of the estate of the "Father of Aluminium," Charles M. Hall, amounting to two millions sterling, had been allocated to Indian and Chinese education foundations, including America College, Madura, and Allahabad Agricultural Institute, Oberlin Shansi Memorial Association, Harvard Yenching Institute, Lingman University, Fukien Christian University, West China Union University, Nanking University, and Shantung University.

As a personal friend of C. M. Hall, having worked with him on this development, it seems to me of value to record, as an inspiration to others, some little idea of what started him on making, not only millions for himself, but also employment for thousands in many parts of the world. His own share in the profits, in my estimation, was modest. Wickham Steed, in "Through Thirty Years" (1922), wrote: "Notable results have been accomplished through the agency of such unimportances." C. M. Hall was the son of a devout preacher, who brought up his family on a meagre income, but he managed to send this son to Oberlin College, Ohio. The Professor of Chemistry showed to his class, in an issue of the *Chemical Journal* (London), a list of unsolved

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chemical problems, and with the question: "Which of you will undertake to solve one of these problems?" inspired C. M. Hall, who, on reading that list and feeling uncertain which to tackle, decided on the first. On what little he could find in the college library he took his chance and patented, as was possible at that time, the extraction of aluminium from its fluorides, his reason being that fluorides were the only combination not the subject of an existing patent. He spent all the money he could borrow on experiments and separated pin-points of metal, using current from the crudest primary batteries.

His father besought him to get an honest clerkship and stop wasting other people's money; but perseverance led to success as soon as adequate power was available and large-scale work was undertaken.

The company of which he was the founder started with natural gas in Pittsburgh in 1889, originated the Niagara Falls power demand by contracting for the total output of the first of the 5,000-h.p. sets put to work in 1893, bought up the "hydraulic company" which had been playing from 1853 with small, low-head plants in a canal around the upper Niagara rapids, enlarged that canal, and utilised the full head; it next developed Shawinigan, a wilderness, where to-day nearly fifteen thousand people are living on a waterfall whose ancient beauties were known to only an occasional hunter. Other water-powers in the United States and Norway were utilised, and to-day the aluminium industry is a vast success. He made reasonable provision for his relations, and the residue was allocated for the benefit of others.

Fatality.

While working with an electrically-operated fan in the Blantyreferme Pit, Newton, near Glasgow, on January 5th, one man received a shock which proved fatal and another was injured.

The Development of an Electric Tractor.

At a meeting of the Highland and Agricultural Society of Scotland, at Edinburgh, a letter was read from Major A. McDowall, Mungoswells, Drem, East Lothian, regarding the development of an electric tractor. Major McDowall stated that the Development Commissioners were keenly interested in the tillage problem, and that the drawings of his latest electric tractor had been approved by a member of the Development Commission. The latter was ready to make grants to a society, such as the Highland, whose duty it would be to apportion the money on machinery and incidental expenses. Major McDowall thought that about £3,000 would be required to carry out the experiments, and urged the Society to apply to the Board of Agriculture for Scotland, through which the money would have to come. After a discussion, in which it was said the scheme must be wide enough to include all electric tractors, and could not be confined to one machine, it was decided to refer the matter to the Implement Committee for a report.—*Implement and Machinery Review.*

Electrical Circuit Breaking.

In the abstract of the I.E.E. paper of Messrs. Wedmore, Whitney, and Bruce, in our issue of December 28th, the first sentence in the third paragraph on page 1133, as it stands, may give the impression that it is the authors' view that "the whole of that part of the (arc) voltage which depends on the length of the arc depends also on the current in the arc." This is, of course, not the case; reference to the original will show that the authors were, in the part referred to, emphasising an aspect of the formulæ of Steinmetz and Norberg. We are informed that a slip occurred in the original paper, where, in the definition of e_1 in the list of symbols given on page 2, the sign "=" should be replaced by "approximately equal to," since from the point of view of energy calculation, as was pointed out in the paper, the term $kl/\sqrt{i}$ in the arc characteristic can be neglected.

Coal Treatment.

The following notes are taken from a paper, "The Future of Coal in Relation to Industry," by Lt.-Col. J. T. C. Moore-Brabazon, M.C., read recently before the Junior Institution of Engineers:—Low-temperature carbonisation has the great advantage that the non-coking coals can be treated even more easily than strongly coking coals. The coal is turned into three main commodities: residual fuel, oil, and gas, each of which is more marketable than the original fuel. The proportions of these vary enormously according to the type of coal used, but representative figures per ton of coal treated are 13-14 cwt. of residual fuel, 3,000 cu. ft. of gas at a B.th.u. value of about 750, and 20 gallons of oil. While coke has a strongly graphitic covering due to the oil cracking which takes place around it at the temperatures involved in its manufacture, residual fuel from low-temperature carbonisation is of an entirely different type, for the structure of the coal is maintained in its original form; its oil content has been extracted, and it has no graphitic covering; it has about 10 per cent. of volatile matter, the rest being carbon and ash. This fuel is readily lit, will burn in an open fire lit by paper (not even demanding wood), and, unlike coke, will burn itself out. Oil from coal contains about 15 per cent. of most valuable lubricating oils, and when it is remembered that in this highly industrial country of ours 98 per cent. of the lubricating oil used is imported from America, it will be realised that the production of lubricating oil from any home source is a very desirable thing.

The advent of pulverised fuel introduces a method of burning coal in a much more efficient way. Residual fuel is eminently suitable, if pulverised, for consumption beneath boilers. Most of the volatile content having been taken out, it is a non-explosive fuel, and, consequently, the future storage in large tanks of this particular fuel is well within sight. It is not pretended that the technical difficulties of the use of pulverised residual fuel in large quantities are at the present moment solved, but the solution is within sight. Such necessities as keeping the powder what is called "fluffed," or in circulation, with inert gas derived from the smoke stack, in order to stop the fuel packing and keeping it always in a fluid state, are problems for the engineer in the immediate future; but what should be stressed more than anything is that here is an actual new field for the consumption of coal. Further, the position which has almost been accepted to-day, that future transport upon the sea will not be coal-driven, has to be strongly fought, and when it comes down—as it must come down—to a fight to a finish between oil and coal as a prime mover of ships, powdered fuel must, due to its economy—and it is economy which will decide the fight—win in the end.

Safety in Mines Research Board.

The Secretary for Mines announces changes in the constitution of the Safety in Mines Research Board. Sir Thomas Mottram, C.B.E., Sir Richard Redmayne, K.C.B., and the Rt. Hon. Thomas Richards retired at the end of the year on the completion of their period of office, but as Sir Thomas Mottram is actively engaged in an extensive and difficult investigation into the methods of reducing accidents from falls of ground, he has been re-appointed for a period of two years.

New Magnetic Alloys.

New magnetic materials known as "Perminvars" have been developed at the Bell Telephone Laboratories, Inc. Several of these alloys have extraordinary magnetic properties, which are particularly suited for uses in electrical communication circuits. An example is one containing 45 per cent. nickel, 25 per cent. cobalt, and 30 per cent. iron, which has besides other unusual magnetic qualities a high initial permeability. The properties of the Perminvars are developed entirely by heat-treatment. The alloys are heated at 1,000 deg. C. for a short time and then cooled; the rate of cooling from 600 to 400 deg. C. determines the degree to which these properties are developed. The best results are obtained when the rate is such that it takes about five hours to cool through this temperature range. Above 600 deg. and below 400 deg. C. any convenient rate of cooling may be used, but it must not be so rapid that strains are set up in the alloy.

For magnetising forces below 1.7 gauss, the permeability of the alloy mentioned is substantially constant. This constancy is remarkable for a magnetic material having an initial permeability approaching 500, and therefore nearly double that of iron. Another property of the Perminvars is the extremely small hysteresis loss in the range of magnetising forces and flux densities in which the permeability is constant. It is noteworthy that while silicon steel and "Armco" iron both have considerable areas within the hysteresis loop, it has been shown that the hysteresis losses for the Perminvars are very minute, and that they are less than that for Permalloy.—*Bell Laboratories Record.*

The Channel Tunnel.

A strong movement is on foot with a view to reopening the question whether sanction can be obtained from Parliament for the construction of a tunnel under the Straits of Dover; Sir William Bull, M.P., has addressed a letter to members of both Houses inviting an expression of their views on the subject. The project was last considered by the Committee of Imperial Defence in 1924, and was rejected on the ground that it was a dangerous experiment.

Electricity Supply in North-West England.

It is reported that the Central Electricity Board's plans for the north-west area allot to the power station of the Carlisle Corporation an area extending from the Border to North Lancashire. The main transmission lines will run from Carlisle over Shap Fell to Kendal, Lancaster, and Preston, with a connection to the mining district of West Cumberland. Transforming stations will be situated at Penrith, Keswitch, Whitehaven, Cleator, and Egremont.

Appointments Vacant.

Motors and hiring superintendent (£308) for the Birkenhead Corporation Electricity Department. Junior charge engineer for the City of Portsmouth Electricity Department. Wiremen (£400) for the Government of Nigeria P.W.D. Electrical Branch. Three junior charge engineers for Bristol Corporation Electricity Department. Electrical engineer for power station in Calcutta (commencing Rs. 640 monthly) for the Calcutta Electric Supply Corporation, Ltd. (See our advertisement pages to-day.)

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Institution Notes.

Institute of Fuel.

The meeting which was to have been held on Wednesday last has been postponed until Wednesday, January 16th. The paper which Mr. H. A. S. Gothard was to have presented unavoidably had to be cancelled. In place of it a paper entitled "Continental Experience in Pulverised Fuel Practice" will be presented by Mr. Berg and Mr. Erich Vogt, of Cologne, in the rooms of the Chemical Society, Piccadilly, London, W.1. The chair will be taken at 6 o'clock by Dr. R. Lessing, F.I.C., F.Inst.F., and a general discussion will follow the reading of the paper.

Illuminating Engineering Society.

The twentieth anniversary dinner of the Illuminating Engineering Society will be held at the Trocadero Restaurant, London, on Wednesday, February 13th, at 7 for 7.30 p.m., when the President (Mr. C. C. Paterson, O.B.E.) will occupy the chair. At the conclusion of the dinner a ball will be available for dancing.

Junior Institution of Engineers.

ANNUAL DANCE.—Tickets are now available for the annual dance, price 6s. 6d. each, which is to be held at the Portman Rooms, Baker Street, London, W., on February 23rd.

CONTINENTAL EXCURSION.—A very attractive summer excursion in Belgium and Germany is being planned; ladies will be welcomed. The party will depart from London on Friday evening, June 21st, and arrive back early on Monday morning, July 1st. The cost per head should not exceed £17 10s., excluding that of passports, and members who are likely to participate should notify the secretary of their intentions at once.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. PERCY STILL's resignation of the honorary secretaryship of the Diesel Engine Users' Association, after fifteen years' service with the organisation, took effect on December 31st. On that day the Association changed its address to its new headquarters (307, Abbey House, Westminster, S.W.1). Engineer-Captain J. HOPE HARRISON, R.N., who has been greatly interested in the Association's affairs, succeeds Mr. Still as honorary secretary, and he will have the assistance of Mr. C. O. MILTON, who has been Mr. Still's co-honorary secretary for the past two years. Mr. G. T. GREENLAND is relinquishing the office of assistant secretary. Mr. F. A. GREEN is the new honorary treasurer.

In succession to Mr. John Aldworth, who retired recently after holding the position for nearly 30 years, Mr. W. G. MARKS, who, until his appointment, had occupied a similar office at Chesterfield, entered upon his duties at the beginning of the New Year as general manager of the Nottingham Corporation tramway and 'bus undertakings. Mr. Aldworth has consented to serve in an advisory capacity.

Mr. STANLEY CECIL DAVIES and Miss ELSIE STEEL, who have been on the staff of the Hewittic Electric Co., Ltd., of Hersham, have been presented on their marriage with a cabinet of cutlery and other gifts by their colleagues.

Prof. E. F. PETRITSCH, who for some years has been the chief engineer of the Pupin coil section of the Dutch State Telegraphs at The Hague, has been appointed professor of the recently-formed department of electrical long-distance communication in the Technical High School of Vienna. It was in the same school of which he is now a professor that he received his early training, later entering the Austrian State Telegraph Department.

The *Electrical Power Engineer* mentions in its December issue a case of gallantry on the part of one of its members, Mr. L. FLATHER, charge engineer, on the occasion of a breakdown at the Carlisle generating station. A 2,000-kW turbo-generator set, on the point of being shut down, suddenly set up violent vibration and proceeded to shed its tachometer and sundry other accessories. At great personal risk Mr. Flather rushed to shut off the steam as the main centre bearing of the machine parted company, and it was only his prompt action and that of his driver which saved valuable machinery in the vicinity from serious damage. In recognition of his prompt action and devotion to duty, the Carlisle Electricity Committee, through the city electrical engineer (Mr. C. W. Salt), presented Mr. Flather with a set of drawing instruments, and his driver with a silver cigarette case.

Mr. NICHOLAS F. DODDS, test superintendent in the Telegraph Department of the General Post Office, Edinburgh, has retired under the age limit.

Councillor W. J. PERRETT has been appointed chairman of the newly-constituted Light Railways and Transport Committee of the Southend Corporation, it having been decided to separate the undertaking into two distinct departments.

The Dover Town Council has appointed Mr. R. BOURN, from the Meter Testing Department, to be shift engineer at the electricity works for a year on probation. There were 55 applicants for the post.

The Barrow Electricity Committee recommends that the salary of Mr. H. R. BURNETT, the borough electrical engineer, be increased from £800 to £950 per annum.

Consequent upon his appointment as district engineer for the North-West England and North Wales Electricity Scheme, Mr. R. BLACKMORE will resign as technical adviser to Nelson and other authorities. Mr. NAYLER was recommended as his successor at Nelson, and the Electricity Committee is to consider the matter and that of the general control of the department.

Hammersmith Borough Council Establishment Committee recommends that Mr. G. A. TOTTMAN, engineer-in-charge at the Electricity Department, be promoted to the position of repairs engineer, at a salary of £399 per annum; and that Mr. D. D. EVANS, junior engineer-in-charge, be promoted to the position of engineer-in-charge, at a salary of £363 per annum.

Major F. J. CHAPPLE, who has lately resigned the general managership of the Yorkshire (Woollen District) Electric Tramways Co. to take over the general management of a big motor-'bus undertaking with headquarters at Harrogate, was on December 31st presented with a bookcase, dinner wagon, and a timepiece by the employés of the company at Dewsbury headquarters.

Mr. E. BELL, of the St. Helens Corporation tramways, has been appointed general manager of the Yorkshire (Woollen District) Electric Tramways Co. in succession to Major Chapple.

Obituary.—MR. S. P. W. V. LUKE.—The death occurred at Newbury, on January 1st, in his 84th year, of Mr. Stephen Paget Walter Vyvyan Luke, C.I.E. He entered the Indian Telegraph Department as long ago as 1868, and after important service, including field campaigning in Afghanistan, he was in 1890 appointed Director of the Construction Branch of the Indian Telegraph Service, being promoted five years later to be Deputy-Director General, and retiring in 1897. Mr. Luke was a director of the Telegraph Construction & Maintenance Co., Ltd., and chairman of the Calcutta Electric Supply Corporation.

MR. J. FERGUSON.—We regret to learn that the death occurred on January 2nd, at Wimbledon, of Mr. John Ferguson, M.B.E., general manager of the Perak River Hydro-Electric Co., Ltd. He was only 42 years of age, and leaves a widow and three children. *The Times* states that Mr. Ferguson was born in Scotland, and after serving an apprenticeship, became assistant engineer in the Hamilton undertaking of Edmundson's Electricity Corporation, Ltd. After further experience on the Clyde, he went to Burma as electrical engineer to the Burma Oil Co., and later became electrical and mechanical engineer to the Patiala State Government. During the war he was attached to the air forces, and did useful work in the organisation of wireless telegraphy and telephony in the air defence of London. After the war he was appointed deputy chief electrical engineer to the East Indian Railway, and acted as chief electrical engineer for three years. He served on a special mission for the Government of India to reorganise the electrical department of the North-Western Railway of India, and soon after was appointed general manager to the Perak River Hydro-Electric Co. At the recent annual meeting of the company, the chairman (Viscount Elibank) referred to the fact that Mr. Ferguson had been compelled by ill-health to return home from the Federated Malay States, and said that the success which had attended the commencement of the company's work in Malaya was largely due to Mr. Ferguson's strenuous efforts. Viscount Elibank also mentioned that Mr. A. H. Topham, who had been in charge of all the electrical construction work for the past year, had been appointed to act as general manager in Mr. Ferguson's absence. Mr. Ferguson was a member of the Institutions of Electrical and Mechanical Engineers. A memorial service was held at St. Columba's, Pont Street, on Monday last. Viscount Elibank and other directors of the Perak River Company attended, as well as a number of representatives of electrical companies and consulting engineers. The interment was to take place in Scotland.

SIG. R. DEMARTINIS.—The death recently occurred in Milan, at the early age of 45 years, of Signor Rodolfo Demartinis, a well-known Italian electrical engineer, who had been associated with the electrification of several lines of railway, notably the Bolzano-Brenner line.

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SIR H. TRUEMAN WOOD.—We have to record the death, at the age of 83 years, of Sir Henry Trueman Wood, who was secretary of the Society of Arts from the year 1879 to 1917. He had been assistant secretary from 1876 to 1879. In 1918 he became treasurer, and in 1919 chairman of the Council. He had been president of the Society, was editor of its *Journal* from 1872, and wrote a history of the Society in 1913. Among many other services rendered to Science and Art during his lengthy career may be mentioned the honorary secretaryship of the Mechanical Science (subsequently "Engineering") Section of the British Association.

HERR O. BONDY.—The death is reported from Vienna, at the age of 83 years, of Herr Otto Bondy, one of the pioneers of electric cable manufacture in Austria and Hungary.

MR. E. S. AMES.—The death took place on January 1st, after four days' illness, of Mr. Edward Simon Ames. Mr. Ames, who was 56 years of age, was in the employ of the Bradford Corporation electricity department for about 26 years, and for over 20 years was the chief motor inspector. The funeral took place at Bowling Cemetery on January 5th, and was attended by over 30 members of the staff of the Department.

MR. F. G. HOLDEN.—We regret to record the death, which occurred in London on Friday last, of Mr. F. G. Holden, formerly manager of the Scarborough Electric Supply Co. When the company's business was taken over by the Corporation he was appointed borough electrical engineer. He retired from that position last March, but continued as consulting engineer. He was with the company for over 30 years.

MR. E. C. FLINT.—We regret to record that Mr. Edwin Charles Flint, who had been for many years connected with the electrical trade, with Messrs. Siemens and other well-known companies, died on January 3rd after several months' illness.

Will.—The late Dr. R. KNOX, editor of the *British Journal of Radiology*, left £4,759 gross and £3,904 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Gee Jay Supplies (Wholesale), Ltd.—Private company. Registered December 29th. Capital, £1,000 in 10s. shares. Objects:—To carry on the business of electrical, wireless, mechanical and general engineers and engineering contractors, manufacturers of, and dealers in radio and telephone apparatus and supplies, wireless service agents, &c. The first directors are:—H. H. Holloway, "The Hetlands," Holway Road, Holywell, electrical and mechanical engineer (permanent managing director); F. T. Neal, "The Villa," Pantasaph, near Holywell, land steward. Solicitor: C. Jones, Vron Chambers, Holywell, Flint.

H. J. Electrical Services, Ltd.—Private company. Registered December 29th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of an electrical service agent and automobile electrical specialist heretofore carried on by F. Hargreaves at 2, Bedford Street North, Halifax. The directors are:—F. Hargreaves (managing director), 2, Bedford Street North, Halifax; W. A. Bradley, "Braeside," Highroad Well, Halifax. Registered office: 27, Harrison Road, Halifax.

Caledonian Wireless Colleges, Ltd.—Private company. Registered in Edinburgh on December 28th. Capital, £2,000 in 4,000 preference and 4,000 ordinary shares of 5s. each. Objects:—To carry on business as indicated by the title. The directors are:—J. H. Semple, 51, Cairns Road, Cambuslang, electrical engineer; J. Maxwell, 33, Howishill Road, Kirkhill, Cambuslang, spice merchant. Secretary: J. H. Semple. Registered office: 24, India Street, Glasgow, C.2.

City Electrical Engineering Co. (Hull), Ltd.—Private company. Registered December 31st. Capital, £2,500 in £1 shares. Objects:—To carry on the business of electrical, wireless, mechanical, automobile and general engineers, &c. The permanent directors are:—S. T. Cooper, 24, Porter Street, Hull; and J. W. Rattle, 17, Park Lane West, Anlaby Park, Hull, electrical engineers.

A. T. M. Pension Trust, Ltd.—Registered as a private company December 31st. Nominal capital, £100 in £1 shares. Objects: To undertake and discharge the office and duties of the trustees of the existing pension fund for the benefit of the staff employés of the Automatic Telephone Manufacturing Co., Ltd., and the International Automatic Telephone Co., Ltd. The number of directors is to be five, two of whom shall be directors and nominees of the Automatic Telephone Manufacturing Co., Ltd., and three staff employés. The first directors are:—D. Sinclair, "Oakwood," Weybridge, Surrey; Sir Alexander F. P. Roger, Yockley House, Camberley, Surrey (nominees of the Automatic Telephone Mfg. Co., Ltd.); G. W. Moore, "Lynwood," Raleigh Close, Hendon, N.W.; A. R. Dodd, "Undercliffe," Cholmondeley Road, West Kirby, Ches.; H. H. Harrison, 51, Mayville Road, Mossley Hill, Liverpool (staff directors).

Tre-Coil Works, Ltd.—Private company. Registered January 1st. Capital, £300 in £1 shares. Objects: To acquire the goodwill of the business of electrical engineers now carried on at 5, Archer Street Works, Shaftesbury Avenue, W., by J. Dorn and R. Lurion, and the right to use the name of "Tre-Coil"; also to acquire all interest in certain inventions of J. Dorn relating to the manufacture and design of a three-coil cone speaker movement, &c. The directors are:—S. Freudenberger, 2, Aldermanbury Buildings, E.C.; J. Dorn, 91, Charlotte Street, Westminster, S.W.; R. Lurion, 40, Dean Street, W.1. Solicitors: Rowe & Wilkie, Stevenage House, Holborn Viaduct, E.C.1.

T.B. Drum & Manufacturing Co., Ltd.—Private company. Registered January 3rd. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in gramophones, amplifiers, loud speakers, and all accessories; manufacturers of and dealers in dynamos, generators, accumulators, batteries, motors and all mechanical appliances used in connection with gramophones, automatic and electrical machines, &c. The directors are:—T. A. Thompson, 59, Gloucester Road, Finsbury Park, N.; W. J. Argent, 93, The Drive, Cranbrook Park, Ilford, Essex; F. E. Darrington, 169, High Road, Salway Hill, Woodford Green, Essex. Registered office: 6, Seaford Street, Gray's Inn Road, W.C.1.

Junction Engineering Co., Ltd.—Private company. Registered January 4th. Capital, £1,500 in £1 shares. Objects:—To acquire the business of a mechanical and electrical engineer now carried on by A. T. Smee, A.M.I.E.E., as "The Junction Engineering Co.," at 149a, Junction Road, N.19. The subscribers (each with one share) are:—A. T. Smee, 146, Duke's Avenue, Muswell Hill, E.10, electrical engineer; S. Thurlow, 42, Olinda Road, Stamford Hill, N.16, solicitor's clerk. A. T. Smee is permanent governing director. Registered office: 149a, Junction Road, Highgate, N.19.

Allands, Ltd.—Private company. Registered January 4th. Capital, £2,100 in 2,000 ordinary shares of £1 each and 1,000 founders' shares of 2s. each. Objects:—To carry on the business of designers and manufacturers of, and dealers in all kinds of electrical fittings and lighting and radio apparatus, &c. The directors are:—E. Parkinson, "Hurstbourne," Marlborough, Bournemouth; F. Alland, 21, Lewes Road, North Finchley, Middlesex; E. G. V. Alland, 9, Queen's Road, Muswell Hill, N. Secretary: F. Alland. Registered office: 7, Duke Street, Manchester Square, W.1.

Zendix Electric Co., Ltd.—Private company. Registered January 2nd. Capital, £100 in £1 shares. Objects:—To carry on business as manufacturers and merchants of the "Zendix" electric brush, and manufacturers of, and dealers in all kinds of electrical appliances and to acquire the trade mark "Zendix." The first directors are:—J. Corfield, "Woodstock," Sutton, Surrey, company director; L. W. C. Edwards, Belmont Avenue, New Malden, manager. Secretary: F. W. Pidduck, 25, Albert Road, Mitcham. Registered office: 93, Mortimer Street, W.1.

Official Returns of Electrical Companies.

Nantwich Electric, Ltd.—Mortgage on 5, Hospital Street, Nantwich, Cheshire, dated December 15th, 1928, to secure £66. Holder: G. A. Racklyeft, Pillory Street, Nantwich, Cheshire.

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Epoch Electrical Society, Ltd.—Debenture dated December 14th, 1928, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. H. Hurst, Holland House, Bury Street, E.C.

Samdon Wireless Co., Ltd.—Debenture dated December 14th, to secure £150, charged on the company's property, present and future, including uncalled capital (subject to prior debenture dated July 24th, 1928). Holder: M. Morris, "Woodcroft," Broom Lane, Higher Broughton, Lancs.

"K.N." Electrical Products, Ltd.—Debenture dated December 7th, 1928, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holder: P. Ferguson, "The Garth," Grange Road, Highgate, N.

Metropolitan Electric Supply Co., Ltd.—Satisfaction in full on July 9th, 1928, of trust deed dated May 15th, 1917, securing £250,000 debentures. (Notice filed December 20th.)

Hendon Electric Lamp Co., Ltd.—Debenture dated December 21st, 1928, to secure £750, charged on the company's property, present and future, including uncalled capital. Holder: J. W. Kilby, 7, Newlands Avenue, Thames Ditton.

City Notes.

Reduction of Capital.

BRITISH ARCA REGULATORS, LTD., & REDUCED.—An order confirming the reduction of the company's capital from £60,000 to £30,000 was made by Mr. Justice Eve in the Chancery Division on December 17th.

Official Notice re Companies.

The names of the following companies are to be struck off the register unless cause to the contrary is shown within three months:—

Anode Wireless and Scientific Instruments, Ltd.
Associated Electric Traders, Ltd.
British Radio Sales Co., Ltd.
Coventry Wireless Supplies, Ltd.
Diamond Wireless, Ltd.
Electrolite, Ltd.
Electric Lamp Regenerators, Ltd.
Holborn Electric Fires, Ltd.
Holborn Radio Co., Ltd.
Humavox, Ltd.
Jenner Light and Power Co., Ltd.
Maywood Engineering and Electrical Manufacturing Co., Ltd.
Mitchell's Electrical & Wireless, Ltd.
Modern Electrical Supply Co., Ltd.
National Wire Manufacturing Co., Ltd.
New Vacuum Cleaner Co., Ltd.
Park Royal Engineering Works, Ltd.
Re-Echo Electrical Mfg. Co., Ltd.
Solray Co., Ltd.
Sunbeam Light Co., Ltd.
Swift Electrical, Ltd.
Tele-Dis (Founders Co.), Ltd.
Wireless Installations, Ltd.

Shawinigan Water and Power Co.

At a special general meeting of the shareholders of the Laurentide Power Company held in Montreal on December 18th, the offer of the Shawinigan Water and Power Co. to purchase the entire assets of the company was formally accepted. The deal gives the Shawinigan Company power control of the St. Maurice River, below the Laurentide development, and virtual power control of the entire river, owing to the rights recently secured on the upper part of the river.

United River Plate Telephone Co., Ltd.

It was announced last week that the holders of over 90 per cent. of the company's ordinary shares had signified their acceptance of the offer to purchase their holdings recently made on behalf of the International Telephone & Telegraph Corporation. The transaction will accordingly be carried through.

Metropolitan Railway Co.

The directors report that the total traffic receipts for 1928 amounted to £1,854,000, an increase of £59,000 as compared with 1927. This increase was due entirely to an advance in passenger traffic revenue, the goods receipts having shown a decline.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

It is announced that the scheme for the final reconstruction of the company will shortly be completed and presented to the holders of the company's debentures, notes and shares.

Allen-Liversidge, Ltd.

An interim dividend of 5 per cent. has been declared on the ordinary shares.

Anglo-American Telegraph Co., Ltd.

The following final dividends have been declared: Ordinary consolidated stock £1 10s. per cent. (making £3 15s. per cent.); and preferred stock £1 10s. per cent., making £6 per cent. The deferred stock is to receive a dividend of £1 10s. per cent. for the year. These rates are similar to those paid for the preceding year.

North Metropolitan Electric Power Supply Co.

An extraordinary meeting was to be held yesterday (Thursday) for the purpose of considering a resolution providing for the raising of the company's capital by £250,000 by the immediate issue of £1 ordinary shares.

Italian Company.

The *Società Italiana Radio Maritima* is making an issue of debentures amounting to 12,061,500 lire, chiefly for the purpose of completing the payment for equipment for Italian merchant vessels purchased from the Marconi International Marine Communication Co., Ltd., and the Cie. Générale de Télégraphie sans Fil.

Stocks and Shares.

MONDAY EVENING.

THE first week of Stock Exchange business in the New Year witnessed a good deal of activity, and brought about price improvements in most of the markets connected with investment and speculative investment interests. There is still no stringency in the money market, and it seems tolerably evident that, unless something very unforeseen occurs, the 4½ per cent. Bank Rate instituted in April, 1927, will serve its purpose for at least a couple of years. Various large loans are appearing, and others are on the point of making their appeal to the public. So long as national trade continues quiet, capital will be compelled to seek Stock Exchange sources for its employment, and, considering the remarkable successes which a good many speculative investors enjoyed in their last year's engagements, it is not very surprising that Stock Exchange brokers should be bombarded with inquiries for stocks and shares that can be relied upon to advance in price during 1929.

The Pressure of Purchasers.

The difficulty is to find the stock which will satisfy the demands of the inquirers. So far as these particular columns are concerned, efforts are made to confine suggestions to stocks and shares of the investment order. This may be regarded as a somewhat humdrum ambition, but we deal with an industry and its branches in which there is more scope for useful work than for gambling opportunities. At the same time, the public are wide-awake to the chances which offer, even in connection with good-class investments. British Insulated, Callenders, Henley's, are moving up, under the constant pressure of buying orders. These, coming into a market in which a meagre supply exists to meet them, are not to be gainsaid by the scarcity of stock, but insist upon being satisfied, and prices are consequently forced up to what, judged by current dividend payments, appear to be very high levels. At the same time, it is impossible to advise sales of shares in such companies as these, for unless the whole of the financial position is going to alter very considerably indeed during the present year, it is a valid supposition that investment will exert cumulative force, and that prices may go still higher than they stand to-day.

General Electrics Boom.

General Electrics have come in for a striking jump in the price, on New York purchases. Last Friday morning the shares were standing about 45s., when orders arrived from the United States to buy the shares at the best prices at which they could be obtained. Within less than an hour, General Electrics had gone up nearly £1 a share to 65s., and, so far as people on this side were concerned no particular reason appeared for such a spectacular jump. So far as American control of the company on this side is concerned, it will be remembered that steps have been taken to ensure the control of the G.E.C. being retained in British hands. Some Stock Exchange people declared that Americans had gone mad in buying General Electrics at such a price, and pointed to the dividend of 10 per cent. as showing the rise to be unjustifiable. Such a quotation has had the effect, no doubt, of bringing in shares to market, though it is well known that few people care to sell on a rise, preferring to wait until the market has turned, when they start to think about realising.

The Shareholder's Dilemma.

What the holders of General Electric shares ought to do at the present time it is extremely difficult to say. The majority of British shareholders in the company will have paid considerably less than £3 for their shares, but the holders wish to make the best, naturally, of their investment, and the mere fact of the mystery which surrounds the rise is in itself sufficient to give a man pause before he determines to let his shares go. On the face of it, General Electrics, which paid a dividend of 10 per cent. last year and 7½ per cent. in

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the preceding twelve months, are not worth anything like £3 a share. On the other hand, there may be developments afoot of which the British investor is at present ignorant. The man who wishes to put himself on velvet in regard to his holding, and at the same time to make the best of both possible worlds, will probably elect to sell half the shares and to keep the remainder.

Strength in Equipment Shares.

The dramatic jump in the price of General Electrics has served to draw attention to other members of the manufacturing group, although these latter are without trans-Atlantic support up to the present. There are rises in British Insulated, Callenders, Henleys, Enfields, Telegraph Constructions, &c. Ever-Ready shares have gone up to 32s. 3d. The rise in Enfields has now lifted the shares to nearly £1 above the price at which they stood shortly before Christmas. There are, however, few shares on offer of any of these companies, and, with investment in its present almost truculent mood, holders of existing securities are in no hurry to part from them. British Aluminiums are again harder, but no recovery has yet occurred in British Electric Transformer preference. New issues are contemplated by the Newcastle and District Company, and by the North Metropolitan. Details are not yet available, but the knowledge of the newcomers helped to stiffen the quotations for the existing shares.

"Tube" Developments.

Underground Electric incomes have gained 3 points, at 129, and the railway market as a whole is very firm. Metropolitans rose 2; Metropolitan District 4½ per cent. first preference advanced to 82½. The dividend announcements in respect of this group are expected to be made public in the second week of February, and, as already mentioned here, the estimates of what the Underground Company will pay on its £1 shares vary from 7½ to 10 per cent. The Underground Electric Railways Company of London is constantly extending its sphere of operations. Now that the enormous new work at Piccadilly Circus station is finished, the directors will have more time and attention for considering the scheme that will carry on the Piccadilly line from Hammersmith, its present western terminus, to Richmond. So far as we are aware, this idea has been discussed only amongst the board, but the increasing pressure of traffic renders it a matter that will have to be dealt with, and boldly, in the fairly near future. The tube line, which at present runs parallel with the District between South Kensington and Hammersmith, can be linked to a part of the District which now goes to Richmond, over which the traffic is becoming continually denser.

Cable Stocks.

Great Northern Telegraphs have been moving in a manner very different from their ordinarily staid behaviour. Last week's price showed a gain of 4½ points, this taking the price to 34½. Later, it rose to 35, and then came back to 32. The reason for the violence of the fluctuation seems to be no more than a little dealing in a very restricted market. The Eastern group is better, Eastern ordinary being up to 270½, which makes a gain of 8½ points within a fortnight. Anglo-American deferred rose to 25½. On the other hand, Automatic Telephones gave way to £2, on the disappointment felt by proprietors with the extremely conservative dividend policy pursued by the Board. Oriental Telephones are ex rights; after being 2⅝, the price spurted to 2⅞. Marconis are unusually quiet: there is no change on the week in the ordinary shares at 78s. 9d. Canadian Marconis stand at £2. To match this against General Electrics would be, of course, to draw a very unfair analogy, but it is impossible to forget that Canadian Marconis were run up one night, on American buying, to £6 a share, a price from which they reacted to the present level within a very short space of time. No comparison, we repeat, can be drawn between the two undertakings, but the violence of the movement in the prices may not be without significance, seeing that American dealing lay at the back of the fluctuations.

Electric Light and Traction.

Electricity supply shares are better for choice. The feature is a jump in County of London ordinary to 48s., being 3s. 6d. up on the week, a rise due to a spurt in Bournemouth and Poole ordinary to 3½, showing a gain of half-a-crown. Metropolitans are also a good market at 46s. 3d. North Metropolitan ordinary advanced to 50s. 6d., and the list, as a whole, although being without many quotable changes, is distinctly firm.

British Electric Traction deferred ordinary at 650 records a nominal rise of 35 points. Other movements in traction and tramway share issues are less sensational; Brazilian Tractions put on a point, Calcutta Tramways ordinary rose to £1, Anglo-Argentine Tramways debenture is a little better, and the Mexican group is practically unchanged, the only alteration being a small gain in Mexican Light and Power first mortgage bonds. Para Electric Railway and Light shares rose to 4s. Amongst dollar stocks, Shawinigan Water at 90½ is better on the week, Canadian and American utilities being in quiet demand.

The rubber share market shows a tendency to improve, but there is no business doing. The iron and steel group holds its own, the North contributing a certain amount of support to shares which are locally popular.

Share List of Electrical Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Jan. 7, 1929.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole ...	1	14†	15	8½	+⅛	... ...
Brompton Ordinary ...	1	8⅜	8½	27/-	—	5 8 8
Charing Cross Ordinary ...	1	8½	8½	26/6	—	5 8 1
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea ...	1	8⅞	8⅞	27/-	—	5 8 8
City of London ...	1	10	10	30/9	—	4 16 0
do. do. 6% Pref. ...	1	6	6	28/-	—	5 4 4
Clyde Valley ...	1	8	8	38/6	—	4 3 0
County of London ...	1	7½	7½	48/-	+3/6	3 2 6
do. do. 6% Pref. ...	1	6	6	23/6	—	5 4 4
Edmundsons' 7% Pref. ...	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation ...	1	11	11	50/9	—	4 6 8
Kensington Ordinary ...	1	8	8	26/6	—	5 5 8
Lancs. Light and Power ...	1	7½	7½	30/-	—	5 0 0
London Electric ...	1	8½	8½	26/-	—	5 7 8
Metropolitan ...	1	8	9	46/3	—	3 18 0
do 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Midland Counties ...	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power ...	1	—	15	2	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	26/3	—	4 11 5
do. 7% Pref. ...	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref. ...	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref. ...	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall ...	5	8	8	27/6	—	5 1 10
Scottish Power ...	1	8	8	31/6	—	5 1
South London ...	1	8½	8½	27/6	—	5 2 8
Urban Ordinary ...	1	7	7	36/9	—	... ...
Westminster Ordinary ...	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec. ...	1	8	8	35/-	—	4 11 5
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	73	—	5 9 7
Metropolitan ...	,,	3	3	67½	+2½	4 9 0
do. District ...	,,	3½	4	80½	—	4 19 5
Underground Electric ...	£1	1½	5	27/-	+6d.	3 14 1
do. do. Income ...	Bonds	6	6	129	+3	4 13 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref. ...	Stock	6	6	103½	—	5 16 0
do. Def. ...	,,	1½	1½	25½	+¼	5 17 8
Automatic Telephone ...	1	10	10	2	—1/16	5 0 0
Eastern Extension ...	10	10	10	26⅞	+⅛	*3 14 3
Eastern Tel. Ord. ...	Stock	10	10	270½	+3	*3 14 0
Globe Tel. and T. Ord. ...	10	10	10	25½	+¼	*3 18 6
do. do. Pref. ...	10	6	6	11xd.	—	5 9 1
Great Northern Tel. ...	10	20	20	32	—2½	... ...
Indo-European ...	25	10	10	47½	—	*5 5 3
Marconi ...	10/-	5	*10	3 15/16	—	... ...
Marconi-Marine ...	1	8¾	12½	8⅜	+	3 9 1
Oriental Telephone Ord. ...	1	12	12	2⅞xr	—	... ...
United R. Plate Tel. ...	5	8	8	12	+¼	*3 6 8
Western Telegraph ...	10	10	10	26¾	—	3 15 0
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	3 1/16	—	3 14 6
do. do. 5% Deb. ...	Stock	5	5	77½	+⅛	6 9 0
British Electric Traction Def. Ord.	,,	—	—	650	+35	... ...
do. do. Pref. Ord.	,,	8	8	124	—	6 9 1
Brazil Traction ...	100	6	7	78½	+1	2 4 0
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	18/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds ...	—	5	5	79	—	6 6 7
Mexican Light Common ...	100	Nil	Nil	77½	—	... ...
do. 7% Pref. ...	100	Nil	7	76½	—	9 3 0
do. 1st Bonds ...	—	5	5	77½	+½	6 9 0
Yorkshire (West Riding) ...	1	Nil	Nil	5/-	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox ...	1	13	15	3½	—	*4 5 9
British Aluminium Ord. ...	1	10	10	2 1/16	+1/16	*4 6 7
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord. ...	1	15	15	4⅜	+¼	3 8 6
Brush Ord. ...	1	10	10	28/9	—	6 19 2
Callenders ...	1	15	15	4 5/16	+¼	3 9 0
do 6½% Pref. ...	1	6½	6½	1 3/16	—	5 9 5
Crompton Parkinson Ord. ...	5/-	—	—	19/6	—	... ...
do. 8% Pref. ...	1	—	8	25/-	—	6 8 0
Edison-Swan ...	4/-	10	10	12/6	—	3 4 0
do. 5% Deb. ...	Stock	5	5	86½	—	5 15 7
Electric Construction ...	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord. ...	1	20	20	5⅜	+⅛	3 14 6
English Electric ...	1	Nil	Nil	7/6	—	... ...
do. do. Pref ...	1	3	Nil	10/-	—	... ...
Gen. Elec. Pref. ...	1	6½	6½	23/6xd.	—	5 10 8
do. Ord. ...	1	7½	10	3	+16/3	3 6 8
Henley ...	1	25	25	5 13/16	+1/16	4 6 2
do. 4½% Pref. ...	5	4½	4½	4¼	—	5 6 0
India-Rubber ...	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips ...	1	12½	10	36/3	—	5 10 3
Met.-Vickers Ord. ...	1	8	6	30/-	—	... ...
do. Pref. ...	2	8	8	2¾	—	5 16 5
Siemens Ord. ...	1	7½	7½	26/3	—	5 14 2
Telegraph Construction ...	12	10	10	25	+½	*4 14 6

†4% of which was tax free.

*Interim.

*Dividends paid free of Income Tax.

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A Review of the Trade Situation in China.

Prospects for British Manufacturers and Merchants.

SOME light is thrown upon the complexities and difficulties of Chinese affairs in a report recently prepared for the Department of Overseas Trade by Mr. H. H. Fox, C.M.G., Commercial Counsellor at the Peking Legation. (Stationery Office, 2s. 6d. net.)

Mr. Fox commences his review of the commercial, industrial and economic situation in China with a number of hints to merchants and manufacturers. As an initial step towards trading with China, the author counsels communication with the Department of Overseas Trade, preferably by means of a personal call. It is essential that as full information as possible regarding prices, discounts, agency terms, &c., should be given. The Department is in a position to advise manufacturers on the subject of agencies and to hold the balance between manufacturers who expect agents to buy machines and sell quantities of them in a virgin field for the usual trade discount, and agents who consider that manufacturers should contribute generously to their office expenses, provide them with advertising matter, and stocks on consignment in return for a promise that they will do their best to sell the goods at some unspecified date. Happily there now appears to be growing co-operation between the two interests, and the trading risk is shared in fair proportions. No new business should be entered into with an unknown Chinese firm before careful inquiry as to its standing has been made. Here, again, the Department can be of assistance. It is agreed that the Chinese are eminently satisfactory people to deal with, but that conditions and customs are liable to engender misunderstandings. Adequate advertisement is now indispensable in China; there are a number of experienced firms known to the Department who specialise in this class of business. Passing mention is made of the unsettled state of the law covering trade marks, patents and copyright. In dealing with the question of tariffs, Mr. Fox expresses a hope of better conditions with the granting of tariff autonomy to China, coupled with the Nationalist Government's promise to abolish *likin*, *i.e.*, internal dues and taxes.

An Obscure Situation.

Proceeding with the survey proper, the author confesses that most of the information available is inadequate and unco-ordinated; consequently it is extremely difficult to generalise or express any unqualified opinion. In spite of the varied disabilities from which trade has suffered, the import and export trade has continued to grow during the past five years. This has led observers to conclude that conditions are not so bad as they have been painted, but the Customs returns are not an entirely accurate barometer of the state of trade. For instance, in 1927 there was an all round decrease in the trade of Shanghai and the Yangtze ports, but this was compensated for by the increased trade done at Tientsin and other northern ports. The inflation of the tael has increased the trade figures; again, there have been abnormal imports of rice and other cereals to make up for bad crops and famine relief. It is also emphasised that the figures only show goods upon which duty has been paid and not necessarily goods that have been paid for.

Mr. Fox says that there is undoubtedly a growing market for British goods, but, for the time being, the demand is restricted owing to the prevalence of civil war with interruption of communications with the interior, a general sense of insecurity among dealers, and a variety of minor causes. "No one can live the best part of a lifetime in a country of such vast and almost unlimited possibilities as China without being an incurable optimist as to the future of the country and its people, but it must be admitted that the events of the past two years have made heavy drains on one's fund of optimism." After detailing a few of the ills to which China is still subject, Mr. Fox says that, after all, there is a ray of hope in the sterling good sense of the Chinese people, their innate love of peace, their remarkable capacity for "carrying on" in the face of apparently insurmountable obstacles, and their ability to recover rapidly from any setback.

Transportation has been very severely affected by the internecine strife. The once-flourishing railway system of China has been reduced to a deplorable state of disorganisation and bankruptcy. With one or two exceptions, China's railways are crippled for the purpose of commercial transport, and are only able to maintain skeleton services. It is, however, a hopeful sign that this threat to the economic life of the nation seems to be fully realised by the new Nationalist Government, which is doing its best to bring order out of chaos. But the crying need is the restoration of the railways to civil control and the provision of funds for the purchase of new material, knotty problems which economic conferences and elaborate plans for rehabilitation have so far been unable to solve. Efforts to construct roads are being made in all parts of the country, but most of these roads are badly made, due to lack of experience and funds.

The Machinery Trade.

The report states that the machinery trade, in common with all others, received a serious set-back in the early part of 1927, but during the first half of 1928 considerable improvement was shown in spite of generally disturbed conditions; a number of orders for industrial plant were placed, and there were numerous inquiries. During the year ended June 30th last a certain number of orders were placed for electric power plants, but British manufacturers were not very successful on the whole. An order for two 10,000-kW sets for the Chapei Electric Light Works (Chinese) was placed in Austria. On the other hand, the machinery required for a considerable extension of the power station of the Shanghai Municipal Council was purchased in the United Kingdom. A complete electric power plant for the Harbin tramway system, with cars, &c., was ordered from Germany during the year, but the boilers, engine and pumps were ordered from England. A new generator and several electric motors, with Anglo-American presses, were ordered from Great Britain for a British-owned oil mill in Harbin. A 1,000 kW turbo-alternator, with American boilers, was ordered by a Chinese electric light company in Harbin. As regards Tientsin, the orders placed in Great Britain during the year included one for a 10,000 kW set for the Peking Electric Light Works and an electric locomotive and accessories. A Belgian concern received a contract for an electric power plant and a 1,500-kW Swiss generator was ordered for a Chinese cotton mill. An American firm secured a contract for the extension of the Tsinanfu Electric Light Works; the generating plant is American, but the boilers are British. The imports of machinery for electric power stations during 1927 were valued at 1,291,351 Haekwan taels, as compared with 831,606 taels in 1926. (£1 = 7 taels approx.)

The production of electrical materials and fittings in China is still of insignificant proportions, but the Chinese are showing what they can do once normal conditions are restored. During 1927 the imports of this class of goods were valued at 9,867,796 taels, against 8,941,185 taels.

Southern Manchuria.

Appended to the main report is a review of the trade of South Manchuria in 1927-28 by Mr. M. E. Dening, the acting British Consul at Dairen. In 1927 the bulk of the trade went to Japan; the British Empire and Germany were second and third, with nearly equal shares. From the four leading countries electric power station machinery valued at 213,677 taels was imported into Dairen. This total was made up as follows: Great Britain 122,468 taels, the United States 63,789 taels, Japan 13,914 taels, and Germany 13,506 taels. The power stations at Anshan, Fushun, Changchun and Dairen have recently been extended. The electrification of the railways from Fushun to Mukden, Dairen station to Dairen wharves, and Nankuanlung station to the new coaling pier at Kanchingtzu being under contemplation, the purchase of further plant may be anticipated in the future. While the policy of purchasing in Japan whenever possible is studiously followed by the South Manchuria Railway, there is always a prospect of a market for machinery of a special nature not manufactured in Japan. There is keen competition, not only from the United States and Germany, but also from Switzerland and Czecho-Slovakia.

A Chinese National Products Exhibition.

The *Chinese Economic Bulletin* reports that a National Products Exhibition was recently held in Shanghai. It was organised under the auspices of the Minister of Industry, Commerce and Labour with a view to encouraging the development of Chinese industries. While the bulk of the exhibits were purely Chinese in character, *e.g.*, porcelain, paper, textiles, &c., there were also on view electrical appliances, radio apparatus, and scientific instruments.

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Foreign Electrical Trade of Denmark.

Imports and Exports during 1926 and 1927 Compared.

THE following table shows Denmark's imports and exports of electrical machinery and apparatus in 1926 and 1927, indicating the principal countries of origin and destination. Notes of increases and decreases are also given. In spite of a fairly well developed export trade in electrical goods Denmark is still a considerable importer; but it will be noticed that Danish exports of electrical goods are increasing substantially in virtually every important line, including cables, batteries and dynamos, although electrical machinery imports are still greater in value than exports. In cables and insulated wire, Denmark seems now to be definitely showing her independence of foreign supplies. Imports of radio apparatus are still very large as compared with exports.

Imports.

	1926. Kr. (thous.)	1927. Kr. (thous.)	Inc. or dec. Kr. (thous.)
Electric cables—			
Total	286	217	− 69
From Germany	101	181	+ 80
Insulated wire—			
Total	1,023	994	− 29
From Germany	562	549	− 13
,, Sweden	58	72	+ 14
,, Holland	132	73	− 59
,, Belgium	110	121	+ 11
,, United Kingdom ...	71	54	− 17
,, United States	73	97	+ 24
Accumulators and plates—			
Total	1,493	1,386	− 107
From United States	202	224	+ 22
,, Germany	1,069	870	− 199
,, United Kingdom ...	149	170	+ 21
Installation material (switches, lampholders, fuses, &c.)—			
Total	1,676	1,794	+ 118
From Germany	1,208	1,265	+ 57
,, United Kingdom ...	127	112	− 15
,, Sweden	80	39	− 41
,, United States	43	94	+ 51
Dynamo lighting sets, ignition magnetos, &c.—			
Total	752	861	+ 109
From Germany	364	404	+ 40
,, United States	331	415	+ 84
Batteries and cells—			
Total	868	962	+ 94
From Germany	518	662	+ 144
,, United States	285	259	− 26
,, United Kingdom ...	27	27	—
Radio apparatus—			
Total	6,439	5,959	− 480
From Germany	3,512	3,022	− 490
,, United Kingdom ...	711	437	− 274
,, Holland	883	1,495	+ 612
Electrical machinery and apparatus not elsewhere specified—			
Total	536	475	− 61
From Germany	378	337	− 41
,, United Kingdom ...	45	30	− 15
,, United States	50	65	+ 15
Dynamos, generators, motors, transformers, stators, armatures, rotors, &c.—			
Total	2,614	2,886	+ 272
From Germany	1,030	970	− 60
,, United Kingdom ...	581	632	+ 51
,, Sweden	359	436	+ 77
,, United States	297	262	− 35
Telephone apparatus—			
Total	73	113	+ 40
From Sweden	26	14	− 12
,, Germany	24	29	+ 5
,, United Kingdom ...	10	58	+ 48
Electrical measuring instruments—			
Total	399	327	− 72
From Germany	319	243	− 76
Other electrical instruments—			
Total (mainly from Germany)	60	33	− 27
Vacuum cleaners—			
Total	1,673	2,254	+ 581
From Sweden	1,365	1,678	+ 313

Exports.

	1926. Kr. (thous.)	1927. Kr. (thous.)	Inc. or dec. Kr. (thous.)
Electric cables—			
Total	512	1,194	+ 682
To United Kingdom	38	420	+ 382
,, Poland	46	118	+ 72
,, Norway	34	232	+ 198
,, Sweden	165	251	+ 86
Motors and dynamos—			
Total	1,858	2,062	+ 204
To Sweden	423	254	− 169
,, Great Britain	227	404	+ 177
,, Norway	80	69	− 11
,, Argentina	165	248	+ 83
,, China	186	94	− 92
,, Spain	48	31	− 17
Insulated wire—			
Total	88	100	+ 12
Telephone apparatus—			
Total	30	10	− 20
Electrical measuring instruments—			
Total	36	25	− 11
To China	—	3	+ 3
,, Great Britain	6	12	+ 6
Installation material (switches, lampholders, &c.)—			
Total	658	719	+ 61
To Sweden	272	297	+ 25
,, Belgium	67	12	− 55
,, Great Britain	52	32	− 20
,, China	21	44	+ 23
,, Norway	57	67	+ 10
Batteries and cells (including flash-lamps)			
Total	5,954	7,268	+1,314
To Great Britain	1,681	1,665	− 16
,, Norway	456	630	+ 174
,, Sweden	1,375	2,046	+ 671
,, Finland	509	855	+ 346
,, Holland	192	145	− 47
,, Belgium	159	203	+ 44
,, Spain	381	298	− 83
,, Argentina	112	272	+ 160
,, British South Africa ...	215	665	+ 450
,, Australia	402	451	+ 49
Electrical machinery and apparatus, not elsewhere specified—			
Total	340	375	+ 35
To Great Britain	41	25	− 16
,, Sweden	43	46	+ 3
,, Holland	65	77	+ 12
,, China	13	40	+ 27
,, Japan	21	23	+ 2
,, Finland	40	57	+ 17
Wireless apparatus—			
Total	122	134	+ 12
To Sweden	30	36	+ 6
,, Iceland	26	53	+ 27
Electrical porcelain goods—			
Total	491	464	− 27
To Spain	84	58	− 26
,, Russia	120	127	+ 7
,, Great Britain	34	43	+ 9
,, Switzerland	136	203	+ 67

18 Kr. = £1 (approx.).

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

The "Teletypesetter."

A machine which, it is claimed, will be of considerable utility in newspaper and printing establishments employing plain type faces was recently demonstrated in America. As its name implies, it enables one typist to operate automatically and simultaneously any number of linotype machines. The basic feature of the new device is an electric typewriter which perforates ticker tape, each group of perforations corresponding to a letter or numeral. The code on the tape is then telegraphed electrically to a newspaper office, perhaps hundreds of miles away, and a tape in the latter office is similarly perforated and fed through a device attached to the linotype machine, electrical impulses translating the code into depressions of the keys which control the typesetting. It is estimated that linotype machines can be speeded up by means of the new device to do at least three times the amount of work done by human operators. The machines shown at the official demonstration produced eight lines a minute without a single stop; they can produce 90,000 ems a day. The Mergenthaler Linotype Company is at work on a machine that will conform to the highest production possibilities opened up by the new device. One of the possibilities is an enormous saving of time and labour in handling syndicated matter mailed by Press associations. At each end of the line a machine decodes and typewrites the perforations so that the operator may see a copy of the message he is sending and the person in charge at the receiving end may read it. An operator may control simultaneously typesetting machines in any number of cities by telegraphic connections. All the experimental work was done in the Morkrum-Kleinschmidt Corporation's factory in Chicago, Ill. The rolls of perforated tape will be a permanent record: book publishers will not be compelled to keep tons of metal plates in their files for the printing of new editions.

A Washing and Drying Machine.

The "Universal" electric washer and centrifugal dryer, fig. 1, recently introduced by Messrs. L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, Kingsway, W.C.2, is specially recommended for use in hotels, clubs, hospitals, and large residences. It will, it is claimed, wash eight sheets, or the equivalent, in 15 min. In a separate compartment in which the clothes are placed after washing, the operations of rinsing, blueing, and damp-drying are carried out without further handling. By merely touching a safety lever (which cannot be operated until the lid is fastened down) this drying compartment revolves at a very

Fig. 1.—The "Universal" Washer and Dryer.

rapid rate, and by centrifugal force the water is extracted without fear of damage to the most delicate fabrics. The soap-suds extracted can be directed back into the washing compartment, the blueing water into a pail for use over again, and the rinse water directly into the sink. By means of a neat electrically-driven pump, forming part of the equipment, the water from the washing compartment is automatically emptied directly into the sink without having to make any hose or other attachments. The tubs are constructed of heavy-gauge copper throughout—nickel-plated inside and blue cellulose painted outside—all suitably mounted on a solid-steel structure specially treated against rust and finished in blue cellulose. Special castors enable the equipment to be readily moved without effort. The apparatus is fitted with a draining board and dryer container constructed of aluminium. The equipment is suitable for both a.c. and d.c. supplies, and the total loading is 200 W.

The "Super-Smoothwell" Automatic Iron.

There are several patterns of electric irons in which thermal cut-out devices are embodied, but the "Super-Smoothwell," to which our attention has been drawn by the makers, PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, can be

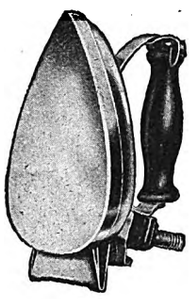

Fig. 2.—The "Super-Smoothwell" Iron.

Fig. 3.—The "Birka" Regulator.

allowed to remain in circuit without danger. This is accomplished by means of the "Birka" regulator. This device is placed in the element circuit, and consists of bi-metal strips and contacts in a vacuum tube. This is adjusted so that it

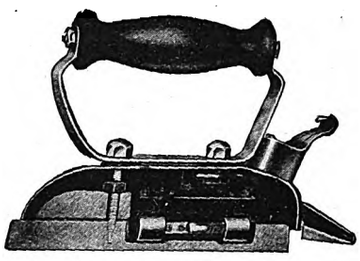

Fig. 4.—Sectional View of the Iron.

maintains the iron at the correct temperature, cutting off the current when the temperature rises above this level, and switching on again when it becomes necessary. Thus if the iron is left "on" no damage will result, and if it is left for a period during ironing operations it is always immediately ready for use. It is seen, therefore, that a great deal of trouble and waiting is obviated. In appearance the iron is very handsome, and the sole-plate is of improved design, having a curved "heel" instead of a square one, as is usual. The connector is substantial, the contacts are well shrouded, and a convenient thumb-rest is fitted. The appliance has a highly polished nickel-plate finish, and it is suitable for either d.c. or a.c. It will be seen that the iron should prove of considerable value in garment factories and similar places where it is essential that the working temperature should be maintained, and not exceeded, in spite of long intervals between operations. The loading is 500 watts; normally the hourly consumption, when idle, with the regulator working to keep the iron at the proper temperature, is 110 watt-hours. Fig. 2 illustrates the iron, fig. 4 is a sectional view showing the regulator in position, and fig. 3 depicts the regulator.

A Transformer Protecting Device.

The ALLGEMEINE ELECTRICITATS GESELLSCHAFT, Berlin, has lately brought out a thermo alarm for protecting oil-cooled transformers. The device is arranged to function when a definite oil temperature, which can be adjusted in steps of 5 deg. C. between 50 and 120 deg. C., is exceeded. It can be set to actuate either signalling devices or the trip coils of oil circuit-breakers, and is fitted with a small oil-immersed quick-acting switch, which opens or closes when a bi-metal strip deflects. The alarm is adaptable for pressures up to 400 volts, and requires no auxiliary relay.

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Selected Radio-Telephone Apparatus.

Some Recent Developments and Improvements.

An " Elastic " Aerial Unit.

Methods of selective reception, some depending upon loose aerial coupling, others on the introduction of fixed series condensers, and still others on loose intervalve coupling, all have the equivalent effect of reducing the aerial pick up of anything but a narrow band to which the receiver is tuned. The regional broadcasting scheme may necessitate the operation of two powerful stations in one district with only a comparatively small difference of wavelength, with the result that with an average aerial and normal reacted detector circuit considerable overlapping interference may be experienced. If the receiver were made more selective by means of reaction, strong incoming signals from both stations would tend to swamp the detector and prevent closer reaction. Mechanical reduction of the aerial size would preclude reception from distant stations, while under some conditions the total removal of the aerial might not be sufficient to reduce the strength of the signals picked up on the coils or earth wire itself to the degree required. Therefore, an " elastic " aerial unit has been designed on the neutrodyne balancing principle: it inserts in the aerial circuit an auto-transformer coil (earthed in the centre) from the extreme ends of which reception signal voltages 180 deg. out of phase will be developed. To these two extremes are connected two fixed plates of a condenser and to a moving plate between them is connected the aerial terminal of the receiving set. If the movable plate is close to either fixed plate, the signal strength will be equal to that normally obtained with the aerial connected to the set itself, as the capacity is about 0.00025 mF. but as the movable plate approaches the centre position between the two fixed plates, not only will the series capacity be reduced to a very small value, but a reverse impulse will also be obtained from the other end of the coil. If the coils of the set, or the earth wire, pick up signals, then the balance will be slightly displaced towards that end of the coil which will give a reverse impulse to compensate for the signals obtained on the coils of the set, or the earth wire. Thus an aerial can be varied from its maximum down to absolutely nothing, and by perfecting the balance the local station fully tuned in with two h.f. valves in a 5-valve set can be cut out to zero by a fraction of a turn of the knob. The use of this unit, which is marketed by Metro-Vick Supplies, Ltd., with a small aerial for portable sets, in conjunction with a frame aerial, will allow extra signal strength without destroying selectivity; moreover, it forms an ideal volume control device, and is applicable to simple 2- and 3-valve reacted detector circuits, as well as to multi-valve sensitive receivers, which are often swamped by being used on too large aerials.

Measuring Instruments.

Messrs. Ferranti, Ltd., have added to their standard line of moving-coil instruments a thermo-couple pattern, fig. 1, for use primarily at radio frequencies. A long scale (2½ in. on a 2½-in. diameter instrument), good damping, and accurate workmanship are features; the thermo-couples are in vacuo

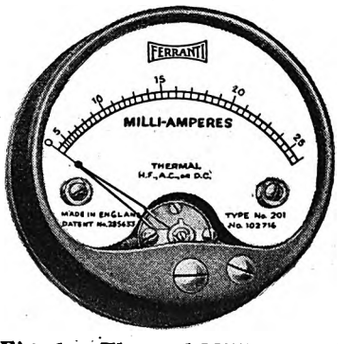

Fig. 1.—Thermal Milliammeter.

for the lower ranges and in air for the higher. The lowest range is 25 milliamperes, which is also used for voltmeters, and the upper 5 amperes, all in the 2½-in. size. The couples are insulated from the heater, thus avoiding capacitance effect of the movement to earth and reversal error on d.c. The instruments are equally accurate at high frequencies, electricity supply frequencies, or direct current, and one of them has been in satisfactory operation for some time on a three-metre wavelength. Temperature compensation is good, less than 0.1 per cent. per deg. C., and the overload capacity is about 50 per cent. momentarily. The moulded insulating cases are particularly suitable for high frequencies. Unlike the old thermo-expansion type, the consumption is very small, in the case of the 25-mA size being about 20 milliwatts. A complete d.c. testing set of first-grade accuracy in a small case (fig. 2) comprises a separate voltmeter and ammeter, the ranges obtainable with each instrument being nine: sixteen are marked on the switch knobs, whilst the other two are obtainable from the movements alone. The voltmeter ranges are 100 and 500 mV, 1, 5, 10, 50, 100 and 250 V, and those of the ammeter 10, 50, 100 and 500 mA, 1, 5, 10 and 25 A. In addition, as the voltmeter has a 1-mA movement, it may be used on the 100-mV range as a milliammeter to 1 mA, and the ammeter is similarly standardised for 75 mV to enable external shunts to be used, an additional terminal being provided for that purpose. The voltmeter is of such a high

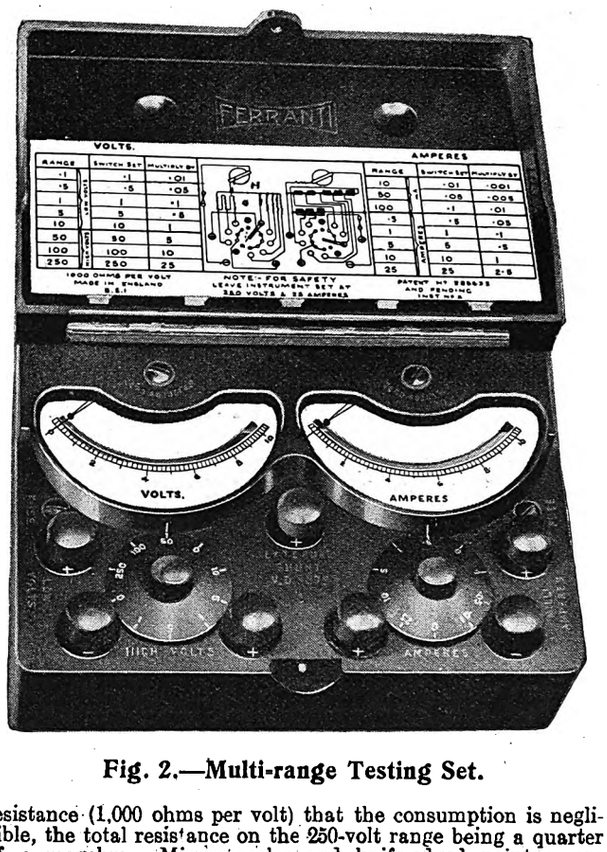

Fig. 2.—Multi-range Testing Set.

resistance (1,000 ohms per volt) that the consumption is negligible, the total resistance on the 250-volt range being a quarter of a megohm. Mirror scales and knife-edged pointers are provided, and the overload capacity of each instrument is very high, so that little chance of damage arises should a high-voltage accidentally be connected to a lower range. The instrument is a complete d.c. testing set of wide range; to enable valve tests to be made, in addition, a set of leads and plugs may be obtained for the direct indication of the quantities required for valves actually in use in a radio set.

A Glass Accumulator.

The " Monolt " 6-volt accumulator made by the Tudor Accumulator Co., Ltd., consists of three cells in a moulded monobloc English-glass box, which eliminates the usual wooden crate necessary to hold individual cells together. The seven-plate sections, having a capacity of 30 ampere-hours at the 10-hour rate, or 34 ampere-hours at the 20-hour rate of discharge, are firmly positioned in the compartments, which have moulded internal ribs to support the plates from underneath. The plates are over 3/16 in. thick, and are separated by treated wood boards. The moulded ebonite lids are sealed with compound which can easily be removed, and special screw-in vent plugs prevent any spraying during charging, an important point when the battery is used in conjunction with a charger at home. The terminals are non-corrosive and provided with vaseline chambers.

The glass box is provided with four small moulded feet and lugs on the ends of the box support a metal handle which can be readily detached. The centre cell is provided with specific gravity indicator floats, the positions of the balls being an indication of the specific gravity of the acid and the state of charge. The " Monolt " can be discharged at rates up to three amperes, and will therefore supply ample current for exciting the field of a moving-coil loud-speaker in addition to heating the valve filaments, the total weight with electrolyte being 18 lb., and the overall dimensions 8 by 5 by 8 in. high.

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Pulverised Fuel Operation in the United States.

A Summarised Report on Recent Progress.

THE "Serial Report of the Prime Movers Committee" on Pulverised Fuel is issued by the National Electric Light Association of New York, and the following notes which have been made on the report for the period 1927-1928, it is hoped, will be of interest.

The report indicates that the use of pulverised fuel has increased appreciably in the United States and Canada during the past year, both in large public utility plants and in industrial works. The boiler h.p. served by pulverised fuel has increased by some 170,000 h.p. over the preceding year, and an addition of 169,000 h.p. has been contracted for. Below is given the total boiler h.p. served by the central and unit systems, respectively, in public utility plants and industrial works for the years ending 1926-27-28; the outstanding feature of these figures is the extended use of the unit-fired systems, especially in industrial plant.

Public Utility Plants.

Year ending.	Total H.P. of Boilers.		Average H.P. of Boilers.	
	Central system.	Unit system.	Central system.	Unit system.
1926 ...	260,000	45,000	1,900	500
1927 ...	290,000	90,000	1,700	1,000
1928 ...	315,000	130,000	2,500	1,300

Industrial Plants.

Year ending.	Total H.P. of Boilers.		Average H.P. of boilers.	
	Central system.	Unit system.	Central system.	Unit system.
1926 ...	108,000	80,000	1,100	650
1927 ...	118,000	160,000	1,000	700
1928 ...	140,000	240,000	1,300	900

It is also to be noted that the unit system is now being applied to much larger boilers than formerly; until 1926, this system was considered only for comparatively small plants. It must be remembered, when referring to this table, that an American "boiler h.p." is equal to 10 sq. ft. of heating surface, or to an evaporation of 34.5 lb. from and at 212 deg. F. Preheated air is being more generally used in the mills for drying the coal, which has in its favour lower first cost and smaller building requirements, also simpler operation. Preheated air is also being used for external dryers, though in some cases steam dryers have been more successful, especially when using lignite. In connection with the dust and ash problem, the location of the exhauster fan on the return side of the cyclone which places the milling system, except for the short length between mill and exhauster, under vacuum, has proved to be a decided improvement; the maintenance of the exhauster blades has been reduced considerably, and the power consumption also somewhat lessened. In one case, the blades, after being in service for a considerable period, showed no signs of wear, the hammer marks being clearly visible on the projecting rivets. The coal in the return main is generally of a very fine nature and causes very little wear. The saving of energy in this particular case was equal to 1 kWh per ton milled.

Tests on the Cottrell electrical dust precipitators installed in one large station are of interest: These precipitators originally consisted of positive electrodes of corrugated steel sheets placed 4 in. apart, the negative electrodes being wire rods, suspended 6 in apart. Trouble was first experienced by arching between the sheets, and the electrodes were redesigned. The positive electrode is now a reinforced concrete slab 2 in. thick, containing ¾-in. reinforced bars spaced vertically at 6-in. centres. The slabs are 18 ft. high and 6 ft. wide, and are placed 8 in. apart and parallel to the flow of gases. The negative rod is the same size as before. There are three passes in each precipitator. The voltage used varies from 35,000 to 50,000 volts, according to the adjustment of an auto-transformer. A synchronous motor working from a low-pressure supply drives the rectifier, the commutators of which are fitted to arms on an extension of the motor shaft. Satisfactory operation was obtained with the gases flowing through the precipitators at 8 ft. per second, the time taken to pass through the machine being not less than 1.75 seconds. The results of tests indicate that for this particular plant the percentage of ash deposited in the furnace bottom increases as the boiler load is increased. Thus, with the furnace releasing heat at the rate of 12,000 B.th.u. per cubic foot, 20 per cent. of the ash is deposited in the furnace and 80 per cent. in the precipitator. If the furnace rating is 17 000 B.th.u. per cubic foot, 45 per cent. will be deposited in the furnace and 55 per cent. in the precipitator. At the 20,000-B.th.u. rate the precipitator only accounts for some 38 per cent. Tests were made with a scrubber-type gas washer with eliminator plates, located between the boiler outlet and the air heater; it was found that 6.9 per cent. of the original ash was discharged to atmosphere, and approximately 40 per cent. eliminated by way of the ash pit. The final flue-gas temperature was reduced by some 88 deg. by passing through the washer, enabling the induced-draught fan to deal with heavier loads. The draught loss across the washer varied from 0.10 to 0.35 in. of water. The sulphuric acid fumes do not appear to be greatly reduced by the use of the washer; this appears to be an important point. It is interesting to note that in one case in which complaints were received of ash being deposited on neighbouring premises, the matter was successfully settled by placing a sample of ash from the station and another found on the premises under a microscope; the peculiar characteristics of pulverised-fuel ash were then found to be strongly different from those of the ash usually found around the houses concerned. The colour of the ash also helps to distinguish pulverised-fuel ash from that discharged by mechanical stokers.

The use of the turbulent type of burner has increased, and the results indicate that this type of burner makes possible a much smaller furnace. This has brought about severe conditions in the combustion chamber, and with coals of a lower fusion point it is advisable to fit some kind of water-cooled wall. With this class of burner nearly all the air enters *via* the burner, and therefore little is added to cool the refractory walls or chill the ash. Nearly all furnaces installed in America carry some kind of water-cooled walls, and a number of complete water-cooled furnaces are in operation. The furnace bottom is either of the dry bottom type, in which the ash is easily removed, or of the wet type in which the ash is broken up by water or steam sprays. In other cases the furnace is kept hot and the ash is removed in a liquid state by a slag tap. A particularly interesting point is brought out in one case where the same company owns plant served by the unit and by the central system. The variation in coal in this particular plant, especially in moisture content, has a marked influence on the unit-fired boilers. Uneven coal feeding and difficulty in milling wet coal cause wide variations in mill output and fineness. The storage-system boilers show an equal steadiness with wet or dry coal, the intervening equipment between the mill and the boilers damping out milling variations. Mills up to 20-25 tons per hour are now being installed, and the wearing parts have a life of between 13,000 and 40,000 tons, varying widely owing to the different qualities of coal used. It is pointed out that fine pulverisation facilitates complete combustion in a minimum of time, and also prevents the formation of hard slag on the boiler tubes. The average boiler efficiency in several large stations is from 88 to 89 per cent., and there is little to choose in this respect between the unit and central systems.

In England there is approximately 1,121,043 sq. ft. of boiler heating surface being served by pulverised fuel with the central system of firing; this, however, includes plants that have been contracted for and have not actually started up. The central preparation system claims 26,835 sq. ft. and the unit system 99,351 sq. ft. The efficiencies obtained vary between 86 and 88 per cent. in many cases, 4 per cent. higher than the guaranteed figure. One of the most important contracts obtained during the year was an extension of the boiler plant of the Synthetic Ammonia and Nitrate, Ltd.; six new boilers are being laid down with the latest improvements, designed for 800 lb. per sq. in., and a final superheat of 840 deg. F. The boilers are capable of dealing with 269,000 lb. per hour and are fitted with water walls, except in the front where the burners are installed.

A Radio-echo Machine.

Dr. E. F. W. Alexanderson, of the American General Electric Co., addressing the International Civil Aeronautics Conference in the United States, claimed to have devised apparatus which will dispatch a wireless wave from an aeroplane to the ground and, by the speed of its rebound, indicate to the airman with the aid of coloured lamps on the dashboard the height of his machine. A mechanical attachment for use at 10 or 15 ft. will indicate in a similar way when to begin landing with safety in darkness or fog.

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Industrial Electric Heating Exhibition.

A demonstration of the most modern applications of electric heat to industrial purposes.

ON Monday last an exhibition and a series of demonstrations of industrial electric heating apparatus was opened at Belle Vue, Manchester, and remains open until to-morrow. The exhibition has been organised by the Industrial Electric Heating Committee of the British Electrical Development Association, Inc., in collaboration with the Electricity Departments of the Corporations of Manchester and Salford, and the Lancashire Electric Power Co., Ltd. Most of the leading firms engaged in this branch of the industry are represented, and several of the furnaces, ovens, &c., are shown in operation. A similar exhibition was held at Poplar a year ago, in which eleven companies took part; on this occasion the number has risen to 14.

The ELECTRIC FURNACE CO., LTD., is showing the body of a one-ton "Ajax-Northrup" high-frequency furnace, which is claimed to be by far the largest steel furnace of this type in existence, previous examples having had a capacity of about 5 cwt. This furnace, which will be equipped with a high-frequency motor-generator of 650 kW, will shortly be in operation in France; the whole of the plant has been designed and built in this country. The same company is showing in operation a 3-kW high-frequency furnace—the

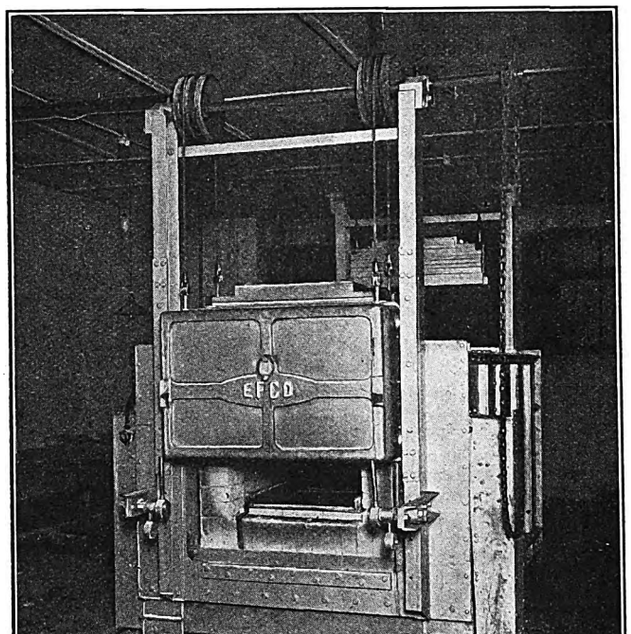

Fig. 1.—Gold-annealing Furnace; Electric Furnace Co.

smallest commercial pattern. Other exhibits are an electric air heater, suitable for core drying and similar purposes, and samples of the products of furnaces installed by the company; these include pottery from the largest electric pottery kiln yet built—a 115-ft., double-track, tunnel kiln, recently erected at Messrs. Doulton's works at Burslem—which, we understand, is giving exceptionally good results as regards both cost of operation and quality of product. Specimens of high-speed steel of higher quality than that produced in crucible furnaces; small cobalt steel castings; and various nickel and nickel-chromium alloys are also shown.

Fig. 1 shows a 27-kW furnace by this company, which is designed for annealing gold and gold-plated strip and sheet.

Included in the display by the GENERAL ELECTRIC CO., LTD., is an 8-kW furnace having a chamber approximately 18 in. long by 12 in. wide by 10 in. high, and a maximum working temperature of 950 deg. C. A 30-kW furnace is also being shown. This has a chamber 21 in. wide by 44 in. long by 17 in. high. It is designed for use in the annealing of metals and for similar processes requiring temperatures up to 1,000 deg. C. Another exhibit on this stand is a small electric japanning oven specially suitable for garages and similar establishments. A "Magnet" air heater on show consists of a bank of elements enclosed in a box-like structure through which air is drawn by an extractor fan and distributed for heating buildings, &c.; it has a maximum loading of 7 kW. Other G.E.C. items include a 2-kW wax tank, having three-heat control; a 1-kW oil-pipe heater, incorporating an element specially adapted for clamping round pipes; a conforming steamer for hats, fig. 2, designed for steaming felt

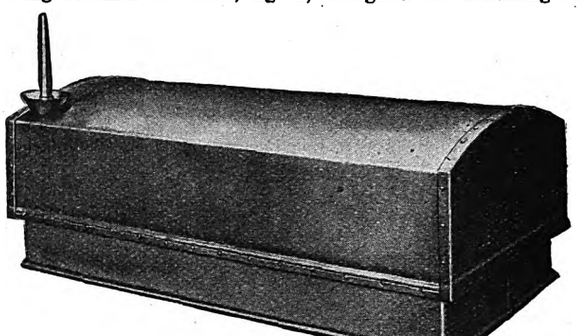

Fig. 2.—Electric Conforming Steamer for Hats; G.E.C.

in the process of shaping; and a 4-kW water still, which will deliver one gallon of distilled water per hour. A standard "Magnet" single-deck baking oven with a loading of 18 kW is another feature of the G.E.C. display.

The BIRMINGHAM ELECTRIC FURNACES, LTD., exhibit two of their standard portable furnaces, out of a range extending from 8 to 40 kW. The smaller one, Model CP.1, fig. 3, is a single-phase furnace with a hearth measuring 20 by 12 inches—shown in use, hardening motor-car parts; the larger is Model CP.4, taking from 25 to 27 kW at 440 V, three-phase, with a hearth 36 by 24 inches. Photographs of installations of the company's larger furnaces are shown. The portable furnace consists of a welded steel cylinder lined with refractory and insulating material; the hearth, however, is flat, and is covered with nickel-chromium sheet, the result being a remarkably even distribution of heat. The heating elements are of heavy nickel-chromium strip, mounted in the roof,

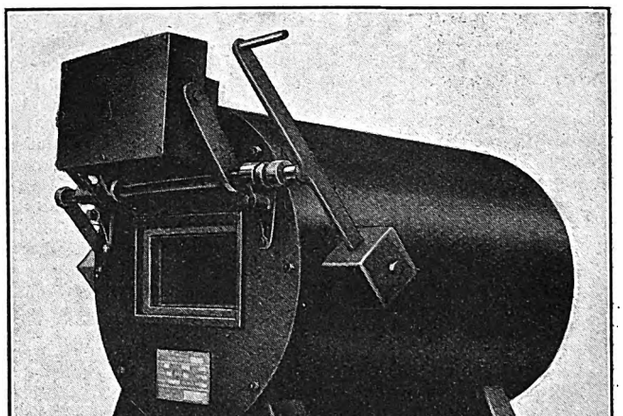

Fig. 3.—"Birlec" Portable Electric Furnace, Model CP.1.

sides, and hearth of the furnace, and protected with nickel-chromium sheet, which permits the heat to pass freely without overheating the elements. "Sil-o-Cel" insulation is used. The door has a patent parallel motion, closing tight without clamping, and is lined with refractory covered with nickel-chromium sheet; opening the door cuts off the current. Automatic control is fitted as standard, maintaining any desired temperature up to 1,000 deg. C.

(*To be continued.*)

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Electrical Advertising Signs.

A Survey of some of the Factors Underlying the Successful Use of Electric Lamps in Advertising.

By H. LINGARD.

(Abstract of a Paper read before the ILLUMINATING ENGINEERING SOCIETY.)

DURING the last few years advertising as the silent sales force, and electrical advertising as the most effective and spectacular form of advertising, have correspondingly attained a more prominent position in the manifold activities of commerce.

The restrictions imposed upon electrical advertisers by local authorities have undoubtedly retarded progress to an enormous extent, and development is still severely handicapped by out-of-date legislation. On the other hand, it must be conceded that these same restrictions have had a certain beneficial effect in eliminating crude and annoying forms of electrical advertising.

Broadly speaking, it is possible to classify electric signs which are used out-of-doors into two classes, "long-range" and "short-range" signs, and the fundamental factors which affect design are somewhat different for the two types. Irradiation plays an important part in the designing and effective operation of all signs employing exposed-lamp construction, since, unless this factor is taken into account, the sign is liable to lose either legibility or appeal throughout the range of its viewing distance.

The effect of irradiation in the case of luminous objects, such as electric lamps, is accentuated or modified by various conditions. The greater the viewing distance the greater is the apparent magnification of the light source. The higher the power of the lamp the greater is the irradiation obtained. The effect of bright luminous sources in the immediate vicinity of one under direct consideration is to diminish the irradiation obtained.

The contrast afforded between the light source and its background also exerts an influence upon the irradiation produced, the effect being at a maximum when the immediate background is absolutely black, while even small increases in the background brightness will result in considerable reductions in the irradiation effect.

The general brightness of the surrounding district, taking into account the street and shop lighting and all other forms of illumination which are competitive to the electric sign, also influence the irradiation, which is at a maximum when the competing illumination is absent.

The correct spacing of lamps in any given sign, in order to obtain the best results at both maximum and minimum viewing distances, will naturally depend, in the case of long-range signs, on the amount of irradiation which can be obtained, since it is always the aim of the sign designer to obtain, as far as possible, a continuous line of light.

It is always important, however, for the designer to bear in mind that the sign must be designed for good legibility at the minimum viewing distance as well as at the maximum distance, and the range of distances within the area of effectiveness are obviously those which should receive prime consideration when designing for legibility and appeal.

The size of lettering most suitable for use in exposed-lamp signs will obviously depend upon the maximum viewing distance at which legibility is desirable. The effective legible range of any sign is dependent to some extent upon the amount of irradiation obtained, since this phenomenon may easily bring about illegibility, due to the overlapping or confusion of letter strokes. A rough method of obtaining the minimum letter height which has been found satisfactory in practice is to divide the maximum viewing distance by 250. This will give a letter height of 4 feet where the maximum viewing distance is 1,000 feet.

Apart from the influence of district brightness on irradiation in the case of signs which are viewed from considerable distances, the computation of total luminous output of the sign will be influenced by the competitive illumination, and where extremely bright surroundings exist, or where the sign will be called upon to compete with other bright signs in the vicinity, the wattage must be increased to ensure the sign having the necessary advertising value. Under these conditions it is difficult to lay down any hard-and-fast rules for the computation of total wattage in any sign, but where the competition is considerable the wattage must be increased over and above the figures obtained from the ordinary methods of design, while, in addition, many other methods of obtaining distinction and attraction, such as the use of contrast colours or simulated motion, obviously can be resorted to, and frequently will be laid down as definite requirements by the advertiser before the sign is designed.

A graphical method for the design of exposed-lamp signs has been developed by Messrs. W. C. Brown and F. E. Carlson.

It is necessary, in the first place, to classify the districts in which a sign may be displayed in order to ascertain the district brightness factor. Table I shows the classification of districts adopted for British conditions.

TABLE I.

DISTRICT LIGHTING FACTORS.

Description of District.	Factors.
Very bright centres in large cities such as Piccadilly Circus, Leicester Square, &c.	1
Main streets in fairly large cities and well lighted shopping centres	2
Centres of smaller towns and suburban districts ...	3
Isolated displays with no appreciable competitive lighting	4

To estimate the effect of the background brightness and the total wattage of the sign to enable the design to be carried out on a graphical basis, an intermediate factor designated "brightness index" (BI) must be employed, which will vary for different district brightness factors, and also with the total number of lamps in the sign. It is necessary, therefore, to make some rough estimate of the total number of lamps required, but some degree of inaccuracy in this calculation is not serious, as it will be eliminated by final recalculation. It is necessary to estimate the minimum letter height to enable complete legibility at the maximum viewing distance. The desirable lamp spacing for giving a continuous line of light should be based on the minimum viewing distance.

Total Number of Lamps.—Having obtained the letter height and lamp spacing necessary, the number of lamps in the sign can then be found by the following equation: No. of lamps = (letter height, in./lamp spacing, in.) $\times 2\frac{1}{2} \times$ no. of letters. The total number of lamps found by this calculation will and may necessitate a recalculation to obtain the final result.

The method of predetermining the night appearance to the average eye of a proposed display at some specific viewing distance, "spot study," may be found of use in the design of exposed-lamp signs. Spot studies may be made by the use of confetti pasted on black paper. A sketch should be made up to such size that when the confetti is pasted on the outlines of the letters or figures the result is a clear picture. The confetti will bear some scale relation to the estimated apparent diameter of the lamps under the given conditions. The diagram should then be viewed at a distance which bears the same scale relation to the maximum viewing distance of the sign, and the result will indicate approximately the appearance of the actual installation

Probably the most important requirement of all in connection with the short-distance sign is that it should be of good appearance both by night and by day, since it is usually mounted on the front surface of the building, and must not in any way detract from or spoil the architectural features.

The popularity of the enclosed-lamp sign is due, in a large measure, to its more pleasing daytime appearance when compared with the exposed-lamp type of sign. The smooth even lines of the strokes of the pattern also lend themselves to building architecture which is quiet and dignified. It is a general rule not to employ enclosed-lamp construction for signs whose letters exceed 18 in. in height, while exposed-lamp signs to be satisfactory should not be used for signs with smaller than 18-in. lettering.

The minimum letter height which should be used in enclosed-lamp signs can be obtained approximately from the following equation: Letter height in feet = maximum viewing distance in feet/250, but this figure should only be adopted after careful consideration of the appearance presented by letters of such a size when viewed from short distances. The chief requirement from a lighting point of view in enclosed-lamp signs is that the luminous surface should be evenly and sufficiently lighted, and it is obviously possible to obtain the desired effect by a number of different lamp arrangements. It is, however, desirable to take advantage of the higher efficiency obtained from the larger lamps by using the highest wattage lamp that can be employed without seriously impairing the brightness uniformity of the luminous surface.

An enormous field of application exists for the types of signs discussed under the preceding headings for short-distance viewing, since the majority of enterprising shopkeepers, once convinced of the value of illuminating their fascia, will be only too anxious to employ the most effective and arresting of all methods, namely, that of using some form of electric sign. Correctly designed trough fittings over the top of the exist-

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ing fascia will give adequate illumination under average conditions if provided with one 40-watt lamp per foot run, and if the fascia lettering is of the raised type the effect may be quite pleasing, provided that the light from the troughing is carefully screened from the eyes of passers-by. A development of this system has been made in one type of fascia-lighting unit which, by the ingenious use of curved plate glass over the fascia lettering, ensures that even illumination is provided from top to bottom of the fascia, thus eliminating the inevitable drop in brightness that occurs on the lower section of such installations when ordinary systems of top lighting are employed. Almost every variety of enclosed-lamp sign can be adapted for fascia-lighting work, the most important considerations being that the sign should have the minimum extension from the building surface, and should have a first-class daylight appearance. For enclosed-lamp fascia signs to have the necessary appeal it is recommended that at least one 40-watt lamp per letter should be employed.

Silhouette signs are also admirably suited to this class of work, presenting, as they do, such excellent daylight appearances, while the ready accessibility of the lamps provided in these signs undoubtedly appeals to the average retailer.

Radio Transmitting Aerials.

The Technical Aspect of the Design of Broadcast Radio-Telephone Radiating Aerials.

By P. P. ECKERSLEY, M.I.E.E., T. L. ECKERSLEY, B.A., B.Sc., and H. L. KIRKE.

(*Extracts from Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE proper method of attacking the problem of mutual interference between stations and the all too limited service area of stations is to attempt to design an aerial so as, ideally, to make it a radiator which only produces a direct ray, or ground ray, *i.e.*, initially parallel to the earth's surface. It is the existence of the indirect ray which produces all the difficulties inherent to the production of a good broadcasting service, not only because it interferes with other very distant stations, but also because it produces fading and bad quality in the local-service area; further, all energy radiated upwards is, in broadcasting, lost. A high aerial with small current is the most efficient, *i.e.*, less power is required to produce a given value of metre-amperes. If all the aerial energy could be directed to produce the type of radiation desired, some interference might be expected, but at a skip distance, not everywhere as at present. Thus the first part of the paper deals with the theory of the aerial as a radiator of the type needed, and includes an account of full-scale experiments with different types designed to achieve the desired result, supported by a kite balloon hired from the Air Ministry by the British Broadcasting Corporation.

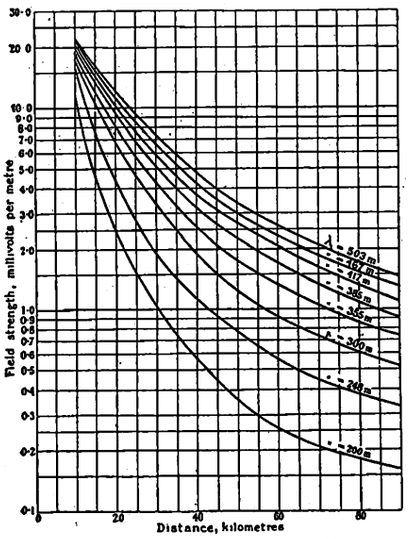

Fig. 1.—Mean Attenuation Curves.

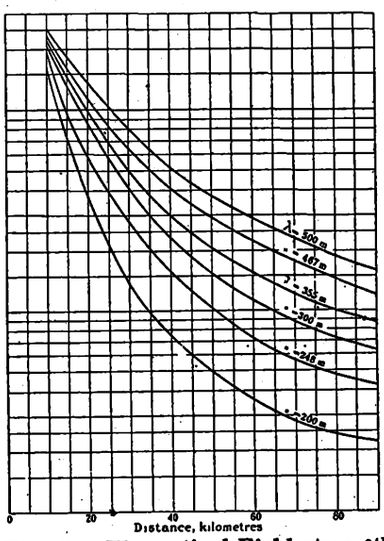

Fig. 2.—Theoretical Field-strength Curves.

The outstanding fact that emerged from the experimental verification of the theoretical analysis is that high aerials appear to be necessary, but their use implies high masts, which are costly.

The wave-band allocated for broadcasting is approximately between 550 and 200 m., or roughly 1,800 to 650 ft., which entails masts for supporting ½λ aerials of from 900 to 325 ft. high, or, allowing for sag, 1,000 to 400 ft.

Assuming that two ½λ aerials could be used, masts 2,000 to 750 ft. high would be required; mechanical and economic conditions, however, impose a limitation of, say, 800 ft. for the highest mast. This means that Franklin aerials cannot be used for wave-lengths greater than about 700 ft. (213 m.), but that ½λ aerials can be used for most wave-lengths. Masts are extremely costly, and the point at issue is: with a given height of mast, what is the best form of aerial? The importance of obtaining a maximum ground ray and minimum indirect ray would seem to override all questions of economics, and only the mechanical limits of mast height (or prohibition by flying authorities) should set a barrier between the ideal and the actual. Nevertheless, owing to mechanical limits masts will always be shorter than is theoretically desirable. Thus, as a compromise arrangement, at this stage and without experimental verification, it would appear best so to arrange a T aerial that the current in the vertical part is the maximum at the greatest possible height from the earth. Care must, however, be taken to see that the ends of the horizontal part of the top hamper are not brought so near to the masts as to induce mast currents and so produce shielding and/or loss; the whole question is not significant if h is less than ¼λ, when h is the physical height of the vertical part of the aerial and λ is the wave-length.

It is pertinent to ask whether the masts could not themselves be used as aerials; the authors, after consideration, believe that, although at first sight attractive, the method is not to be recommended as sound engineering practice, chiefly because of the entire lack of flexibility. Wave-lengths change from year to year, and any broadcasting organisation

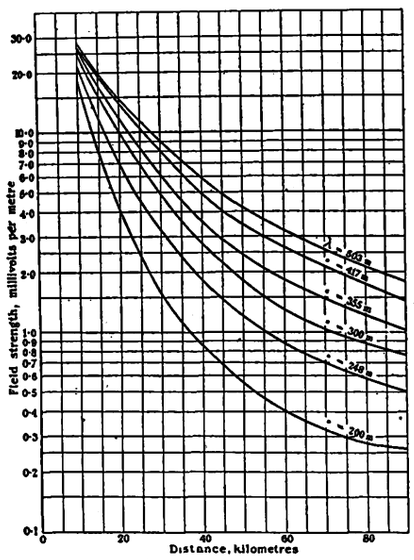

Fig. 3.—Theoretical Field-strength Curves.

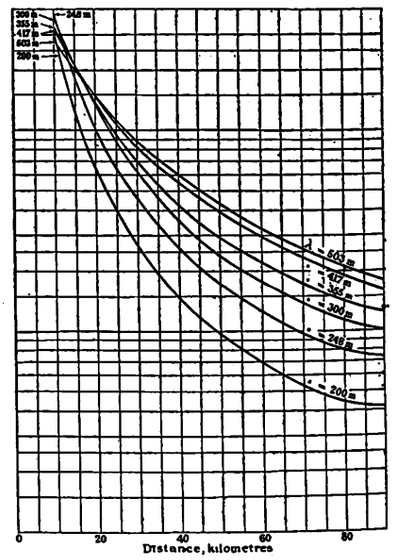

Fig. 4.—Family of Field-strength Curves.

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finding itself forced to particular waves for certain stations might suffer. We must realise that high insulated masts are not easy to construct mechanically, and that an electric as well as a mechanical strain on the insulator might bring disaster. The effect of the stays is incalculable and might be deleterious. Wooden masts with a conducting core are attractive in theory, but always present the risk of fire; further, the life of such masts might be short and their cost for great height greatly in excess of that of steel masts. If, however, dual masts carrying the conventional type of aerial are to be used, it is particularly important to guarantee that they will not cast shadows of a serious nature. This trouble has been acute at the Daventry broadcasting station and a repetition of the difficulties would be foolish; it is therefore imperative to insulate the mast. It is suggested that the masts could be tuned to have a natural wave-length, when unearthed, equal to the wave-length used, so that no current would flow in the mast when earthed.

The second section of the paper deals with the theory of attenuation of waves of frequencies between 500 and 1,500 kilocycles per second; includes a complete set of curves actually obtained by the B.B.C. from a transmitting aerial near London, and data to enable one to specify in general terms the extent of service area and the effectiveness of the service to be expected when using a given power, frequency of emission of carrier wave, height of aerial, and earth conductivity.

The paper contains too little experimental verification of the theory outlined therein. A conclusion should, however, deal with generalities, and it is obvious from what has gone before that certain incontrovertible principles can, and should, be stated before more damage is done by organisations which appear to concentrate on an undignified scramble for the all too-limited facilities rather than thinking how best to use what are, in plain fact, the actual facilities available. The facts which emerge are :—

(1) The design of aerials for broadcasting should aim at using the energy to produce the strongest possible horizontal radiation, while diminishing upward radiation.

(2) To produce this desirable end, high aerials are a *sine qua non*.

(3) Nothing, however, that is done with special aerial design will prevent a serious limitation of service area, relative to that obtained with the longer waves, when the shorter waves are used.

(4) That, nevertheless, organisations must employ such waves, which are more efficiently used by the employment of high aerials.

Responsible technical authorities have in the past been chary of using waves below 300 m. for broadcasting because of their expectation that stations using such wave-lengths will have too limited a service area under practical conditions. This may be true in certain cases, but it is to be remembered that limitations are inevitable, and it is better to have a limited service than one which suffers continual interference. The use of shorter waves is perfectly economical in densely populated districts. It is hoped that the final analysis will help engineers to gauge the extent of the usefulness of all waves so that existing facilities may be most efficiently used. To this end we may combine theoretical analysis and the practical results set out in the foregoing. A set of curves is therefore reproduced which shows, at any rate to the right order of magnitude, the "effectiveness" of the different wave-lengths for the production of service area.

It is not easy to find a basis of comparison for the "effectiveness" of the various wave-lengths, as conditions of listening vary in different districts and areas. The point finally to be held in mind, however, is that the excellence of a service from a broadcasting station (apart from the quality of transmission, which is the same, practically speaking, for all wave-lengths) can only be judged by the degree of interruption experienced by the majority of listeners. It is for this reason that Capt. P. P. Eckersley defines service area in terms of signal strength alone, but points out that densely populated areas (where worse background noise exists) require a greater field strength than that necessary for rural districts, but both natural and man-made static diminish as the frequency to which the receiver is tuned becomes greater. The authors have therefore taken this factor of diminishing interference as being proportional to the square root of the frequency of the carrier wave.

The final analysis therefore is as follows :—

(1) A set of curves (fig. 1) for a $\frac{1}{4}\lambda$ aerial with 10 ohms dead loss for 1 kW *input* to the aerial.

(2) A set of curves (fig. 2) using a vertical aerial 400 ft high (500-ft. masts) having a constant dead loss of 10 ohms and 1 kW *input* to the aerial.

(3) A set of curves (fig. 3) with the above conditions, but with a vertical aerial 700 ft. high (800-ft. masts).

(4) The curves of fig. 3 are multiplied by a factor (proportional to $1/\sqrt{\lambda}$) to increase their apparent "effectiveness" as suffering less interference when the wave-length is shorter (see fig. 4); thus, using $\frac{1}{4}\lambda$ aerials, it requires, for a given service, say, 25 kW, but with 800-ft. masts this station, for the same service, can be run on 10 kW.

(5) The last set of curves (fig. 4) shows that the broadcasting engineer need not so greatly fear to use waves below 300 m., for the use of the shorter waves must come, and it is hoped that this paper may be of help to those who will one day have to use them.

The painstaking nature of this work cannot be over-emphasised; actually the field-strength measurer travelled 28,000 miles in the course of the investigations, and a tribute must be paid to the British Broadcasting Corporation's engineers and all those who participated in the tests, particularly many amateurs and Radio Research Board observers.

Transformer Breakdowns.

Report of a Meeting of the London Local Technical Group of the Electrical Power Engineers' Association.

At a meeting of the London Local Technical Group of the Electrical Power Engineers' Association held on December 11th, Mr. S. Austen Stigant, M.I.E.E., read a paper on transformer breakdowns. A study of the records of modern transformer breakdowns over a period of years, he said, showed conclusively that between 70 and 80 per cent. of them were due finally to short-circuits between turns. Short-circuits between turns might result from abrasion of the insulation caused by the dislodging of, or shock to, one or more turns consequent upon an external short-circuit, or upon repeated unfavourable switching-in operations. In certain cases the trouble might not become apparent immediately, but should the transformer vibrate while on load, due to looseness of the core plates, core bolts, or core-clamping structure, the insulation would ultimately break down. Short-circuits between turns might also occur if the copper conductors had sharp edges which would chafe the insulation should the transformer vibrate on load, so bringing the copper conductors into contact. A source of danger was the use of square conductors on which the double cotton covering had not been tightly wrapped. In core-type transformers the mechanical stresses acted in a radial direction, and usually the conductors themselves were sufficiently strong to resist the bursting tendency set up under short-circuit conditions. If, however, the centres of the h.p. and l.p. coils did not coincide, an axial component of the stress was introduced which had the effect of forcing the conductors upwards and downwards in an axial direction. This tendency must be combated by providing rigid supports for the windings in an axial direction. In transformers with sandwiched windings the mechanical forces normally set in a radial direction, and also horizontally between high- and low-pressure coils, while if the centres of the h.p. and l.p. coils did not coincide, distorting forces were introduced.

Breakdowns due to transient voltage waves were discussed, and diagrams were exhibited to illustrate how the reflected and transmitted wave phenomena could be modified by the insertion of a protective condenser, or a protective choke coil, before the transformer.

Continuous excessive overloads always resulted in complete breakdowns sooner or later. The general characteristic of such breakdowns was the charring and carbonisation of the insulating fabric and the formation of hydrocarbon sludge deposits from the oil. The question of overload was intimately connected with the proper design of the internal cooling facilities (the oil ducts, &c.), and a case was on record of a transformer which, being badly designed from that point of view, burned itself out, even though subjected to quite a small overload for only a short period.

Discussing breakdowns in the magnetic circuit, Mr. Stigant said the breakdown of the insulation of the bolts inserted through the cores of core-type transformers for the purpose of clamping the laminations together, had the effect of short-circuiting the laminations themselves, producing in them local eddy currents; if, in addition, two or more of the core bolts broke down, heavy currents would circulate in the bolts, as they would form a short-circuited turn through which magnetic flux passed. Dealing with breakdowns due to magnetic-circuit characteristics, he discussed the switching-in current rush,

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which was dependent mainly on the point of the pressure wave at which the transformer was switched in. If the transformer was switched in at the instant when the wave was passing through zero, the maximum current rush was obtained. Under certain conditions it was theoretically possible to switch a transformer in at the instant of zero voltage without any current rush occurring, *i.e.*, if the core possessed residual magnetism equal to and of the same polarity as the normal induction, the initial flux waves would follow their normal course and there would be no current rush.

Dealing with the oil used with oil-immersed transformers, Mr. Stigant said it was impossible to give too much attention to the question of moisture in oil, as innumerable transformer breakdowns had definitely been traced to that cause. Photographs were shown of transformers in which extensive sludging had occurred, and they demonstrated the importance of providing substantial oil ducts and of designing the supporting structure so that free circulation of the oil was not impeded. Reference was also made to the breakdown of insulating cylinders between high- and low-pressure windings, and also of insulating washers from the windings to ground. The breakdown of these was due often to some flaw in manufacture, which usually took the form of, either the inclusion of air between the paper layers or some contamination of the surface.

Finally, Mr. Stigant emphasised that it was only by thorough, careful and common-sense inspection that the majority of, if not all, faults could be eliminated.

Discussion.

Mr. WALLIS asked if efforts had been made to produce an apparatus which would ensure switching off a transformer at precisely the correct time. He had in mind Constantinesco's system of shooting bullets through the revolving blades of an aeroplane propeller; perhaps switching could be arranged only when the flux was at its right density.

Mr. STIGANT said he believed such an arrangement had been made in the laboratory at Liverpool University, but to his knowledge it had never been applied in practice.

Mr. HENDERSON said that the large percentage of breakdowns which had been due to short-circuits between turns seemed to indicate carelessness in inspection; there was no doubt that success in transformer work, particularly when dealing with high voltages, depended to a very large extent upon continuous supervision throughout the process of winding. He asked if Mr. Stigant still favoured the use of wooden packing blocks between coils, and what was the nature of the insulation reinforcing material he used at the beginnings of the windings.

Mr. STIGANT said that provided the wood was thoroughly dried and impregnated, it was satisfactory for supporting the tops and bottoms of the coils of concentric circular windings for core-type transformers, but for high-voltage transformers he would not use it.

Mr. HENDERSON, referring to the statement that the oil temperature should not exceed 90 deg. C., pointed out that local heating might occur. Mr. STIGANT replied that 90 deg. C. was usually specified as the maximum temperature in the hottest layers of the oil, *i.e.*, the top layers, and that was where the temperature was usually measured. In a properly-designed transformer, 90 deg. C. was the highest oil temperature.

Mr. PARR asked if Mr. Stigant considered that buffer resistances should be fitted to high-pressure switches invariably for switching in transformers, and whether they would be burned out as the result of a big rush of current. Mr. STIGANT said there was no need whatever for equipping switches with buffer resistances indiscriminately. They had been somewhat prevalent many years ago, but it must be admitted that in many cases they had fallen into disrepute.

Mr. BRETTLE asked if there existed any reliable protective gear to guard against short circuits between turns. The author replied that a certain type of protective gear which had been patented, but not put into practical operation, had one of the windings split into two parts and connected in parallel through suitable current transformers. Under normal conditions the inductive effects of each of these halves with respect to the other winding were equal, but if a fault between turns occurred on one of the halves, or on the winding which was not split, that inductive equality was upset.

Mr. SKINNER, referring to the method of testing the dielectric properties of oils by transmitting current at increasing pressure between two small spheres in a small sample of oil, asked whether the voltage at which the initial sparking occurred, or that at which the final breakdown occurred, was the criterion of breakdown voltage. Mr. STIGANT replied that the voltage at which final breakdown occurred was regarded as the breakdown voltage, and that could be determined visually by reason of the very heavy and continuous discharge or flashover between the two spheres.

Mr. HILLING asked if the author would advocate the use of a non-sludging type of oil in a kiosk transformer, and what precautions he would take to ensure that samples of oil drawn off for test when the transformer was running were not contaminated. It was replied that in British Standard Specification No. 148 it was stated that a certain grade of oil should not be used where temperatures of more than 75 or 80 deg. C. were reached, and the non-sludging grade was recommended for temperatures above that up to 90 deg. C. It depended entirely on the temperature at which the transformer was to be operated.

Mr. D. A. S. PORTEOUS said that although the effect of protective reactance might be the same as that of protective capacity, he had always understood that it was considerably easier to obtain the necessary protection by means of capacities than by reactances. He asked what were the relative costs of affording protection by each of these two methods. He understood that a very good method of protecting the transformer was to introduce a fairly long length of cable between the overhead line and the transformer. Mr. STIGANT said it was much more expensive to install protective condensers than protective choke coils. The practice of introducing a length of cable between the line and the transformer was initiated, he believed, by the engineers on the north-east coast, and the number of failures that occurred in various parts of the system had been reduced to a very small fraction of the number that had occurred previously.

The Chairman, Mr. W. J. OSWALD, referring to the use of wood for packing and insulating purposes, said he had wondered whether the material as used was really wood. In the first place, wood was thoroughly dried and placed in a vacuum; what remained was a cellular mass into which insulating material was then introduced and compressed, the pressures to which it was subjected being fairly heavy. Mr. STIGANT replied that there were certain interests endeavouring to push the use of wood, or, rather, endeavouring to sell varnish, and it was claimed that the impregnation of the wood with the varnish so improved the qualities of the wood as to make it suitable for extra-high-pressure work. He would have no hesitation in using it for transformers up to 11,000 volts, but would be very chary of using it for the insulation of transformers for higher voltages.

Mr. STRETTON asked whether, in the event of a large bank of water-cooled transformers having to be operated for a short period with the water shut off, the ascertainment of the temperature of the oil by means of a thermometer would give a good indication as to whether the transformers were being operated at a safe temperature. Mr. STIGANT said it was probable that, providing the oil temperature was not allowed to exceed the oil temperature specified for self-cooled transformers, it would give a reasonably safe indication of the maximum permissible loading of the transformer. It had to be borne in mind, however, that when artificially-cooled transformers were operated as self-cooled units the internal temperatures might be slightly higher than those in a transformer designed only as a self-cooling unit.

Legal.

Thefts of Electricity.

AT the Thorne (Yorks.) Police Court recently, George Merrick, a miner, was charged with having fraudulently abstracted electricity from the mains of the Electrical Distribution of Yorkshire, Ltd., by inserting filed copper coins in a shilling-in-the-slot meter and for stealing money from meters belonging to the company. He was found guilty and sentenced to two months' imprisonment and fined £3, or in default a further month's imprisonment.

Another miner, John Bristow, who pleaded guilty to a charge of obtaining electricity by putting buttons in a slot meter, was fined 40s.

A representative of the company stated that the slot-meter system was being so badly abused that the company would have to abandon it if the conditions continued.

AT the Brighton Police Court on January 2nd, Capt. John Crowe, V.C., was charged at the instance of the Corporation with the fraudulent consumption of electricity. A Corporation inspector said that he found that the defendant had installed temporary wiring, by means of which he obtained electricity for lighting from the power circuit.

The defendant denied that he had habitually obtained light in this way. He said that he wished to charge accumulators in a dark place and merely fitted up a temporary arrangement to give him the necessary light. The magistrates imposed a fine of £5, or, in default, 21 days' imprisonment.

Overhead Lines and Road Widening.

A point of considerable importance is associated with the granting of a Special Order to the Dawlish Electric Light Company to supply electricity in the parishes of Kenton and Starcross, Dawlish West, Ashcombe, and Mainhead. At the recent inquiry the application was opposed by the Devon County Council for the purpose of securing the insertion in the Order of a clause providing that in the case of any road widening the Company should be responsible for removing and re-erecting the electric poles or standards. This clause was resisted by the Company, which has been granted the Order without its inclusion therein.

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Rural Electrification in South Australia.

Notes from a Report in the Quarterly Bulletin of the Institution of Engineers, Australia, of the Retiring Chairman's Address to the Annual General Meeting of the Adelaide Division.

By J. R. BROOKMAN, M.E., M.I.E.Aust.

THE problem of rural electrification lay in the length of line required to supply each individual consumer, and the necessity of keeping the capital expenditure down in order that the limited revenue available might provide a reasonable return on the expenditure. The first movement in the direction of rural supply in South Australia was made about 1912, when supply was given by the Adelaide Electric Supply Co. to some market gardens in Campbelltown for pumping water for irrigation purposes. In order to cut the cost of construction down as much as possible, the company put up high-pressure lines overhead, and developed a cheap type of overhead transformer station These economies had the desired effect, and rapid progress was made. In 1922 the whole of the pumping in the Torrens Valley, from Athelstone to Fulham, was done by electricity. In 1926 the Adelaide Company purchased the undertaking of the Mount Barker Electric Supply Co., and to connect it a 33,000-V line was built from Piccadilly, giving supply *en route* to Aldgate, Bridgewater and Ambleside, and an extension was also made through Littlehampton to Nairne. The bulk of the power load connected on this line was of a different class from that previously mentioned, including, as it did, brick yards, bacon factories and a flour mill.

Generally speaking, the pole lines were taken along the roadways, but in some cases it was found necessary to traverse private property and follow the stream from which the gardeners obtained their water. No attempt was made to obtain easements for these lines, written permission being accepted as sufficient authority. It had been found that an attempt to obtain an easement endorsed on the title of a property often aroused the strenuous opposition of the owner, or induced extravagant demands for compensation. The company relied on the fact that electricity was essential to the gardeners and that electricity supply on a property enhanced its value. Where main transmission lines were concerned, easements were obtained, or properties were purchased outright. As a *quid pro quo* for these permissions, the company agreed, instead of making the usual charge for the whole of the service lines required to serve the owner's house and motors, to allow him free one pole per horse power of motors, and one pole per house, any excess length being charged at so much per yard. The disadvantage of this scheme was that the owner was liable to put in an oversize motor in order to get an extra pole or two free, which reacted unfavourably on the power factor of the supply, but otherwise it was most successful. The power factor of rural supply was, however, generally poor, and in this case was not much better than 50 per cent. The irrigation business was attractive because it was an "off peak" load, promptly shutting down when the clouds began to gather, thus leaving the power house free to supply the lighting which was then called for in shops, offices and factories. As a summer load it helped to even up the difference between the summer and winter loads caused by office radiators.

The Adelaide Electric Supply Co.'s rural power consumers totalled about 450, with 3,400 h.p. of motors connected, resulting in a revenue of £10,000 per annum. In addition to this, their household requirements would account for another £3,000 per annum. There was also a large number of consumers along the rural distribution lines requiring electricity for household purposes only, who added considerably to the revenue. Having acquired the electrical plant of the Gawler Corporation in 1923, and connected it by a 33,000-V transmission line from Port Adelaide, the Adelaide Electric Supply Co. was in a position to consider giving a supply to Freeling, Nuriootpa, Angaston and Kapunda. Requiring as it did about 40 miles of 33,000-V transmission line, the chief difficulty was to keep the expenditure down to a figure which would permit energy to be supplied at a reasonable rate. Fortunately, at that time, Mr. J. C. Stobie, A.M.I.E.Aust., came forward with his proposal for the steel and concrete pole, which he had since patented (ELECTRICAL REVIEW, September 18th, 1925, p. 453). By adopting this pole, and using spans of 600 ft. instead of 250 ft., costs were brought down to the required figure.

The work was then put in hand, including also a 36-mile line to Balaklava. The latter had been since extended through Blyth, Brinkworth, Georgetown Gladstone, Caltowie to Jamestown, a route length of 100 miles from Adelaide. The latter extensions could not be strictly classified as "rural," as up to that time no attempt had been made to take the supply beyond the limits of the townships, but in Angaston and Nuriootpa there was a small amount of pumping load, and the wineries were using electricity for grape crushing, cellar lighting and wine pumping. Similar conditions applied along the 30-mile line recently constructed through Reynella to McLaren Vale and Willunga. There was, however, a branch line six miles long through McLaren Flat, a district largely devoted to fruit growing, where motors were used for irrigation purposes.

Those long country lines were operated at 33,000 V, and could not be used for local supply *en route* on account of the cost of the transformers and switchgear which would be necessary. The step-down stations, however, for the supply of the country towns which occurred at intervals of roughly 12 miles, along the line, provided suitable jumping off points for possible rural distribution lines to the surrounding farms. The problem that yet remained to be solved was how to supply the farms. The great difficulty lay in the scattered nature of the load. Whereas the market gardener might have a property comprising anything from 5 to 50 acres, the average farm was probably of about 800 acres. The length of line required to supply the gardener averaged one-quarter mile per consumer, while that to supply the farmer was over a mile. The power requirements of the farmer were small, bringing in not more than one-third of the revenue obtained from the average market gardener. If the farmer could be persuaded to do his cooking electrically, and put in a hot-water system and refrigerator, the revenue obtainable would still not justify any great extension. In all electrical undertakings it was found that there was a definite maximum ratio, usually about 3 or 4 to 1, between the capital which might be spent on an extension and the revenue to be derived from it, in order that it might return sufficient to meet interest, maintenance, and depreciation charges on the investment.

It was found in South Australia, and confirmed by experience in America, that even if the farmer had an all-electric home, the supply undertaking could not afford to extend more than one-third of a mile if the extension was to be even barely payable. There were only two alternatives: (1) For the farmer to pay the cost of the line required to reach him, perhaps £250 to £350; (2) for the farmer to pay the interest, maintenance and depreciation charges on the extra length of line not covered by the revenue, amounting to, say, £30 to £40 per annum, in addition to the cost of energy.

The method which appeared to the Adelaide Electric Supply Co. to be most satisfactory to all parties was for the consumer to pay the capital cost of the extension, and in return receive a rebate of, say, from 15 to 20 per cent. on the cost of energy supplied to him, which was charged at the rates ruling in his particular local government area, or in the nearest township. This rebate was continued until his deposit was repaid. Other consumers connected to the extension who had not contributed to the deposit did not receive the rebate on their consumption, but it was distributed among those who had contributed. This plan had the advantage of stimulating the use of electricity in order to secure the return of capital, and made the contributing consumers keen on getting as many as possible of their neighbours connected.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Bottom or Side Heat?

Your pointed editorial note *re* "The Design of Electric Ovens," referring to your contributor "A Station Engineer" is very opportune, and the article "Bottom or Side Heat" clearly illustrates that the subject of correct design should be seriously studied.

Unfortunately designers of electric ovens or cookers have taken the orthodox gas oven practice as the basis of correct design. Because gas burners are placed at the side of the oven, they locate exposed elements on the sides of the electric oven, using a baffle-plate to protect the element and distribute the heat. They have not taken full advantage of the flexibility of electricity for heating and cooking.

To add to the proofs of neglect of this particular application of electricity we have only to refer to the B.E.S.A. Glossary of Terms No. 205-1926. Sub-section 85 covers heating and cooking, with a ridiculously short list of 12 terms. If this is intended to be comprehensive, then it clearly indicates how little is actually known of the important field of electric heating and cooking.

A prominent member of the profession, during the discussion following the reading of my I.E.E. paper, "Large Electric Baking Ovens," stated that electric baking was a simple matter, following the lines of electric cooking. It is this indifference to the subject which must be taken as a veneer to cover actual ignorance It *may* be simple, but the present designs of cookers do not reflect much credit on the electrical industry.

Visiting an electrical showroom in a "Garden City" recently, I saw a range of cookers of a prominent firm's make. Reference was made to another well-known make of cooker, which produced the surprising information that a dozen or more had been installed, but were taken out after a few months' use and were packed away in the stores, having caused

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a series of troubles. They are certainly not cheap cookers, consequently the design must be wrong.

Personally, I consider present-day practice all wrong. Designers should consider following the method employed in designing electric ovens as used by bakers; shallow ovens with elements outside the baking chamber, located above and below the baking chamber. It should not be necessary for the housewife, cook or whoever uses the cooker to continually stoop when attending to the article that is being baked, being literally choked when the door of the cooker is opened. American and Canadian designers have long recognised this disadvantage and build the cookers raised on legs of convenient height, a practice now being imitated by a few English manufacturers.

In the shallow type of oven as mentioned it is possible to bake everything perfectly. Joints, pastries, potatoes, fruit cake, scones, bread, &c., obtaining the required uniformity with variable top and bottom heat. Admittedly more floor space is required, but the space below the oven can be utilised economically.

"Station Engineer" is apparently doing a little bluffing when he refers to light packing of a woolly nature. He surely knows that this is slag wool. The criticism of this method of heat insulating is justified, as slag wool has a tendency to settle down, and this is accelerated by the continual shock due to closing the oven door. For the oven sides and back, block lagging is certainly the best. Slag wool can be used for the top and bottom if desired, but block lagging throughout is certainly the better job.

A reasonable air space between the lagging and the elements is desirable to permit equalising of the heat on top and below the baking chamber. An air space between the lagging and the outer casing is also an advantage.

The subject can be carried further, but I have already encroached too far on your valuable space. It is a pleasure to note your progressive attitude towards the practical applications of electricity, and it is to be hoped that, following your lead, the year 1929 will witness progressive attempts to deal with the problem of cooking and baking by electricity, so that a reliable set of standards can be made available. It is not sound progress to model designs on antiquated gas cookers.

W. Ellerd-Styles.

London, *January 1st*, 1929.

I was very interested in the remarks on "Bottom or Side Heat" by "A Station Engineer" in your issue of the 28th inst. May I be allowed to comment on his very interesting article?

As a practical cook with long years of experience with many makes of cookers, I should like to say that I agree with his views on the subject of "top and bottom heat."

At one time I was in favour of bottom and side, but since I have grown used to top and bottom, I have learned its economy and efficiency, and find the results good every time for all classes of cooking.

It is perfectly correct that in the North, where cooking is of a heavy type (and especially for bread baking), the best results are obtained where bottom heat is chiefly relied on.

As everyone knows, heat ascends and circulates; therefore, top heat is only required for occasional use. Here let me add that when the top element of the oven is used as a grill it is not only more economical, but also more efficient, and a new departure which is worthy of more consideration. An obvious advantage is that with the space available in the oven a considerably larger grill can be conveniently provided, which would enable a lunch of reasonable size to be grilled in one operation.

Again, a small ventilator in the oven is a great aid in keeping the oven lagging from condensation and causing steam in ovens.

Annie Mole.

London, *January 1st*, 1929.

Hire and Hire-purchase Schemes.

With reference to the report on page 33 of your issue dated the 4th instant, in reading through the remarks attributed to "Mr. Bryant, Hackney," I conclude that I failed to convey clearly precisely what I intended.

According to your report, my proposal was that cooker hire rentals should be raised from, say, 10s. to £1 per quarter, and the energy charged should be dropped from 1d. to, say, 0.6d. This, however, constitutes but a step in my argument. Obviously, such a comparatively enormous rental would almost completely stem the cooker hire business; but, in order to overcome this, I would issue the cooker installation on hire-purchase terms. Thus, the greatly increased charge would be, I submit, justified.

My argument is that under such conditions electric cooking would soon become established as being very cheap indeed, and, whilst the hire-purchase charge would be high, as compared with the hire charge, the consumer would, it is thought, be satisfied, inasmuch as ultimately he would become the owner of the apparatus. I have in mind that the hire-purchase period should be of the order of seven years.

I suggest that the life of a cooker of any reputable make is more or less indefinite, provided it be properly cared for. This proviso is an overwhelming factor in the hire of cookers. It is, I think, an established fact that hired apparatus is, more often than not, *not* properly cared for. If, however, the installation were on terms of hire-purchase, the hirer would probably, in view of the fact that he would be the ultimate possessor, take due care of it.

Furthermore, capricious applications for exchange of cookers, coupled with threats of final removal, would be largely eliminated, for the reason that the hirer would feel that he had become so deeply committed in the transaction that he would not be likely to sacrifice the aggregate amount paid in respect of hire-purchase rental. Of course, the overall payments for hire plus energy in the average cases of hire and hire-purchase would be approximately the same, only the allocation being different.

In making my remarks at the meeting, I omitted to make mention of the fact that in connection with my proposals it was my intention that maintenance should be included, as is done in the case of plain hire, except that where the maintenance costs involved were disproportionately high a covering charge would be made.

The outstanding advantages of hire-purchase as opposed to plain hire appear to me to be that the supplier of the cooker is more reasonably secured in the transaction, whilst the consumer who makes abundant use of the supply is recompensed by the lower energy charge. Thus increased consumption is encouraged.

Edward Brown,
Sales Manager.

Electricity Department, Hackney.
January 7th, 1929.

Lamp Trading.

Mr. J. H. Noble once again raises the writer's point under the above heading, and I whole-heartedly agree with your correspondent in his grievance. Has this discount "business" not now developed into a cancerous growth so far as all things electrical are concerned? Lamps, plant, fittings are apparently sold to Tom, Dick, and Harry at discounts, sometimes better than those given to *bona-fide* electrical people. The *bona-fides* of the E.L.M.A. is, I believe, beyond reproach, but this Association cannot take any action against suspected people without absolute proof. It may seem strange that we contractors do not ask our tailor or shoemaker for discount on our purchases, the reason for this being that so many of us are on the point of retiring on our huge (?) profits in order to allow the large poverty-stricken (?) wholesale houses to carry on.

A. Milne.

Glasgow, *January 5th*, 1929.

Thermal Efficiency.

"M.I.Mech.E.'s" query in your issue of January 4th may be answered by the formula—

$$\text{Overall thermal efficiency} = \frac{\text{kWh dd. to outgoing feeders} \times 3{,}412 \times 100}{\text{B.th. units in coal consumed.}}$$

That is to say, the thermal efficiency of a power station is the ratio between the thermal units equivalent to the output (at 3,412 B.th. units per kWh) and the B.th. units in the coal consumed.

Assuming a case in which 2 lb. of 12,000-B.th.u. coal is consumed per kWh delivered to outgoing feeders, the overall efficiency will be—

$$\frac{3{,}412 \times 100}{2 \times 12{,}000} = 14.23\%.$$

M.Inst.C.E.

January 5th, 1929.

The Value of Technical Qualifications.

The writer of the article entitled "A Young Engineer Takes Stock" is much to be congratulated on earning a salary of apparently five to six pounds a week at 29, on having increased his salary steadily, on escaping unemployment—even in the dreadful post-war years, and having gained a considerable variety of experience. He is hard to please. As with thousands of others, I find my salary is less, in spite of exceptional technical attainments and some 10 years of varied experience, and I have had bad runs of unemployment.

Much reflection has driven me to the following conclusions:—

A salary of much over £5 per week is exceptional for young engineers (say, under 35) in the manufacturing side, and this is usually considered good.

There is no appreciable market for wide theoretical knowledge in young engineers such as may be gained in the four or five years day or evening schools. The industry is now so highly specialised that only routine jobs exist for young men, and the slight technical knowledge necessary can be imparted to untrained, but intelligent, men very easily.

That whilst a good training and a variety of experience

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mean much expenditure of time, money, and comfort, they are of little commercial value.

Nothwithstanding the aspirations of fond parents and relations, and the demoralising character of modern thought and literature, a young engineer might well be content with, say, £5 to £6 per week if his job is not greatly exhausting or uncertain.

What do your readers think?

Disillusioned.

January 6th, 1929.

Price-cutting and Unfair Competition.

I am writing this letter to draw the attention of the trade (if that is necessary) to the constant price-cutting that is going on, especially by the big stores. These lines are also meant as a very strong protest against what is very unfair competition.

As an instance, one big store was recently offering in the Press "Oak or mahogany table standards, wired complete with flex, keyswitch holder, and parchment shade, at 6s. 11d. each."

Then, again, another store was advertising the "New Cossor melody-maker" at £6 15s., whereas the retail price is known to be £7 15s. The manufacturers themselves were advertising at the latter figure only last week, nearly two weeks after the store had offered the same thing at £1 less.

Now what chance does a retailer stand, when he relies on his trade discount to pay overhead charges? What confidence has anyone in the electrical industry (or any industry for that matter) to-day, that will encourage him to order goods for stock?

I suggest that the manufacturers are solely to blame, for selling to the stores at prices which enable them to undercut what is considered to be a fixed retail price for a given article.

I have heard manufacturers argue that the stores naturally get preferential terms, as they buy in large quantities. Whilst not agreeing with this justification, I suggest that they buy large quantities with the knowledge that they can easily dispose of them by undercutting. Why do the manufacturers allow this sort of thing? I know a few of them have put their backs up, and will not allow it.

I think the time is ripe when the trade should get together and insist that retail prices should be maintained to the public by refusing to supply any firm disregarding this ruling.

It is not a case of old stock being disposed of, as is proved by the instance of the wireless set above mentioned, which is known to be comparatively new. I know this question is a very large one, and I shall be on the look-out for any other comments of your readers.

S. L.

January 1st, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1927.

15,620. "High-speed commutator switches in television apparatus." J. L. Baird and Television, Ltd. June 11th, 1927. (302,187.)

16,052. "Method of balancing telephone cables." Pirelli-General Cable Works, Ltd., and H T. Werren. June 16th, 1927. (302,373.)

21,042. "Automatic or semi-automatic telephone systems." Associated Telephone & Telegraph Co., and J. Wicks. August 9th, 1927. (302,200.)

21,271. "Electrical conductors and cables." M. A. Bolton and J. W. Walker. August 12th, 1927. (302,202.)

23,197. "Electric radiator fires." S. Z. De Ferranti and Ferranti, Ltd. September 3rd, 1927. (Addition to 300,565.) (302,256.)

23,538. "Devices for transmuting the energy of visible light rays." I. E. McCabe. September 7th, 1926. (277,344.)

23,683. "Electromagnetic apparatus suitable for use as a relay, switch, ractor, or like device." Creed & Co., Ltd., F. G. Creed, W. H. Storey, and R. D. Salmon. September 8th, 1927. (Cognate application 34,152/27.) (302,259.)

23,764. "Liquid-supply devices for electric batteries." J. D. Sartakoff. September 9th, 1927 (302,296.)

23,786. "Fire-alarm systems." Telefonaktiebolaget L. M. Ericsson. September 11th, 1926. (277,362.)

23,948. "Protective systems for electrical circuits." C. M. Longbottom. January 24th, 1927. (284,202.)

24,057. "Variable condensers." C. F. Burton and H. Burton. September 13th, 1927. (302,264.)

24,058. "Rheostats." C. F. Burton and H. Burton. September 13th, 1927. (302,298.)

24,168. "Call-finding arrangements in automatic telephone systems." Siemens Bros. & Co. Ltd., H. E. Humphries, and R. G. Dixon. September 14th, 1927. (302,301.)

24,219. "Ignition apparatus for internal-combustion engines." J. Lucas, Ltd., and E. G. Harris. September 14th, 1927. (302,302.)

24,317. "Electric arc-rectifier systems." British Thomson-Houston Co., Ltd., and J. C. Read. September 15th, 1927. (302,389.)

24,363. "Holders for thermionic valves." Collinson's Precision Screw Co., Ltd., and F. E. Collinson. September 15th, 1927. (302,392.)

24,471 "Electrical signalling or control systems." Aronwerke Elektrizitats Ges. and W. Stern. September 16th, 1927. (302,396.)

24,722. "Insulation material for electrical apparatus." H. D. Symons. September 17th, 1927. (302,397.)

24,727. "Electrical terminals, contacts, or connectors." A. Kirk. September 20th, 1927. (302,405.)

24,777. "Thermionic-valve holders." G. A. Mathieu and S. B. Smith. September 20th, 1927. (302,407.)

24,781. "Fire-alarm systems." Automatic Telephone Manufacturing Co., Ltd. (C. E. Lomax). September 20th, 1927. (302,409.)

25,141. "Vacuum electric tube devices." E. Y. Robinson, E. J. E. Hubbard and Metropolitan-Vickers Electrical Co., Ltd. September 23rd, 1927. (302,418.)

25,498. "Electric relay arrangements." Relay Automatic Telephone Co., Ltd., F. W. Davis and F. A. Wilding. September 27th, 1927. (302,422.)

25,815. "Electric lighting systems for road vehicles." J. B. Saunderson. January 24th, 1928. (302,424.)

26,409. "Covers for joints in electric cables." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. October 6th, 1927. (302,432.)

26,426. "Switches for electric circuits." L. Barrett. October 6th, 1927. (302,433.)

27,034. "Circuit arrangements in automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and A. E. Caswell. October 12th, 1927. (302,441.)

28,073 "Cathodes for gas-discharge vessels." Siemens & Halske Akt. Ges. October 23rd, 1926. (279,497.)

29,190. "Cone-type loud-speakers." W. K. Webster. November 2nd, 1927. (302,459.)

29,866. "Electric switches and fittings therefor." J. Birch & Sons, Ltd., and C. Birch. November 8th, 1927. (302,463.)

30,090. "Electric motor generators." G. H. Fletcher, A. Tustin and Metropolitan-Vickers Electrical Co., Ltd. November 9th, 1927. (302,466.).

30,194. "Lids or covers for galvanic batteries." Oldham & Sons, Ltd., and W. D. Wilde. November 10th, 1927. (302,469.)

31,251. "Secondary or storage batteries." Chloride Electrical Storage Co., Ltd. (Electric Storage Battery Co.). November 21st, 1927. (302,472.)

31,276. "Direct-current excitation of synchronised asynchronous motors." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 21st, 1927. (302,473.)

31,284. "Method of and means for balancing cables and land lines, provided or not with compensating leads and earth cables." H. Tinsley and D. C. Gall. November 21st, 1927. (Addition to 262,991.) (302,474.)

31,798. "Automatic control switch for radio receiving apparatus." M. Fleischamann. November 27th, 1926. (281,320.)

32,111. "Apparatus for receiving transmitting, and amplifying high-frequency and low-frequency electrical currents." R. Deason. November 29th. 1927. (Cognate applications 6,405/28 and 6,406/28.) (302,482.)

32,156. "Construction of dynamo-electric machines." English Electric Co., Ltd., R. D. Ball and H. A. Brown. November 29th, 1927. (302,483.)

32,876. "Electrodes for indication and determination of the chemical composition of liquids." H. S. Hatfield. December 5th, 1927. (302,490.)

33,807. "Low-voltage continuous-current motors." A. V. Keller and B. F. Ancock. December 14th, 1927. (302,497.)

34,790. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. December 22nd, 1927. (302,502.)

34,870. "Manufacture of cathodes for electric discharge tubes." M-O Valve Co., Ltd., and J. W. Ryde. December 23rd, 1927. (302,503.)

1928.

749. "Electrical insulators or the like." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 9th, 1928. (302,507.)

904. "Fuses, fuse boxes, or the like." Soc. C. Schneider et Cie. January 11th, 1927. (283,502.)

3,459. "Automatic multipolar toggle-lever electric switch." W. Leyhausen. February 4th, 1927. (284,716.)

3,976. "Shielding systems for electric discharge devices." British Thomson-Houston Co., Ltd. February 8th, 1927. (285,020.)

4,992. "Insulated electric conductors." Siemens Bros. & Co., Ltd., and A. E. Foster. February 17th, 1928. (302,522.)

5,644. "Electric notors." E. D. Feldman. February 22nd, 1928. (302,523.)

5,956. "Electrical switches." J. T. Welsh. March 2nd, 1927. (286,268.)

6,988. "Process for the manufacture of cathodes for discharge devices." Allgemeine Elektricitäts Ges. March 7th, 1927. (Addition to 268,815.) (286,650.)

8,203. "Manufacture of electric heating resistances." U. Elektro-Heiz Warme Ges. March 19th, 1927. (287,458.)

8,611. "Apparatus for heating rods, tubes, and the like by electricity." E. F. Northrup. March 21st, 1928. (302,529.)

12,358. "Automatic switching systems." British Thomson-Houston Co., Ltd. April 28th, 1927. (289,475.)

13,154. "Electric switches." I. Inaba. May 4th, 1928. (302,538.)

13,653. "Zinc-lead electric accumulators." A. Pouchain. May 19th, 1927. (290,665.)

15,004. "Pressure-applying devices for two or more concentric transformer windings." Akt. Ges. Brown, Boveri et Cie. May 23rd, 1927. (291,011.)

16,582. "Electric heating apparatus." C. G. Nobbs and W. W. Nobbs. June 7th, 1928. (302,550.)

16,900. "Arrangement for the electric control of railway points or other traffic-regulating devices which are required to remain in one position until each passing train completely clears them." W. J. Underwood. June 11th, 1928. (302,551.)

21,441. "Transmission of pictures." British Thomson-Houston Co., Ltd. July 25th, 1927. (294,546.)

25,060. "Vacuum cleaner with two impellers." Siemens-Schuckertwerke Akt. Ges. September 16th, 1927. (297,113.)

30,179. "Direction-finding aerials for use on aircraft." Telefunken Ges. fur Drahtlose Telegraphie. October 19th, 1927. (299,016.)

32,131. "Automatic or semi-automatic telephone systems." Associated Telephone and Telegraph Co., and J. Wicks. August 9th, 1927. (Divided application on 302,200.) (302,217.)

34,265. "Electric current-collecting brushes." Siemens-Schuckerwerke Akt. Ges. November 25th, 1927. (301,084.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned :—

DECEMBER 26th, 1928.

Fultograph. No. 495,269. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Wireless Pictures (1928), Ltd., 11, Bishopsgate, E.C.2.

Disto. No. 496,114. Class 50. Accumulator fillers made of celluloid.—La Société d'Exploitation des Produits Scientifiques, 56, Rue de l'Université, Paris. (British representative: Eric Potter, 11, Park Row, Nottingham.)

The Lightning Electric Slicer (lettering and design). No. 496,157. Class 6. Machines for slicing food.—British Weighers and Slicers, Ltd., Sheffield Road, Tinsley, Sheffield.

JANUARY 2nd, 1929.

Neolux. No. 495,659. Class 13. Chandeliers, lamp shades and supports, electric light fittings, &c.—Louis Dernier & Hamlyn, Ltd., 23, Newman Street, W.1.

Mammoth lamps (lettering and design). No. 480,659. Class 13. Electric lamps (ordinary).—Martin Fraenkel, 5, Siegmundshof, Berlin. (British representatives: Salop Pottery, Ltd., Broseley, Shropshire.)

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALTRINCHAM.—Extension of the County High School for Boys (deposit £1 1s.); F. A. Browne, county architect, Newgate Street, Chester.

AMPTHILL.—Additional 62 houses, for the R.D.C.; surveyor.

AYRSHIRE.—College, for the governors of West of Scotland Agricultural College; Principal Paterson.

BALA.—Extensions, County School for Boys (£6,500); Merioneth Education Committee.

BOLTON.—Works extensions, New Holder Street; Pilkington Bros.

BRADFORD.—Street improvement, with new building, Leeds Road and Bridge Street site; city engineer.

BURNHAM (BUCKS.).—Houses (32), for J. E. Shuttleworth. Four factories, for Slough Estates, Ltd.

BURY (LANCS.).—Extensions, technical college, for the T.C.; borough engineer.

CARDIFF.—Baptist church, Rumney; trustees.

CARSHALTON.—Two schools (1,000 places), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

COVENTRY.—Works extensions for the Maudslay Motor Co., Ltd.; T. D. Griffiths, architect, Hertford Chambers.

DAGENHAM (ESSEX).—Motor manufacturing factory (300-acre site), for Ford Motor Co., Ltd.

DONCASTER.—Four schools (1,760 places), for the borough E.C.; W. Bagshaw, clerk.

DUNDEE.—Shopping centre at Craigiebank housing scheme (£9,500); city architect.

DUNSTABLE.—Works extensions, High Street South, for Cross & Co., manufacturing stationers.

EPSOM.—Clinic, Chase estate (£2,945), for Surrey E.C.; Education architect, Kingston-on-Thames.

FILEY.—Extensions, Hunmanby Hall Secondary School for Girls (£18,000); Wesleyan Methodist Association.

GLASGOW.—492 tenement houses at Haghill, for Corporation (£150,000); director of housing, City Chambers. Cinema; J. Mackissack, architect, West Regent Street.

GUILDFORD.—Technical school; director of education.

HORSFORTH.—Housing scheme (30); surveyor to U.D.C.

HUDDERSFIELD.—Rebuilding business premises, King Street, with electric passenger lift for four floors, and central heating, for Messrs. Alfred Kaye, drapers; Abbey & Hanson, architects, Cloth Hall Street.

HULL.—150 houses, Charterhouse estate; city architect. 34 houses, Westcott Street; city architect. Flats on three sites; city architect.

ILKESTON.—Estate development, off Park Drive; Sir A. Ball.

INVERNESS.—Cinema (£16,000), for Highland Cinema Co.; the secretary.

LEEDS.—76 houses and 36 flats, Hawksworth Wood estate; city engineer. Rehousing scheme, Southfield estate: city architect. Shops and offices, New Street; G. W. Atkinson, architect. Elementary school, Oakwood Lane; Education Committee.

LIVERPOOL.—Housing schemes, Clubmoor (78) and Fazakerley Hall (102) (deposit £2 2s.); acting director of housing, Municipal Buildings, Dale Street.

LONDON (ILFORD, E.).—Tuberculosis dispensary, Cranbrook Street; Essex C.C.

(WEST HAM, E.).—Mental Home, South Ockendon, for the T.C.; borough engineer.

(E.C.).—Premises, Tudor Street; Associated Newspapers, Ltd. Buildings, 29-30, Newgate Street; Moorgate Trust, Ltd., and J. Grossmith & Son, Ltd.

(HORNSEY, N.).—Block of 33 flats (£12,000), for the T.C.; borough surveyor.

LONDON (*continued*).

(ELTHAM, S.E.).—Three-storey school, Ealdham Square, for the L.C.C. Education Committee; director of education.

(SOUTHWARK, S.E.).—Town hall extension; Town Hall Committee.

(WIMBLEDON, S.W.).—Swimming bath, Park estate; borough engineer. Reconstruction, 67, 67a and 69, The Ridgway; E. Iles.

LOUGHTON.—Extensions, high school (£18,820); Essex county architect.

MARKET HARBOROUGH.—Extensions, factory, St. Mary's Road; Harboro' Rubber Co.

MITCHAM.—Two central schools (£37,000); elementary school, Galpins Gardens; extensions, Lonesome School (£5,000); Surrey Education Committee.

MORECAMBE.—Garage, for Stansfield & Sutcliffe, Pedder Street; R. Dobson, architect.

NELSON.—Extension of the town hall; borough engineer.

NORTHALLERTON.—Extensions, County Hall (£12,118), for North Riding C.C.; building surveyor.

ORSETT (ESSEX).—Housing scheme (50), Aveley, for the R.D.C.; surveyor.

OSWESTRY.—Housing scheme (50), St. Martins, for the R.D.C.; surveyor.

PERTH.—Extension scheme (£20,000), for directors of Perth Infirmary; the medical superintendent.

RAMSGATE.—Development of Station site, with band enclosure, baths, shops, &c., for the T.C.; A. Minoprio and Hugh C. C. Spenceley, architects, London. Ladies' pavilion, for the T.C.; W. E. Healey, architect, 119, Grange Road.

RENFREWSHIRE.—Works at Grahamston Foundry, for Grahamston Hosiery Manufacturing Co., Ltd.; the secretary.

ROTHERHAM.—Housing scheme (300), Herringthorpe (deposit £2 2s.); borough engineer.

RUGBY.—Mineral water factory, for Burton & Co.; Willard and Son, architects.

RYDE.—Bank, High Street; London County and Westminster Bank, Ltd.

SALFORD.—Exhibition hall, for a local company; particulars from Councillor J. F. Emery, J.P.

SHEFFIELD.—Workshops for blind (£27,750); housing scheme at Greenhill; further houses, Wybourn estate; city architect. 22 houses, Dykes Hall estate; James Laver and Sons, Ltd.

SMETHWICK.—Extensions, Dartmouth Road works; Birmingham Aluminium Casting Co., Ltd. Extensions, Surrey Works; Evered & Co., Ltd. Works extensions, Beakes Road; World's Wear, Ltd. Central clinic (£12,000); Education Committee.

STIRLINGSHIRE.—Administrative offices, for Stirlingshire Education Authority; architect, Education Authority, Stirling. School at Falkirk (£80,000), for Stirlingshire Education Authority; Mr. Malcolm, architect, Stirling.

STOCKTON-ON-TEES.—Central stores, Wellington Street, for the Co-operative Society; Townsend Gray, architect, Co-operative Wholesale Society, Newcastle-on-Tyne.

THORNBURY (GLOS.).—Additional 54 houses, for the R.D.C.; surveyor.

TRURO.—Hostel, Royal Cornwall Infirmary, with electrical work (£3,000); Cowell, Drewett & Wheatly, architects; J. Williams & Co., builders, St. Austell.

UPTON-ON-SEVERN.—Extensions to Institution (£11,600), for the Board of Guardians; clerk.

WALSALL.—Extensions, school of art (£2,777), for the borough E.C.; Director of Education.

YORK.—Public hall, exhibition buildings site; city engineer. Machine shop, Hull Road; York Engineering and Foundry Co.

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The

Electrical Review

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High-Pressure Cables.

THE successful operation of high-pressure cables is of such general importance that interest in any contribution to the furtherance of our knowledge of the causes of failures is no longer confined to the cable manufacturer alone. We are sure, therefore, that our readers will welcome the article by Mr. C. J. Beaver which is commenced in this issue.

The value of Mr. Beaver's contributions to the literature on cables is universally recognised; it is twenty-four years this month since he read his first paper before the Manchester Section of the Institution of Electrical Engineers. Every word of his many articles bears the stamp of extreme care in preparation, and any statement by him, therefore, must be accepted as being backed by experiment and authority.

The theory has long been generally accepted that the lead sheath of cables is distended beyond its elastic limit due to the expansion of the insulating material under conditions of normal loading, and that voids are thus formed within the cable on cooling. It came as a shock to many, therefore, when, in a contribution to the discussion on the paper recently read by Messrs. Riley and Scott before the Institution of Electrical Engineers, Mr. Beaver stated that this theory was not borne out by experiments which he had carried out. In the course of their reply the authors said: "Although, therefore, we do not wish to suggest that Mr. Beaver has not taken every possible precaution in carrying out the experiments, we feel that there must be an explanation for the results other than that which he has put forward." Doubt also was expressed by Mr. Höchstädter. Such an important matter, of course, could not be left in that position, and we welcome the opportunity of publishing Mr. Beaver's article describing his further experiments and conclusions.

We have no doubt that this article will give rise to considerable comment, but we content ourselves with drawing attention to just one point. Mr. Beaver assumes that the maximum working temperature of

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33,000-volt cables will be less than 50 deg. C., and gives authority for this assumption. We are aware of a very large user of cables who specifies that the cables supplied to him for this working pressure shall be suitable for a maximum operating (copper) temperature of 60 deg. C. continuously, and 65 deg. C. for short periods. Further, though perhaps scarcely relevant, it is interesting to note that the manufacturer's guarantee for the 132,000-volt New York and Chicago cables is stated to include a maximum allowable copper temperature of 65 deg. C. (*vide Journal* A.I.E.E., Vol. XLVII., page 125).

In his conclusions Mr. Beaver claims to have "proved, indicated or suggested" that under normal working conditions of load in high-voltage cables, the internal pressures produced are insufficient to produce permanent distension of the lead sheath; but, with a caution reminiscent of the Irish toast, "May you *never* die, and when you *do* die, &c.," he further claims that the troubles may be got over by substituting hard-lead alloy for lead, and by employing the method of prior-impregnated dielectric in preference to the more usual vacuum (*en masse*) impregnated type. As is well known to many of our readers, Mr. Beaver has employed this prior-impregnation method exclusively for the past thirty years, and his claim (which is borne out by the curves in the article) that this method of application has a distinct advantage as regards pressure variation within the cable sheath is of high interest.

We commend the article to our readers' careful perusal as a communication of the first importance, and shall welcome correspondence on the subject.

Sir Basil Blackett's Appointment.

THE appointment of Sir Basil Blackett—or to be strictly accurate the approval by the Government of his nomination—as chairman of the Communications Company which is to be formed, marks an important stage in the progress of the scheme which began to take shape just over a year ago. In our first leading article dealing with the subject (December 9th, 1927), under the title "Competition or Co-operation," we advocated co-operation "rather than destructive or ruinous competition," and we find in one of the first Press statements attributed to Sir Basil after the announcement of his appointment the remark: "the whole purpose of this merger . . . is to substitute for uneconomic competition . . . a co-operative development of the telegraphic communications of the Empire." He describes the function of the new company as "an inter-Imperial public utility service." There will be plenty of room for the co-operative spirit between the respective parties over whose deliberations Sir Basil will preside. He states that a little time will be occupied in the completion of formalities connected with the setting up of the company. He and those associated with him have a great and grand task before them full of important potentialities for good for the whole British Empire, and we wish them every success, for that success will mean that one of the big economic questions of the Empire has been solved by providing the best facilities for keeping the whole British family in efficient and economical touch and for safeguarding strategic interests.

The Gas "Grid" Coming?

WITH the memory of the Holborn gas explosion fresh in mind, and several other serious fatal accidents due to gas within a few weeks, we note with interest that the Gas Light and Coke Company, the biggest gas company in the world, which already supplies gas over an area of 265 square miles, is seeking powers to increase the area to 450 square miles. Simultaneously the Government has appointed a Committee to carry out a recommendation of the National Fuel and Power Committee last year, that an investigation should be undertaken regarding the technical and economic aspects of an "area gas supply system" comprising an interconnecting network of pipe lines fed by a number of gas works, coke ovens, and the like (ELEC. REV., September 28th, 1928, p. 529); and the gas industry for months past has been hammering at the door of the Cabinet, demanding legislation to remove the anomalies under which it is said to labour. In the second report of the National Fuel and Power Committee, which was issued last week, the proposals for amending existing legislation which were put forward respectively by the National Gas Council and the Board of Trade were reviewed, and were in the main commended as designed to simplify and cheapen the procedure for obtaining additional powers, to extend the thermal system of charging for gas, and to enable the Board of Trade to deal with various matters in which at present it has no authority to act. One of the innovations would be the power to charge for gas on the two-part tariff system. It may be admitted that in some respects the existing Acts do place the gas industry at a disadvantage; but whether Government intervention will prove beneficial to it, or the contrary, is a moot question. The electrical industry has "enjoyed" plenty of it, and has been accorded the ironical congratulations of its friends in the gas world; the last dose (1926) may or may not have been wholesome—it was certainly unpalatable, and during 1928 there has been a general advance in the value of gas securities, showing that the position of our rivals has not suffered from the "favouritism" (!) displayed by the Government towards electricity.

As for the proposed network of pipes, extending over long distances, the fact that gas can be economically stored, and thus the pipe lines can be run at a high load factor, is in its favour. The lack of storage on a large scale is the fundamental handicap of electricity supply, which necessarily lives from hand to mouth; were that disability removed, what an immense impulse would be given to the electrical industry!

The Fittings Statutory Committee.

IN March last we published the announcement of the Electric Fittings Statutory Committee that it was ready to commence operations, and expressed the opinion that it was not likely to be overworked; the first report of the Committee has now been issued, but does not appear to add much to our information, as it covers the nine months ended March 31st, 1928, and is dated June 6th. The report states that the Committee endeavoured to draw up a list of recognised prices of "all goods covered by the statutory term 'fittings'", a feat which, we are not surprised to learn, proved to be impracticable; it was therefore decided to abandon this proposal and to determine prices in respect of individual transactions when the need arose. No complaint of underselling had been submitted up to the end of the session. An Installations Sub-Committee was appointed to ascertain whether and on what terms agreement could be reached between municipal authorities and contractors as to the prices to be charged for installations, a question which was under discussion at March 31st. Apart from the work of organisation, that concludes the business for the period covered by the report. The members of the Committee are to be congratulated on their assiduity, as their attendances at meetings aggregated 88 per cent. of the possible number.

In our previous reference we said that the absence of occasion for the Committee to exercise the functions of an arbitrator would indicate the existence of a state of perfect peace in municipal areas; we hope that the lack of incident in the report justifies that inference.

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The Brisbane Power Station.

The first section of the new Brisbane (Australia) electricity works is equipped with two 7,500-kW turbo-alternators and three 44,000-lb. boilers.

By G. R. STEER, M.V.O., M.Inst.T.

THE Brisbane City Council's new power station at New Farm has been designed to supply the whole of the electric current used for tramway purposes in the city, and also the lighting and power requirements of the district of Ithaca to commence with, and of other suburbs when the present contracts expire. The contract for the supply of machinery and equipment was let in December, 1926, and pile driving for the foundations was commenced in the following month. In January, 1928, steam was raised for the first time, when the testing of the turbines and other plant commenced. Meantime, the laying of the high-pressure cables was proceeding under the supervision of the City Council's electricity supply department, and the erection of the converting sub-stations was being carried out by the tramways department. In April, current generated at New Farm was used for the first time for the trams, and in June the official opening ceremony was held and the plant went into continuous service.

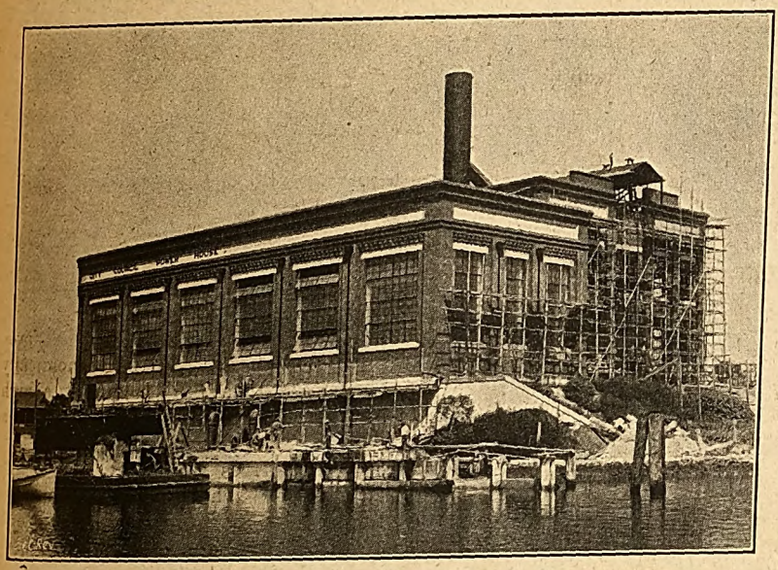

Fig. 1.—Power House from River, during Construction.

The station, figs. 1 and 6, is situated on a bend of the Brisbane River adjoining New Farm Park, this site being selected on account of the facilities for coal supply by rail and for obtaining plentiful supplies of river water for the condensers, as well as its nearness to the points to which electrical energy will be supplied. The building is divided into two main portions, the turbine room and the boiler house. The former measures 120 ft. by 72 ft., while the latter covers an area of 95 ft. by 90 ft. Two turbo-alternators, figs. 3 and 4, normally rated at 7,500 kW each, with a maximum continuous rating of 9,375 kW, 11,000 V, 3-phase, 3,000 r.p.m., 50 cycles, by the British Thomson-Houston Co., Ltd., together with the necessary auxiliary equipment and boilers, are at present installed, while there is space inside the existing building for the installation of a third generating unit of double the capacity of the existing machines. Tenders for this unit have already been called, and it is intended that it should be in operation before the end of 1929. Its foundations have already been provided, and the foundations under the present generators have been designed and built to carry machines of double the capacity if it is desired to replace them in the future. Sufficient ground is available for extension of the power house in the future for a total capacity of five generating units. Future extension of the station buildings will take place in the south-west direction. To carry the weight of the power house, with its machinery, about 800 ironbark piles, averaging 50 ft. in length, have been driven, the ground consisting of a stiff clay of good bearing qualities. The brick walls of the building, and all heavy machine parts, rest on solid concrete reinforced with old steel tramway rails. The floors (except the basement) are of reinforced concrete, supported on fabricated steel joists and columns.

Protection of the power house from stoppage or damage by abnormal flood has been secured by making the turbine room water-tight up to the turbine-floor level. The brick walls up to this level are of sufficient strength to resist water pressure, and the few pipes which of necessity pass through these walls are provided with valves which can be closed when required. Natural lighting is availed of to the fullest extent, all outside walls being provided with large windows of reinforced translucent glass, and roof lights are also provided.

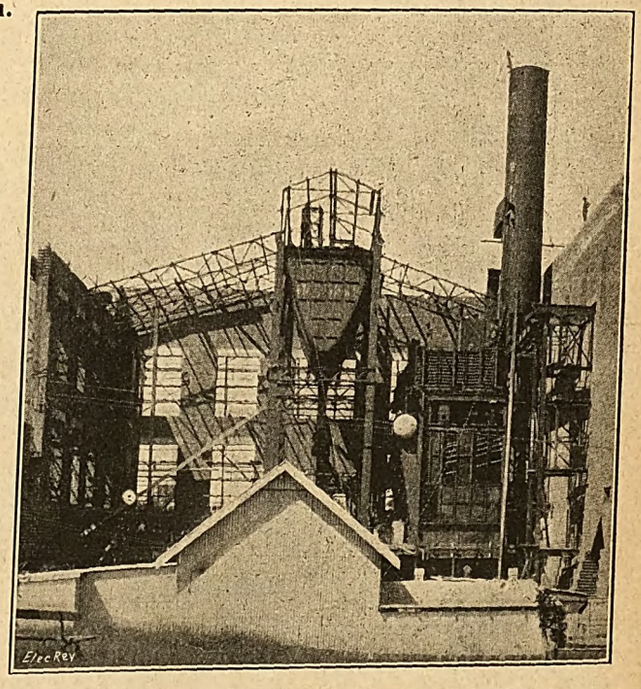

Fig. 2.—Boiler House and Plant, under Construction.

Coal is conveyed to the power house in railway hopper-trucks, which can be pushed by the locomotive or hauled up a slight incline by an electrically driven

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capstan, and then emptied into a concrete hopper, from which the coal is taken by a bucket conveyor to the 400-ton bunker in the boiler-house roof, 70 ft. above ground level. This bunker is of catenary shape, and is constructed of steel plates lined with concrete. It holds sufficient coal to keep the power house in operation for about a week with the present conditions of load. From the bunker the coal falls by gravity down metal chutes to two small hoppers on each boiler, from which it is distributed uniformly on to the travelling chain grates, of which there are two per boiler, each with an area of 6 ft. by 20 ft. The ashes are discharged into an ashpit underneath each boiler, from which they are taken in small trucks and elevated by an electric crane into an ash bunker, underneath which motor lorries or railway trucks can be brought. This crane also serves to transport coal from the railway siding and a reserve heap to the power house yard. Approximately half a mile of railway track has been laid down on the property for handling the coal and ash trucks.

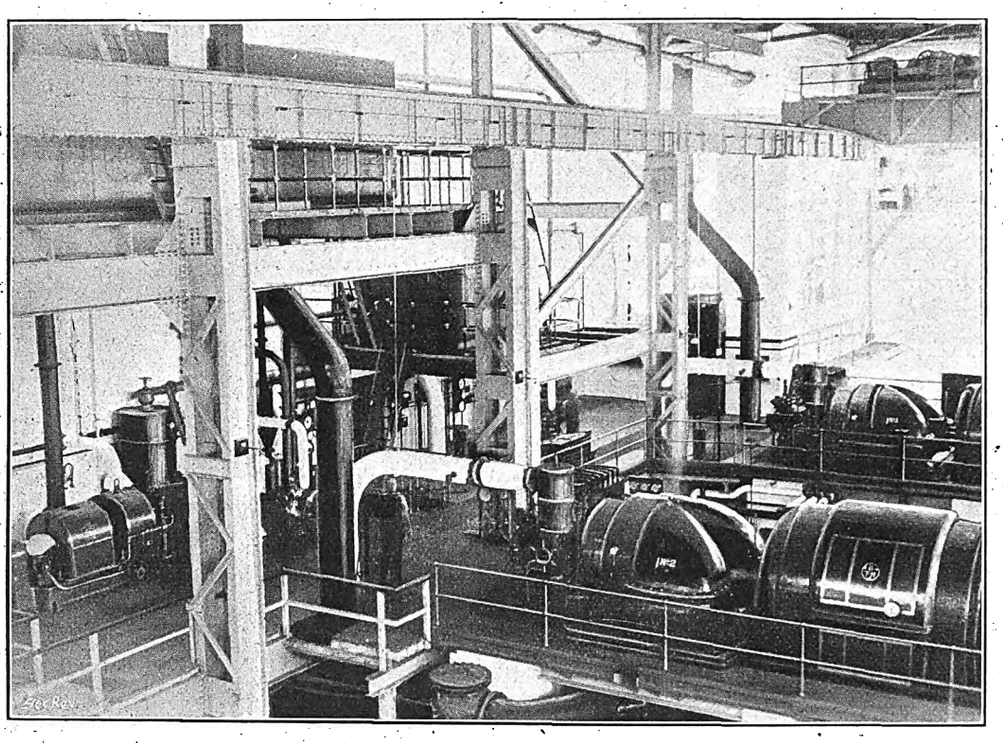

Fig. 3.—Turbine House and Pump Room.

The boiler house contains three Babcock and Wilcox boilers of the single-drum marine type, fig. 5, each having a normal evaporation of 44,000 lb. of steam per hour at a pressure of 300 lb. per sq. in., and a temperature of 700 deg. F. Each boiler has a heating surface of 6,620 sq. ft., and is fitted with a cast-iron horizontal tube economiser of 3,881 sq. ft. heating surface, and a superheater of 3,318 sq. ft. heating surface. Each chain grate is driven by a 1½-h.p. induction motor through a four-speed gear box. Each boiler has its own induced-draught fan, of Sirocco make, driven by a 42-h.p. induction motor and discharging into a chimney stack, 60 ft. high, there being one chimney per pair of boilers.

Two steam-driven rotary pumps, each capable of delivering 132,000 lb. of water per hour, are installed for delivering feed water to the boilers, which are fitted with Copes feed-water regulators, while a Weir evaporator is provided for dealing with the make-up water. A 20,000-gal. raw-water storage tank supplies water to the evaporator, and steam is supplied, either from a saturated steam connection on the boiler drums, or from a bleeder connection on the turbine. The vapour from the evaporator, together with the exhaust from the feed pumps, is condensed in a heater condenser, the heat being used for feed-water heating. Air extraction from the condenser is carried out by a two-stage steam-jet air ejector of the "compactum" type, the steam jets being condensed by circulating condensate through the apparatus. The heater drains are returned to the condenser through a sealing tank. A surge tank is provided to give flexibility between the condensate pump and boiler feed pump, while the level of the water in the surge tank controls the supply of steam to the evaporator by means of a float-controlled valve. Fig. 2 shows the boiler house, boilers and bunkers during construction.

High-pressure switchgear of the compound-filled type, fig. 4, with duplicate busbars, is used to control the current between the generators and the eight 11,000-V underground feeder cables leading to the sub-stations. Each generator is fitted with circulating-current protection operating in conjunction with field-suppression equipment. Stand-by overload and earth leakage protection with a fixed time delay is also provided, and the generator neutral is earthed through a resistance of 11 ohms. The outgoing feeders are protected by induction-type overload and earth-leakage relays with d.c. trip coils, a 24-V battery being provided to operate the latter. This switchgear is, for the present, hand controlled and mounted on the turbine-room floor, but it will later be transferred to a permanent switch-house in which the control gear for all generators, feeders and equipment will be housed.

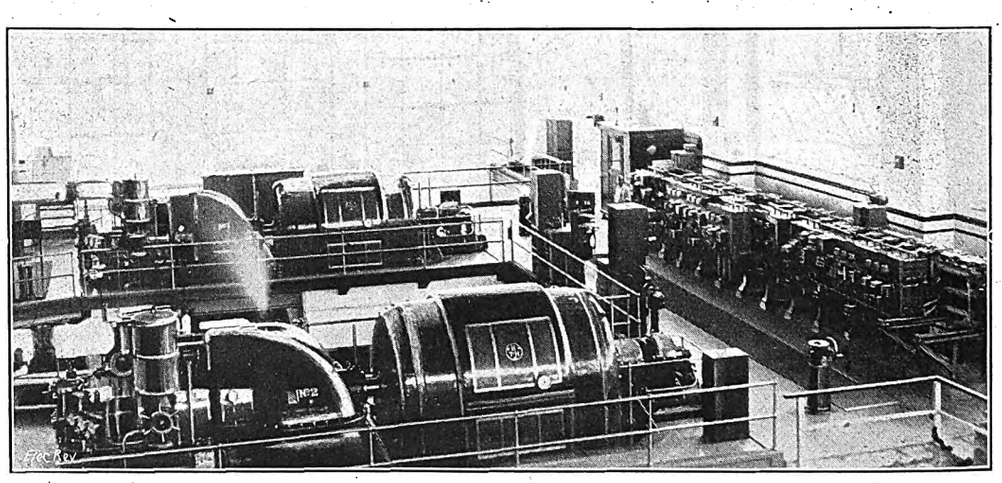

Fig. 4.—Turbine Room, showing H.P. Switchgear.

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All the auxiliary motors, with the exception of the two steam-driven boiler feed pumps, are electrically driven, the essential ones being supplied at 415-V three-phase a.c. from either of two step-down 500-kVA transformers energised from the main station busbars. Certain non-essentials, such as the turbine-room crane, air compressor, coal- and ash-haulage capstans, and the ash-handling crane, are d.c. driven, being supplied at 600 V from the nearest tramway sub-station. A 200-kW, 415-V a.c. turbo-generator exhausting to atmosphere is provided for the purpose of starting up the station when the busbars are dead.

The main condensers were built by Messrs. Britons, Ltd., Sydney, together with the circulating-water pumps, each of which is driven by a 90-h.p. B.T.H. induction motor, and is capable of delivering 10,000 gal. of water per min. The circulating water is taken from the river through two 24-in. cast-iron pipes from a concrete intake chamber built about 60 ft. out from the river bank and fitted with removable vertical metal screens. The warm water, after passing through the condensers, is discharged into a large cylindrical chamber from which it flows through a 36-in. concrete pipe to the river. The discharge outlet is shielded from the suction chamber by a concrete wall, 180 ft. long, parallel to the river bank, the whole being supported on reinforced-concrete piles.

A 40-ton overhead travelling crane is installed in the turbine room for handling all heavy lifts, and a loading dock with access both by road and by rail is provided at one end of the turbine room, so that machinery and supplies can be lifted by the crane directly out of lorries and railway trucks and placed wherever required. Accommodation for the power-house staff has been provided at the other end of the turbine room along the temporary end wall.

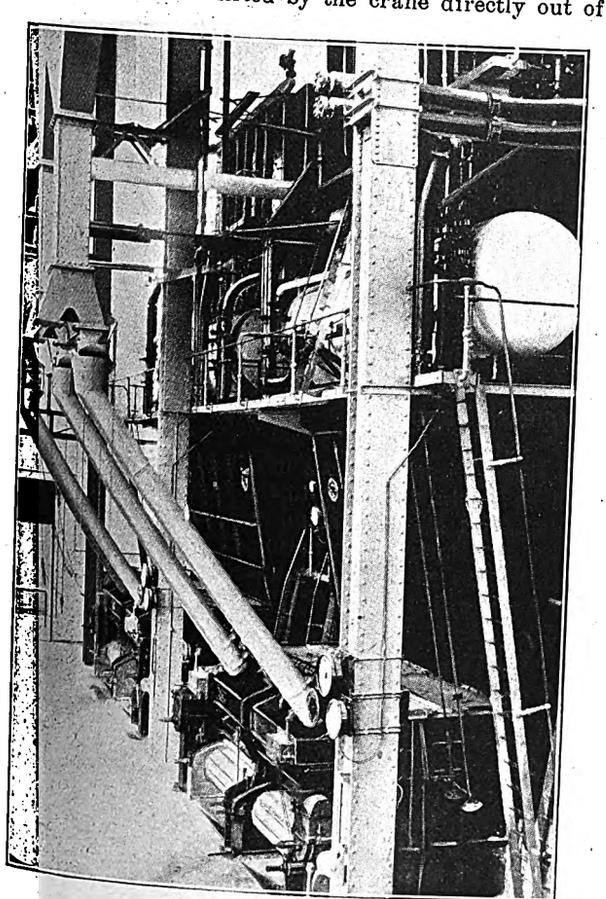

Fig. 5.—Boiler House; Interior.

The plant is fully equipped with modern measuring instruments to secure efficiency and economical working, among which are included steam pressure, temperature and vacuum recorders on each turbine, steam flow meters on all turbines, feed pumps and boilers, multi-point temperature recorders for each boiler and a combined indicating and recording CO_2 and CO measuring equipment of the "Cambridge" electrical type for all boilers.

Fig. 6.—Power Station, showing Coal- and Ash-handling Plant.

The general design and layout of the plant was carried out by Mr. C. J. Lees, M.I.M.E. (supervising engineer of the New South Wales Railways and Tramways), and Mr. W. A. R. Kerle (assistant divisional engineer of the New South Wales Railways), and the erection was directed and supervised by Mr. W. Arundell, M.I.E.E., M.I.E.Aust. (chief engineer), and other officers of the Tramways Department of the Brisbane City Council.

The Australian General Electric Co., Ltd., was the principal contractor for the plant, the sub-contractors being Messrs. Babcock & Wilcox, Ltd., for boiler plant, and Messrs. Britons, Ltd., for the condensing plant.

Swiss Railway Electrification.

At the end of 1928 the first stage in the electrification of the Swiss Federal Railways came to a close, and with it the heaviest expenses that the Confederation will have to face in this particular project. The electrification has cost Switzerland less than was expected, the figure being 550,000,000 Swiss francs, instead of 700,000,000. It is calculated that the sum which will be saved on imported coal during the forthcoming year will not be less than twenty million francs. Upkeep of rolling-stock, too, is far less costly, and the electrification scheme has enabled the C.F.F. to reduce the number of hands employed. National industry has also received a fillip as a result of the enterprise; the greater part, if not all, of the 220,000,000 francs spent in buying equipment has remained in the country. When the machines at present under construction have been delivered, the C.F.F. will have no fewer than 55 motor coaches and 367 locomotives. Fifty of these have been specially constructed for the traffic on the St. Gothard section, with a speed of 75 km. per hour; 236 of the machines run at 90 km. an hour. Sixty locomotives for express trains are furnished with a patent safety brake to be used when running with one-man control. The amount of electricity used per kilometric-ton is 46.4 kWh, so that in 1929 it is calculated that the C.F.F. will need 520,000,000 kWh. When the new power houses planned at Etzel and Rupperswil are finished, the C.F.F. stations will be able to supply a total of 700,000,000 units per annum.

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The Physical Behaviour of Lead Sheaths in Relation to Failures of High-Voltage Cables.

The author suggests that the alleged creation of voids in normal cables as a result of permanent distension of lead sheaths is a view which distinctly lacks foundation.

By C. J. BEAVER, M.I.E.E.

IN the recent extensive discussions which have taken place throughout the world on the subject of high-voltage cable failures, the most noticeable feature has been that the general consensus of opinion points to ionisation of occluded (*ab initio*) air and gases, and of "voids" formed subsequently in the course of operating the cables, as the ultimate, or at least the penultimate, cause of breakdowns. From this it will be noted that manufacturing methods are impeached so far as *original* occlusions are concerned, while as regards the supposed *subsequent* creation of voids, the suitability of the materials to withstand the effects of cycles of heating and cooling is clearly called into question.

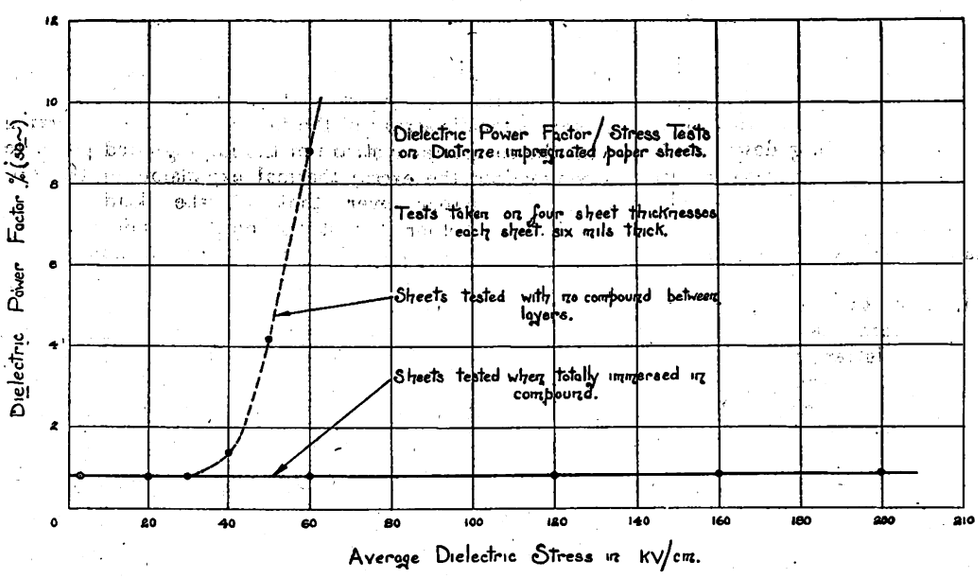

Fig. 1.—Effect of Air Occlusions in Laminated Impregnated Paper.

Examination of the patent literature of the subject of high-voltage cables reveals strenuous efforts to minimise the *original* occlusion of ionisable matter in the dielectric, and incidentally shows in all its nakedness—often out of the very mouths of those who employ it—the inefficacy of the ordinary *en masse* method of vacuum impregnation of the dielectric. For example, one important specification reads: "The objection to this method is that the whole cable is submerged before the paper is fully impregnated and that traces of air or moisture may thereby be trapped in the paper by the compound entering, and may not subsequently escape although a vacuum is maintained above the compound."

Again, to quote another specification: "Known treatments theoretically should result in all the air being drawn out from every part of the cable, its place being taken by the compound; but because of the difficulty of sucking compound through the paper walls it has never yet been found practicable absolutely to replace all the air." And later in the same specification, referring to the physical properties of the impregnating material: "A large amount of compound usually runs out from the interior of the cable when it is withdrawn from the vacuum tank prior to being lead-covered, and this is difficult to avoid, because if the paper were sufficiently close to prevent the compound running through it, it would probably be sufficiently close to prevent drawing the compound through it into the interior of the core."

To quote from another sphere of literature, a succinct statement on the subject was made by Emanueli in his paper[1] on "The 132,000-volt Cable Lines in New York and Chicago" as follows:—"The gas occlusions left in the insulation during the construction are due to many causes:—

"(1) The vacuum, which may be built up in the impregnation tanks, is never perfect.

"(2) The compound which is used to impregnate the cable contains a large quantity of gas in solution. This gas is set free during impregnation, and diminishes the vacuum in the core.

"(3) When the cable is lead sheathed the insulation is still warm, and empty spaces may be created by the subsequent contraction of the compound."

Even after making due allowance for the natural vehemence of the inventor about to describe an improvement, modification or departure, it will be fairly apparent to the impartial observer that these expert statements indicate the practical impossibility of ensuring elimination of the said occlusions by the ordinary *en masse* vacuum process of impregnation; and equally, it can hardly escape his notice that the undesirable features enumerated will be accentuated as the working voltage—and consequently the radial thickness of dielectric—is increased.

The manner in which occlusions of air affect the quality and consequently the life of laminated paper insulation (comparable with that in an impregnated paper cable), can readily be demonstrated by a simple experiment, as illustrated in fig. 1, which, for present purposes, is self-explanatory. It will be clear that in the case of the impregnated papers with no compound between, the occluded air begins to become ionised at about 30 kV per cm. At a stress of 60 kV/cm. the loss of energy in the air occlusions due to ionisation is eight times as much as in the dielectric proper, and the consequent charring at the boundaries of the air pockets—due to the highly localised release of energy—is leading on to inevitable breakdown; whereas in an air-free con-

[1] I.E.E. informal discussion, February 27th, 1928.

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dition (*i.e.*, the case in which the air films between layers are replaced by impregnating compound), and under the same conditions of mechanical pressure of electrodes, &c., no sign of such incipient breakdown is traceable up to at least four times that value.

The comparison to which fig. 1 relates affords a striking illustration of the futility of pursuing ultra-refinements as regards dielectric materials unless complete evacuation is ensured in the ordinary vacuum (*en masse*) impregnation process, or air-free assembly in the prior impregnation process; or conversely, it demonstrates that the intrinsic excellence of dielectric components may be utterly wasted in the presence of occlusions of air and gases, and of electric stress conditions which may be sufficiently high to ionise them, although absurdly low for the purposes of stability at high working voltages.

With regard to the prevention of the *subsequent* formation of ionisable voids, many patents bear on oil-duct forms of cable in conjunction with reservoir systems which are designed to maintain a head of oil therein, while a number of suggestions aim at restricting, modifying or compensating the expansion and contraction effects which are alleged to contribute largely to such void formation. The means adopted for the latter purpose chiefly take the form of metal strappings of high tensile wire or strip applied over the lead sheath. Thin copper strip wound over the dielectric has been used, with the idea of providing an outer electrostatic boundary which will follow the expansion and contraction of the dielectric and render it independent of the lead sheath.

It is undoubtedly true, as shown by statistics, that a large proportion of the total failures occur at periods of light load following periods of normal working: that is to say, when the cables are cooling down, and when, therefore, the pressure in existing cavities is being reduced, thus rendering them—according to well-known laws—more susceptible to ionisation.

Of the two kinds of ionisable space above referred to, *i.e.*, those originally occluded (or arising from aggregation of such occlusions), and those subsequently formed, by far the greater prominence has (perhaps not unnaturally) been given to the latter; and the most deeply rooted conception and most generally accepted statement regarding this alleged subsequent formation of voids in an impregnated paper dielectric has been that after expansion by heating and internal pressure under load conditions, the lead sheathing suffers permanent distension, due to its failure to retract to its original dimensions on cooling. Two or three fairly recent examples of statements to this effect may be quoted as typical.

Riley and Scott, in their paper on "Insulating Oils for High Voltage Cables,"[2] explain the alteration in the power factor/voltage characteristic in a certain cable which had been heated to 60 deg. C. (140 deg. F.) as follows:—

"During the heating, the compound expands and distends the lead. After cooling, the lead does not return to its original dimensions, and as the compound contracts, voids are formed in the cable."

The grounds for this conclusion are not given, and it can only be assumed in the absence of evidence that permanent distension had really occurred that the statement is merely speculative, as at least one alternative conclusion is tenable.

R. W. Gregory,[3] in the discussion on Riley and Scott's paper above mentioned, said:—

"I am glad to see that they have mentioned the most important cause of breakdown of so many well-built cables, namely, the expansion of the compound when heated and the resultant permanent stretching of the lead sheath."

N. A. Allen,[4] in a communication on Dunsheath's paper on "33,000-volt Cables with Metal-sheathed Cores," states:—

"The chief cause for vacuous spaces, however, and one which is absolutely unavoidable in any cable whatsoever, is entirely omitted from the list, *viz.*, the expansion of the impregnating oil during heating with load . . . The coefficient of expansion of the oil is many times greater than that of the lead. To allow of the oil expanding as the cable heats up, the lead expands beyond its elastic limit and is permanently enlarged."

Emanueli,[5] immediately following his previously quoted remarks on the causes of gas occlusion during manufacture, proceeds to state with regard to the creation of voids during operation:—

"There is another well known cause of the formation of empty spaces during the operation of the cable. When under load the cable becomes warm, the compound expands, forcing the lead sheath to increase in diameter; when the cable cools down the lead sheath does not regain its original diameter, and causes the formation of new empty spaces."

It is an extraordinary fact that although this statement is being constantly reiterated, experimental evidence of a quantitative character has never, to the writer's knowledge, been adduced in support of it;[6] and as in many minds it has been the turning point of general ideas and conceptions as to the inevitable limitations of high-voltage insulated cables, it is clearly of the utmost importance that this crucial matter should be elucidated. Consideration of the broad question will show that the fundamental facts are as follows:—

When a cable is subjected to heat, all of its constituents tend to expand. The thermal expansion of the impregnated paper exceeds that of the other materials, and a state of equilibrium inside the cable is attained when the internal pressure thereby set up produces sufficient tensile strain of the lead sheath in conjunction with the compressive strain of the impregnated paper to accommodate the excess thermal expansion of the impregnated paper over that of the lead sheath. Obviously, whether the strain on the lead sheath is purely elastic or a combination of elastic and plastic strain (entailing permanent distension), depends solely upon the quantitative values of the factors involved.

One has only to visualise the construction of an impregnated paper lead-sheathed cable, with its spirally disposed components and indefinite internal compressibility, to realise that mathematical investigation is of little or no help in prognosticating the degree of diametral expansion which may be brought about by raising the conductor temperature, even though the coefficients of expansion of most of the materials concerned may be accurately known.

It requires little consideration to realise that because of the spirality of the stranded conductors and of the paper strips lapped upon them, and the further spiral arrangement of the insulated cores, the lateral component of the volumetric dilatation must be very different to that of a rigid bar, which is the only basis on which calculations of linear expansion can be made.

The conditions are such that the production of a lateral resultant of the total cubical expansion is facilitated; while on the other hand, by reason of the ductility of lead, it is easily checked or diverted by any external resistance which opposes movement. This has been experimentally demonstrated by the writer,[7] but is not peculiar to the high-voltage cable. It constitutes the reason why cables at all voltages have withstood the vicissitudes of expansion and contraction without

[2] *Journal* I.E.E., Vol. 66, No. 380, p. 809.
[3] *Journal* I.E.E., Vol. 66, No. 380, p. 837.
[4] *Journal* I.E.E., Vol. 65, No. 365, p. 481.

[5] *Ibid.*

[6] The writer's attention has since been called to an article entitled "Sur la stabilité en service des cables souterrains pour transmission d'energie," by M. Höchstäder and R. Barrat, in the *Revue Générale de l'Electricité*, dated December 31st, 1927, Vol. 22, p. 1175. As the theoretical treatment in this article is based only on coefficients of expansion and neglects elasticity of the lead sheath and compressibility of the dielectric, and as the numerical data from experiments are meagre, and, moreover, no indication is given regarding the experimental conditions, nor as to how the "augmentation relative du volume" was measured, no variation of the above statement appears to be called for. Certain reference will be made later to the general purport of this article.

[7] *Journal*, I.E.E., Vol. 53, p. 65.

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disastrous results, or even a relatively appreciable amount of trouble, for the greater part of half a century.

Most operating engineers will agree that under the loading conditions obtaining in average British practice, and in proportion to the mileage of cable in use, expansion troubles are almost negligible, except where conditions of laying or fixing (*i.e.*, conditions external to the cable) are such as to facilitate one phase of the expansion and contraction cycle and oppose the other. Examples of this are almost entirely confined to drawn-in systems, in which the facilitated conditions above mentioned may apply to complete draw lengths when the duct line is on an appreciable slope; or, in the case of a flat contour, to parts where the resistance to movement varies; for instance, where the cable leaves the duct to enter a manhole. In each of these cases it will be noted that the conditions are such that greater resistance is opposed to retraction than to expansion.

This general experience proves that lateral expansion due to heating does not, under average conditions of cable usage, lead to permanent or cumulative longitudinal distension. If further practical proof is required, the domestic lead hot-water supply pipe, with its far higher temperatures and frequent cycles of heating and cooling, would appear to furnish it; for it is common knowledge that under the usual conditions of uniformly intermittent fixing or anchorage, there will be no apparent lateral distension after forty or fifty years' service. The important point in the present connection is that the relative effect of this lateral component of the total cubical expansion is often overlooked, although *per contra* it is sometimes overestimated in attempts to account for breakdowns. Turning to the diametral component, it will be readily apparent that the modern high-voltage cable, with its greatly reduced content of occluded air and gas in the dielectric, is on a different plane to the old low-voltage cable so far as the internal radial pressure is concerned, because the easily compressible gaseous matter which existed in the latter is replaced in the former by relatively incompressible matter, and the radial pressure caused by the "solid dilatation" of the non-gaseous material will obviously be greater. While this broad fact is generally recognised, it is not usually appreciated that a certain degree of compressibility remains, owing to the physical characteristics of the cellulose constituent of the dielectric. This is well exemplified in the experiments of Dr. P. Junius,[8] in which the progress of elimination of air was traced by capacity measurements on cables during the vacuum impregnating process. Plotting capacity against time, Junius produced curves of exponential type, and showed that after the impregnation was well advanced an abrupt rise in value could be produced by breaking the vacuum. On renewing the vacuum the value was shown to fall back to a point lying on a continuation of the curve. This is illustrated in fig. 2, which represents one shown by Junius in the article referred to. The author concludes that if the capacity/time relation followed a linear law, a point would be reached at which no rise of capacity would occur on breaking the vacuum, and which would represent the attainment of complete impregnation. He deduces that the ideal air-free dielectric cannot be produced by vacuum impregnation.

The point of interest in the present connection, however, is that the variation in value of the dielectric constant with the pressure in the impregnating chamber is undoubtedly due to the expansion and contraction (at constant temperature) of the occluded air in the dielectric, and therefore a certain degree of compressibility is shown to exist in the paper component of the dielectric. The question of factors on which this degree depends is rather outside the present scope, but it will be clear that the extremely small canals and cells in the individual fibres of the paper (which are often completely enclosed in the cellulose walls) will always represent the irreducible minimum with regard to evacuation so long as paper is used in its present form, and there will in consequence remain a certain degree of compressibility—varying in different classes and makes of paper—apart from that of the cellulose substance itself, the value of which will be very difficult to differentiate therefrom. It may be noted that even if the enclosures above referred to are appreciable *in toto*, the employment of an impregnating compound which is highly viscous under the maximum working temperature conditions will ensure that they can never aggregate as they would tend to do in a thin mobile medium, so that even

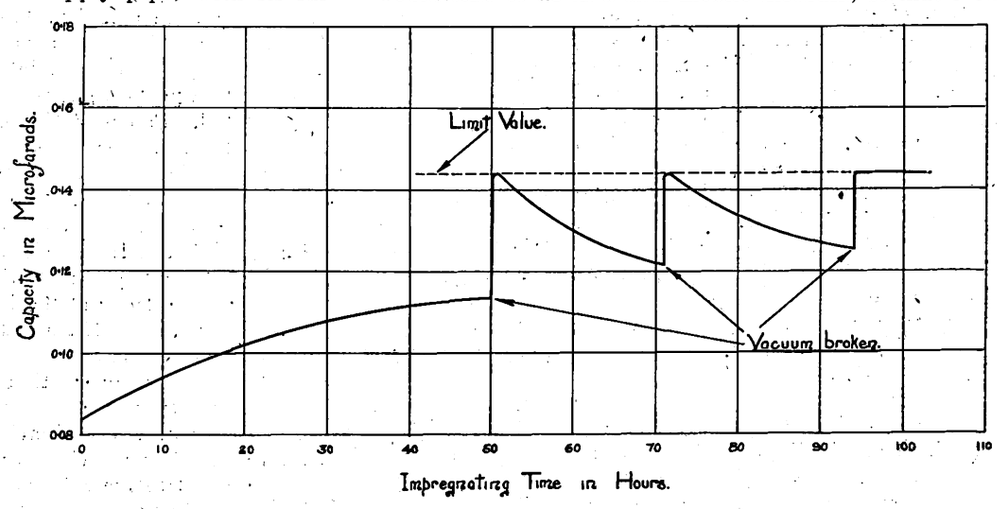

Fig. 2.—Junius' Experiment, based on Compressibility Effects.

though the dielectric is to some extent intrinsically heterogeneous, it can by suitable design and manufacture be made uniformly free from susceptibility to the aggregation which is undoubtedly the prelude to ionisation, as experimentally demonstrated by the writer.[9]

On this matter of aggregation, Emanueli,[10] referring to the vacuum *en masse* method of impregnation, says:—

"It is quite probable that the dielectric of the cable would not be spoilt by the presence of the gas occlusions if these built up, during the contraction of the insulating compound, in small bubbles uniformly distributed all through the insulation, but this, unfortunately, is not the case in cables made in the ordinary way."

Apart from these, as it were, microscopic ramifications of the dielectric-material question, the physical consistency of the impregnating medium influences to some extent the actual radial pressure on the interior surface of the lead sheath. For example, if the compound is solid or highly viscous, it will remain in its original position in the form of films of a capillary order of thickness, between the layers of paper, causing each layer to be separately compressed by the pressure due to the compound film on either side of it. In other words, if the impregnating medium is not liquefied by the heat from the conductor, there will be a fall of pressure across the dielectric, just as there is a fall of temperature. On the other hand, with a thin oily medium the pressure due simply to the coefficient of expansion of the oil will be directly transmitted to the lead sheath by paths between the laminations and through the gaps between the edges of the spiral convolutions of the paper.

(To be continued.)

[8] E.T.Z., April 19th, 1928, p. 604.

[9] *Journal*, I.E.E., Vol. 66, No. 380, p. 831.

[10] *Ibid.*

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The Market of the Middle East.

Some general notes on the selling of engineering products overseas, with special reference to Anatolia, Syria, Iraq and Palestine.

By C. H. DOBELL, A.M.I.Mech.E.

MUCH has been said and written on the subject of overseas trade, both from the manufacturers' and the customers' points of view, but seldom have we heard the views of independent engineers, whose objects are the advancement of British goods in different parts of the world and the prosperity of the industries of those particular parts, therefore the following views and suggestions, based on ten years' experience in the countries of the Middle East, are put forward.

The review is divided into three parts as follows: (1) The representation of the manufacturers. (2) The education of the customers. (3) The financial aspect.

Correct representation ensures that the right kind and type of machinery passes into the right quarter where it can fulfil its most efficient purpose, but this cannot be determined without a visit being paid to the districts concerned, and then only by an engineer of experience. To avoid duplication of the work of representing and of spying out the land, manufacturers should take concerted action, especially since we are interested in the sale of British machinery as a whole and not that of any particular maker. We have presumed that a travelling representative has been appointed and has set out to consider the possibilities of the countries under review, and that naturally he will be getting into touch with the electricity supply companies, from whom he will obtain great assistance in getting information as to where business lies, and also with several Government Departments, if in a British mandated country, or from the commercial secretary or British consul in a foreign country. Of the countries of which we are speaking, Turkey in Asia (Anatolia) is an independent republic, Syria is under a French mandate, and Palestine and Iraq under British mandates.

The travelling representative is recommended, in the first place, to make himself acquainted with engineers with workshops rather than the purely commercial men, although, of course, he will need to meet these also. He must study all the requirements of the countries, present and future, note business men of repute, workshops, and factories, and report to a central body at home, representative of the manufacturers as a whole, who can decide in which country each particular line shall be taken up, and appoint local agents, on his advice, to represent groups of manufacturers, *e.g.*, electrical, agricultural machinery, oil engines, pumps, &c. This group system is most important since foreign competition is so keen, that there must be no danger of manufacturers "cutting each others' throats.

In addition to local agents, a British resident representative should be maintained in each of the four countries, to control the agents, watch the finances of the country and also give the manufacturers an intelligent forecast of the country's future requirements. Such representatives will be found among the many British men who have settled in these countries either before or since the war, and who deserve support from home. Their knowledge of the language would be invaluable and would solve a difficulty so often encountered, that of knowledge of the native mind. It is very essential, nevertheless, that the travelling representative should have a working knowledge of either French or German, preferably the former, perhaps, because it is more generally used in these parts. Local agents with engineering works, who are able and willing to conduct business on behalf of the British manufacturer, will be found in these countries.

Electricity is making rapid strides all over the Middle East; Bagdad and Basrah (Iraq) have public supplies, the Rutenberg companies are extending their networks all over Palestine, and a town supply is being installed in Jerusalem; the principal towns of Syria have electricity supply companies, and in Anatola there are small town installations. Mining, agriculture and the oil fields all need electricity, and it is imperative that the preliminaries should be taken in hand now before the Continental firms get too firmly set.

The resident representative and the local agents having been decided upon, the next question is the education of the prospective customers and the personnel of the agent's business, in the operation and maintenance of the machinery for sale, and this is very important because the inhabitants of Anatolia, Syria, Palestine and Iraq seem to be extraordinarily unacquainted with British machinery and imagine that it requires so much more careful handling, and that repairs and overhauls need to be carried out with greater skill than is the case with the Continental or American machine. They also feel that, having paid a higher price and obtained a superior article (they recognise that), they are faced with the difficulty of finding anyone in the country with sufficient knowledge and skill to carry out repairs or overhauls when the necessity arises, and it is a fact that with small electric motors they prefer to purchase a much cheaper machine which they can discard and replace if a serious breakdown occurs.

To remedy this state of affairs, it is proposed that first-class general mechanics should be sent out to the local agents on short tours of, say, 6 to 12 months, to demonstrate the goods, a very important feature and much appreciated in these parts, and to instruct the personnel in the agents' workshops among whom many quick and intelligent fellows will be found, in the operation and maintenance of the goods sent out.

After a time it might be found more economical to inaugurate a system of apprentice scholarships, whereby the more intelligent and efficient of the agents' apprentices would have a course of training in the works of the manufacturers in England for a period of say twelve months, possibly one from each country per year. Sufficient stress cannot be laid on this educational scheme, if the strong position obtained by our Continental competitors is to be undermined. The combination of a resident representative and the instruction of the local engineers is bound to forge a very strong link between the manufacturers and the countries to be supplied.

The financial aspect is rather more complicated as capital must be set aside to stock the agent's premises so that it becomes a showroom, in which can be displayed and demonstrated such goods as the resident representative considers advisable, due consideration having been given to the possibility of a ready sale or the needs of the immediate future. This will not be difficult where electrical goods are required, for there is always a demand for cables, small motors, fans, meters, table and pendant lamp fittings, &c., and undoubtedly as soon as the power charges are reduced through the development of hydro-electric schemes, there will be a demand for heating, cooking, and other domestic

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appliances, to say nothing of power plant for agricultural work. The stocks held at present are all Continental, solely because greater financial risks are taken and facilities given in the matter of longer credits by our competitors. Can manufacturers afford to set aside capital for such a service? They must bear in mind that prospective buyers are not disposed to wait while their requirements are procured from England when, near at hand, they can be obtained from stock.

Another important service which will call for a further capital outlay, is the maintenance of a liberal stock of spares. This will give a feeling of security to a customer, since he will know that, in the event of a breakdown, the necessary part can be obtained at once, apart from the fact that the repair will be carried out by a mechanic trained in that particular machine. The capital should not be prohibitive for such a service, on a sale or return basis, if the combination or group system suggested in this article is put into force.

The annual cost of maintaining four apprentices from overseas in this country would be approximately £150 each, including passages, not a very great sum to be found by the group but one which would very soon justify itself. The annual cost of a mechanic overseas would be at least £450.

The question of the ability of the agent or his customer to pay can only be judged by the observations of the travelling and the resident representatives, and such knowledge of customers' business as the latter as part of his duties would obtain in the usual way, by reference to banks, Chambers of Commerce, &c.

It is felt that 80 per cent. of the machinery imported by these countries should be British, and that if goods are demonstrated and thoroughly explained by means of an efficient campaign with a punch in it and a system adopted as is outlined here, in a very few years this proportion would be obtained to the mutual benefit of the manufacturers and the local populations.

Suspended Matter in Boiler Feed Water.

After Chemical Precipitation, Mechanical Filtration is Necessary.

By ROY BALDWIN.

CLARKE'S soda-lime method of softening water is generally regarded as a chemical process, yet actually it consists of two parts: (*a*) The precipitation of the dissolved solids by chemical reaction, (*b*) the mechanical filtration of the suspended matter left in the water after the chemical treatment. In many cases in practice the chemical side is carefully watched, but the filtration of the treated water is more or less left to look after itself.

The action of the soda on the permanent hardness deposits chalk in the water, similarly the lime throws down the temporary hardness by absorbing the half-combined carbon dioxide and forming another molecule of chalk. Thus the softened water will contain twice the value of the temporary hardness, and once the permanent hardness, as suspended matter. This precipitated chalk is in a very finely divided state and settles slowly. It is the duty of the filter to hold this chalk, but if the filter is dirty, or the softener is being worked at too fast a rate, the final outlet water will contain a considerable quantity of this precipitated chalk.

Such a water is often more dangerous than the raw untreated water. At points in the pipe line where the velocity of the flow is checked there will be a tendency for the suspended matter to be deposited, and throughout the pipe line scale will be formed by the particles of the chalk lodging in the irregularities of the pipe surface. The important point to be observed is that such a water forms scale at any temperature, whereas raw untreated water only deposits its temporary hardness when heated to a temperature approaching that of boiling point. The necessity for good filtration is obvious, and if trouble is being experienced with the scaling of the softened-water pipe line, the water should be carefully examined for suspended matter.

The mixing of two waters of various compositions may also cause a troublesome precipitate to be thrown down. Water leaving the softener frequently contains a slight excess of soda or lime; while there is little chance of this excess causing trouble on its own, if the water is mixed with untreated water some of the salts contained in the latter will be precipitated, especially if the water is warmed.

With the Permutit process of softening there is the same danger on mixing the waters. The sodium bicarbonate left in the water after passing through the Permutit bed tends to give off carbon dioxide and the neutral sodium carbonate remains; this water will naturally precipitate the permanent hardness of untreated waters as in the former case.

In certain parts of the country, natural waters are found containing the carbonates or the bicarbonates of sodium; these waters present the same problem as those already mentioned. If, however, a water of this nature is mixed in the correct proportions with an untreated water *before* it has passed through a soda-lime softener the permanent hardness will be removed and only lime need be added by the softener. Thus a loss may be turned into a profit.

The cases mentioned above show that a chemical analysis is not always a criterion of the suitability of a water, so it is advisable to examine the water for suspended matter at the same time as the usual tests are made. The precipitated chalk can usually be detected by the naked eye if the sample is examined in a clean flask against a light. A quantitative test may be made in the usual way by filtration, but a rough test may be taken as follows: Filter a sample of the water and titrate with N/10 acid against methyl orange as for the alkalinity. Next take a sample of the unfiltered water and add an excess of the standard acid, warm and keep stirred for half an hour, then titrate with N/10 caustic potash until the red coloration changes to yellow. If 70 c.c. of water were taken in both tests, then: 5 (c.c. N/10 acid used in second test—c.c. of N/10 acid used in first test—c.c. of caustic potash used)=grains of suspended chalk per gallon.

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The Urgency of Overseas Development.

The need for taking the long view of the utilisation of Empire resources in planning schemes for absorbing British population.

THE temporary relief that has been and is being provided on so generous a scale for what are described as the distressed areas must not lull us into any belief that the unemployment question itself is being even in part solved by these measures. The knowledge of the willingness that exists both at home and abroad to render voluntary aid in relieving the immediate poverty and suffering of those whose occupation has disappeared, is gratifying, and certain trades no doubt will be somewhat revived through the circulation of money from the Funds, whether from private or Exchequer resources. But the general unemployment situation seems to be getting worse rather than better, and it is wrong to ignore the signs that the problem is eclipsing, even in the minds of politicians, all other questions.

We must treat the official figures as the chief basis upon which to form our view of the situation, and everybody must regard the latest available return as most disquieting, for at December 31st, when the temporarily engaged Christmas labour had been discharged, the number of persons on the Registers of the Employment Exchanges was 1,520,700, or nearly 250,000 more than a week before Christmas and 184,397 more than at the beginning of 1928. These figures appeared in the Press side by side with reports intimating the reluctance of boys to emigrate, the slow progress that is being made with the transfer of miners to other districts, the record of relief distribution, and an account of a local authorities' deputation to the Ministry of Labour asking for removal of limitations on grants-in-aid so that work may be made for unemployed in other areas.

The most cheering news that appears just now is that which announces the placing of contracts for electrical, railway, engineering, iron and steel and shipbuilding works, the re-lighting of furnaces, and the re-opening of pits. The situation as it is followed intelligently in the Dominions should mean more business coming to the Mother Country and less going to foreign works. The British electrical industry still remains one of the brightest spots, and we believe that it will continue so if those who can direct the course of business recognise their responsibility to their kith and kin at home. But all the attention that varied interests may devote to measures for making more work immediately does not relieve us of the necessity for taking the long view, looking well ahead to the future and taking a large hand in the development of the resources of the world as a means of ensuring a continuous flow of orders of the right kind.

While the duty of concentrating more and more definitely upon the development and utilisation of the vast resources of the British Empire is becoming generally recognised, there is the danger that interest may not be maintained when we enter into matters of detail. Imposing looking blue-books and conference reports consisting of many sub-sections overwhelm us with the great potentialities, and we may well wonder whether there need be want, hunger or dole for any British subject willing to work if only the Empire could be developed and run on systematic business lines. It is when we come to consider the separate sections, or our own particular and specialised section, that we find that there is nothing at all easy about doing this. We have, through Commissions, collected all that there is to know about the hydro-electric resources that nature has placed at our disposal, and reports have been prepared upon many of them by experts, but experience shows the impossibility of doing anything practical by considering them as a whole. Each has to be considered in relation to local requirements—actual and reasonably prospective—and Governments or private financial-engineering concessionaires have to shoulder special individual responsibilities leading to the placing of work-producing contracts, and later local consequential resource developments, absorbing, if men and women will go, labour from this or other countries. Or consider transport; there is nothing more essential to the development of new territories whether for agricultural, mining or general colonising, than the provision of railways or other mechanical means of communication, after the pioneer has done his work and left some sort of a line of telegraphic communication. The construction of railways or the provision of other forms of transport, employs a certain amount of labour at once, and provides work-producing contracts for material, &c., so that areas are developed creating homesteads and towns. It is the old story over again every time of pioneering and colonising to prepare the way.

As one tries to come to closer grips with the problem, therefore, one is not surprised, however disappointed one may be, to find that those who have investigated the problem of overseas settlement, and what hopes can reasonably be entertained of such schemes providing an early way out for our million and a half unemployed, hold out little prospect of much relief being obtained while many things are as they are. So many thousands may be sent to Canada or to Australia per annum, and some to other parts, but all the while these do not reach anything like the yearly addition to our population. The slow results attending the efforts made for transfer of men and their families from dead or idle areas to areas where work can be found for them at home, afford an illustration of the greater difficulty that confronts us when we contemplate large-scale transfers overseas where they are really not wanted until developments reach a more advanced stage. The reduction of the fares to Canada, after much bargaining between the Government and shipping companies, is one way of helping with the matter, though, of course, we should recognise that it is only one out of many ways in which the problem is being tackled. We should suppose that it would be a thoroughly good investment to pay all the costs of those who are willing to go overseas where there is a prospect of their being absorbed. It ought to be made as easy as possible, under existing circumstances for any man, woman, boy or girl to begin anew, for not only does it afford an immediate relief to the Home situation, but, in addition, every emigrant who "makes good" improves the prospect for those at home by making a market for products and paving the way for others to follow them in course of time. We are often told that "in the future" Canada will become as great as the United States. It is satisfactory to note that Canada is showing some disposition to accept British subjects on a larger scale in prefer-

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ence to foreign. But that "United States" kind of Canada is not yet, and our problem presses urgently.

When we have written here from time to time about the future prospects in overseas countries, railways and telegraphs have always stood among the first things that must be constructed in order that all other progress might follow. The position has undergone considerable alteration in these matters with the progress of motor transport, wireless communication, and aviation, and the hardness and loneliness of the vast spaces are by no means what they were. Remembering all the plans that were in preparation making for development in Russia, China, America, India, and so on before 1914, and were reviewed in our pages, it becomes obvious that if all the disturbances that have occurred during the 14 years had been averted (the world war, the Chinese revolutions, Indian ideals and unrest, among them), the world might have been a far different place to-day. Yet against that we must note that important developments have taken place in some places directly as the consequence of these disturbances which, if world troubles had not occurred, might not even now have been thought of. But the world would have been rich enough to continue and accelerate the rate of its legitimate development, creating opportunities for peopling the vacant spaces. And all the while, even with the bigger population, we might have avoided unemployment on its present scale, seeing that this, even now, if not directly due to the four years' war, is indirectly consequent upon it as the outcome of new conditions and ever-changing ideas of communities and even nations. It is perfectly true, as Sir John Cadman, of the Industrial Transference Board says, that to move the unemployed to other employment in this country or overseas is the only humane and sensible policy, but there must be work to send them to and a willingness of localities to receive them. Since August last only 10,000 workers of all classes have been moved by means of the Employment Exchanges. So far as transfer overseas is concerned, one can derive little immediate hope or encouragement from the report of the Economic Mission to Australia, for it declares that the time is not opportune for increasing British migration. Every regard, it says, must be had to absorptive power. It is shown that many millions of pounds expended on settlement schemes have been largely wasted.

When we talk of developing Inter-Imperial Trade, of making a great trade and manufacturing unit of the British Empire, we cannot merely consider a rearrangement of trading relations between that Empire and foreign countries, and contemplate what might happen if we could change the totals of certain columns in trade statistics; we must get right back to the pioneering or originating work promoting the actual development of the Empire territories and resources themselves by the execution of public works and other undertakings. No short view avails us much, as Overseas Settlement reports show. We have to take the long view if we are to deal with the difficulty permanently and on automatically progressive lines. Therefore, while we feel that those who have been hoping for some large Empire development proposition which would offer immediate relief are doomed to a measure of disappointment, we hold also that the latest step taken by the Government in setting up a committee to study every aspect of mechanical transport likely to further the economic development of the Empire overseas is a good and necessary one. Indeed, one is inclined to be critical, however well-wishing, and wonder why it was not done long, long ago. Motor transport development is no new thing, indeed achievements in some new territories have been remarkable, and it must inevitably play a pioneering part either preceding or permanently taking the place of the railway. The official announcement of the appointment of the Empire Mechanical Transport Committee states that one of the primary objects of the investigations of the Committee will be the development of a large mechanical transport unit, not confined in its operations solely to good roads. It is hoped that by increasing the load now hauled in ordinary practice, the ton-mile costs of transport will be materially reduced. Experiments will be carried out in selected areas overseas as soon as the progress of the work justifies them.

It is contemplated that the expenses of the Committee shall be shared between the Empire Marketing Board, which will provide half the total amount, and the various overseas Governments who take part in the work; in order to enable work to commence forthwith, the Empire Marketing Board is advancing the whole amount required for the first year.

Considerable work on this subject has already been done in Australia, and the development of the tropical African Colonies in particular is closely bound up with a solution of the problem involved.

It is proposed ultimately to set up an Overseas Mechanical Transport Committee containing representatives of his Majesty's Government in Great Britain, the Colonial Empire, and of the Governments of the Dominions, India, and the Sudan should they desire to co-operate. The present Committee has been appointed in order that work may be started promptly. Mr. J. C. May, O.B.E., has been appointed secretary of the Directing Committee, at Millbank House, 2, Wood Street, Westminster, S.W.1. Sir James Currie, K.B.E., C.M.G., is chairman, and the other members are Sir Henry Fowler, K.B.E., Brigadier-General F. D. Hammond, C.B.E., D.S.O., and Mr. Herbert Niblett, C.B.E., D.S.O.

"Empire Development on Business Lines" is the title of an editorial in the current issue of *The Times Supplement*. The writer, after mentioning that the next Imperial Conference, which takes place a year or 18 months hence, will be concerned chiefly with economic questions, says that to those who profoundly believe that the future prosperity of Great Britain depends to a far greater extent upon the British Empire than upon any other factor, the position of the cause of Empire development in this country appears perplexingly paradoxical for the active progress that can be discerned is so small compared with the general agreement that exists as to the desirability of Empire trade development. The subject draws "but a thin house" at Westminster; in the City there is general agreement, yet lack of intensive interest; but there is no doubt whatever that among the people of this country as a whole, there is a gradually increasing Empire consciousness which is likely sooner or later to be manifest in the evolution of practical schemes of Empire economic development. Great Britain needs immediately markets to absorb the products of her factories, thus promoting increased employment, and it therefore follows, as our contemporary suggests, that those parts of the Empire in which there are good prospects of the rapid development of natural resources and in which Great Britain holds a large proportion of the import trade are those which should be first selected. "Not for the first time," says the writer, "it may be found that the people will force the pace and the constituencies demand practical schemes from political candidates."

The subject of this article has some interest in connection with Sir Hugo Hirst's speeches in Melbourne, published in our last issue, and is timely because of the appearance of the Economic Mission's report which we abstract on another page to-day. At one of the functions mentioned it was remarked that the engineer was the forerunner both of settlement and of the greater growth of population. This incontrovertible statement is ample justification for our devoting space to urging engineering and other readers of this REVIEW to study for all they are worth the ways in which they can assist the development of the Empire in particular, and the world as a whole, with a view to providing work for our brothers of to-day and our children of to-morrow. The engineer must lead the way in turning to account the vast unutilised resources of the world, but he cannot go alone: he needs the backing of finance. The financier and the engineer are interdependent; and they, too, require the goodwill of governments and of public authorities.

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Permanent Magnets in Telephone Receivers.

The author elucidates the theory of the increased transfer of energy from the electrical circuit by the addition of a permanent magnet.

By C. COPPOCK.

THE presence of the permanent magnet in a telephone receiver has come to be regarded so much as a matter of course as to be accepted without question, until some chance query as to its purpose and utility sets us searching for an explanation to account for its inclusion. Comparatively little has been published in this country on the telephone receiver, outside the transactions of various societies, and the majority of text-books condense any reference to the subject into

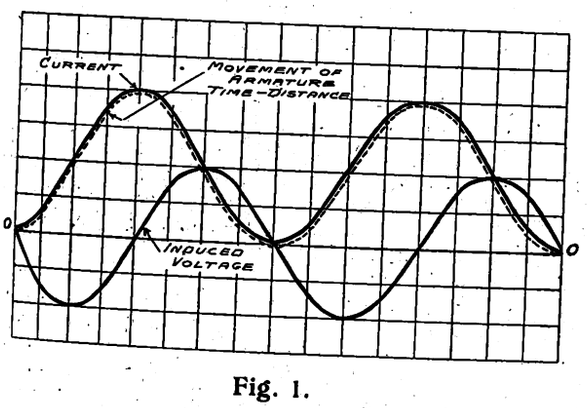


Fig. 1.

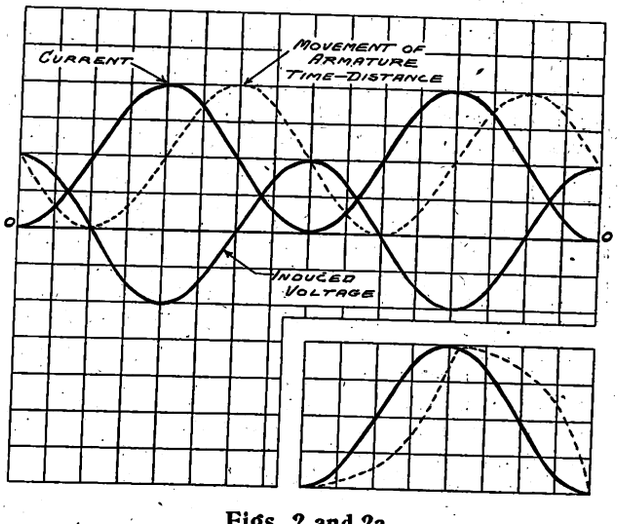
a much smaller space than that to which its very considerable technical interest would appear to entitle it. Usually authors of such books are content to explain the presence of the permanent magnet by reference to the fact that the pull exerted by a magnet on its armature, or diaphragm, varies as the square of the induction, according to the formula $B^2A/8\pi$.

A simple calculation based on this formula serves to illustrate the degree of improvement which may be expected to result from the addition of a permanent magnet to a piece of electro-magnetic apparatus such as the telephone receiver. Thus, if an electro-magnet gives rise to a flux of 10 lines through its keeper, due to the current in its coils, the pull which it exerts on the keeper will be proportional to $10^2=100$ units of force. If, however, owing to the presence of a permanent magnet, 1,000 lines already traverse the keeper, and to these the magnetising coils add 10 more, the total flux will be 1,010 lines, and the total pull will be proportional to $1{,}010^2=1{,}020{,}100$ units of force. Since the permanent magnet was responsible for 1,000,000 units of force, the increase due to its presence has been 20,000 units, or a 20,000 per cent. increase on the force due to the coils alone.

The above explanation is satisfactory up to a certain point, but at first sight rather leaves an impression on the mind that something has been gained for nothing; in other words, it may fail to convey a clear idea of how it comes about that a greatly increased transfer of energy can take place from the electrical circuit, through the magnetic medium, to appear finally as mechanical energy, simply by the addition of a permanent flux. Since there appears to be no satisfactory mechanical analogy for this state of things, it may assist an understanding of the matter if we approach it from the most elementary point of view and imagine the simplest form of electro-magnetic motor, in which a soft-iron-cored electro-magnet attracts a keeper against the tension of a spring. Let it be supposed that with the armature at its greatest distance from the magnet, a maximum flux of 10 lines crosses the air-gap, due to the coil alone, and that this is increased to 20 lines when the armature reaches the limit of its travel towards the magnet. Further, let it be assumed that the armature moves towards the magnet along a frictionless path of no resistance, the whole of the energy imparted to it during its forward movement being stored up in the spring.

It will provide a basis for a simple calculation if we remember that for every 10 lines which link with one ampere-turn of the magnetising coil, in such a way as to induce in it a back e.m.f., one erg of energy will be transferred from the electrical circuit, and the energy so transferred may be stored either magnetically or mechanically, part being subsequently converted into work and part returned to the electrical circuit. In order to convert the greatest amount of electrical into mechanical energy, it will be necessary to so arrange matters that the maximum number of magnetic lines will link with the coil when the current in the latter has reached its highest value.

Assuming that the maximum m.m.f. of the coil amounts to 10 ampere-turns, and that we retard the



Figs. 2 and 2a.

movement of the armature until the current reaches its highest value, 10 lines will by that time have linked with the coil turns, and the energy stored in the magnetic form, before the armature commences to move, will be $(10\times5)/10=5$ ergs.

If the armature is now allowed to move forward against the tension of the spring, and complete its travel whilst the current in the coil is at its maximum, 10 more lines will have linked with the coil at its full magnetising power, with a further storage of energy of 10 ergs. The total energy stored, magnetically and

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mechanically, has therefore been 15 ergs. Let us now assume the armature to be held in its position near the magnet until the magnetising current has fallen to zero. The 20 lines established in the coil will be withdrawn and $(20 \times 5)/10 = 10$ ergs of energy will be returned to the electrical circuit, leaving 5 ergs stored in the spring and available for doing work on the backward stroke of the armature.

The above example illustrates the well-known fact that in a magnetic system such as that described, not more than 50 per cent. of the energy abstracted from the electrical circuit can be converted into mechanical work, the other 50 per cent. being returned to the electrical circuit; and to obtain this ratio in the present instance the armature would have had to commence its travel at an infinite distance from the magnet. To carry the matter a stage further, let us now assume that a permanent magnet is included in the simple magnetic circuit described. As before, a maximum flux of 10 lines, due to the coil, crosses the air-gap with the armature at its greatest distance from the magnet. To this is now added 1,000 lines due to the permanent magnet itself.

When the armature has reached the limit of its travel towards the magnet, the 10 lines due to the coil will, as before, be supposed to have increased to 20, and at the same time the lines of permanent magnetism will have increased in the same proportion. Repeating the former procedure and restraining the armature until the m.m.f. of the coil reaches a maximum, we shall have again a storage of 5 ergs before the movement of the armature commences. As this moves forward, however, the case will be different, and $1,000 + 10$ lines will be introduced with full current in the coil, giving a storage of energy of $(1,010 \times 10)/10 = 1,010$ ergs, to which must be added the 5 ergs already stored magnetically. Again, supposing the same procedure to be adopted on the backward stroke as in the previous case, we shall have 10 ergs returned to the electrical circuit, leaving 1,005 ergs stored in the spring and available for doing work. It will be seen that the amount of energy converted in the two cases can be represented by the figures 5 and 1,005, the addition of the permanent magnet having resulted in an increase of 20,000 per cent., which is in agreement with the previous estimate based on pull alone. It is also of interest to note that when a permanent magnet is included in the system, the rule which places a limit of 50 per cent. on the conversion efficiency does not apply.

It can be understood from the foregoing that, resulting from the variation of the permanent flux by the movement of the armature, an alternating voltage has been induced in the circuit, and the matter can be regarded as a plain a.c. proposition. If the coil is energised by a varying current, which may be supposed to be of sinusoidal wave form, but of constant direction, the phase relation between applied and induced voltages will depend largely upon that between the current and the movement of the armature, and it has been seen that, in order to bring about a maximum transfer of energy in the system, it was necessary to retard the movement of the armature with respect to the current in the coil. If the armature moves in exact synchronism with the current, no electrical energy will be transformed into work, the alternating voltage induced being then 90 deg. out of phase with the current, as shown in fig. 1, where the alternating voltage has the same phase displacement as though induced by a true leakage flux, and the same amount of energy is being returned to the electrical circuit as has been stored up in the magnetic form.

When, however, the movement of the armature lags in relation to the current by 90 deg., current and induced voltage will be in opposition, as shown in fig. 2. In this latter figure the movement of the armature, although 90 deg. out of phase with the current, is still supposed to follow a sinusoidal wave form, but when the retarding force on the armature is considerable, and its inertia is small, there will be a tendency for the wave form of its movement to be distorted and for this to approach more nearly the form shown in fig. 2a.

In many cases in practice, if the experiment is tried of replacing the permanent magnet in a receiver by a soft-iron core, the results obtained will at first sight appear to contradict the estimate arrived at in the foregoing paragraphs. For instance, if the permanent magnets of a pair of wireless headphones are carefully annealed, satisfactory reception may still be obtained; in fact, its quality and volume is frequently only slightly inferior. This is due to the fact that where such receivers are used for wireless reception with valve sets, rectification is usually taking place on the upper bend of the curve, and with the value of h.t. voltage employed, a considerable unvarying current flows through the coils of the 'phones, the m.m.f. of which is in many cases almost sufficient to replace that of the permanent magnet. If, however, a comparison is made with and without the permanent magnet, using the lower bend of the rectification curve, the difference will be immediately appreciated.

Reviews.

Alternating-Current Power Measurement. By G. F. TAGG, B.Sc. Pp. viii+65; figs. 50. London: Sir Isaac Pitman and Sons, Ltd. 1928. Price 3s. 6d. net.

Existing treatises dealing with electrical instruments are more inclined to lay stress on the details of construction and principles of operation of the several types of instruments with which they deal, than on practical directions regarding the use of them. In this little book Mr. Tagg has attempted to deal with the important subject of power measurement in alternating-current circuits. In addition, he has touched briefly on the determination of reactive power, and power factor, and on the theory of instrument transformers.

The introductory chapters deal in a conventional and very elementary fashion with the conception of power in one-, two-, and three-phase circuits. The important subject of the power factor of unbalanced three-phase circuits is very scantily treated, and space might have been found at this point for a brief treatment of the method of resolving unbalanced three-phase circuits into symmetrical components of opposite phase-sequence; a method developed by Fortescue, and one which sheds so much light on the otherwise difficult subject of polyphase power factor. In developing the theory of the dynamometer wattmeter, the author uses the cumbersome methods of the integral calculus for an investigation practically identical with that developed in the first chapter by the use of elementary trigonometry only. It would almost appear that some authors consider that the value of their works is enhanced by the appearance in them of unnecessary signs of integration. A little more space might well have been devoted to the induction wattmeter. Its theory is very interesting and, in its integrating form, at any rate, it is an instrument of first importance.

Several methods of measuring power in approximately balanced three-phase circuits are described in detail. The usual proof of the two wattmeter method of power measurement appears, and an inordinate amount of space is devoted to the proof of the power factor formula, using the sum and difference of the two wattmeter readings. The chapters dealing with the measurement of power in three-phase four-wire circuits, and with the summation of the power in two or more circuits are useful and acceptable. A short chapter deals with the measurement of reactive power in three-phase circuits. Whilst the author is quite at home in dealing with balanced circuits, he is able to give very little guidance in the general case of unsymmetrical loading, and the obvious method of obtaining quadrature potential from mid-point taps on voltage transformers is not mentioned. The chapter on power-factor meters is so scanty as to be of very little use—the rudimentary theory is not even explained. There is a fair account of the theory of instrument transformers, but the improvements which have been recently effected in these important auxiliaries to a.c. power determination by the discovery of the nickel-iron alloys is not mentioned. A brief appendix deals with vector diagrams.

We are sorry to have to refer to this book somewhat unfavourably. It is really, however, more remarkable for what it omits than for what it contains.

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The Wireless Manual. By Capt. JACK FROST. Pp. ix+220; figs. 102. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

The author says that "this little book is intended to act as a guide to those who intend either purchasing a set, or who, having purchased a set, require to know something about the capabilities of it and about the mysteries of wireless." We consider that as a guide for this purpose, or indeed for any other purpose, the book is not only useless, but worse. Much of it is really unintelligible, and many of the statements are inaccurate. The Appendix on Electrical Measurements, which is written by Capt. Craufurd, R.N., is perhaps meant to be amusing, but it could certainly impart no useful information to any reader. Constant references are made throughout the book to a new invention which is called the "Acceptor," and at the end of the book we are informed that "the instrument is now upon the market and is being produced by the inventors themselves in, at present, limited quantities at a low retail figure (17s. 6d.)." We are *not* told how the instrument works, but we *are* told of its advantages for reception, *viz.*, no aerial, all interference greatly diminished, no lightning risk, tuning very selective, reaction effects obtainable on non-reaction sets. We are *not* told that the name of this wonderful device is "The Craufurd-Frost Acceptor."

We have had no opportunity of judging whether the "Acceptor" is worthy of a market, but we have had an opportunity of judging this book, and our opinion is that the book at any rate is not worthy of a market.

Conduction of Electricity Through Gases. By Sir J. J. THOMSON and G. P. THOMSON. Pp. 491; figs. 121. Cambridge: University Press. Price 25s. net.

"Conduction of Electricity Through Gases" was first published in 1904; a second edition appeared two years later. The preparation of a third edition was commenced in 1913, and part of it was indeed in type when the war broke out, but the disturbance of all scientific work in the following five years, and the subsequent pressure of Sir J. J. Thomson's official duties, caused a further delay, and it is only now, and then due largely to the efforts of Prof. G. P. Thomson, that we have the third edition before us—and of that so far only the first of the two volumes into which the original single volume has grown.

The sub-title of Volume 1 is "General Properties of Ions. Ionization by Heat and Light." Most, though not all, of the original paragraphs have been retained, a few in a shortened form. Otherwise little alteration has been made in them beyond replacing values of the fundamental constants by the more accurate modern ones. Some of the paragraphs could well have been omitted if this were a new book, but, as the authors point out, there are advantages in maintaining continuity with the older editions. The new matter is inserted at the appropriate points; the care and completeness with which it has been selected is immediately apparent when we find that the first chapter has references to a 1928 paper by Millikan on the cosmic rays—the older work on the natural ionization of gases makes very interesting reading now, and one has to admire the persistence of Kölhorster and the other early workers in tracking down to its true origin what many must have thought a mere lack of care in setting up insulation. The second chapter takes us on to the problem of the recombination of ions, and here we find a full account of Sir J. J. Thomson's theory of 1924; one wishes that the experimental work on this branch were better, and one cannot help feeling that a fundamental cause of error in it is the usual omission to first reduce the reaction vessel to a really good vacuum, and only then to introduce gas, and that in a pure state or mixed with carefully controlled impurities. The same remark applies to much of the experimental work on mobilities (Chapters 3 and 4); the theories and the methods are sound enough, but their testing and application are technically faulty, in this case, of course, to a less degree, through the recent work of Erikson, Loeb, and Tyndall. K. T. Compton's work (1923) has perhaps not received the attention to which it is entitled. In Chapter 5, again, on the effects of magnetic fields on the motion of ions, the important investigations of Langmuir and Mott-Smith are not mentioned, although this is perhaps understandable, in view of the fact that they were published in the *General Electric Review*, where one would hardly expect to find them. In Chapter 6 one is forcibly reminded of the time that has elapsed since 1906 by the fact that Bestelmeyer's determination of e/m (1911) is new; one finds here, too, the ancestor of the Kerr electrical shutter in Wiechert's apparatus (1899). Paschen's spectroscopic evaluation of e/m (1916) is, incidentally, not the latest word in the determination of the constant by this method. There is, in the end of this chapter, an account of Aston's very recent work on isotopes, although there is no mention of Millikan's or of Petterssen's applications of the results, and a description of Dempster's positive-ray apparatus, but not of Smyth's. Chapter 7, on the charge of a negative ion, includes Wilson photographs of the trails of ionizing particles, but in common with most books, this one represents the alpha trails as smooth, which they most certainly are not, as has been abundantly demonstrated by Chadwick and Emeleus Auger, and by C. T. R. Wilson himself; Millikan's classical measurements of e have, however, received proper attention. Chapter 9, on thermionics, makes no pretence at completeness in its treatment of the subject, but it is particularly valuable as a historical resumé, and the attribution of fig. 89 (temperature variation of the saturation current) to "O. W. Richardson, in the Cavendish Laboratory," serves as a reminder that still another of our greatest living physicists has had the benefit of early contact with Sir J. J. Thomson—then (1902) simply Prof. Thomson. It is rather strange, too, to find that Prof. Sir E. Rutherford was at one time actively interested in space-charges. We notice here for the first time a printed statement (p. 354, footnote) to the effect that the Fermi-Dirac system of statistics is unlikely to affect to any important extent the older theories of electrons in free space, because of their small volume densities. Several references to Italian literature, again, raise in the reader's mind the pertinent question of how much work from that country must have been effectively lost through our general ignorance of the language. Chapter 10 is on flames, and, again, although much briefer than the publications of H. A. Wilson and of Marx, is good, whilst the last chapter, on photoelectricity, is again useful, although not completely up to date.

We cannot assess the value of this volume until we have had the opportunity of reading its companion; perhaps some of the omissions that we have noticed may represent matter transferred to the latter, but this is unlikely, in view of the different class of phenomena in question. The present volume appears to us to have given, in so far as it set out to do so, a reasonably complete account of what may be referred to as the older discharge work, its main concern being with high-pressure phenomena. We can only hope that the second volume will be found to contain an equally good account of the newer work, with its leaning towards high vacua, and gas-discharges at low pressures.

K. G. E.

Physics in Medical Radiology. By SIDNEY RUSS, L. H. CLARK, and B. D. H. WATTERS. Pp. xii+234; illustrated. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

The subject of medical radiology seems at present, from a certain point of view, to be in a transition period. The X-ray specialist need not yet compulsorily possess a diploma in radiology, yet the institution of such in the Universities of Cambridge, Liverpool and Edinburgh, affords evidence of a tendency in this direction. At the moment, therefore, a graduate in medicine is entitled to take up radiological work on the admittedly slender knowledge of physics gained in his first professional curriculum, and he finds himself with three possible courses of action: (1) to devote a year or so to obtaining a diploma in radiology; (2) to engage in more or less private study of X-ray physics and electro-technics; or (3) to ignore theory and rest content with manipulative ability.

From the circumstances alluded to at the outset, it is scarcely surprising that the present authors conceived the idea of providing a book to meet the needs of students of either of the first two categories just mentioned, as two of them have for some years been engaged in the teaching of physics in one of the diploma courses.

Professor Russ, Dr. Clark, and Mr. Watters are to be congratulated on having brought out a work of convenient size and moderate price which unquestionably meets a present need in matter and treatment, and forms an admirable basis for a course of study in the subject of which it treats.

There are seventeen chapters, each dealing concisely, yet clearly and adequately, with the different sections of the subject. Cathode rays and X-rays are introduced in Chapter IV, after a preliminary discussion of Electro-statics, Current Electricity, Electrical Conductivity of Gases, and Electro-Magnetic Waves.

The production, properties, and measurement of X-rays occupy three chapters, and there then follow three chapters dealing with radioactivity and radium therapy.

A very important chapter (XI) is entitled "Photography, Light and X-Rays," and deals with a number of points which are vital to the understanding of the photographic process in the present connection, but which for the most part have been available hitherto only in original papers.

Chapters XII to XVI treat respectively of Electro-magnetism and the production of Alternating Currents, Electric Motors, Alternating-Current Circuits, High-Voltage Generators, High-Frequency Currents, and Electrical Measuring Instruments. It is not quite obvious why these chapters should not have found an earlier place in the book, but doubtless the authors had excellent reasons for the sequence presented.

It will be realised from the foregoing account of the contents of "Physics in Medical Radiology" that the scope of this subject is somewhat special, as demanding a knowledge which in certain directions goes beyond the scope even of "Applied Physics" as ordinarily recognised, and touches upon matters of pure electrical engineering.

In addition, an adequate acquaintance with the photographic process is indispensable, as faulty technique in this department may lead not only to bad results, but even to erroneous diagnostic findings.

In their preface, the authors comment upon the average medical man's horror of mathematical formulæ. This is very real, but is scarcely surprising, for after learning the whole of physics in six months (!) at the commencement of a medical course, they have little subsequent occasion to

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employ either mathematical formulæ or methods. In the present work a certain amount of mathematical treatment has necessarily been retained, but the book is not thereby robbed either of interest or value to the reader to whom an exponential equation conveys just as much as does a Latin prescription to the ordinary "layman."

In appendices are given the recommendations of the X-ray and Radium Protection Committee, and a very useful and interesting account of a hospital radium service, reprinted from the British Journal of Radiology, while a list of reference books and a general index complete the volume.

C.N.K.
J.L.T.

Fundamentals of Electrical Design. By A. D. MOORE. Pp. xxi+343; figs. 124. London: McGraw-Hill Publishing Company, Ltd. Price 25s. net.

This book is an addition to the large number of those volumes which have been published having for their inspirations the laboratory or lecture room notes of the engineering college of which the particular author is a member. Most of these books are all very excellent in their way, but of necessity there is a good deal of overlapping, although on the other hand, their publication is often justified by novel treatments in part or in whole. It is natural that teaching methods vary with their exponents, and it also follows as a natural corollary that when any special methods or modes of presentation have become identified with any one individual, that person seeks, and justly so, to place these on permanent record, primarily for the benefit of his students, but also for the benefit of all others who may be interested in the subject. This we judge to be the reason for the publication of the present volume, which, broadly speaking, is divided up into two distinct parts, the one dealing with certain fundamentals of electrical design and the other devoted exclusively to the d.c. machine. The first part of the volume, which deals with electric and magnetic fundamentals, embraces 16 chapters in all, which comprise much of the fundamental data usually found in text books on units, magnetic materials, conductors, and insulation. Of unusual interest, however, are the chapters, six in number, dealing with magnetic and electric fields and the technique of their plotting. The author indicates how the plotting can be effected, and he gives numerous diagrams showing the fields resulting from conductors placed in certain positions with respect to surrounding metallic structures of various shapes. One chapter is devoted to a study of the inductive circuit, coupled, so far as treatment is concerned, with the analagous problem in heating, the latter subject being subsequently followed up by three further chapters upon heat radiation and dissipation and thermal properties coupled with methods of thermal calculation. A single chapter is concerned with a brief survey of electromagnetic devices of the types exemplified by the short-stroke tractive magnet, series lock-out magnetic switch, and lifting magnet. The remainder of the volume deals with d.c. machines and the treatment covers the usual form of general construction, armature and field windings, equalisers, flux calculations, armature reaction, commutation, notes on design data, and the necessary procedure for the design of a new direct-current motor. As regards the section on d.c. machines, frankly we feel the same ground has already been covered much more thoroughly by other authors, notably in the case of Miles Walker's "Specification and Design of Dynamo Electric Machinery." This view, however, is not to be regarded as non-recommendatory, for the work cannot fail to be of very material value to the earnest student, particularly so, of course, to those of the college with which the author is connected. The book, being published by McGraw-Hill, leaves nothing to be desired from the point of view of production, but we think it could command a wider sale at about 75 per cent. of its published price.

S. A. S.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

American Electrical Machinery Production.

The Department of Commerce, Washington, announces that, according to data collected at the biennial census of manufactures taken in 1928, the establishments engaged in the manufacture of electric generators, transformers, motors, and fans in 1927 reported a production of the value of $312,576,294, an increase of 4.9 per cent. as compared with $298,010,383 for 1925, the last preceding census year. The more important items contributing to this total were as follow: Generators—steam-turbine driven, a.c., 483, valued at $8,741,001, with a total rated capacity of 1,848,167 kVA; other a.c., including synchronous condensers and frequency changers, 2,373, valued at $9,594,416, total rated capacity 1,783,904 kVA. Automobile generators and starter-motors, 3,364,936 sets, valued at $62,992,264. Self-contained power and lighting outfits (not over 5 kW capacity, including engine, generator, and control, but excluding storage batteries), 46,608, value $8,792,808. Transformers—1 to 500 kVA, 226,617, valued at $32,242,869; over 500 kVA, 3,855, total rated capacity 10,085,470 kVA, value $22,805,740. Stationary motors—fractional horse-power, 2,876,990, valued at $32,504,952; 1 h.p. and over, d.c., 63,762, total rated h.p. 627,845, value $15,544,229; a.c., polyphase, 352,815, total rated h.p. 3,297,929, value $37,544,453. Railway and vehicle motors (not including automobile starter-motors), 10,616, total rated h.p., 507,880, value $10,445,919. Electric fans, 650,805, valued at $10,484,283.

British Engineers' Association.

The first informal luncheon for 1929 was held at the St. Ermin's Hotel on Thursday last week, Sir Gilbert Vyle being in the chair. In the course of his short address Sir Gilbert mentioned that while the engineering exports for the first eleven months of 1928 were an improvement on the whole 12 months of 1927, imports were still much too high, and a large quantity of material was still coming in which could equally well be made here. He thought that there was still a number of municipal and other bodies who did not realise the short-sightedness of purchasing foreign material on account of a slight saving in first cost. He pointed out that our exported goods had a value of approximately £98 per ton, while imported goods of similar character were worth £168 per ton, which meant that we were having to make nearly two tons of engineering products for every one ton which was brought in. Mr. Reavell, who followed Sir Gilbert, thought that 1929 should bring us more stabilised conditions and greater general trade. He felt that British engineers had in recent years been too much inclined to go abroad for designs, and hoped that better results could be brought about if greater attention were given both to technical education and research. A short discussion terminated the proceedings.

A "Mond" Conference for Australia.

Following upon the lines of the Industrial Peace Conference organised by Lord Melchett in this country, an Australian conference of employers and trade unions was recently instituted. The chairman is Sir Wallace Bruce, a former Lord Mayor of Adelaide; there are 20 representatives of employers of varied industrial interests and 16 trade union delegates. Among the former is Mr. P. J. Pringle, general manager and chief engineer, Electric Supply Co. of Victoria, Ltd., who has made a close study of Australia's economic and industrial problems. The initiative in calling the conference was taken by Mr. J. MacDougall, president of the Associated Chambers of Manufactures of Australia.

Engineers' Aid for Distressed Areas.

At a conference held in Birmingham this week between representatives of 27 trade unions and 14 employers' associations, convened by the Engineering and Allied Employers' Federation, proposals for contributing to the relief of the distressed areas were approved. The substance of the proposals was that an appeal should be made to all local employers to contribute generously to the Lord Mayor of Birmingham's Relief Fund; and that all employés should be asked to contribute to the fund a weekly sum equal to one penny in each pound of wages or salaries for twelve weeks.

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New Welsbach Showroom.

The WELSBACH LIGHT CO., LTD., is one of the oldest of the gas-appliance concerns, and it is therefore an event of some significance when such a company opens an electrical showroom. The company's first entry into the electrical world was some time before the war, but then circumstances compelled it to abandon the experiment. Some three or four years ago it made a second appearance in the electrical sphere, and now it is slowly establishing itself in the industry. The opening of a new electrical showroom at Welsbach House, Gray's Inn Road, W.C.1, last week definitely stamps the company as electrical, although it is still a leader of the gas industry. The new showroom is very well designed and arranged. It is a long room with a number of bays very simply furnished. Down the centre of the room are specialised lines of fittings, three-light pendants, bowl fittings, and shades (including wood fittings). Each bay is distinctively decorated in harmony with the type of fitting displayed. A short oak staircase leads up from the entrance into an apartment with an oak fireplace and appropriate decoration. In this Jacobean oak and mahogany fittings are arranged, as well as examples of electric fires. One bay is devoted entirely to hall lanterns of many designs; in the next are arranged examples of dressing table pendants; then crystal fittings appear in a special setting. The three bays on the other side of the room are devoted respectively to bowl fittings, "Amberlight" fittings, and moulded glass and fancy indirect lighting designs. Numerous examples of glassware are arranged round the central pillars, and there are some beautiful floor standards in between. In each bay show cases are fitted, in which silk shades in great variety are displayed. In an annexe to the main room there is a selection of domestic appliances, fires, kettles, irons, &c., including the company's "Handiheater" one- and two-bar fires, and the "Welsbach-Kern" heater. The showroom is in charge of Mr. R. Tempany, the manager of the Electrical Department, who was responsible for its arrangement. We reproduce herewith two views of the showroom.

The Welsbach Electrical Showroom.

Local Exhibition.

MARLDON.—Under the auspices of the Torquay Corporation Electricity Committee an electrical exhibition, including water heaters, fires, floor polishers, sweepers, cookers, refrigerators, washers, and other appliances was held at Marldon on January 3rd.

Domestic Electrical Development in Victoria.

In a recent report, Mr. R. Liddelow, the commercial manager of the Victorian Electricity Commission, gives the results of a tour of investigation in Great Britain and the United States. In the course of the report, according to the *Australasian Electrical Times*, Mr. Liddelow says that he found that "almost without exception electricity supply utilities, both in England and America, sell electrical appliances." Later in the report it is said that Victoria's domestic load is very poorly developed, but that there was a considerable growth during the year ended June 30th, 1928. At the end of the year 64.75 per cent. of the residential consumers had adopted the two-part t riff, an increase of 46.3 per cent. during the year. This is attributed to the increased sales of appliances. The appliance which made the greatest advance during the year was the vacuum cleaner, the number in use rising by 74 per cent. The number of electric stoves rose by 73 per cent., toasters by 40 per cent., grillers by 39 per cent., radiators by 27 per cent., kettles by 26 per cent., and irons by 21 per cent.

J. H. Holmes & Co., Ltd.

Those of our readers who feared the disappearance from the industry of the firm of J. H. Holmes & Co., Newcastle, after more than forty years' work, will be glad to learn that the business has now been reconstructed under conditions which involve no break with the favourable traditions of the past. The directors of the reorganised company, J. H. Holmes and Co., Ltd., are Mr. Wilfred Hall, Mr. N. D. Newall, and Sir Arthur N. L. Wood; the manager is Mr. R. Robinson. We have received two illustrated leaflets from the company, one dealing with "Holmes-Clatworthy" duplex motor equipments for newspaper presses and the other with "Castle" electro-plating motor-generators.

Social Events.

The engineering sales staff of the Edison Swan Electric Co., Ltd., held a dinner and *soirée at* Freeman's Restaurant, Enfield, on January 5th, about 70 members and friends attending. Mr. T. S. Read (sales manager) presided, supported by Mr. F. V. Hasemore (general manager) and Mrs. Hasemore, Mr. Evans (works manager) and Mrs. Evans. The loyal toast was proposed by Mr. T. S. Read; "The Sales Manager" by Mr. C. H. Beazley; "The Visitors" by Mr. T. S. Read, responded to by Mr. F. V. Hasemore; and "The Engineering Sales Staff" by Mr. F. A. East, responded to by Mr. L. E. Bacon. A musical and dance programme followed the dinner.

The sixth annual G.E.C. Junior Social was held in the Lecture Hall, Magnet House, on January 4th, when over 200 members of the junior staff were entertained by the directors. Dancing, games, conjuring and ventriloquial entertainments, together with a plentiful supply of refreshments, contributed towards a merry evening. Messrs. J. Y. Fletcher and Mr. L. C. Gamage, directors of the company, were present, and Mrs. L. C. Gamage presented the prizes for the best dancers of the evening.

The fourth annual dinner of the staff of the Lincoln Corporation Electricity Department was held on January 4th, under the presidency of the assistant electrical engineer, Mr. Arthur Letts. The toast of "The Undertaking" was proposed by the city electrical engineer, Mr. Stanley Clegg. During the evening, the chairman of the Electricity Committee, Ald. W. S. White, presented an inscribed clock to Mrs. Wicks (*née* Miss E. Welbourn) in recognition of her services to the Department.

A New Use for Cable Drums.

Our contractor readers may be interested to learn of a new use for small cable drums. Messrs. JOHNSON & PHILLIPS, LTD., have had a letter from one of their customers stating: "We were invited to a bazaar held at St. Mary's Home, Rusholme, Manchester, and whilst there greatly admired a pouffe in black satin. To our surprise we were told that Johnson and Phillips's lead cable reels had been used in the production of these, forming the interior."

Trade Announcements.

Mr. RONALD B. BEATTIE, 1a, St. James' Street and Hall Street, Burnley, is extending his electrical and radio business to include a department dealing with radio and other gramophones and musical instruments, especially those employing electricity in any way.

Mr. J. LYON, electrical and mechanical engineer, has opened an office at 89, New Oxford Street, W.C.1, and asks for manufacturers' catalogues of electrical goods.

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Book Notices.

"Business Building." Edited by F. F. Sharles, F.S.A.A. Part 1. London: Sir Isaac Pitman & Sons, Ltd. Price 1s. 3d. net.—This is the first part of a work which is to be issued in 24 fortnightly parts. It is described as "a complete guide for the wholesaler, retailer, manufacturer, agent, &c.," and includes articles on many phases of industry and commerce.

"Cinemas, Theatres and Ballrooms." (Pp. 99.) London: The Haycock Press, Ltd. Price 5s.—In this well-produced work there are a number of articles, all of them profusely illustrated, upon various matters connected with the subjects of the title. They include architecture, decoration, lighting, heating, ventilating, &c., and each subject is dealt with by a specialist. The use and abuse of electricity form the subject of an article by Mr. C. W. Rabbetts. The volume was edited and produced by Mr. D. McMillan Muir.

"The Post Office Electrical Engineers' *Journal*." Vol. XXI. Part 4. January, 1929. London: ELECTRICAL REVIEW, Ltd. Price 1s. 3d. net.

"Pioneers of Wireless," by E. Hawks, F.R.A.S. Pp. xix+304; figs. 45, plates xxiii. London: Methuen & Co., Ltd. Price 12s. 6d. net.

"Chest Radiography." Pp. 15+4; figs. 5. London: X-Rays, Ltd.—A descriptive account of the new installation at the Brompton Hospital, London.

"Electrical Transmission and Distribution," edited by R. O. Kapp, B.Sc. Two volumes. Illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net each.

Long Service with the B.I.

On January 11th there was held the first of a series of interesting functions at the Prescot works of the British Insulated Cables, Ltd. Mr. Dane Sinclair (chairman), assisted by Mr. G. H. Nisbett (managing director) presented medals to 463 employés with over 20 years' continuous service with the company; 75 of these have over 30 years to their credit. Mr. G. H. Nisbett, Mr. W. Kerfoot (secretary), Col. D. Bates (works manager), Mr. A. J. McPhail (publicity manager), Mr. Wolbourn (chief engineer), Mr. Nash (resident electrical engineer), Mr. J. L. Packer (head of the Cables Department), and Miss A. Bradbury (chief secretarial typist), all come within the latter category. A photograph of some of the older members of the company is reproduced herewith.

Standing (left to right): I. Atherton (Insulating Department); W. H. Birchall (Mains Engineer); J. L. Packer (Manager, Cables Department); A. J. Macphail (Publicity Manager); A. Lauder (Superintendent, Lead Covering Department); E. Warde (Cables Department).
Seated (left to right): R. Hayes (Mechanics Department); Col. D. Bates (Works Manager); R. P. Nash (Resident Electrical Engineer); Wm. Atherton (Superintendent, Insulating Department).

Long-Service Employés of the B.I.

At the ceremony the B.I. Silver Band rendered a programme of music and accompanied those present in community singing. The medals presented were only for employés of the Prescot Works; altogether 813 are being awarded by the company.

Registered Contractors.

The following is a list of applications for registration which were accepted by the Executive Committee of the National Register of Electrical Contractors at its meeting on January 11th:—

Cropper & Hancock, Leeds.
Alderson, Harold, Durham City.
Woodward, Herbert, Wood Green, London, N.22.
Modern Electrical Supplies, Leeds.
Allenby & Stokell, Leeds.
Wilkinson, John, & Sons (Greengates), Ltd., Apperley Bridge, Bradford.
England, Sidney E. J., Bath.
East Sussex Wiring Co., Ltd., Crowborough.
Taylor, Whiting & Taylor, Derby.
Bysouth, Christopher, Baldock, Herts.
Jones, E. W., & Co., Wellington, Salop.
West Wales Electric, Ltd., Criccieth, North Wales.

At the same meeting six applications were declined, and one was withdrawn.

Bankruptcy Proceedings.

J. G. RITCHIE, 54, Woodsley Road, Leeds, electric lamp dealer.—Receiving order made January 3rd on a creditor's petition.

H. D. DOUGLAS, 42, Bromley Road, Catford, S.E., engineer, wireless factor, &c.—Application for discharge to be heard January 30th, at Carey Street, W.C.2.

E. M. LANCASTER, the Younger, 21, Hanover Lane, Leeds, electrical engineer.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds; released January 1st.

A. LAWRIE, trading as Houchin & Lawrie, at 9, Melbourne Parade, Palmer's Green, electrical engineer.—First and final dividend of 1s. 2¾d. in the £, payable January 23rd, at the Official Receiver's Office, 29, Russell Square, W.C.1.

C. K. GOVETT, trading as Kenneth Govett & Co., 179, Albany Road, Cardiff, electrical contractor.—Receiving order made January 5th, on debtor's own petition.

Company Liquidations.

AUTOMOBILE ACCESSORIES (BRISTOL), LTD.—Last day for receipt of proofs for dividend, January 23rd. Liquidator, Mr. A. Taylor, Exchange Chambers, Bristol.

WAREHAM ELECTRIC SUPPLY CO., LTD.—Preferential creditors are to receive a dividend (prior to a distribution to the debenture holders). Proofs to be sent by January 23rd to the liquidator, Mr. G. D. Pepys, Senior Official Receiver and Liquidator, Carey Street, W.C.2.

FLUORADS, LTD.—Winding up voluntarily. Liquidator, Mr. W. Elles-Hill, 41, Bedford Square, W.C.1, appointed January 4th. The liquidator is authorised to enter into an agreement with Luminads, Ltd.

Dissolutions of Partnership.

MAGNUM ELECTRICAL APPLIANCES, 16, Limes Road, Croydon.—Messrs. L. A. Gommersall, T. S. Lattimer, and F. D. Soares have dissolved partnership so far as concerns Mr. F. D. Soares, who retires from the firm.

KEENE & HARWOOD, electrical engineers, 68, Church Road, Barnes, S.W.13.—Messrs. J. A. Keene and G. W. K. Harwood have dissolved partnership. Mr. Harwood will attend to debts and continue the business under the style of "G. W. K. Harwood."

New Catalogues and Lists.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—January price list of electrical supplies, including wiring materials, lighting fittings, and domestic appliances.

MESSRS. BLACKSTONE & CO., LTD., Stamford.—Publication No. 450, illustrating and describing the company's new 1, 1.5, 2.5, and 3.5-kW generating sets.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Church Road, Leyton, E.10.—A comprehensive illustrated catalogue of "Lewcos" radio components and accessories.

MESSRS. A. P. LUNDBERG & SONS, LTD., 477-489, Liverpool Road, Holloway.—A series of illustrated and priced leaflets dealing with two-way tumbler switches, press-button switches, flush switches, &c.

THE LONDON ELECTRICAL CO., LTD., 1, Sherborne Lane, King William Street, E.C.4.—A series of new publications, including an abridged net price list of wiring materials (No. 777) and a price list of conduits and fittings.

MESSRS. R. A. S. WILLIAMS & CO., 37, Cursitor Street, Chancery Lane, E.C.4.—An illustrated and priced leaflet advertising the "Revelation" flashing adaptor.

THE GLOBE ENGINEERING CO., LTD., Brighouse.—Leaflet No. 15, bearing illustrations and prices of the company's battery-charging sets for garages.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Booklet No. 201, containing particulars and prices of dark room outfits and accessories for users of "Metalix" X-ray tubes.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for January, dealing, as usual, with many phases of the company's activities—lighting equipment, radio apparatus, domestic appliances, &c. The new works at Birmingham are described and illustrated.

THE T.B.T. ELECTRIC CO., LTD., 171, Queen Victoria Street, E.C.4.—January stock list of d.c. and a.c. motors from 0.15 to 130 h.p.

GUESTS'S BRASS STAMPING CO., Cardigan Works, Belmont Row, Birmingham.—List G.B.S.3, illustrating examples of hot die pressings in brass, copper and yellow metal.

MESSRS. J. G. STATTER & CO., Queen Anne's Chambers, Westminster, S.W.1.—Leaflet No. X221, illustrating and describing 3-phase, 3,300-V ironclad draw-out switchgear.

SUPERLAMP, LTD., 92-94, Paul Street, E.C.2.—A profusely illustrated catalogue of "Supaul" lighting fittings and glassware. Priced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A catalogue of "Valhalla" sun-tinted electric-lighting fittings of modern design. Illustrated in colour and priced.

"Osram" Lamps in British Guiana.

The GENERAL ELECTRIC CO., LTD., has sent us a photograph which indicates once more the ubiquity of the "Osram" lamp. It was taken in British Guiana during a recent Empire Week, and depicts an "Osram" lamp tableau mounted on a motor-cycle.

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Our Foreign Electrical Trade.

The following table shows the values of exports and imports of electrical goods and machinery during December :—

	Dec., 1928. £	Inc. or dec. as compared with Dec., 1927. £	12 months, 1928. Inc. or dec. £
Exports—			
Electrical goods and apparatus	922,664	− 60,887	− 249,136
Machinery	4,499,244	+313,537	+3,828,288
(Inc. electrical machinery	512,774	+ 24,526	− 6,333)
Imports—			
Electrical goods and apparatus	470,492	+ 25,267	+ 454,502
Machinery	1,234,665	−124,258	+ 812,399
(Inc. electrical machinery	150,373	+ 3,433	+ 125,072)
Re-Exports—			
Electrical goods and apparatus	13,716	− 2,395	+ 18,893
Machinery	141,584	+ 12,553	+ 150,109
(Inc. electrical machinery	8,597	− 6,300	+ 26,968)

New Italian Companies.

Among the companies recently organised in Italy are the Società Elettrica di Montenere, Milan, capital 120,000 lire; La Società "Italpila," Fabbrica Italiana Pile et Apparechi Elettrici, Milan; La Società Costruzione Esercizio Impianti Elettrici, Legnano, capital 100,000 lire; and La Società Elettrica dell' Arsa, Novara, capital 250,000 lire.

New Indian Company.

The Sirsa Electric Supply Co. has been formed at Sirsa, District Hissar, Punjab, with a capital of 100,000 rupees.

Liverpool and Sub-Contractors.

The Co-ordination Committee of the Liverpool Corporation recently had under consideration a proposal that in all contracts which involved electrical work, this should be the subject of a direct contract between the Committee concerned and the electrical contractor, and not sub-contracted by the main contractor. After reviewing all the circumstances, the Committee recommended the City Council not to adopt the proposal. It was pointed out that all work executed by sub-contractors was subject to the same conditions as if executed by the main contractor. In the opinion of the Committee it was desirable that the main contractor should be solely responsible to the Committee for all work under the contract, including that performed by sub-contractors.

The Importation of Radio Apparatus into Rumania.

The *Board of Trade Journal* says that, according to a Customs Circular dated December 14th radio apparatus and accessories may be imported into Rumania without any permit from the Rumanian postal authorities.

The British Electrical Trade Protection Association.

A well-attended meeting of this new association was held on Tuesday last, when the following were appointed :—

Chairman : Major Hogan (Hogan & Wardrop).

Vice-Chairman : Mr. C. Orgell (Super Lamps, Ltd.).

Executive Committee : Messrs. T. Beadle (Beadle & Co., Hull), A. Hunstone (Electrical Conduits, Ltd.), P. L. Dwyer (Dwyer & Co.), F. W. Evans (National Electric Supply Co.), J. Godden (Godden & Co.).

The German Electrical Industry.

The directors of the Siemens & Halske Company state that during the year ended September 30th, 1928, the works in general were well occupied, but with great fluctuations on the whole, and particularly in individual departments. It was possible for the most part to balance in other branches the diminution in the orders received from the Reich Post Office. The foreign business further developed, but it was found necessary to make many sacrifices in prices to secure contracts. The sales of broadcasting apparatus increased considerably, and there was a revival in automatic telephone installations. There was fair activity in telephone cables, Pupin coils and amplifiers. There were larger orders for technical measuring apparatus, which led to a corresponding increase in the production plant. The total number of persons employed by the company, the Siemens-Schuckert works, and the companies controlled by them increased from 110,000 in 1926-27 to 130,000 last year. The dividend is raised from 12 to 14 per cent.

The report of the Siemens-Schuckert Works Company, which also covers the year ended September 30th, 1928, states that the increased activity which was noted in the second half of 1926-27 continued. Although the turnover increased considerably, the profits did not rise in the same proportion. It was not possible or desirable to meet the growth in production costs by advancing sale prices. The degree of activity was not uniformly favourable in all departments. The expansion in the turnover last year was obtained in the inland market, although the foreign turnover still formed an important part of the total. Thanks to the extended sales organisation in all countries it was possible to maintain the company's share of foreign orders. In 1926-27 this was only possible at a sacrifice, and during the past year the difficulties became still greater. The orders received from electricity supply undertakings exceeded those of the previous year. The steam turbine business was not altogether satisfactory; although large sets for public supply works were ordered, the contracts for medium and small turbines did not come up to expectations. In the hydro-electric branch the company specially devoted itself to the question of hydraulic equalisation and storage works with pumps and turbines. Business in convertors declined somewhat owing to the progressive change over from d.c. to a.c., but this was compensated for by increased orders for other plant. The cable branch remained as satisfactory as in the previous year, while the business in switching installations was specially active, including apparatus for 110,000 and 220,000 V. As mentioned in an earlier issue, the dividend is increased from 9 per cent. in 1926-27 to 10 per cent.

Unemployment.

There was an increase of nearly a quarter of a million in the number of registered unemployed during the fortnight ended December 31st. At that date the total was 1,520,700 as compared with 1,271,120 on December 17th and with 1,336,300 on January 2nd, 1928. This large increase is attributed to the dismissal of workers after the Christmas trade and to extended short-time working. In the corresponding period of 1927-23 the increase amounted to 232,250.

Unemployment in Germany.

The Berlin correspondent of *The Times* says that German unemployment insurance returns showed a further increase in the second half of December. The number of persons in receipt of insurance relief rose by 402,000, or 31 per cent., from 1,300,000 on December 15th to 1,702,000 on December 31st, and the number of persons in receipt of extended benefit from 116,800 to 127,400, or 9 per cent. The total number of registered unemployed at the end of the year was therefore 1,829,400.

For Sale.

Newport (Mon.) Corporation has for sale generating and boiler plant with accessories. The Willesden Parish Guardians have for sale a 46-b.h.p. steam-driven generating set. The County of London Electric Supply Co., Ltd., has for disposal the complete equipment of its City Road generating station. Mr. H. J. Shaw has been instructed to sell by auction on January 23rd, at 13, High Holborn, W.C.1, office furniture and stock of the Beko Lamp Co., Ltd. (See our advertisement pages to-day.)

A Commercial Travellers' Motor Badge.

A special motor-car badge is now being issued for the use of those employing cars in business. This badge is recognised by a large number of provincial police, so that a motor-car may be given certain consideration when drawn up to the kerb during a business interview. So far official recognition has not been granted in the metropolitan area, but it will be found that the police will afford every courtesy to prevent undue interference with a traveller's calling, according to circumstances of the traffic at the time, where cars bearing this badge are found. The conditions governing the issue of the badge can be obtained from the Hon. Sec., Electrical Trades Commercial Travellers' Association, 24-28, New Oxford Street, W.C.1.

New French Company.

A company has been formed in Paris (1, Rue de Metz), with a capital of three million francs and the title La Société Indo-Chinoise de Constructions Radio-Electriques et Electro-Mécaniques, to engage in the electrical business in Indo-China.

The Timber Trade.

Our timber trade correspondent reports that owing to much larger imports in December, due to the more attractive prices by shippers, stocks of European softwoods now on the market are larger than was previously anticipated. These stocks, however, are not heavy, and any good spurt in general consumption would find them getting scarce before the arrival, in May, of the new season's wood. Hardwood logs are arriving sparingly, particularly mahogany and teak, which are firm in value, the latter particularly. More sawn hardwoods are arriving, but fresh American supplies are decreasing. The market generally for these sawn hardwoods is quiet. There is considerable activity in the plywood market, and the larger quantities arriving month by month show that this material is increasing in favour.

Electricity in Tin Mining.

The Tin Selection Trust, Ltd., proposes to increase its capital from £1,000,000 to £2,000,000. The new capital is required mainly in connection with a hydro-electric undertaking which will eventually supply power for the whole of Bauchi Plateau (Nigeria). In a circular the directors state that one of the company's associates, Northern Nigerian (Bauchi) Tin Mines has reduced its costs very considerably by the use of hydro-electric power.

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Recent Contracts.

The following are among the orders recently received by Messrs. MIRRLEES, BICKERTON & DAY, LTD.:—Two 3-cylinder 225-b.h.p. "Mirrlees-Diesel" engines and one 2-cylinder 40-b.h.p. engine for the Marconi wireless station at Abu Zabul, Egypt; a 6-cylinder 600-b.h.p. "Mirrlees-Diesel" engine for the Rafaela power station, Argentina; a further 4-cylinder 200-b.h.p. "Mirrlees-Diesel" engine driving a centrifugal pump, for the Alexandria waterworks, Egypt; a 2-cylinder 50-b.h.p. "Mirrlees-Diesel" engine for driving a Mirrlees "Chokeless" pump, for the Port of Spain Municipality, Trinidad; and two 330-b.h.p. 6-cylinder "Mirrlees-Diesel" engines direct-coupled to B.T.H. generators for the new electric generating station at Beira Port, Mozambique.

The Admiralty has placed a contract for several thousand vacuum and gasfilled lamps for ship and dockyard use with SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD.

METRO-VICK SUPPLIES, LTD., has also received a part contract for the supply of metal filament vacuum lamps from the Admiralty.

The MULLARD WIRELESS SERVICE CO., LTD., is installing its public address system for the amplification of announcements during the presentation of the various mannequin parades at the forthcoming exhibition of British artificial silk goods, Olympia.

Among the orders recently received by the EQUIPMENT AND ENGINEERING CO., LTD., are one for a rail plane from the Shanghai Electric Construction Co., Ltd., and one for phono electric trolley wire from the Cardiff Corporation.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during November last were valued at £73,244, bringing up the total for the first eleven months of 1928 to £483,247, as compared with £350,233 in the corresponding period of 1927.

Calendars and Diaries.

A wall calendar with large monthly sheets has been received from POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.

From the CREDENDA CONDUITS CO., LTD., of Oldbury, we have received a neat little set of "Creda" spanners, fitting all the nuts on "Creda" cookers, as well as many of those on a motor-cycle. Supply authorities and firms handling these cookers should get into touch with the makers, who will also comply with applications from individuals, so long as the stock lasts.

Illustrations of Saulter's patent coiling devices appear on a wall calendar received from Messrs. R. H. SYMONDS, LTD., 39, Victoria Street, S.W.1.

A reproduction of an old hunting scene, in colour, appears on the wall calendar of Messrs. RICHARD JOHNSON, CLAPHAM AND MORRIS, LTD., Trafford Park, Manchester.

A very neat desk pad mounted in a chocolate "Bakelite" moulding has come from BAKELITE, LTD., 68, Victoria Street, S.W.1.

Mr. SAMUEL BAXTER, 102 & 110, Greyhound Road, W.6, has sent us a wall calendar bearing monthly date sheets and particulars of holidays, postage, &c.

A wooden cut-out representing a "Brown" loud speaker and a Pekingese dog, with monthly date slips, form the calendar of Messrs. S. G. BROWN, LTD., North Acton, W.3.

Central Electricity Board Contracts.

In our advertisement pages to-day the Central Electricity Board invites tenders for the following:—

North-West England and North Wales Electricity Scheme.—132,000-V transformers and outdoor switchgear for transforming stations.

South-East England Electricity Scheme.—66,000-V switchgear for the London area.

Prices of Raw Materials.

In their letter of January 12th, Messrs. James Forster & Co. said that last week the lead market was dull and uninteresting, prices fluctuating within narrow limits. Demand from consumers has been extremely quiet in contrast to the activity seen in the previous week, and similar conditions appear to prevail on the Continent. Supplies, on the other hand, though not excessive, are quite sufficient for current needs, and there seems no prospect of a shortage in the near future. The outlook therefore is for steady markets until consumers' demand revives, when a further advance may be seen.

Messrs. F. Smith & Co. report, January 15th:—Copper (electrolytic) bars, £78 15s., £3 10s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £88 15s., £3 10s. inc.; ditto ditto h.c. wire, 11d., 7/16d. inc.; Silicium bronze wire, 11½d., ½d. inc.

Messrs. James & Shakespeare report, January 15th:—Copper bars (best selected), sheet and rod, £102, no change; English pig lead, £23 5s., 5s. dec.

Messrs. Edward Till & Co. report, January 15th:—India-rubber, Para fine, 7½d., ½d. inc.

Lighting and Power Notes.

Aldershot.—MAINS AND SWITCHGEAR.—The Town Council has received sanction to a loan of £8,800 in connection with the supply of electricity to the Aldershot Park housing scheme, and North Town. Of this sum £7,500 is for mains, and £1,300 for sub-station equipment and kiosks.

Birkenhead.—MAINS AND SERVICES.—The Corporation Electricity Committee has received sanction to the borrowing of £30,000 for mains and services in Birkenhead and £25,000 for mains and services under the Wirral scheme.

Bradford.—TRANSFORMER CHAMBER.—The Corporation Electricity Committee has recommended a scheme for the provision and equipment of a district transformer chamber in Roundhill Street, Manchester Road, at an estimated cost of £3,764.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Winnipeg electorate has given an overwhelming majority in favour of a by-law providing for the expenditure of $6,500,000 on the development of hydro-electric power at the Slave Falls site on the Winnipeg River. Plans of the City "Hydro" contemplate the erection of plant designed for an output of 100,000 h.p., and tenders have already been received in respect of two generators of 12,500 h.p. each. This initial installation of 25,000 h.p. is expected to be completed and in operation in 1931. Mr. J. G. Glassco, manager of the City "Hydro," in outlining plans for the Slave Falls development, has intimated that an additional 35,000 h.p. will before long be developed at the existing Pointe du Bois plant, which is now producing 105,000 h.p. The expansion programme indicates that the City of Winnipeg will eventually have at its disposal approximately 240,000 h.p. of hydro-electric energy from its two sites on the Winnipeg River. The hydro-electric power requirements of the City of Winnipeg and surrounding territory are also met by the Winnipeg Electric Company and its subsidiary, the Manitoba Power Company. The installation in the Manitoba Power Company's plant at Great Falls on the Winnipeg River is this year being brought up to 168,000 h.p., and the Winnipeg Electric Company's plant on the Pinawa channel has an installed capacity of 37,800 h.p. The Pinawa development is, however, to be superseded by the Seven Sisters Falls development now under construction by the North-Western Power Company, Ltd., also a subsidiary of the Winnipeg Electric Company. The installation at Seven Sisters is expected to reach 132,000 h.p., and it is understood that the capacity of the site will permit of further installation up to 225,000 h.p.

Cardiff.—HOSPITAL SUPPLY.—According to the *Western Mail*, the Cardiff Union has approved the recommendations of the Plans Sub-Committee for the installation of electrical plant at Llandough Hospital at a cost of £39,200 for lighting, heating, and power. The annual maintenance costs, including 10 per cent. for capital charges, are estimated at £10,450. The scheme includes three Lancashire coal-fired boilers (one as a stand-by) with economisers, &c.; two (one as a stand-by) 150-kW, 230-V, d.c., back-pressure type engine generating sets; one 1,000-amp.-hr. battery; switchboard; heating calorifiers with circulating pumps; domestic hot-water calorifiers with circulating pumps; centralised refrigerating plant; refuse destructor; and fitting shop.

Carlisle.—NEW PLANT.—The Corporation Electricity Committee has received a letter from the Electricity Commissioners, intimating that they are prepared to give consent to the extension of the power station by the installation of one 15,000-kW turbo-alternator set, together with three 30,000-lb. boilers and auxiliaries, and stating that they have been in communication with the Central Electricity Board as to the procedure in connection with the extension of selected stations, and that the Board will shortly give a direction to the Corporation under the provisions of Section 5 (1) of the Electricity (Supply) Act, 1926, in respect of the above-mentioned extension.

SHOW WINDOW LIGHTING.—The Electricity Committee has decided to allow a special tariff for late shop-window lighting at an annual rental of 32s. per annum, in respect of the time switch and meter, with a flat rate of 2d. per kWh.

Continental.—RUSSIA.—The Council of People's Commissaries of the Soviet Union and the Council of Labour and Defence have, it is announced, decided to appropriate 186 million roubles in the State Budget for development of power schemes in 1928-29. A number of regional stations are to be commenced this year, including stations at Stalingrad, Briansk and White Russia (Ossinovo).—*Reuter* (Moscow).

ITALY.—The Italian Government has given its consent to a project of the Società Garigliano and the Società Italiana Potassa, of Rome, for the establishment of a hydro-electric plant at Castelforte, to utilise the water power of the River Garigliano to the extent of 8,344 h.p. The Società Trentina di Elettricita also proposes to establish a 9,680-h.p. plant to utilise the power of the Valsura River at Ultimo (Bolzano).

NORWAY.—The town and district of Bergen are now being supplied with electricity from a new hydro-electric plant completed at Dale, where the Store falls are utilised. The equipment so far installed includes two 16,500-h.p. Pelton twin-wheel turbines coupled to 7,500-V, 50-cycle alternators running

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at 375 r.p.m. For transmission purposes over a distance of about 32 miles electricity is stepped up to 22,000 and 80,000 V. The capacity of the plant is later to be increased to 90,000 h.p.

BELGIUM.—The Société de l'Union des Industries, of Brussels, is interested in a scheme for the establishment of a power station to be operated by the waste blast furnace gas in the iron and steel industrial centre of Belgium. The plant will have a capacity of 15,000 h.p., and is intended to supply 70 million kWh per annum to the distribution system of the Union des Centrales Electriques du Hainaut.

Douglas (I. of M.).—ELECTRICITY SUPPLY.—At a recent meeting of the Corporation Electricity Committee the chairman reported that he, along with the town clerk and the borough electrical engineer, had attended the meeting of the Electricity Commission at which the whole circumstances of the supply to Douglas and the Isle of Man supply were discussed. After discussion, the Commission asked for the decision of the Committee on the following questions: (1) Whether the Corporation desired to undertake the supply and distribution over the whole island. (2) Whether it would be agreeable to the formation of a Joint Electricity Authority on which it would be represented, and to which it would sell its generating station and plant, and from which it would buy its electricity, continuing to distribute in its own area. (3) Whether it would be prepared to undertake the supply and distribution over the whole island, if the alternative was the taking over of its station by a Joint Electricity Authority. (4) Whether the Corporation would be prepared to sell electricity in bulk to a company or electricity authority for the purpose of distribution outside the Douglas area on the terms of the second schedule of the English Electricity Act, 1926. The Committee has decided to reply in the negative to questions 1 and 2, and, as regards question 3, that it is of opinion that this contingency cannot arise. Replying to question 4, the Committee states that it is prepared to supply on any terms which could be considered equitable.

Dumfries.—EXTENSION SCHEME SANCTIONED.—The consent of the Electricity Commissioners has been received by the Town Council to an extension scheme at the Corporation electricity works which will cost £16,000. The scheme has been suspended for some time in view of the national "grid" scheme and of the Galloway power project, but the Commissioners have assured a deputation from the Council which recently waited upon them in London that the Dumfries works will be a "pick-up" station between the stations at Carlisle and Kilmarnock, and that it may be used to supply the "grid" system in emergencies.

East Ham.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £2,222.

Fylde.—INSTITUTION SUPPLY.—The Board of Guardians has decided to install electricity in the Institution and in the Kirkham offices, and a contract will be entered into with the Preston Corporation which will give a supply at a fixed annual charge of £250, plus 1d. per kWh. Last year the Guardians expended £450 on gas, and it is hoped by adopting electricity to save at least £100 per annum.

Glasgow.—PROGRESS DURING NOVEMBER.—Under the Corporation Electricity Department's scheme 692 houses were wired in November, making the total to date 10,654, while applications for the hire of appliances numbered 606, bringing the total to 21,775.

CHANGE-OVER.—The Committee has approved a proposal by the manager that the works of Messrs. Cockburns, Ltd., Cardonald, be changed from d.c. to a.c., 50 cycles, at an estimated cost of £1,700.

MAINS EXTENSIONS.—The Committee has recommended that distributing mains be laid at a total cost of £3,098.

MUNICIPAL CONTROL.—The Corporation, on January 10th, decided to ask the Town Clerk and the electricity manager to submit a report on the question of the municipal control of the city area which is at present taking a supply of electricity from the Clyde Valley Electric Power Co. Mr. Pilkington pointed out that 20,000 people in the city were being supplied by the company. Rutherglen Town Council had an arrangement with the company that consumers in the town would not be charged more than the rates charged by the Glasgow Corporation Electricity Department. If the Clyde Valley Company would give this concession to Rutherglen it was not asking too much that the manager be allowed to inquire if it was not possible to extend it to the Glasgow consumers.

Gravesend.—CABLE EXTENSIONS.—The Corporation Electricity Committee is to put in hand the following work: a.c. supply cables between Pelham Arms kiosk and El Teb, along Old Road West (£2,165); cables from Pelham Arms kiosk along Dover Road (£1,080); and through Dashwood Road to Meadow Road, in Cross Lane West (£450).

Hastings.—LOANS.—The Corporation Electricity Committee is applying for sanction to the following loans in connection with the extended area of supply: services, £2,500; mains and overhead lines, £1,000; and transformers, £500.

"GRID" SCHEME.—The Committee has received a report from the borough electrical engineer stating that he has been asked by the Central Electricity Board to fix the voltage of the incoming supply from the proposed main grid. He reports that following interviews with the district engineer he is of opinion that it would be best to fix it at 11,000 V, 3-phase, 50 cycles, with a certain tolerance plus or minus—the present generating voltage being 6,600 V, 3-phase, 50 cycles. The higher voltage will entail the provision of another switchboard and modifications to buildings at an approximate cost of £7,000, but part of the cost (about £750) will be payable by the Central Electricity Board, and in any case a portion of the expenditure, estimated at £3,500, will be necessary next year to cope with the increased Bexhill supply. The Committee has considered the report and recommends that the voltage of the incoming supply be fixed at 11,000 V.

Heston and Isleworth.—BULK SUPPLY.—The Urban District Council has decided to notify the Twickenham and Teddington Electric Supply Co., Ltd., of its desire that the price charged by the company for energy in bulk be revised, and also of its intention to terminate its agreement to purchase a bulk supply in February, 1930.

Liverpool.—LOAN.—The City Council is to apply for sanction to borrow £300,000 for prospective expenditure on mains.

London.—SHOREDITCH.—The Borough Council Electricity Committee has recommended that application be made for sanction to a loan of £27,000 for extensions to the boiler house, and the provision of one water-tube boiler of 100,000-lb. evaporative capacity, complete with accessories.

Lytham St. Annes.—STREET LIGHTING.—A new tramway-pole lighting system has been approved by the Corporation. The existing type of lamp will be gradually changed over to arc lamps.

Middleton.—MAINS EXTENSION.—The Town Council has decided to lay a h.p. cable to a special sub-station to supply electricity to 70 new houses on the Mainway, Middleton Junction, at an estimated cost of £3,470.

Oswestry.—PURCHASE OF UNDERTAKING.—The Corporation has decided to purchase the undertaking of the Oswestry Electric Lighting & Power Co., Ltd.

Pontefract.—INQUIRY.—The inquiry into the charges made for electricity supplied by the Yorkshire (West Riding) Electric Tramways Co., Ltd., in the borough, which was to have been held on January 8th, has been postponed until February 4th and 5th.

Scotland.—HYDRO-ELECTRIC SCHEMES.—Inverness Town Council has decided to oppose both the West Highland and Grampian hydro-electric schemes, and to obtain the services of senior and junior counsel and also the services of expert witnesses.

Kirkcudbright Town Council, on January 7th, decided to oppose the Order of the promoters of the Stewartry hydro-electric scheme.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by H. & S. W. Thomas Co., Ltd., authorising them to supply electricity in part of the rural district of Narberth, and William George Heath, authorising him to supply electricity in the borough of Okehampton, the urban district of Tavistock, and the rural districts of Okehampton and Tavistock.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the North Somerset Electric Supply Co., Ltd., to supply electricity in the rural district of Langport and parts of the rural districts of Bath, Keynsham, Shepton Mallet, and Wells; Warmley Rural District Council to supply electricity in part of the rural district; Brentwood District Electric Co., Ltd., to supply in parts of the rural districts of Billericay and Romford; Braunton Electric Light & Power Co., Ltd., to supply in part of the rural district of Barnstaple; and Tonbridge Urban District Council to supply in parts of the urban district of Tonbridge and of the rural districts of Tonbridge and Malling.

Wimbledon.—NEW SUB-STATIONS.—The Electricity Committee is to erect and equip two new sub-stations at Franks Avenue and Cavendish Road, New Malden, for the supply of new private building estates now being developed. The estimated cost is £1,000.

PURCHASE OF MAINS.—The Committee has offered the Electricity Committee of the Kingston Corporation £500 for the purchase of the mains and services laid by that Committee to supply electricity to the housing estates at New Malden.

Tramway and Railway Notes.

Continental.—BELGIUM.—The Société Nationale des Chemins de Fer Vicinaux is preparing plans for the electrification of the local railway between Ghent and Deynze.

Doncaster.—RAILLESS CARS.—The Town Council has applied to the Ministry of Transport for permission to anticipate sanction to the conversion of the tramway on the Hexthorpe route to railless cars, in order that the necessary work may be proceeded with immediately, owing to road widening and improvement works.

Eastry.—EXTENSION OF TIME.—The Rural District Council has received from the Minister of Transport an Order authorising the extension of the period for the completion of railways authorised or revived by the East Kent Light Railways Orders to June 30th next.

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London.—NEW TYPE OF TRAMCAR.—According to *The Times*, the L.C.C. is about to test a new type of tramcar, specially designed for ascending and descending hills. Two cars, which are now being constructed at the Charlton works, will be tested on the Camberwell to Catford route, which includes Dog Kennel Hill and Denmark Hill. The new cars will be of the double-bogie type, with eight wheels, and will be constructed with powerful brakes and the latest improvements in car construction. They will seat seventy-four persons, compared with sixty-two in the present type. If the test proves successful it is intended to build enough of the new cars for the whole of that service, with the result that there will be an improvement in accommodation and a general speeding-up throughout the route.

NORTH LONDON TUBE PROPOSAL.—Representations have been made to the Traffic Committee of the L.C.C. to give consideration to a scheme for the provision of a tube railway to serve Stoke Newington and the neighbouring districts. The proposal is for an extension of the Central London Railway northwards from the Liverpool Street tube railway terminus, under Kingsland Road, Kingsland High Street, Stoke Newington Road, Stoke Newington High Street, and Stamford Hill, and thence northwards, through Tottenham and Edmonton, to Waltham Cross. The *Daily Telegraph* reports that in a letter to the chairman of the Committee the Stoke Newington Ratepayers' Association states: "A point of the most vital importance is that the new line would relieve the over-pressure which has existed so long at the bottle-neck of the old Great Eastern Railway at Bishopsgate, and which seems irremediable. We are convinced that the traffic upon such a line as is proposed would be enormous, and to a large extent continuous throughout the day." The Association submits that the suggested extension of the Piccadilly Tube northwards from Finsbury Park would give no relief whatever to Stoke Newington and the neighbouring districts.

Southern Railway.—DEVELOPMENTS DURING 1929.—The Southern Railway's programme of improvements and developments during the current year includes the completion of the electrification scheme on the central section, involving the conversion of the old overhead system to the third-rail method, which will be completed in March. The total length of electrified line will then amount to 875 track miles. Further extensions are under consideration. The programme also includes the provision of colour-light signalling between London Bridge and New Cross and the abolition of New Cross "A" signal-box.

Kidderminster and Stourport.—ABANDONMENT OF TRAMWAYS.—The Kidderminster and Stourport Electric Tramway Co. has applied to the Ministry of Transport for consent to abandon the whole of the tramways at Kidderminster, Stourport, and in the rural district of Kidderminster.

Telegraph and Telephone Notes.

Canada. — TELEPHONE EXPANSION. — The Bell Telephone Co., of Canada, contemplates an expenditure of $27,000,000 during 1929 on construction and expansion of facilities on its lines in Eastern Canada. This will be the highest appropriation in the history of the company, comparing with $22,000,000 during last year, which in turn was $4,000,000 larger than the 1927 amount. Of the $27,000,000 for this year, $7,000,000 will be for extending long-distance lines, including expenditure on new carrier-current facilities, new cables, &c. Part of the total is for the new headquarters building in Montreal, which will be ready for occupation in five or six months; eleven major building projects are under way.

China.—AMERICAN WIRELESS LINK.—A commercial wireless service between New York and Shanghai, *via* the Phillipine Islands, was to be inaugurated on January 14th by the Radio Corporation of America.—*Reuter* (New York).

Germany.—SUBMARINE TELEPHONE CABLE.—The Post and Telegraph authorities have recently placed a contract with the Siemens & Halske Co., of Berlin, for the manufacture and laying of a third submarine telephone cable in the Gulf of Finland between Leba and Pillau, a distance of about 166 miles, thus providing additional means of communication between Pomerania and East Prussia. The Pupin coil cable to be used will, it is claimed, be the longest for submarine use so far constructed.

Irish Free State.—TELEPHONE SERVICE.—The proportion of telephones to the population is 1 to 125; in Greater Dublin 1 to 60; in Central Dublin 1 to 26; and in Cork City 1 to 43 persons. Since the service was taken over from the British Post Office in 1922 the number of exchanges has increased from 194 to 676, and the number of call offices from 552 to 1,156; two automatic exchanges are in service in Dublin, with a total of 2,112 subscribers.

International Telephony.—SWEDEN.—A statement by the Government Department of Telegraphs and Telephones shows that Sweden is in telephone communication with no fewer than 19 different countries: they are Denmark, Norway, Finland, Lithuania, Germany, Austria, Czecho-Slovakia, Switzerland, France, England, Holland, Belgium, Danzig, Hungary, the United States, Canada, Mexico, Cuba and Luxemburg. Within a few months connection with three more countries, *viz.*, Poland, Italy and the Argentine, will be established.

The Telegraph Service.—LONDON-SINGAPORE.—Direct telegraph communication in both directions between Singapore and London was established on January 7th by the Eastern Telegraph Company, thus eliminating the relaying stations. According to *The Times*, a signal was sent from London to Penang and back again in 2 5/6 seconds, and transmission between London and Singapore was accomplished in about two seconds. The regenerator, it is claimed, is superior both in efficiency and in accuracy to the relaying stations which it displaces. The system was first installed by the Eastern Telegraph Company on the London and Cape Town route some time ago. It was extended to the services between London and Bombay last August, and is now in operation between London and Alexandria also.

The Telephone Service.—PRIVATE LINES.—A concession has been made by the Post Office authorities to business firms renting private telephone lines between their London headquarters and branches in the provinces. Firms whose private lines are connected with provincial offices which are technically subsidiary companies are to be charged on the same scale as firms whose lines run to offices which are branches within the legal definition of the word. The basic charge for such undertakings has hitherto been substantially higher. The Federation of British Industries recently took the matter up with the Post Office, and as a result it has been agreed that the extra charge shall be waived.

Radio Notes.

Canadian Commission.—SAILS FOR EUROPE.—The members of the Commission appointed by the Canadian Government to study and report upon the regulations governing wireless broadcasting in Great Britain and on the Continent sailed on January 7th in the White Star liner *Baltic*, which was due to arrive at Liverpool on the 15th inst.—*Reuter's* (Halifax, Nova Scotia).

France.—EIFFEL TOWER STATION.—Broadcasting from the Eiffel Tower is to be suspended after 9 p.m. in order to avoid the present interference with Daventry (5XX). According to an announcement by the French Under-Secretariat of Posts and Telegraphs, the Eiffel Tower changed its wave-length from 2,650 metres to 1,484 metres, and the Under-Secretariat admits in the communiqué issued that numerous protests have been received since the beginning of the year. The change was, however, inevitable, since the big liners are now utilising waves exceeding 2,000 metres. It was for this reason that the Washington Conference of 1927 provided that the major European wave-lengths should be confined to a band between 1,340 and 1,875 metres. The Administration also points out that the new length has given satisfaction in Southern Algeria, the Levant, and Alsace. The forthcoming European conference in Prague may find a satisfactory solution.

Irish Free State.—LICENCES.—At present there are 26,000 receiving licence holders in the Free State, bringing in a revenue of £13,000; on March 31st, 1928, the number was 24,000. On January 13th, 1929, the wave-length of the Dublin station (2RN) was changed from 319 to 411 metres, in conformity with the European redistribution. The Free State intends to be represented at the international conference which is to take place at Prague in April next. The Post Office recently submitted to the Ministry of Finance a memorandum on the service, including the proposal to erect a high-power station. There are now three studios, a new one having been opened last year in the P.O. buildings in Dublin.

League of Nations.—SHORT-WAVE TESTS.—There is no truth in a report that cable communication is being established between Geneva (Switzerland) and Kootwijk (Holland) for the world broadcasting of League conferences at Geneva. According to *The Times*, the report probably arose out of the fact that the League Secretariat proposes to begin, at the end of February or the beginning of March, new technical experiments (on the lines of those of last summer) in the broadcasting of speeches from Geneva to distant points by a short-wave transmitter. The Netherlands Government is again placing its Kootwijk station at the disposal of the Secretariat for one experiment a week.

New Zealand.—RECEIVING LICENCES.—The number of wireless listeners' licences issued in New Zealand last year was 42,801, which is an increase of 4,616 over the figure for the previous year.—*Reuter* (Wellington).

Tristan da Cunha.—RADIO RECEPTION.—The world's loneliest island is to have a wireless receiver. When the Rev. A. G. Partridge sails this month to take up his voluntary

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duties as chaplain he will have with him a standard Marconiphone three-valve short-wave set, which has been presented to the island by friends. As there are no facilities for charging batteries, the high-voltage anode energy will be provided by a bank of 90 large Leclanché cells, and the valve filaments will be heated by special Sterling "Invicta" cells. It is calculated that they should last twelve months, and as it is hoped that arrangements will be completed for a special schooner from Cape Town to call at least once a year, there should be no interruption of reception. Thus the little community will be brought into daily contact with three continents: Europe, through 5SW (Chelmsford, England) and PCJJ (Holland); America, through 2XAD, 2XAF, and other short-wave transmitters; and Australia, through 2FC (Sydney), and perhaps 3LO (Melbourne). It is also possible that the Cape Town (South Africa) station may be heard.

United States.—TELEVISION.—At its meeting on December 22nd, the Radio Board decided to rescind on January 1st, 1929, the licences of two television stations, namely, WGY Schenecaty, and WIBO Des Plaines, Ill.; and indicated that a special broadcast band would be set aside for television experiments, says *World-Radio*. This action, it appears, followed reports that television transmissions were causing interference with the regular broadcasting channels.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—NEW SOUTH WALES.—February 11th. Department of Public Works. Supply, delivery, erection and maintenance of hydro-electric plant in connection with the Hume Reservoir hydro-electric development. (B.X. 4989.)*

January 21st. Static transformers for Young-Wyangala section of the Burrinjuck hydro-electric development. (B.X. 4995.)

Aylesbury.—Electricity Department. 11,000-V switchgear. (See this issue.)

Basingstoke.—January 29th. Electricity Department. One heavy oil engine direct-coupled to a 800-kW, 3-phase, 50-cycle alternator. (See this issue.)

Belfast.—January 29th. Public Health Committee. Installation of automatic telephones in the Infectious Diseases Hospital, Purdysburn. (January 11th.)

Belgium.—January 22nd. Municipal authorities of Saint Gilles, Brussels. 400 3-amp., 220-V and 1,600 5-amp., 222-V ampere-hour meters. Particulars (5 francs) from Service de l'Electricité, Hotel Communal, Saint Gilles.

Cheadle and Gatley.—January 25th. Electricity Department. Electric lamps, meters, cable protection boards, service cables, plywood meter boards, ironclad service cut-outs. Specifications and quantities from engineer and manager.

Egypt.—CAIRO.—January 31st. Ministry of the Interior. January 27th. Transformer kiosks, cables and accessories for the extension of electricity supply from Mit-Ghamr power station. (B.X. 4893.)*

Glasgow.—January 28th. Corporation. Electrical and heating installation at additional police headquarters. Specifications, &c., from Public Works office, 64, Cochrane Street (deposit £3 3s.). Offers to town clerk.

India.—January 23rd. Bombay, Baroda, and Central India Railway Co. 400-kW heavy oil engine driven generating set. Specifications from the offices, White Mansion, 91, Petty France, S.W.1. (deposit £1). (January 4th.)

February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

Liverpool.—January 31st. Corporation. Supply of various electrical materials. (January 4th.)

London.—CENTRAL ELECTRICITY BOARD.—February 15th. 66,000-V cables (London area) in connection with the South-East England Electricity Scheme. (January 11th.)

February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (January 11th.)

January 21st. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area), and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (See this issue.)

L.C.C.—February 4th. Wiring and fittings for electric lighting, heating and cooking in 86 tenements on Ossulston Estate. H.p. and l.p. cables, core re-actors, control battery, &c., for Greenwich power station. (See this issue.)

Lough Derg, Pettigo (Co. Donegal).—February 14th. Supply, delivery, and erection of two 10-kW heavy oil engine generating sets, storage battery, and switchboard. (See this issue.)

Newry.—January 25th. Urban District Council. Supply of single- and three-phase meters.

New Zealand.—WELLINGTON.—February 12th. Posts and Telegraph Department. Dry cells for telephone work. (B.X. 4991.)*

February 28th. Telephone cordage. (B.X. 4990.)*

January 23rd. Supply and delivery of armoured multiple twin telephone cable. (B.X. 5016.)*

March 12th. Switchboard cords. (B.X. 5017.)*

January 31st. Manawatu-Orona Electric Power Board. Automatic reclosing switchgear for pole platform mounting. (B.X. 4988.)*

April 9th. Public Works Department. Induction voltage regulators for Lake Coleridge scheme. (B.X. 5018.)*

Portsmouth.—February 6th. Tramways Committee. Insulating materials, lamps, motor windings, overhead line materials, &c. (See this issue.)

Ripon.—February 1st. Corporation. Works in connection with the proposed electricity supply undertaking as follows:—Contract No. 2: Overhead 11,000-V transmission line. (January 4th.)

Sheffield.—February 14th. Electricity Supply Department. Turbo-alternator, condensing plant, evaporating and steam preheating plant, water-tube boilers, chimneys, superheaters, stokers, or pulverised fuel firing equipment, economisers, &c., wagon tippers, conveyors and elevators, cooling towers, electrically and hand-operated travelling cranes. (January 11th.)

South Africa.—JOHANNESBURG.—January 24th. Town Council. Electric cable. (B.X. 4977.)* Oil switches. (B.X. 4994.)*

CAPE TOWN.—January 23rd. City Council. Electric cable. (B.X. 4978.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—

Cable (£312), W. T. Glover & Co., Ltd.; (£300), Macintosh Cable Co., Ltd.; and (£138), British Insulated Cables, Ltd.

300-kVA transformer (£157).—English Electric Co., Ltd.

H.p. truck type transformer cubicle (£132).—British Thomson-Houston Co., Ltd.

Bradford.—Tramways Committee. Accepted:—

Five tons of copper trolley wire (£467).—Enfield Rolling Mills, Ltd.

One hundred steel tramwheel tires (£336).—Vickers-Armstrong, Ltd.

Forty-one tons of copper trolley wire (£3,951).—British Insulated Cables, Ltd.

460 steel poles (£3,024).—Bromford Tube Co., Ltd.

Eleven single-deck and six double-deck railless electric trolley vehicles (£28,279).—English Electric Co., Ltd.

Brookwood.—SURREY C.C.—Accepted:—

Installation of electric light in new reception hospital, cottages, &c., at Brookwood Mental Hospital (£1,225).—V. G. Middleton & Co., Ltd.

Dewsbury.—Town Council. Accepted:—

Cable (£532).—Power & Lighting Cables, Ltd.

Glasgow.—Watching and Lighting Committee. Recommended:—

Cable (£562).—British Electrical & Manufacturing Co.

Statute Labour Committee.

Installation of electric passenger lift and goods lift at buildings at Glasgow Cross (£1,118).—A. & P. Steven, Ltd.

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Tramways Committee. Accepted:—
Special track work and special points.—Hadfields, Ltd.
Special track work.—Edgar Allen & Co., Ltd.
Car-washing machine.—James Robertson.
Motor generating set for battery charging at new garage.—Macfarlane Engineering Co., Ltd.
Health Committee. Recommended:—
Electric lighting, bells and fire alarms at Mearnskirk Sanatorium (£1,572).—Kennedy, Stark & Co.

Gravesend.—Health Committee. Recommended:—
Electric lighting installation at sanatorium.—Freed Bros.

Lamp Contract.—The Omega Lampworks, Ltd., has received a contract from the Dublin United Tramways Co. (1896), Ltd., for 12 months' supply of vacuum traction-type lamps.

London.—FULHAM.—Board of Guardians. Accepted:—
Installation of two electric elevators at the Hospital (£1,079); Hammond Bros. & Champness.
HAMMERSMITH.—February 6th. Electricity Department. Stores and materials for 12 months. (See this issue.)
WESTMINSTER.—Board of Guardians. Accepted:—
Installation of generating plant at St. Stephen's Hospital (£1,347).—Belliss & Morcom, Ltd.
Alterations to existing switchboard (£171).—General Electric Co., Ltd.

Manchester.—Cleansing Committee. Accepted:—
Electric lighting at Oldham Road depôt.—Brooks & Co., Ltd.
Electricity Committee. Accepted:—
Weldless steel spigot and faucet tubes, street lighting extensions.—Stewarts & Lloyds, Ltd.

Plymouth.—Electricity Committee. Accepted:—
Feed pump for Prince Rock station (£291).—Harland Engineering Co., Ltd.
Works Committee. Accepted:—
Two batteries for electric vehicles (£212 each).—Chloride Electrical Storage Co., Ltd.
Tramways Committee. Accepted:—
Steel girder tramway rails.—Cargo Fleet Iron Co., Ltd.

Warrington.—Electricity Committee. Accepted:—
600-kVA transformer.—Fuller Electrical & Manufacturing Co., Ltd.

Weymouth.—Electricity Committee. Accepted:—
Isolation panel for sub-station switchboard (£117).—English Electric Co., Ltd.

Worcester.—City Council. Accepted:—
Re-wiring the Market Hall and Butchers' Market and providing electric fittings (£120).—Abell & Smith.

Forthcoming Events.

British Electrical Development Association.—Friday, January 18th. Royal Society of Arts. 7.30 p.m. "Electric Heating and Cooking Development."

Royal Institution of Great Britain.—Friday, January 18th. 21, Albemarle Street, W. 9 p.m. "Further Progress in Crystal Analysis." Sir Wm. Bragg, F.R.S.
Thursday, January 31st. 5.15 p.m. "The Early History of X-Rays." Sir Wm. Bragg, F.R.S.

Royal Society of Arts.—Monday, January 21st. John Street, Adelphi. 8 p.m. Cantor Lecture. "The Treatment of Coal." Dr. C. H. Lander.

British Electrical Development Association, Inc. (Cambridge Circle).—Monday, January 21st. Central Hall, Cambridge. 7 p.m. "Improved Lighting of Factories, Workshops, and Workrooms." Mr. H. Lingard.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, January 22nd. Junior Institution of Engineers, 39, Victoria Street. 7.15 p.m. "The Handling of Coal and Resultant Products in the Boiler House." Mr. J. D. Troup.

Institution of Electrical Engineers.—Thursday, January 24th. Institution, London, W.C. 6 p.m. "The Construction of the Grid Transmission System in Great Britain." Messrs. Johnstone Wright and C. W. Marshall.

(London Students' Section).—Monday, January 21st. Institution of Mechanical Engineers, Storey's Gate, S.W. 7 p.m. "Engineering Insurance." Mr. H. R. Sketch.

(North-Western Centre).—Wednesday, January 23rd. Midland Hotel, Manchester. 6.45 p.m. Annual dinner.

(South Midland Centre).—Monday, January 21st. University, Birmingham. 7 p.m. Special "Wireless" Lecture. Capt. P. Eckersley.

Mersey and North Wales (Liverpool) Centre.—Monday, January 21st. The University, Liverpool. 7 p.m. Discussion on "The Anticipation of Demand, and the Economic Selection, Provision and Lay-out of Plant," with introductory papers by Capt. J. M. Donaldson, M.C., M.I.E.E. (power systems) and Mr. J. G. Hines, M.I.E.E. (telephone systems).

Birmingham Electric Club.—Friday, January 25th. Grand Hotel, Birmingham. 7 p.m. Presidential address.

Engineering and Scientific Club.—Friday, January 25th. Wolverhampton. 7 p.m. "Trams *v.* 'Buses." Mr. A. C. Baker and Mr. C. O. Silvers.

Physical Society.—Friday, January 25th. Imperial College of Science, South Kensington. 5 p.m. "A Method for the Determination of the Equivalent Resistance of Air-Condensers at High Frequencies," by G. W. Sutton, B.Sc. "The Measurement of the Anode Circuit Impedances and Mutual Conductances of Thermionic Valves," by L. Hartshorn.

Notes.

Electrician Saved by Collar Stud.

The vagaries of that frolicsome imp, Electra, are charmingly exemplified by a report which appeared under the above heading in *The Times* of January 1st—perhaps three months too soon. We are informed that "Mr. W. Peacock, of Cross Keys, South Wales, an electrician employed at Risca Colliery, thinking that the current was turned off, put his hand on the terminals, and received the full charge of 2,200 volts through his body. The electricity concentrated on a front metal collar stud with celluloid base, which jumped and was forced into Mr. Peacock's windpipe to a depth of 2½ in. The stud was removed, and he survived, though he was badly burned. A doctor who attended him said he had been saved by the stud, in which the current had expended itself."

In view of this notable discovery, we strongly recommend those of our readers who wear collars and are exposed to the concentration of electricity to procure insulated metal studs without delay, and to attach thereto stout lanyards, so that when the studs jump they can be removed from the depths of the windpipe with the minimum of delay.

Apart from its life-saving aspect, this phenomenon might be turned to good use in other directions, such as the marketing of a novel toy, eclipsing the jumping bean, or a simple and cheap solution of the problem of expending our surplus electricity.

Picture Transmission.

On Wednesday last week, a meeting of the Institute of Wireless Technology was held at the Engineers' Club, London, for the purpose of a lecture on the transmission of photographs and a demonstration of the process by Mr. J. Priechenfried. Mr. E. H. Turle, M.I.E.E., was in the chair, and stated that a sudden indisposition had unfortunately prevented Mr. Priechenfried from attending the meeting, but Mr. Green had taken his place at the shortest notice. After explaining the apparatus employed (the Fultograph) Mr. Green set it in operation, successfully transmitting several pictures; many questions were asked by members of the audience, to which he replied, and great interest was shown in the details of the mechanism.

E.A.W. Activities.

The following are included in the spring fixtures of the Electrical Association for Women: January 23rd, a visit to the showrooms of Messrs. Troughton & Young, Ltd., and a lecture on "Modern Decorative Lighting of Interiors" by Mr. A. B. Read; January 30th, special "At Home"; February 7th, visit to Soho School of Cookery, and lecture-demonstration on "A Five-course Dinner" by Miss Mabel Collins; February 19th, visit to Singer Sewing Machine Co., Ltd., and a short talk on "The Construction, Use and Maintenance of Electric Sewing Machines"; March 6th, "At Home"; March 13th, visit to the Ideal Home Exhibition; April 16th, annual luncheon at Hotel Cecil.

A course of evening lectures arranged by the Electrical Association for Women includes: January 29th, "How Electricity is Generated at West Ham," by Mr. F. W. Purse, M.I.E.E.; February 12th, "Radio Progress and its Connection with the Thermionic Valve," by Mr. H. de A. Donisthorpe; March 19th, "Some Elementary Facts Concerning Electric Motors," by Mr. H. Bourne, M.C.

A general meeting of the Rugby Branch of the E.A.W. was held at the Percival Guildhouse on January 9th, when a lecture entitled "Electricity in the Home—The Labour Saver and Comfort Bringer," was given by Mr. B. C. Holding, Editor, *Electrician*.

Domestic Rates in the United States.

The Department of Public Information, National Electric Light Association, states that although electrical apparatus and equipment now costs from 60 to 75 per cent. more than in 1913, and wages and the cost of coal per ton are approximately 200 per cent. greater, the average price for *all* electricity (light, power and traction) sold to the people of the United tates was the same in 1928 as in 1913. If domestic rates for electric service had risen from 1913 to 1928 as much proportionately as the cost of living has increased, it would have involved an additional charge to the public of approximately $550,000,000 more in 1928 than the amount actually collected by the electric light and power industry. Putting

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it another way, the average price for household electricity in 1928 was about 6.75 cents per kWh, as against 8.7 cents in 1913. On the other hand, the cost of living is still 70 per cent. above 1913. If the cost of domestic service had increased at the same rate as the cost of living, it would now stand at 14.75 cents per kWh. It has thus decreased—in terms of cost of living—by 54 per cent., and now stands at 46 per cent. of the 1913 value.

Highland Water-power.

At a meeting of Inverness Rotary Club on January 3rd, Mr. Kenneth Chisholm opened a discussion on the West Highland and Grampian hydro-electric schemes. There was no reason, he said, why this country should not have cheaper electricity. The real duty of Inverness town and county was to see that provision was made in the Special Order ensuring that all power was not taken away from the Highlands. There should not be blind obstruction to the development of the schemes.

Power Transmission at 220,000 Volts.

For a number of years past considerable experimental work has been carried out in the A.E.G. laboratories and test rooms in Berlin in preparation for the time when the transmission voltage will be substantially increased.

The development of hollow cable was the first-fruit of these endeavours. Some time ago we briefly reviewed the installation of the first German 220,000-V transmission line, for which various new methods of erection had to be introduced. This line will eventually function as an international bus-bar, connecting thermal power plants situated in the lignite fields near Cologne with hydro-power plants in the Austrian Alps, a distance of about 300 miles. At present about 125 miles of line has been erected. The line is so designed that when completed it will be able to transmit at the extraordinarily high pressure of 380,000 volts; hence another important problem to be dealt with was the development of switchgear and transformers suitable for such high voltages. The experimental work in this connection has now reached an advanced stage, and the experience accumulated has been put to practical use. Thus, a few months ago, a contract was placed with the A.E.G. for a number of 220,000-V transformers and oil circuit-breaker banks for the first European super-power transmission system.

As their design departs markedly from that hitherto known, some technical data may prove of interest. The largest of the 220,000-V three-phase transformers to be supplied will have a rated capacity of 60,000 kVA at 50 cycles. By changing the connections of the low-voltage winding, the transformer can be connected with networks having voltages of about 33, 55, 66, or 110 kV. A maximum efficiency of 99.1 per cent. will, it is claimed, be maintained from about ¾ to ½ full load. In compliance with international engineering standards, a test voltage of 440 kV will be applied between the higher voltage winding and the iron frame for one minute. The test voltage for the 220-kV outdoor bushings will be higher than the above figure while, to limit the consequences of line short-circuits, the transformers have been designed to have an impedance voltage of 13 per cent.

It has been found possible to build the 60,000-kVA transformers as three-phase units, so that the assembled transformers comply with the loading gauge of the German railways, only the bushings and rollers having to be dismantled during transport. A special wagon with a loading capacity of about 160 tons has been constructed for the rail transport of the sets.

The oil circuit-breakers to be used in connection with the 220-kV installations will be tested up to 460 kV; they are equipped with explosion chambers which can deal with a short-circuit load up to one and a half million kVA. We are indebted to "A.E.G. Progress" for the foregoing particulars.

Fatalities.

On Saturday last an inquest was held at Stakeford on William Howard Arkle (24), a motor driver. It was stated that a lorry driven by the deceased had developed clutch trouble, and was taken to a garage at Stakeford for inspection. According to the evidence given by Robert Bell, who assisted, Arkle attached an electric lamp to a length of wire which he connected to a socket. Arkle was showing the light to his mother, who was looking from a window, and witness heard him say: "It would make a grand button-hole, wouldn't it?" and then Arkle shouted: "Bob, put the light out." He did so, and found that Arkle was on the ground, and the wires were lying near him. The bulb was detached and lay about two yards away. The flex was wound round the fan of an engine in the garage to prevent it trailing. It was stated by Gordon Bell, an electrician, who examined the lamp, that two studs in the holder were loose; when subjected to a strain the wire would be brought into contact with the brass sides of the holder. The act of waving the lamp in his hand would cause the contact. A shock of 250 volts would be received by Arkle. The cause of death was stated by Dr. A. S. Brown to have been "electrocution," and a verdict to that effect was recorded.

An inquest was conducted by the Manchester County Coroner last week, with regard to the death of John James Jeffrey, aged 21, a law student, who was found dead in his bath on December 13th. Evidence showed that the bath was half full of water, and that an ultra-violet ray apparatus was at the side of it; expert examination revealed several ways in which a shock could be received from the apparatus, the insulation resistance being low and the construction of the device faulty. There was no provision for earthing the metal case. A book of instructions accompanying the apparatus recommended the purchaser not to use it in a bathroom, and the deceased himself had underlined this note.

The Coroner, recording "Death from misadventure," said there was no adequate warning as to the danger attaching to the use of the apparatus on a 230-volt circuit, and regarded it as reprehensible that such an appliance should be supplied by firms posing as beauty experts.

Local Society.

The Edinburgh Electrical Society held its annual dance and whist drive on January 4th. Prizes for the whist drive were supplied by the electrical trade.

Ultra-violet Rays and Tracing Cloth.

In a letter to *Nature* of January 12th, Mr. C. H. Young, of McGill University, Montreal, states that ultra-violet rays from a quartz mercury-vapour lamp pass through ordinary commercial tracing cloth (or linen) to a remarkable extent, regardless of the thickness and the number of meshes per cm. Heat rays, on the other hand, do not pass through it so freely as through glass or vita-glass. Hence, whether in sunlight or in artificial ultra-violet radiation, much of the heat can be screened off whilst retaining most of the ultra-violet with a single layer of tracing cloth, between wide-meshed wire screens, which forms a cheap and effective substitute for special glasses, and should be useful for small houses, chicken farms, &c.

Magnetic Sound Recording.

Electrical wireless and phonograph circles in Paris are discussing the German "steel wire phonograph" of Dr. Stille, the inventor who has been exhibiting his apparatus in Paris, says the *Broadcaster*. It is composed, essentially, of a bobbin of steel wire, the magnetisation of which is utilised to register sounds, and permits of their reproduction. There is no limit to the length of the wire; the result is that the phonograph, instead of having an ordinary three-minutes disk limit, can store speeches of several hours' duration on its six- or eight-mile reels. When the record is being made the wire is unwound, while exposed to a magnet controlled by a microphone. The sounds emitted produce variations of the intensity of the magnetising current which modify in a durable manner the molecular arrangement of the steel. When the modified wire is passed anew before the electromagnet (a loud-speaker being in the circuit) one obtains reproduction. Poulsen showed a similar device at the 1900 Paris Exhibition; his "telegraphone" was fully described in the ELECTRICAL REVIEW of October 12th, 1900, and on later occasions. Dr. Stille claims to have discovered an alloy whose permeability and preservative power are such that the wire retains the record efficiently.

The Television Society.

The Secretaries announce that the informal meeting and exhibition of members' apparatus which was to have taken place at the next meeting is postponed until the annual general meeting, on Tuesday, March 5th. The next meeting of the Society will be held at the Engineers' Club, Coventry Street, London, on Tuesday, February 5th, at 8 p.m., when Mr. R. R. Poole, B.Sc., will give a paper on "Methods of Light Modulation in Receivers." Visitors are welcomed to the lecture.

Appointments Vacant.

System control engineer (450 taels per month). Assistant shift charge engineers (350 taels per month). Distribution engineering assistant (400 taels per month) (tael=2s. 7d.) for the Shanghai Municipal Electricity Department. Electrical engineer for the New Mills U.D.C. Shift charge engineer for the Corporation of Worcester Electricity Department. Installation assistant and assistant meter tester for the City of Coventry Electricity Department. Electrical engineer for the Public Works Department of the Government of Nyasaland. Electricians-in-charge for Hornsey Electricity Department. Engineer to take charge of private estate power station. (See our advertisement pages to-day.)

A Large Heating, Cooling, and Ventilating Scheme.

Referring to the article under the above heading in our last issue, describing the installation at the premises of Messrs. Bourne & Hollingsworth, Ltd., we are asked to state that the temperature measuring outfit was supplied by Cambridge Instrument Co., Ltd.

In the same article, the name of the electrical contractors, given as Messrs. Barlows, Ltd., should read Messrs. Barlow Bros. & Co., who, we understand, were also responsible for the lighting installation, the total loading of which is nearly 800 kW.

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Electrical Uses of Cadmium.

In a paper, "A General Survey on Cadmium," by Mr. C. F. Moore, read recently before the Junior Institution of Engineers, are some notes on the uses of cadmium in the electrical industry. The production of cadmium, except as a by-product when the major portion of the cost of manufacture is borne by some other more commercial metal, is uneconomical. The metallurgical treatment of the ores of zinc, lead and copper for their principal metal results in the formation of a number of by-products, flue dusts, condensed fumes, &c., in which the cadmium of the ore is concentrated.

One of the new uses for metallic cadmium is in the manufacture of tungsten electric lamp filaments. An alloy of 42 per cent. cadmium, 53 per cent. mercury, and 5 per cent. of bismuth, is impregnated with tungsten powder, about 30 per cent. of the whole; this is accomplished by heating and grinding in a mortar. The mixture is made into wire by the extrusion process, as used in lead-pipe manufacture, and is then passed through a die. It is finally heated to drive off the alloy, and finished by heating in a vacuum to render the tungsten solid. Mercury-cadmium alloys have an important application in the manufacture of standard electric cells, of which they form one of the principal components. For use as a high-temperature resistor material in electric furnaces, cadmium-oxide is finely ground with water, with or without the addition of powdered zirconium silicate, and the paste shaped as desired and heated to 800 deg. C. The oxide then forms a compact mass of high tensile strength, and is particularly suitable for the manufacture of electric furnace resistances on account of its low negative temperature coefficient of resistance, even at 1,000 deg. C. A cadmium vapour arc lamp, which gives an intense monochromatic red light, practically that of pure cadmium, has been devised and constructed by Bates. The lamp is in the form of an inverted U tube of 10 c.c. capacity, and is fitted with two long quartz capillaries at its ends by means of which the tungsten wire electrodes are admitted. The electrodes are fastened into the capillaries by means of lead seals. The lamp is filled by distilling from a quartz bulb attached at the bend of the U tube a gallium-cadmium alloy containing 2 to 3 per cent. of gallium. During the distillation the cadmium carries over a minute quantity of gallium, which is sufficient to keep it from breaking the tube on solidification. The presence of the gallium also renders the cadmium soft and prevents its expansion, thus further avoiding breakage. When sufficient alloy has been distilled into the lamp, the narrow tube by which the bulb is connected is sealed off. The lamp lights with 3 A at 110 V with a drop of 14 V across the terminals, but is more efficient with a current of 7 A and a drop of 25 V. To start the lamp one limb must be heated with a bunsen flame. The lamp is durable, and requires little attention, and is free from clouding by adhesion of cadmium to the walls. Electrical cable coverings are very often sheathed with a lead alloy instead of with pure lead, alloys being more resistant to vibrational disintegration. The alloys which have been principally employed are the 3 per cent. tin, 97 per cent. lead, and the 1 per cent. antimony, 99 per cent. lead. But just recently patents have been taken out which are attracting some attention. Two of these alloys are 98.25 per cent. lead, 0.25 per cent. cadmium, 1.5 per cent. tin, and 99.25 per cent. lead, 0.25 per cent. cadmium, 0.5 per cent. antimony. Tin improves the mechanical properties, but relatively large quantities are required, 3 per cent. being generally adopted, and its use is therefore expensive. Antimony has a similar effect in improving the mechanical properties. The introduction of cadmium also gives improved mechanical properties to lead, particularly with regard to resistance to failure under alternating stresses, and to produce this result smaller quantities are required than with either tin or antimony.

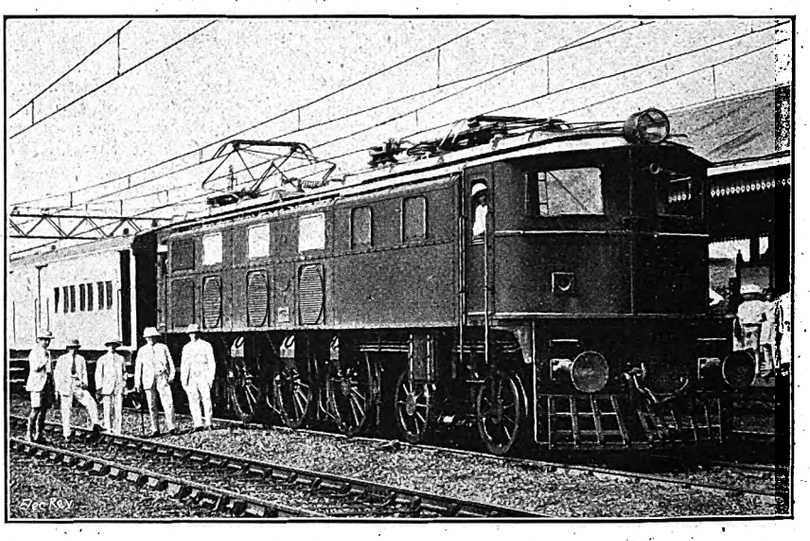
Large Coal Winders.

Two electrically-operated winding engines constructed by the Société des Ateliers de Constructions Electriques, of Charleroi, have recently been installed at the Waterschei collieries of the Société des Charbonnages André Dumont-at Genck in the Belgian Campine coalfield. The engines are at present arranged for raising coal from a depth of 765 yards, but have been so built that eventually they will be able to hoist from a depth of 1,090 yards. They are each fitted with an electric motor able to develop a temporary maximum of 3,000 h.p., and 2,200 h.p. continuously.

Passenger Locomotive for India.

An important contract for twenty-one 2,160-h.p. electric locomotives for express passenger service on the Great Indian Peninsula Railway has been placed with the Metropolitan-Vickers Electrical Co., Ltd. The award is the result of an interesting competition. After consideration of many different designs, both British and foreign, the G.I.P. Railway ordered three sample locomotives from different manufacturers, designed to the specification of Messrs. Merz and Partners, consulting engineers for the electrification scheme. All three locomotives were delivered and put into service during the past year, and it is as a result of extensive trials and tests under service conditions that the present bulk contract has been placed. The locomotives now ordered are to be similar to the Metrovick sample locomotive submitted, which is shown in the accompanying illustration in service on the G.I.P. Railway.

The design presents many interesting features, especially with regard to obtaining stability at high speeds. The construction is of the 4-6-2 type, consisting of three driving axles, one four-wheel bogie truck and one two-wheel pony axle working in conjunction with the nearest driving axle so as to form virtually a four-wheel truck. The weight of the locomotive is about 100 tons, of which about 60 tons is adhesive weight. In order that as little dead weight as possible shall be carried on the axles, the motors and their gearing are rigidly mounted on the frame of the locomotive and transmit power to the driving axles through a universal-motion flexible link drive. All the weight is thus spring-borne, and the centre of gravity is comparatively high. The normal maximum service speed will not exceed 75 miles an hour, but all parts are designed for a speed of 85 miles an hour.



High-speed Passenger Locomotive on the G.I.P. Railway.

The electrical equipment includes six 360-h.p. motors and electro-pneumatic control gear. The pneumatically-operated switches are arrayed in a high-pressure chamber, those for the line and main resistances being of the single-unit type arranged in groups, and those for the motor combinations and reversing being of the cam group type. The units of the control gear are easily replaceable and, together with many of the auxiliaries, are to a large extent interchangeable with the corresponding parts of the Metrovick 2,600-h.p. freight locomotives which are in use on the railway. It will be remembered that a contract for forty-one locomotives of the latter type was placed with the Metropolitan-Vickers Company some time ago. On the very heavy gradients where the railway crosses the Ghats, which average as much as 1 in 40 for long distances, a passenger train locomotive will be assisted by a freight locomotive operating as a banking engine, the characteristics of the locomotives being such that they will operate together with a proper sharing of the load. Both types were illustrated and briefly described in the ELECTRICAL REVIEW of May 11th, 1928, p. 809.

Institution Notes.

Institution of Engineers and Shipbuilders.

The report of the Council of the Institution of Engineers and Shipbuilders in Scotland (Inc.) for the 1927-28 session shows at the end of the session a total membership of 1,540, representing a decrease of 56. The income for the year was £4,994, resulting in a balance of £145.

British Institute of Radiology.

Arrangements have been made to hold a series of informal meetings of medical members, at which no set papers will be read, but interesting cases, with films or lantern slides, will be reported and discussed, or modifications in technique described. Such meetings will take place on January 18th, February 15th, March 15th, and April 19th.

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Institution of Electrical Engineers.

PROGRAMME.—The arrangements for the second half of the session include a paper on January 24th by Messrs. Johnstone Wright and C. W. Marshall, on "The Construction of the Grid Transmission System in Great Britain"; the annual dinner on February 7th; a paper on February 14th by Mr. W. Cruickshank on "Voice-Frequency Telegraphs"; the Faraday Lecture on February 28th by Mr. Ll. B. Atkinson, on "How Electricity Does Things"; papers on March 14th by Messrs. T. N. Riley and T. R. Scott on "Electrical Insulating Papers for the Manufacture of Power Cables," and by Messrs. S. G. Brown and P. A. Sporing on "The Prevention of Ionisation in Impregnated Paper Dielectrics"; papers on March 21st by Sir Charles A. Parsons and Mr. J. Rosen, on "Direct Generation of Alternating Currents at High Voltages," and by Mr. J. A. Kuyser on "Recent Developments in Turbo-Generators"; a paper on April 11th by Mr. B. L. Goodlet on "The Testing of Porcelain Insulators"; a paper on April 18th by Mr. R. A. Chattock on "The Modern Use of Pulverised Fuel in Power Stations"; and on April 25th the twentieth Kelvin lecture, by Dr. G. C. Simpson, on "Lightning."

The WIRELESS SECTION will meet on February 6th for a paper by Messrs. B. Hodgson, L. S. Harley, and O. S. Pratt, on "The Development of the Oxide-Coated Filament."

The METER AND INSTRUMENT SECTION on February 1st will hear a paper by Mr. J. L. Carr on "Recent Developments in Electricity Meters."

INFORMAL MEETINGS will take place on January 28th. "Mains Testing" (opened by Mr. F. C. Raphael), and on February 4th, "Earthing and the Safety of the Public" (opened by Mr. W. R. Rawlings).

At the Local Centres many of the papers mentioned above will be read and discussed; in addition, at the IRISH CENTRE, on February 21st, Dr. K. Ott will read a paper on the Shannon Scheme; at the NORTH-EASTERN CENTRE, on February 25th, Mr. R. W. Gregory will deal with electricity supply in rural districts; at the SCOTTISH CENTRE, on January 29th, Mr. E. Seddon will describe recent extensions to Portobello power station; and at the SOUTH MIDLAND CENTRE Capt. P. P. Eckersley will lecture on "Wireless" on January 21st.

WESTERN CENTRE.—The annual dinner of the Western Centre of the Institution of Electrical Engineers was held at the Grand Hotel, Bristol, on Monday last, Mr. Walter J. Bache being in the chair. Among those present were Messrs. S. T. Allen, J. W. Beauchamp, J. M. Kennedy, Frank Crawter, J. T. H. Legge, H. Marryat, H. Faraday Proctor, Lt.-Col. Vignoles, T. P. Wilmshurst, A. Page, and Sir Andrew Duncan.

The toast of "The Institution of Electrical Engineers" was proposed by Mr. Frank Hodges, J.P., who spoke of the remarkable growth of the Institution membership, which corresponded with the industry which had shown the most remarkable advance in the industrial era. He hoped that the industry would remain young and would continue to devote time and money to research, so that it might not suffer as some older and less enterprising industries were now suffering. Nothing would satisfy the Central Electricity Board until an abundant supply of heat, light, and power was brought into every home, however humble, throughout the country.

In reply, Lt.-Col. Kenelm Edgcumbe, President of the Institution, said he felt much at home in coming back to the West Country, of which he was a native. The Centre represented about 50 per cent. of the membership of the Institution, and provided it with the greater part of its strength. Speaking in Bristol, he felt that more of the old spirit of the Merchant Venturers was needed amongst our merchants to-day, and he hoped that our people would do more to show the foreigner what England had to sell.

"Kindred Societies and Guests" were proposed by Mr. S. B. Haslam in a happy speech, and responses were made by Mr. A. Nichols Moore, M.I.Mech.E., President of the Incorporated Municipal Electrical Association; Miss C. Haslett, Director of the Electrical Association for Women; and for the guests by Professor Andrew Robertson, Dean of the Faculty of Engineering, Merchant Venturers' Technical College.

The toast of "The Chairman" was given by Councillor James Moore, of Cheltenham, to which Mr. Bache, who was acclaimed with musical honours, replied in felicitous terms.

Entertainment was provided by the Bristol Glee Singers and Mr. Charles Thomas. Mr. C. T. Allan may congratulate himself on having provided the Western Centre and its guests with a most enjoyable evening.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. F. O. HARBER has resigned his position with Metropolitan-Vickers Electrical Co., Ltd. (extra-high-voltage switchgear development section), and has joined Messrs. Norman E. North and Partners, consulting and development engineers, 86, Strand, London, as assistant engineer.

Mr. J. N. WAITE took up his new duties as city electrical engineer at Hull on January 14th.

It is announced that Mr. GORDON C. TOUCHE has been elected to the board of the Anglo-Argentine Tramways Co., Ltd.

Mr. KENNETH HUNTER, late of Andrews & Co., Glasgow, in July last assumed the position of manager of the Kuala Lumpur Branch (head office) of Messrs. Kyle, Palmer & Co., Ltd. He will be responsible for the management of the entire engineering (mechanical, electrical, general, and importing) side of the business at that office.

Mr. W. C. ROY, manager of Kirkwall and District electricity undertaking, was presented with a smoker's cabinet on leaving to take up a similar appointment in Wick.

Mr. J. HARDING, the retiring manager of the Derby Corporation Tramways, has been presented with a testimonial from the employés.

The Bedwellty Urban Council has fixed the salary of the electrical engineer, Mr. BEN JONES, at £425 per annum as from the New Year. This was the commencing salary when Mr. Jones became electrical engineer about 12 months ago, when it was agreed to review the salary at the commencement of 1929, but the figure was reduced to £371 a month ago in accordance with the general policy of the Council.

Alderman WILFRED TURNER has been compelled by ill-health to resign from the Bradford City Council, and from the position of chairman of the Electricity Committee. Ald. Turner has held the chairmanship since 1913, and during his period of office has done a great deal towards the development of electricity supply in Bradford and the surrounding area. As chairman of the conference of local authorities concerned, he took an important part in the negotiations regarding the West Riding (Aire and Calder) Electricity District. In announcing his resignation, Ald. Turner expressed his indebtedness to the city electrical engineer (Mr. T. Roles) and other Corporation officials.

The Duddell Memorial Medal of the Physical Society has been awarded to Dr. C. E. GUILLAUME, director of the International Bureau of Weights and Measures, at Sèvres, the inventor of invar, elinvar, and platinite; the first two of these remarkable alloys are mainly used in surveying and in watch and clock making, but the third—a nickel-iron alloy which can be fused into glass and make a permanently gas-tight joint—as a substitute for platinum in the manufacture of incandescent lamps, is said to effect a saving of a million sterling per annum.

The Government has approved the appointment at £8,000 per annum of Sir Basil P. Blackett as chairman of the proposed Communications Company which is to take over certain cable and wireless services, and that of Lord Clarendon as a director of the company. Sir Basil Blackett, who is 47 years of age, has been in the Civil Service since 1904. During the war he represented the Treasury in the United States and was Finance Member of the Executive Council of the Governor-General of India from 1922 until last year. Lord Clarendon is chairman of the British Broadcasting Corporation, and is a former Parliamentary Under-Secretary for Dominion Affairs.

Obituary.—MR. G. T. BAKER.—We regret to record the death, which occurred on January 10th, of Mr. George T. Baker, who was for more than 30 years London manager for Messrs. J. H. Tucker & Co., Ltd., of Birmingham, and was well known in the electrical trade, having many friends, particularly among the "old guard." Mr. Baker, who was 59 years old, first became associated with the electrical industry in the early days with Messrs. Woodhouse & Rawson, with whom he remained for several years. Mr. Baker, who had suffered from an internal complaint during the last three months, is survived by his widow and three sons. The funeral took place at Forest Hill Cemetery on Tuesday.

MR. J. M. GORHAM.—We regret to record that Mr. John Marshall Gorham, M.Inst.C.E., M.I.E.E., a director of Messrs. Drake & Gorham, Ltd., died on Saturday last. Mr. Gorham had been connected with the electrical industry for over half a century.

LORD ATHLUMNEY.—Messrs. Sternol, Ltd., announce the death of the Rt. Hon. Lord Athlumney, who had been their chairman since the close of the war.

MR. A. O. KOLKHORST.—The death occurred suddenly, on January 11th, at a sanatorium in Merano, Italy, of Mr. Alfred Oscar Kolkhorst, late general manager of the Lisbon Electric Tramways Company in Lisbon.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Howden-Buell Combustion Co., Ltd.—Private company. Registered January 4th. Capital, £30,000 in £1 shares. Objects: To carry on the business of manufacturers and sellers of all plant and equipment connected with the use of pulverised coal or other fuel, founders, marine, mechanical and electrical engineers, boiler makers, &c. The subscribers (each with one share) are: A. E. Hibbert, 15, Mornington Avenue, Ilford, secretary of companies; H. C. B. Thomson, Ivycliff, Upminster Road, Hornchurch, bookkeeper. Secretary: H. G. Warren. Registered office: Cory Buildings, Fenchurch Street, E.C.3.

Rich & Pattison (Leeds), Ltd.—Private company. Registered January 10th. Capital, £500 in £1 shares. Objects: To carry on business as factors of gas and electrical fittings, radio goods, &c. The first directors are: H. P. Rich, 323, Pershore Road, Edgbaston, Birmingham, factor; J. M. Rich, 17, Brunswick Place, Leeds, factor.

Official Returns of Electrical Companies.

Edison Accumulators, Ltd.—Satisfaction in full on December 19th, 1928, of debenture dated May 18th, 1925, securing £18,000.

Nantwich Electric, Ltd.—Charge on 5, Hospital Street, Nantwich, dated December 14th, 1928, to secure £400. Holders: Sandbach Permanent Benefit Building Society.

C. Barnett, Ltd.—Particulars filed of £1,000 debentures authorised by resolutions of November 15th and December 13th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

J. W. Gray & Son, Ltd.—Particulars filed on January 2nd, 1929, of £1,500 debentures authorised October 29th, 1928, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Cranleigh Gas and Electricity Co., Ltd.—Particulars filed of £2,500 debentures authorised November 12th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £2,000.

Anti Vibration Electric Lamp Co., Ltd.—Particulars filed of £3,000 debentures (of which £2,000 has already been registered) and bonus of 2 per cent. on £1,000, authorised by resolutions of November 13th, 1922, and December 18th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500 and bonus of 2 per cent.

"Loud Speaker" Co., Ltd.—Private company. Registered January 9th. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio and electrical apparatus and equipment, &c. The directors are: E. C. Little, 63a, Wilton Road, S.W.1; C. R. Priestley, 58, Southbourne Grove, Westcliff. Registered office: 38, Palmer Street, Westminster, S.W.1.

Electric Super Service Co., Ltd.—Capital, £3,000 in £1 shares. Return dated November 17th, 1928. 2,000 shares taken up. £1,800 paid, £200 considered as paid. Mortgages and charges, nil.

Western Electricity Supply Co., Ltd.—Capital, £250,000 in 100,000 preference and 150,000 ordinary shares of £1 each. Return dated December 10th, 1928. All shares taken up. £250,000 paid. Mortgages and charges, nil.

Pacific and European Telegraph Co., Ltd.—Capital, £100,000 in £10 shares. Return dated November 8th, 1928. All shares taken up. £40,000 paid (£4 per share). Mortgages and charges: £66,500.

Radio Service (London), Ltd.—Satisfaction to the extent of £125 on December 15th, 1928, of debenture dated July 25th, 1927, securing £2,750.

Marconi's Wireless Telegraph Co., Ltd.—Satisfaction to the extent of £1,206,786 between January 1st and December 31st, 1928, of debenture stock dated November 17th, 1922, securing £1,500,000.

City Notes.

Symphony Gramophone and Radio Co., Ltd.

Speaking at the statutory meeting on January 10th, the chairman (Col. Sir A. R. Holbrook, K.B.E., M.P.) said that the company's production was increasing rapidly, and it was earning profits in excess of the rate estimated in the prospectus. There was no truth in rumours of an amalgamation, but negotiations of an entirely different character were proceeding which would greatly benefit the company and the Symphony Foreign Co.

Westinghouse Brake and Saxby Signal Co., Ltd.

Lord Southborough, the chairman of this company, presided at the annual meeting on January 10th. He said that substantial progress had again been made. It had been suggested that changes should be made in the form of presentation of the accounts, but the directors had unanimously decided that it was inadvisable to disclose particulars of the accounts on profits of the concerns in which the company was interested. He went on to say that although their company was subject to the keenest competition it continued to make progress. He attributed that to the wise policy of the managing director (Mr. H. G. Brown), who continually analysed the methods of production for the purpose of adopting new and more scientific methods. This involved the continual purchase of the newest plant and machinery and the watching of experimental development at home and abroad. Efficient plant and the most up-to-date methods of securing the largest production were vital in connection with the reconstruction of British industry. Referring to "safeguarding," Lord Southborough said that he was glad to think that efficiency was taken into account when applications were being considered. Protecting the inefficient would result in general inefficiency, but the protection of the efficient might be necessary in the case of certain industries under the abnormal conditions in which they were trying to make an industrial living.

City of Santos Improvements Co., Ltd.

It was reported last week that holders of not fewer than 750,000 shares had accepted the offer of purchase made by the Brazilian Traction, Light & Power Co. The offer was to remain open until January 15th.

Electrolytic Zinc Co. of Australasia.

An interim dividend of 6 per cent. has again been declared.

West Gloucestershire Power Co.

The company has acquired practically the whole of the shares of the Chepstow Electric Lighting & Power Co.

Ever-Ready Co. (Great Britain), Ltd.

The directors have called an extraordinary meeting for January 31st to secure approval to a resolution for capitalising part of the reserve. At present the general reserve stands at £200,000. It is proposed to take £74,000 of this and issue it in the form of 5s. ordinary shares to existing shareholders in the proportion of one new share for each five held. In a circular to the shareholders the directors point out that the company's profits and dividends for the last three years have been as follows:—1926, £139,488 and 25 per cent.; 1927, £174,588 and 35 per cent.; and 1928, £187,964 and 35 per cent. They estimate that the profit for the current year (ending March 31st) will be £210,000. A substantial interest has been acquired recently in a large manufacturing business in part similar to the company's own but including the manufacture and sale of numerous other classes of goods which the company does not at present manufacture. The directors expect that considerable benefit will accrue from this transaction.

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To meet the large capital expenditure during the past year, it is intended to make an issue of ordinary shares in due course to the shareholders on bonus terms.

The *Wireless Trader* reported recently that it had learned that the company was acquiring an interest in Lissen, Ltd.

Stock Exchange Notices.

Dealings in the following have been allowed by the Stock Exchange Committee under Rule 159:—

Pinchin Johnson & Co.—180,217 ordinary shares of £1 each, fully paid Nos. 848,751 to 881,229, 883,790 to 893,496, and 895,537 to 1,033,567.

Application has been made to the Committee to allow the following to be officially quoted:—

Brazilian Traction, Light and Power.—939,557 ordinary shares of no par value.

Mersey Power.—400,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 400,000.

Turner & Newall.—126,500 ordinary shares of £1 each, fully paid, Nos. 2,232,849 to 2,359,348.

Underground Electric Railways.—207,390 ordinary shares of £1 each, fully paid, Nos. 6,802,951 to 7,010,340.

Traction and General Investment Trust, Ltd.

The directors of this company (formerly the Traction and Power Securities Co., Ltd.) have declared a final dividend of 10 per cent. on the ordinary shares, making 16 per cent. for the year (against 15 per cent. for 1927).

Singapore Traction Co., Ltd.

The directors recommend the payment of a dividend of 5 per cent. on the 7 per cent. cumulative preference shares.

Brazilian Traction, Light and Power Co., Ltd.

To finance the purchase of the ordinary shares of the City of Santos Improvements Co. and extensions which are in contemplation, the directors propose to make an issue of no-par-value shares to the extent of $31,000,000. The ordinary shareholders will be offered one new share at $40 for each seven shares held. About a year ago the company's $100 ordinary shares were divided into four shares of no par value. It is announced that holders of preference shares desiring to convert their holdings into ordinary shares will be given an opportunity of doing so. A dividend of 50 cents per share has been declared on the ordinary shares in respect of the past quarter.

Melbourne Electric Supply Co., Ltd.

The report for the year ended August 31st last shows that the balance, after meeting debenture interest, &c., was £124,308, against £121,287 in 1926-27. Adding interest received, and £21,284 from general reserve, there was available £145,617. As we have already reported, the total dividend on the consolidated ordinary stock was 10 per cent., free of tax. A balance of £1,156 which remains is paid over to the Electricity Commission. During the year £445,407 was borrowed from the Government of Victoria for capital expenditure, bringing the total thus borrowed up to £1,109,162. The capital expenditure in Melbourne was £345,583, and that in Geelong £76,796. The loss of the traction load caused a decrease in sales of energy from 141,506,000 kWh to 130,223,000 kWh.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets continue their activity, and the interest of the public in stocks and shares spreads over a wider circle week by week. There can be no doubt that much of the attention which is being paid to markets draws its inspiration from America, where the gambling fever is, apparently, running as strongly as ever. The Americans are buying stocks and shares in British companies, and it is only necessary for a rumour to gain ground that New York is about to list one or other of the British-owned companies for the shares in that undertaking to experience a sharp rise, and to achieve quick popularity. The high excitement which ran up the price of General Electrics to 3¼ has subsided to some extent; the price fell back to 52s. 6d., then hardened to 55s. One of the features during the past few days has been a violent rise in the price of Atlas Light and Power shares. The price came up from a little under 20s. to nearly 25s. before there was any sort of reaction. Some of those people who sold their shares at 23s., or thereabouts, deemed it discreet to buy them back in the hope of doing still better in the near future. New York is said to be anxious to acquire control of a large part of the company's capital, in order to obtain interest in the various companies in which the Atlas Light and Power has invested money.

Atlas Assets.

The Atlas Light and Power Company owns the entire share and loan capital of various companies operating in South America, amongst them being Cordoba Light and Power, Cordoba (Argentine) Electric Tramways Construction Company, Ltd., Argentine Tramways and Power Co., Ltd., Parana Tramways Co., Ltd., the Tucuman Tramways Light and Power Co., and various others. Last November, half a million pounds of new capital was offered, divided between ordinary and preference shares, all of which are at present 10s. paid, the remainder of the money being due on March 1st next. Last year's net profit came to £471,600. It may be recalled that at the time these new shares were issued, the price of the existing ordinary was so close to 20s. that the "rights" possessed practically no market premium. Possibly a good many people who were entitled to subscribe for the new shares, declined to exercise an option which, valueless at the time, now shows a good profit to the allottees who paid.

Home Railway Dividend Dates.

The Metropolitan Railway will declare its dividend on January 31st, and the announcement from the Underground Electric Railways of London comes a week later, on February 7th. A good deal of interest is felt in the declarations which are to be made, the chief point of attention being, of course, the dividend on Underground Electric Railways of London £1 shares. The price of the latter company's income debenture has held its rise at 129, the shares hardening to 27s. 6d. Districts and Metropolitans are unchanged on balance; Central London stocks scarcely move.

Brazilian Traction Bonus.

The Brazilian Traction Company has announced a share distribution at 40 dollars per share, one new share to be given for every seven shares held. This issue will provide the company with about 6¼ million pounds sterling, and thereby put it in funds for the purchase of City of Santos Improvements ordinary shares, the announcement in regard to which was made a fortnight ago. Part of the money will also be used for expansion of business in the company's operating subsidiaries in Brazil. A quarterly dividend of 50 cents per share has been declared on the issued ordinary, this being a rise of 6 cents as compared with the two previous interim dividends. The price of the shares was put up in advance of the announcement, and shows a rise, at 80½, of 2 points on the week. Disappointment is expressed by some of the bulls who had expected a bonus, without their being asked to find more money for it.

Sir Basil Blackett.

The appointment of Sir Basil Blackett as chairman of the proposed Communications Company that will take over the business of merging the cable and wireless undertakings, had a favourable effect upon prices in the cable group. These previously had gone down rather sharply—Eastern ordinary to 265, for instance, but on the rebound the price strengthened to 270, ex the 2½ per cent. free of tax dividend. Accordingly, the stock is better on the week, and the shares of the other three companies of the group—Eastern Extensions, Western and Globe—have correspondingly advanced. Sir Basil should make a good man for the position, his wide experience of Indian affairs being likely to prove of peculiar service in his new post. The prices of the various Marconi shares continue quiescent, speculation having somewhat subsided from this market for the time being. The Americans are apparently content to leave Canadian Marconis alone, and the price eased off to 38s. 9d. Marconi Marines have slipped back to 3½, and the parent company's shares to 77s. 6d.

Cables and Cuts.

Great Northern Telegraphs added another £2 to their last week's gain of 50s., and now stand at 34. Indo-Europeans put on 30s., the price strengthening to 49. What lies at the base of the demand for shares in these two companies must remain to be seen. The merging of the Eastern cable quartette with the wireless and beam system has served to attract people's notice to other cable companies' stocks, and there is a very vague idea that possibly, one of these days, the Great Northern and the Indo-European may be included in the same group. Anglo-American Telegraph deferred stock has risen to 26 on the announcement of the usual dividend for the year of 30s. per cent.; it is payable on February 1st. The Transatlantic companies are announcing reductions in rates between this country and the States, as well as to Canada. Marconis have started, this week, a night letter service at the rate of 2d. per word between Great Britain and New York, with corresponding reductions to other places in the United States and Mexico. The Western Union Telegraph Company follows suit with a practically identical cut, also coming into force on Monday in this week. The Western Union rates apply to Canada as well as to other places in the Americas.

Electricity Supply.

The market for home electricity supply shares is quite a good one, and further rises have taken place in what may be called the popular shares—that is to say, those which com-

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mand a certain amount of speculative following. Amongst these, County of London ordinary, with a rise of 1s., at 49s., Electric Supply Corporation, with a jump of 7s. 3d. to 58s., and Metropolitans, with a rise of 1/16 to 47s. 6d., are outstanding examples. Gossip linked the rise in Electric Supply shares to American purchasers. City of London ordinary has followed in the same upward direction, gaining 1s. 3d. to 32s., and Urban ordinary at 40s. 9d. are a florin to the good. The provincial shares are also showing improvement, rises having occurred in Newcastle-on-Tyne ordinary and preference, Scottish Power at 33s., and Clyde Valleys at 39s. The rise in Scottish Power represents an improvement of 1s. 6d. Bournemouth and Poole have gone back a little to 68s. 6d., Isle of Thanet ordinary are 35s. 6d. and the preference 27s. As regards the list of the London shares, where the prices may now be said to have come to something like their apex until a change may occur in the money market, no alterations have occurred, but it is far from easy to buy shares in the good companies. There are 2,000 London Electrics on offer at 26s., and 5,000 Westminster ordinary at 27s. The yields until 1931 in each case work out to 6½ per cent. on the money, though afterwards they become reduced in accordance with the Electricity Supply Acts. The yield on Electric Supply Corporation shares is now very little more than 3¾ per cent. on the money.

Shares on Offer.

A few hundred Delhi Electric Supply and Traction ordinary are obtainable at 55s., returning £4 7s. 3d. per cent., on the basis of the last 12 per cent. dividend. Kalgoorlie Electric ordinary, which are 10s. shares, can be bought at their par price; they received 6 per cent. last June. River Plate Electric ordinary stock, of which £5,000 is in the market at 223, gives £4 18s. 6d. per cent. at that price, and 500 East African Power and Lighting ordinary shares at 29s. 3d. yield £4 2s. per cent. A return of 5¾ per cent. is available from the Cawnpore Electric ordinary, of which 2,000 can be bought at 34s. 6d., with May and November dividends. Calcutta Electric ordinary at 54s. 6d. pay a trifle over 5 per cent. It may be mentioned that North Metropolitans, at 46s. 6d., are ex rights.

Traction and Tramway.

British Electric Traction deferred ordinary has repeated its last week's rise of 35 points, and now stands at £685, the quotation in the Stock Exchange Official List being the extraordinary one of £650 to £725. a margin of 75 points. Stock changed hands last Friday at 675. The preferred ordinary remains at 124, and bargains take place on about this basis. London United Tramways preference have been rather more active, and now stand at 10s. London & Suburban Traction preference eased off a trifle, although the nominal figure is left at 13s. The ordinary shares stand at 5s. middle. These last-named have had no dividend since the month in which war was declared; the last dividend paid on the company's preference shares, which are cumulative, was in March, 1924. The 4½ first mortgage debenture stock is quoted at 69, and the 5 per cent. debenture stock at 97, at which price a bargain was done about a week ago. Reference has already been made to the Brazilian Traction new issue, and in the Mexican group the outstanding feature is a rise of 7 points in Mexican Light and Power common shares to 84½. It is stated from New York that a gigantic merger is in contemplation for amalgamating a whole series of public utility companies, and the names of J. P. Morgan & Co. are mentioned as being one of the parties to what may prove to be an enormous combination of utility interests. Canada is also busy with big schemes in connection with power companies, and on Tuesday in this week a public hearing was due to commence in Ottawa for Government approval of plans for a hydro-electric scheme on the River St. Lawrence, which would develop 300,000 horse power and call for something like 13 millions sterling capital.

Miscellaneous Movements.

Manufacturing stocks and shares remain very firm. British Aluminium have been one of the features, with a jump of 3s. 9d. to 50s. General Electrics, as already noted, are 5s. down at 2¾. Siemens ordinary have risen 3s. 9d. to 30s., and an improvement of 6s. 3d. lifted Metropolitan-Vickers ordinary to 36s. 3d. The rise in the last-named was accompanied by the usual reports as to Americans being anxious to acquire a larger interest in the concern. It may be recalled that the company has lately succeeded in obtaining important contracts, two at least of very considerable extent. One was with the Rotterdam Municipality, the other with the Great India Peninsular Railway, and the money involved is said to be nearly half a million pounds sterling. Ever-Ready shares went back a little to 32s. 9d., on the announcement of a bonus issue of ordinary shares, 296,000 fully-paid shares to be allotted in the proportion of one new for every five old shares held. This is equivalent to a bonus of 20 per cent. The announcement had been fully discounted in advance. Ever-Lite shares have had a jump to 9s. 6d. The rubber market has gone ahead strongly on a rise of about 2d. per lb. in the price of the raw material. Considerable activity developed, but owing to the lack of supply of floating shares with which to satisfy prospective purchasers, the actual business transacted was small in proportion to the rises which took place in the prices of rubber shares. Amongst iron and steel descriptions, Vickers at 13s. are a firmer market.

Share List of Electrical Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Jan. 14, 1929.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14†	15	68/6	—1/6	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 8
City of London	1	10	10	32/-	+1/16	4 7 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	39/-	+6d.	4 2 0
County of London	1	7½	7½	49/-	+1/-	3 1 3
do. do. 6% Pref.	1	6	6	23/-	—6d.	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-xd.	—	5 12 0
Elec. Supply Corporation	1	11	11	58/-	+7/3	3 15 10
Kensington Ordinary	1	8	8	26/6	—	5 5 6
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	47/6	+1/16	3 15 8
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power	1	—	15	2 1/16	+1/16	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	27/-	+9d.	4 9 0
do. 7% Pref. ...	1	7	7	26/6	+6d.	5 5 6
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	+1/6	4 17 0
South London	1	8½	8½	27/6	—	5 2 6
Urban Ordinary	1	7	7	38/9	+2/-	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	35/-	—	4 11 5
†4% of which was tax free.						
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	,,	3	3	67½	—	4 9 0
do. District	,,	3½	4	80½	—	4 19 5
Underground Electric	£1	1½	5	57/6	+6d.	3 12 9
do. do. Income ...	Bonds	6	6	129	—	4 13 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 0
do. Def.	,,	1½	1½	26	+½	5 15 5
Automatic Telephone	1	10	10	2	—1/16	5 0 0
Eastern Extension	10	10	10	27xd.	+⅜	*3 14 3
Eastern Tel. Ord.	Stock	10	10	27xd.	+2½	*3 14 0
Globe Tel. and T. Ord.	10	10	10	26	+½	*3 17 0
do. do. Pref.	10	6	6	11¼	+¼	5 9 1
Great Northern Tel.	10	20	20	34	+2	... ...
Indo-European	25	10	10	49	+1½	*5 2 0
Marconi	10/-	5	*10	8⅞	—1/16	... ...
Marconi-Marine	1	8⅝	12½	8½	—½	3 11 5
Oriental Telephone Ord.	1	12	12	2⅞	—	... ...
United R. Plate Tel.	5	8	8	12⅛	+⅛	*3 6 0
Western Telegraph	10	10	10	27	+¼	3 14 6
*Interim.						
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	3 7/16	—	8 14 6
do. do. 5% Deb. ...	Stock	5	5	77½	—	6 9 0
British Electric Traction Def. Ord.	,,	—	—	685	+35	... ..
do. do. Pref. Ord.	,,	8	8	124	—	6 9 1
Brazil Traction	100	6	7	80½	+2	2 9 9
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	95½xd.	—	5 4 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	—	... ..
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	79	—	6 6 7
Mexican Light Common	100	Nil	Nil	84½	+7	... ..
do. 7% Pref.	100	Nil	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ..
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	13	15	8½	—	*4 5 9
British Aluminium Ord.	1	10	10	2½	+3/16	*4 0 0
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅜	—	3 8 6
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4 5/16	—	3 9 0
do 6½% Pref.	1	6½	6½	1 3/16	—	5 9 5
Crompton Parkinson Ord.	5/-	—	—	19/6	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan	4/-	10	10	12/6xd.	+3d.	3 4 0
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	1	20	20	5⅝	—	3 14 6
English Electric	1	Nil	Nil	7/6	—	... ..
do. do. Pref	1	8	Nil	10/-	—	... ..
Gen. Elec. Pref.	1	6½	6½	28/6xd.	—	5 10 8
do. Ord.	1	7½	10	2¾	—5/-	3 12 8
Henley	1	25	25	5¼	+1/16	4 5 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ..
Johnson & Phillips	1	12½	10	36/3	—	5 10 3
Met.-Vickers Ord.	1	8	6	36/3	6/3	... ...
do. Pref.	2	8	8	2¾	—	5 16 5
Siemens Ord.	1	7½	7½	30/-	+3/9	5 0 0
Telegraph Construction	12	10	10	25	—	*4 14 6

*Dividends paid free of Income Tax.

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Advice to Australia.

The Report of the British Economic Commission.

FROM time to time during the past two months we have reported the activities in Australia of the British Economic Mission, consisting of Sir Arthur Duckham, Sir Hugo Hirst, Sir Ernest Clark, and Mr. Dougal Malcolm. The objects of the Commission were to study matters of mutual economic interest to Great Britain and Australia with a view to the improvement of trade between them and the increase of settlement in the Commonwealth.

Last week a report prepared by the Commission was made public after presentation at a meeting of the Premiers of the States. We are indebted to *The Times* for the following summary of the matters covered in the report.

It is first postulated that only the enhancement of the prosperity and absorptive power of Australia can bring about improved trade and increased settlement. Although the existing financial position of the Commonwealth is sound, inasmuch as it is able to meet all its obligations, there has been a great deal of unprofitable expenditure, which has been incurred in connection with development schemes that have been embarked upon without sufficient regard to the probable financial and economic results, or adequate preliminary investigation. The future has been mortgaged too deeply and the Government is advised to restrict its borrowings for development purposes and leave the field more widely open for private enterprise. The accounts of each Government undertaking should be prepared in such a form as to make clear the exact financial position. A substantial improvement is expected from the validation of the financial agreement between the States and the Commonwealth, the establishment of the Loan Council and from the Development and Migration Commission and the Council of Scientific and Industrial Research. The Government should consult competent financial authorities before making loans and should definitely state the objects of each loan in the prospectus. It is considered bad finance that a proportion of overseas loan money should accrue to the Government as revenue and be spent accordingly.

The present circumstances are regarded as unfavourable to immigration, which has recently declined sensibly. The terms of the £34,000,000 Immigration Loan Agreement with Great Britain should be extended so as to make the money available for general work to promote immigration. A more intensive use of the land by scientific research is advised, as this would be quicker and cheaper than more extensive development.

The report goes on to deal with the questions of production costs and Customs tariffs. It is stated that the effects of the tariff, the Arbitration Act, and the Navigation Act have laid an unduly heavy burden upon the unsheltered primary industries which have to export at world prices. It is urgently necessary to break the vicious circle of increased prices due to the tariff and increased wages without lowering the standard of living or real wages. The power to alter the tariff by administrative action must be prudently used if it is not to hamper trade. The settled protection policy of Australia may be sound, but it should be possible to calculate its economic cost. It is a policy difficult to carry out in detail; there is risk of error in the way of giving excessive or too-prolonged assistance to infant industries and in the way of protecting inefficient industries. The total burden of the tariff has probably reached economic limits. Efficiency should be a condition of protection and protected industries should be liable to furnish the Government with the fullest information regarding prices, costs, and conditions. A thorough investigation should be made forthwith by the Commonwealth Government into the whole question of the economic effect of the tariff and the incidence of the duties. Pending this there should be no unavoidable increase of duties. Protection when granted should be effective. A reduction in duties may mean a decrease in the amount of British preference, but if the reduction is to Australia's economic advantage Great Britain has really more to gain from that source than from the preference accorded to her.

The system of settlement of industrial disputes by awards of the Arbitration Courts has failed and has tended to divide employer and employed into two opposing camps. There should be a minimum of judicial and Governmental interference; industrial disputes should be settled by way of discussion and frank interchange of views between the parties concerned. The system of basing wages upon a cost-of-living index figure is open to the gravest criticism as it gives the workers no interest in the reduction of the cost of living.

In conclusion, the Commission expresses the hope that good results will accrue from the Industrial Conference (between employers and employed), and it looks forward to suggestions from that body for a solution of the problem of fixing wages and settling the conditions of employment. The solution of the closely-related problem of tariff revision should thereby be greatly facilitated.

The British Industries Fair.

A Further List of Birmingham Exhibitors.

IN our issue of December 21st (p. 1067) we printed a list of exhibitors of electrical and allied products in the Birmingham Section of the British Industries Fair, there being about 120 of them. We have now received from Mr. E. J. Jennings, hon. secretary of the Electrical Section, a further list containing a number of names which we did not include; these are set out below :—

A-1 Electric Welding Appliances Co.; Allday, Wm., & Co., Ltd.; Beldam Packing & Rubber Co., Ltd.; Braithwaite and Co. (Engineers), Ltd.; British Brass Fittings, Ltd.; British Hanovia Quartz Lamp Co., Ltd.; Cape Asbestos Co., Ltd.; Catterson Smith, R. M.; Cellon (Richmond), Ltd.; Chesterton, Jones & Co., Ltd.; Coade, L. G., & Co.; Day & Millward, Ltd.; Dexine, Ltd.; E.A. Mfg. Co., Ltd.; Electric Furnace Co., Ltd.; Harper, John, Ltd.; Hartland & Eastwood; Holman & Co., Ltd.; Holmes, J. H., & Co., Ltd.; Hope, H., & Sons; Ideal Mfg. Co.; Ingram & Kemp; Kelvin, Bottomley & Baird, Ltd.; Langham Engineering Co.; Metal Gravure Co.; Modern Plastic Art Crafts; Mudie's Electrical Co., Ltd.: Ozalid Co.; Parker, Winder & Achurch, Ltd.; Parkinson & W. B. Cowan, Ltd.; Parkinson Stove Co., Ltd.; Premier Electric Heaters, Ltd.; Restlight, Ltd.; Spauldings, Ltd.; Speights, Ltd.; Sperryn and Co., Ltd.; Star Vacuum Cleaner Co.; Streetly Mfg. Co., Ltd.; Sutherland Meter Co., Ltd.; Swingler, G. & J., Ltd.; Taylor & Challen, Ltd.; Turner Bros. Asbestos Co., Ltd.; Turner, Stuart; T.V.E. Co., Ltd.; Vitalite, Ltd.; Wild-Barfield Electric Furnaces, Ltd.

Legal.

Lamps Obtained by False Pretences.

AT Bradford on January 10th, Ernest H. Hammond, an electrician, was sentenced to twelve months' hard labour for obtaining electric lamps by false pretences from the Shipley Urban District Council and from a local firm of electrical contractors. It was stated that he asked at the electricity showrooms for 50 electric lamps, presenting an order form purporting to be from "The Drighlington Electrical Co." He said he was an employé of that firm, which was wiring new houses at Shipley. The story was believed and the lamps were taken away, but it was found later that there was no such firm and also that no houses were in course of erection in the district as stated by the prisoner. A witness who had purchased a number of lamps from Hammond was disallowed witness fees.

Claim for a Vacuum Cleaner.

AT Bradford County Court on January 11th, deferred judgment was given for Mr. J. E. Berwick, proprietor of the Barracks Hotel, Lumb Lane, against Associated Distributors, Ltd., Leeds, with regard to a balance claimed from Berwick by the company in respect of a vacuum cleaner which he had on trial from the Electrical Trading Co., Ltd.—a firm subsequently absorbed in Associated Distributors, Ltd. When the case was previously before the Court, Berwick denied that he had signed an order form and the judge, agreeing that the signature on the order form looked rather like an imitation, had adjourned the case for the company to bring the agent who was alleged to have secured the order. The defendant Berwick was present at the adjourned hearing, but the plaintiff company was unrepresented. His Honour Judge McCleary gave judgment for the defendant with £2 2s. costs.

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The Physical Society's Exhibition.—I.

Annual Display of Electrical Instruments and Scientific Apparatus.

THE nineteenth of the series of annual displays arranged by the Physical Society of London and the Optical Society as an indication of the year's achievements in the design and construction of electrical, physical, and optical apparatus and associated equipment was staged as usual at the Imperial College of Science and Technology, South Kensington, on January 8th, 9th, and 10th.

Supplementary to the trade section of the show, in which 82 manufacturing concerns participated (an increase of one), a research and experimental section was included for the fourth season in succession (30 exhibitors, an increase of 7). Group A illustrated recent physical research, Group B lecture and instructional experiments, and Group C historical exhibits.

During the first two days admission was by ticket only, the morning session of the second day being restricted to members of the Physical and Optical Societies only, but on the third day the public had free access.

Amongst the discourses which were delivered was one on "Experiments with High-frequency Sound Waves," by Prof. F. Lloyd Hopwood, D.Sc., F.Inst.P., and Mr. S. R. Humby demonstrated some experiments with sound waves.

We commence below brief descriptions of some of the newer exhibits of an electrical nature that were on view in the trade section of the show.

H. W. Sullivan, Ltd.

A modulated c.w. wavemeter of novel form, which can be accurately calibrated without trouble due to the valve and its associated circuits, the ordinary pattern being somewhat troublesome in this respect and more complicated generally, has been invented by Dr. N. W. McLachlan, M.I.E.E. It depends upon a new electrical effect: when the anode voltage

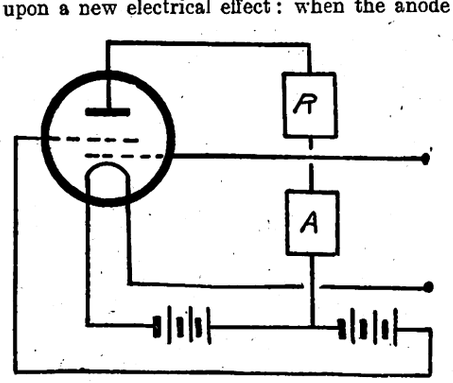


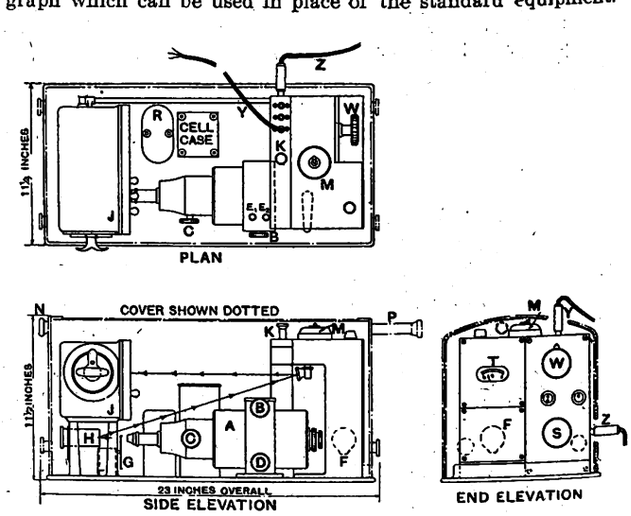
Fig. 1.—Modulated c.w. Wavemeter Circuit.

of a screened valve is less than that of the screen the valve has a negative resistance; in the anode circuit (fig. 1) a coil and condenser R tuned to a radio-frequency are connected in series with a similar arrangement A tuned to an audio-frequency, so that when suitably proportioned a radio-frequency modulated by an audio-frequency is obtained. If this modulated c.w. wavemeter is placed near a radio receiver, the audio-frequency will be reproduced by the loud-speaker, provided the receiver circuits are tuned to the wavemeter. Thus a receiver can be tuned without the aid of a transmitting station; alternatively, if the receiver is tuned to an unknown station, its wavelength can be found at any time, even when the station is shut down. The wavemeter can also be used as a master oscillator to control, or to check, the wavelength of a transmitting station; for check purposes the radio-frequency of the meter is held constant by a quartz crystal and a note of the same pitch as the audio circuit is obtained by heterodyning the radio-frequencies of meter and transmitter. If the latter frequency alters, a slow beat will occur between the two audio-frequencies, which can be made visible on a meter. By omitting the radio circuit and using a suitable inductance, another new effect can be secured: a series of interruptions of peculiar waveform occur and the sound resembles a chirrup. In this case the frequency of the oscillations is *imaginary*, but the circuit damping is negative. For steady oscillation the frequency is, of course, real and the damping negative. Various other effects can be obtained. Important practical features of the instrument are its simplicity and inexpensiveness; no reaction coils are needed; a modulated wave is obtained with only one valve; calibration is independent of the valve; and tuning is effected without a receiver in the absence of a carrier wave.

A new form of double bridge completely mounted and screened in one desk has been designed for the very accurate determination of out-of-balance capacities of trunk telephone cables. A multi-functioning switch having a rotary dial of fifteen testing positions is incorporated to effect "between quad" unbalance measurements, as well as the more usual "within quad" unbalance measurements; this extension of the usual test is now under consideration by the C.C.I., and at the request of manufacturers the switch has been designed to perform the complete series of tests. The desk set is complete with two differential variable air condensers of precision quality with double screening and a novel range extension device (patent applied for), non-reactive matched ratio arms, 15 position multifunctioning switch, and balanced screened transformer; a series of six variable air condensers is also included for the purpose of eliminating any initial unbalance due to switch or testing lead. Due to the special feature of range extension employed in the differential air condencers, a total unbalance of 1,600-0-1,600 $\mu\mu$F is obtained with a very high degree of accuracy; although having such a wide range of capacity adjustment, it is possible to measure unbalances of 1 or 2 $\mu\mu$F with ease, and range extension is effected without affecting the symmetry of the high-potential plates to screen. The equipment was exhibited by permission of the Pirelli-General Cable Works, Ltd., as was also a Wien bridge for capacity determinations on telephone cables in the form of a self-contained and screened testing desk specially arranged for works determinations at mean speech frequencies.

Cambridge Instrument Co., Ltd.

Most of this company's exhibits were shown for the first time. The most popular novelty was a portable electro-cardiograph which can be used in place of the standard equipment.



A, galvanometer; B C D, fibre adjustments; E_1 E_2, fibre case terminals; F, lamp box; G, time marker; H, lens; J, camera; K, push button switch; L, calibrating scale; M, main switch; N P, handles for carrying case; R, box for spare fibre case; S, compensator; T, voltmeter; W, standardising switch; Y, plug for electrodes; Z, plug for battery.

Fig. 2.—Portable Electro-cardiograph.

It can be taken to a patient's house, and is also suitable for use in the consulting room in the ordinary way. Rigidly assembled, on removal of the metal protecting cover, it is ready for immediate use, no connections being required other than those to the electrodes and to a 12-volt battery which forms part of the equipment. The record is taken on a film wrapped round a cylindrical holder and exposed in three sections in the normal way; three film holders are provided so that three complete records (each of three leads) can be taken without resorting to the dark room, and a spare fibre and lamp are carried with the outfit so that, if necessary, they may be replaced at any moment. Adjustments are fundamentally the same, but operation has been somewhat simpli-

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fied. The galvanometer (A, fig. 2) is of a novel form: it is more compact and lighter in weight than the standard, and, as it is entirely iron-enclosed, does not create any material magnetic field which is likely to affect external objects, such as watches, &c. The energising coils are wound close to the air gap, and therefore concentrate the field over that area. A fibre-sensitivity adjustment (B) and focusing device (C) are provided, and (D) enables the position of the fibre image to be varied in relation to the camera aperture. The sensitivity is comparable with that of the standard model; the fibre is shorter and, owing to a novel form of protecting sheath, is more readily accessible; it is inserted through the top of the casting, the connecting terminals being shown at

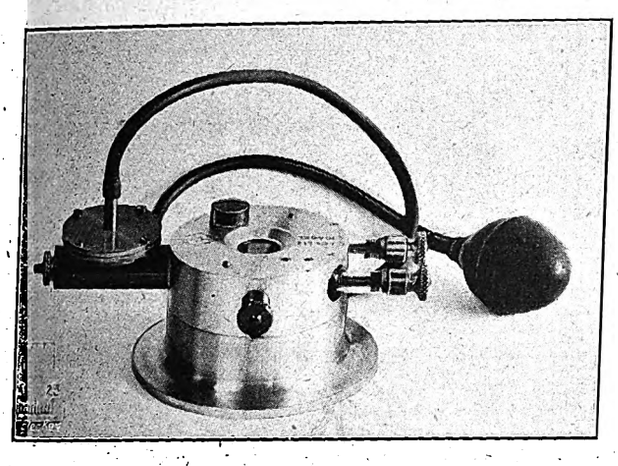

Fig. 3.—Electrometer and Earthing Switch.

E_1E_2. The spare fibre case is contained in the box R. The source of illumination is a 12-volt filament lamp in a separate compartment (F). After the beam leaves the galvanometer it is interrupted by the spokes of a new form of rotating time marker (G), whence it impinges on a silvered lens (H), which is capable of adjustment, and reflects the beam at an angle of about 25 deg. with the horizontal plane on to a mirror, from which it is again deflected (through a similar angle), forming an image on the sensitised photographic surface. It is thus possible to obtain within the compass of the portable carrying case the rather long projection distance required to comply with the 600 diameters necessitated by the Einthoven Convention. A novel form of camera (J) is used which takes films 6¾ in. by 3¼ in. (the size of a standard plate), being spring-driven and electrically governed. To take a record, the push-button switch (K) is depressed, which winds the spring controlling the spindle; on releasing the switch, the spindle makes one revolution at constant speed. The depressing and releasing of this switch also operates

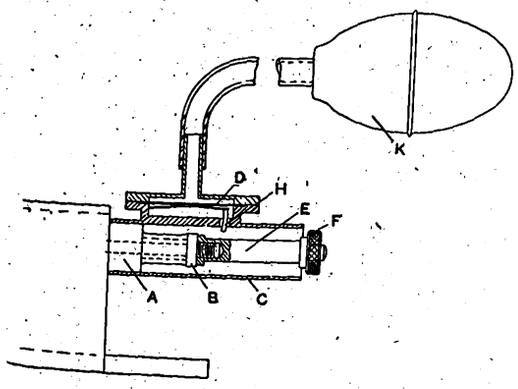

Fig. 4.—Electrometer Earthing Switch Diagram.

the time marker (G), of the rotary pattern, which rules a line on the record each 1/25th sec., with a heavier line each 1/5th sec.

To take an electro-cardiogram, it is only necessary to connect up the electrodes and the battery, operate one main switch (M) governing the complete equipment, standardise and compensate the fibre, and depress the single exposure control (K). The electrodes are of the Cohn pattern. This apparatus does not employ any system of valve amplification, the method being a direct recording one throughout, and the curves cannot be distorted by varying valve characteristics. When the metal protecting cover is in position the apparatus is easily lifted by means of the handles (N) and (P). The 12-volt accumulator, together with the three film holders and the electrodes with connecting leads, are contained in a separate case, the approximate dimensions of which are 16½ in. by 12½ in. by 10½ in.

When using an electrometer some device is generally necessary whereby the quadrant, or the needle, according to the type of electrometer, can be restored to earth potential and the charge upon it removed. When measuring minute electrical charges precautions are necessary to guard against capacity effects, particularly where a Lindemann electrometer, or similar small instrument, is used for photo-electric measurements of very light intensities, such as those encountered in astrophysical work. For such a purpose the switch used must be of a size proportionate to the instrument to which it is to be fitted, suitably shielded to avoid capacity effects, and must add but slightly to the capacity of the apparatus, in addition to being capable of being operated from a small distance. The earthing switch shown in figs. 3 and 4 has been designed to satisfy these conditions; they show the switch mounted on a Lindemann electrometer fitted with a bush A (fig. 4), through which passes a quartz insulator carrying the needle terminal B, and over which is pressed a short length of brass tubing to shield the lead-in. When fitting the switch the shield is removed, together with the knurled terminal head, and replaced by the tubular body of the switch and the terminal head by the distance piece E. When the rubber bulb is pressed the thin rubber diaphragm D is distorted, depressing a light spring carrying the pin H, so that the pin is brought into contact with the distance piece E, thereby earthing the needle so long as pressure is maintained on the bulb. To avoid thermo-electric effects of any appreciable magnitude, the pin H is made of gold and the portion of the distance piece E with which it makes contact is heavily gold plated.

The instrument shown in fig. 5 records changes of angular velocity in any rotating number and enables irregularities, or cyclic fluctuations, in the rate of turning to be easily traced and measured; it may also be used to detect torsional resonance and its effect on the running of the engine, or accessory apparatus. The outfit may be applied to all varieties of

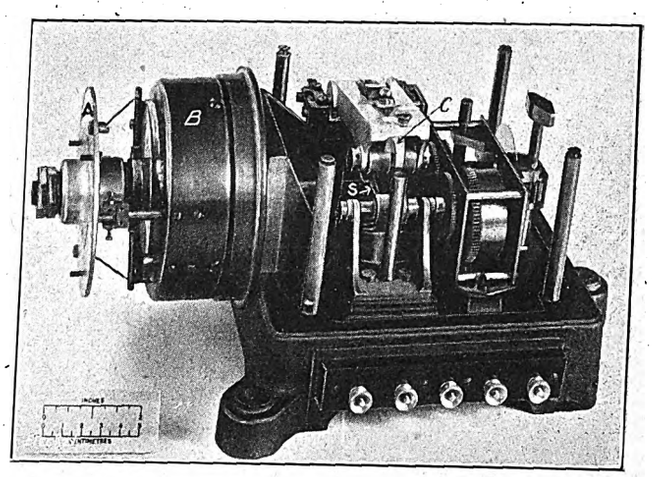

Fig. 5.—Rotational Accelerometer.

rotating electrical machines. A wheel A on a horizontal spindle is driven by the engine under test by a form of belt which accurately transmits the instantaneous angular velocity; the belt can be readily joined up on site in a few moments, and may be driven from any small length (⅝ in. upwards) of exposed shaft, or small pulley, or coupling. To A is flexibly attached a heavy wheel B, carried on the same spindle, but mounted entirely separately from the driven wheel A. The peripheral speed of B quickly becomes steady, and tends to remain so, while that of A varies with the instantaneous variations in the rate of turning of the engine shaft; the difference in the angular positions of the two wheels is transmitted to a stylus S, by a novel form of flexible link which eliminates back lash, pressed lightly into contact with a continuous strip of celluloid C (12 mm. wide), which is moved by clockwork mechanism at a speed which can be varied over wide limits, so that a permanent and clearly-defined record of the variations in the rotational velocity is traced in the celluloid surface. This method, which does not depend upon optical or photographic methods, is capable of great accuracy even when recording rapidly changing acceleration. Two electromagnetic marking mechanisms are so fitted that a time scale can be marked on the film by one while the revolutions of the engine, or other shaft under test, can be recorded by the other; in each case by means of a separate stylus operating on the back of the film, so that it is possible for the stylus making the record of acceleration to pass over the whole of its range without fouling either the time-marking or the revolution recording stylus. The instrument can be set in operation and the film speed adjusted electrically from a distance. The records can be examined at once by means of a suitable microscope, or direct enlargement can be obtained by photographic methods, or by projection upon a screen and tracing.

A new alternating-current potentiometer, fig. 6 is a Campbell modification of the simple Larsen instrument, in which the unknown voltage is balanced by another of the form

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$(r+j\omega m)\ i_1$, where i_1 is a constant standard current and r and m are resistance and mutual inductance, both variable. In the simple type the quadrature component $\omega m i$ is obtained by multiplying the observed $m i_1$ by the pulsatance ω (*i.e.*, 2πx frequency). The new system avoids this trouble by ensuring that at any given frequency the current through the

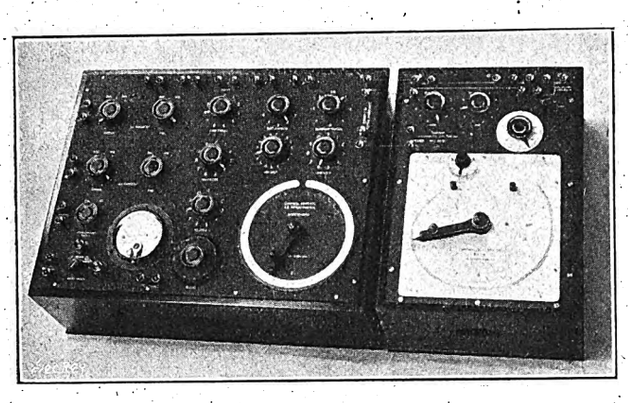

Fig. 6.—New A.C. Potentiometer.

primary of the mutual inductance shall be such a multiple of i_1 as to make the balancing voltage $(r+jbM)\ i_1$ where M is the mutual inductance and b a constant. This is achieved by an arrangement of loop-shunt, which can be set for any given frequency, so that the readings of r and bM shall give the two components directly in millivolts. The standard alternating current i_1 is set and held constant by a thermal null method in which it is balanced against a known direct current.

A frequency recorder consists of a recording potentiometer with an electromagnetically-operated vibrating member which is tuned approximately to the frequency to be recorded. This member carries two contacts, and at each oscillation one of them completes a circuit through a precision mica condenser and a standard cell; the circuit is then broken, and the second contact connects the condenser through a resistance to the potentiometer, thus enabling the condenser discharge to be recorded. The standard cell ensures a constant charging voltage, so that the value of the condenser discharge depends on the frequency with which it is charged and discharged per second, that is, on the frequency of the circuit connected to the electromagnet actuating the vibrating member. The resultant temperature coefficient of the condenser and standard cell is so small as to render the arrangement almost independent of temperature variations. The record is traced on a continuous chart 7 in. wide, the range of frequency covered being 8 cycles per second, which gives a very open scale. The instrument shown had a range of from 46 to 54 cycles per second.

A valve method of controlling a high-voltage supply depends upon the fact that when a thermionic valve system is operated entirely from one source of electrical energy, the anode currents of the valves will be very sensitive to fluctuations in the supply voltage unless some form of control is employed. The apparatus shown was operated from several windings of one transformer: the d.c. high-voltage was obtained by full-wave rectification and applied through an ohmic resistance to the anode of the control valve, the filament of which was heated from a winding of the same transformer. The actual voltage at the anode of the control valve depends on the ratio of the fixed ohmic resistance to the resistance, or impedance, of the valve. An increase in the supply voltage will be reflected, both in the rectified a.c. and in the filament winding, and in the latter instance it will have the effect of decreasing the impedance of the valve. The value of the ohmic resistance can therefore be adjusted so that the voltage at its junction with the anode is independent of variations in the main supply. Such control can be adjusted to compensate for changes induced in any auxiliary apparatus, and is also applicable when both high- and low-voltages are obtained from separate windings of a rotary generator.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Rotating Lighting Fitting.

A means of producing spectacular lighting effects for kinemas, window displays, dance halls, and so on, is marketed by ATTRACTA ELECTRICAL CO., 2 and 3, Tichfield Street, Dean Street, W.1., in the form of the "Attracta" rotating mirror bowl, fig. 1. The bowl proper is of aluminium studded with numerous small glass mirrors, and is suspended by chains from a reliable clockwork motor which will revolve the bowl for seven or eight hours for one winding. Beams of white or coloured light are projected on to the bowl by means of one or more spot-light fittings, which can be supplied with the bowl if desired. The beams are reflected by the mirrors in an ever-changing shower of colour spots. The bowl is

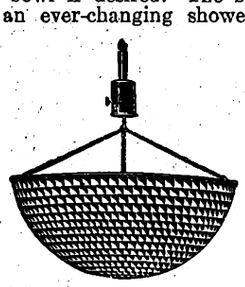

Fig. 1.—Rotating Mirror Bowl.

Fig. 2.—Spot-light Projector.

available in two types, A and B, with diameters of 18 in. and 24 in., respectively. Fig. 2 shows one of the spot-light lanterns supplied by the firm. It has a 6-in. lens and is designed to take a 100/400-W projector lamp. A second model available is carried by a telescopic stand with heavy cast feet.

A Magnetic Pin Holder.

We have received from Messrs. F. A. WILKINSON & PARTNERS, LTD., Gretton, near Kettering, a sample magnetic pin holder. This takes the form of a "candle stand and stick," the stand being non-magnetic and the stick magnetic. Dipping the magnetic rod in a packet of pins provides a cluster of pins ready for use.

A Small Windmill Dynamo.

A recent production of Messrs. F. A. WILKINSON & PARTNERS, LTD., Gretton, near Kettering, is a small windmill-driven dynamo unit, fig. 3, which, it is claimed, is suitable for supplying headlights on road vehicles, lighting petrol-pump signs,

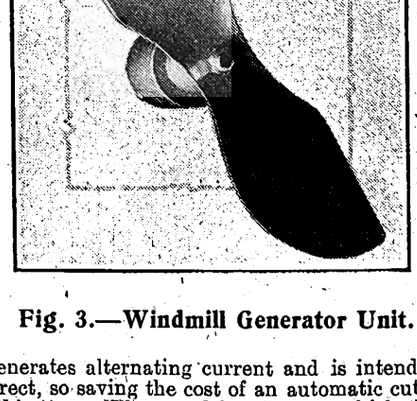

Fig. 3.—Windmill Generator Unit.

&c. It generates alternating current and is intended to light a lamp direct, so saving the cost of an automatic cut-in-and-out switch and battery. When used for a motor vehicle the machine can be mounted on the radiator, or the roof of a saloon car or van, and when used for signs it should be installed on a light tubular mast with a wind-direction vane.

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Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

"Point 8" Valves.

AN addition to the extensive range of valves marketed by the General Electric Co., Ltd., is the "point 8" group, consisting (at present) of the H. 8, HL. 8, and P. 8, which have rather unusual filament characteristics, the voltage being 0.8 volt and the current 0.8 amp. A short thick filament with such characteristics can be supplied with a.c. direct from the domestic mains through a suitable step-down transformer; unlike K valves, which have indirectly-heated filaments, the heating element is also the electron-emitter. Emission being practically constant, in spite of the slight, but rapid, change in the heating of the filament, the new valves can be inserted in any of the amplifying stages of a receiver without introducing objectionable hum and with the great advantage that the accumulator, and all its attendant maintenance worries, can be entirely dispensed with. The H. 8 valve is suitable in front of a resistance-capacity coupling; the HL. 8 is a general purpose valve, which can be usefully employed as a high-frequency amplifier, or first low-frequency amplifier; the P. 8 is intended for use in the last power-amplifying stage. With a.c. mains of a reasonably good wave form, the HL. 8 may be used as an anode-bend detector with success (leaky grid rectification should not be employed with these directly heated valves).

The only departure from general practice in a 3-valve combination is in the grid-return connections: thus whereas g.b.+ and h.t.− are usually connected to l.t.−, in the "point 8" circuit g.b.+ and h.t.− must be taken to the slider of a low-resistance potentiometer, the winding of which is shunted

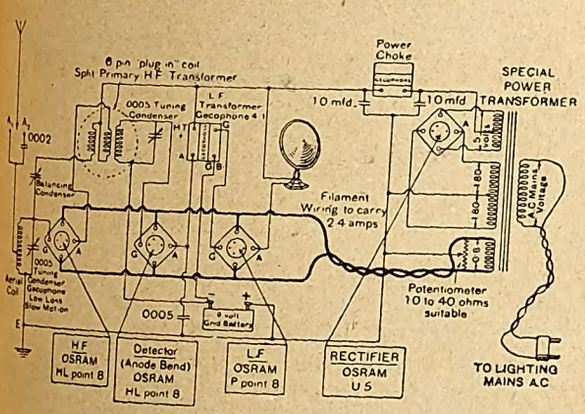

Fig. 1.—"Point 8" Three-valve Receiver.

across the 0.8-volt filament transformer. Another point of difference is the necessity for filament leads of sufficient thickness to carry the total filament a.c., which in the case of three 0.8 valves amounts to 2.4 amps. When making a receiver advantage can also be taken of the "Osram" U.5 rectifier, which, with a suitable transformer and smoothing circuit, will provide anode current from a.c. mains; in this way an "all-mains" receiver can be arranged, as shown by the diagram (fig. 1). The great advantage of the new directly-heated "Osram" valve is the great simplicity of wiring.

"Clix" Plugs and Terminals.

We received samples recently from Lectro Linx, Ltd., of power plugs and sockets with insulating bushes for use with battery eliminators, chargers, &c. Originally designed for medical apparatus, they are strongly made, and incorporate the resilient principle covered by the "Clix" patents. Lead-coated spade terminals are useful for accumulator service, and a wood screw socket is now available for plug extensions of all descriptions.

A Rectifying Voltmeter.

Messrs. Ferranti, Ltd., have combined their standard 2½-in. radio-instrument movements with copper-oxide rectifiers to produce a.c. instruments having the following distinctive features: (1) high torque, equal to that of moving-coil instruments; (2) efficient damping, again equal to that of ordinary moving-coil instruments; (3) very small current consumption, which is constant for all ranges, unlike other a.c. instruments; (4) improved scale shape. The three-range self-contained model illustrated in fig. 2, is one of a number of new instruments possessing the above features. The lowest range has a separate scale, but 10 and 100 volts are on one scale. Consumption is either 7.5 or 1.5 mA, and these figures apply to the 1-volt range equally. The single-range pattern is available in ranges from 0-1.5 mA to 0-50 mA, and from 0-1 V to 0-250 V. They are correct at all power supply frequencies and wave-forms;

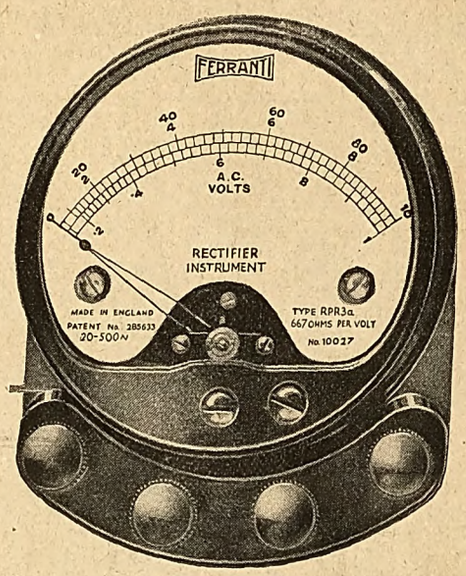

Fig. 2.—Rectifying Instrument.

peaked or other distorted wave-forms are not read correctly, as the calibration is in r.m.s. volts. They are corrected for temperature, the error being very small.

Philips Products.

A 2-valve receiver recently placed on the market by Philips Lamps, Ltd., is only 7 in. long, 10 in. wide, and 7 in. high. It has been designed to operate entirely off domestic a.c. mains, without batteries, and is primarily intended for local station reception, but distant stations can be heard under favourable conditions: a wave-length switch for 200/400, 400/600 and 1,000/2,000 metres covers all requirements, and single-control tuning is simple, while reaction adjustment regulates volume. The Mullard valves used are a special steep

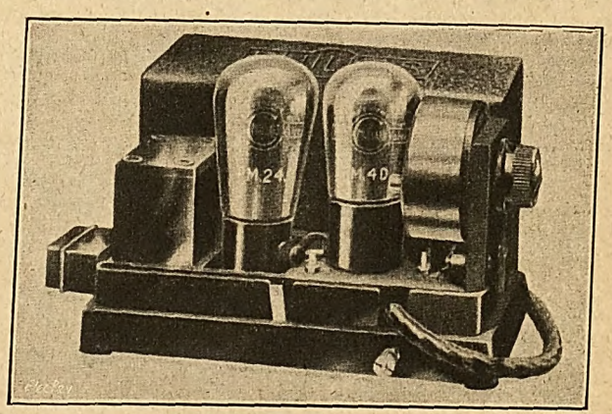

Fig. 3.—Philips Gramophone Amplifier.

slope detector and "Pentode," and facilities for connecting a gramophone "pick-up" are provided. The latter is of light weight, and an ingenious holder simplifies needle fixing. The gramophone amplifier (fig. 3) incorporates an l.f. transformer and two valves of the type mentioned above, besides a volume control switch that is claimed to have been designed on a new principle to permit of the variation of volume without altering the sound proportion between high and low notes.

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Industrial Electric Heating Exhibition.

A demonstration of the most modern applications of electric heat to industrial purposes.

(*Concluded from page 82.*)

ONE of the useful positive features of the Industrial Electric Heating Exhibition held at Manchester last week, of which we gave some particulars in our last issue, was that the attendance of visitors was practically confined to those members of the public who have a definite interest in the applications of electric power to industrial heating purposes. An examination of the visitors' book revealed the names of representatives of well-known business concerns located, not only in Manchester, but in the surrounding towns.

The BRITISH RESISTOR CO., LTD., exhibited an electric furnace fitted with "Globar" non-metallic heating elements, for the heat treatment of carbon and alloy steels, and for working temperatures up to 1,350 or 1,400 deg. C., together with the control gear. Other interesting exhibits were the "Uno" electric branding iron, fig. 4, and the "Utility" electric burner for burning paint off doors, steelwork, &c.; these tools are heated with "Globar" elements, the former taking 2 kW

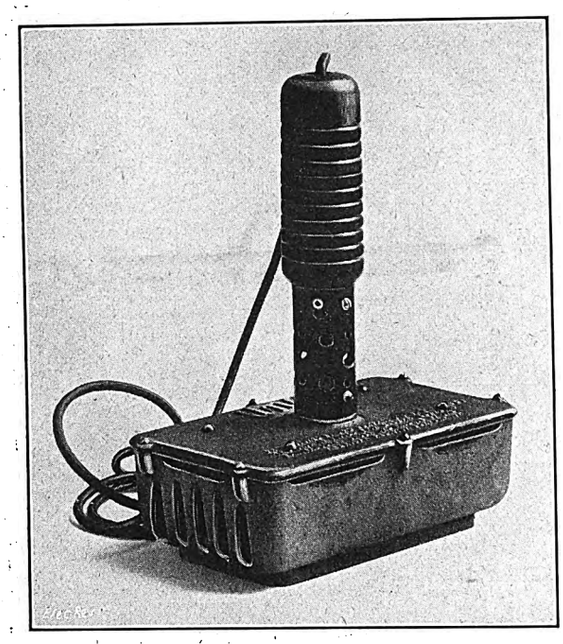

Fig. 4.—The "Uno" Branding Iron.

and the latter 1.2 kW. The elements have a long life, and are easily replaced, and the safety, convenience, and efficiency of the tools are strong points in their favour.

Messrs. JACKSON BOILERS, LTD., showed various types and sizes of "Jackson" self-feeding water boilers, with and without coffee-making machines and milk containers. The "Jackson" self-contained coffee-making machine was also shown.

Among a selection of "Lecfur" products shown by the LEEDS ELECTRICAL CONSTRUCTION CO., LTD., were an annealing machine for the bright annealing of non-ferrous metal wires, an electric furnace for operating at temperatures up to 1,350 deg. C. for the heat treatment of high-speed steel tools, another for operating at temperatures up to 1,050 deg. C. for annealing, fusing enamels, preheating high-speed steel tools, carburising, and general heat treatment, and an electric melting pot, fig. 5, for melting lead, type metal, babbitt and similar metals. Fig. 6 shows a "Lecfur" twin tool furnace for treating high-speed steels. In the company's high-temperature furnaces, which operate up to 1,350 deg. C., a non-metallic heating element is employed, and in the other types nickel-chrome elements are used.

The equipment on the stand of Messrs. FERRANTI, LTD., was confined to electro-thermal storage water-heating plant, and included a range of water heaters of capacities varying from 20 to 300 gal. A selection of accessories for controlling the electricity supply to the heaters, including thermostats and load-levelling relays, was also displayed by this firm. The load levellers are simple switches for the automatic control of the electricity supply to storage water heaters and are an alternative to time switches. The switch in the circuit of the water heater is allowed to close only when the demand from the other equipment on the main circuit of the household is less than a predetermined figure. (See ELEC. REV., February 24th, 1928, p. 356.)

WILD-BARFIELD ELECTRIC FURNACES, LTD., had four furnaces on view—vertical and horizontal electromagnetic hardening furnaces of the well-known Wild-Barfield type, taking 11.9 and 7.9 kW respectively; a high-speed steel furnace with preheating and tempering chamber, and high-temperature chamber, taking 7.6 kW; and an internally-

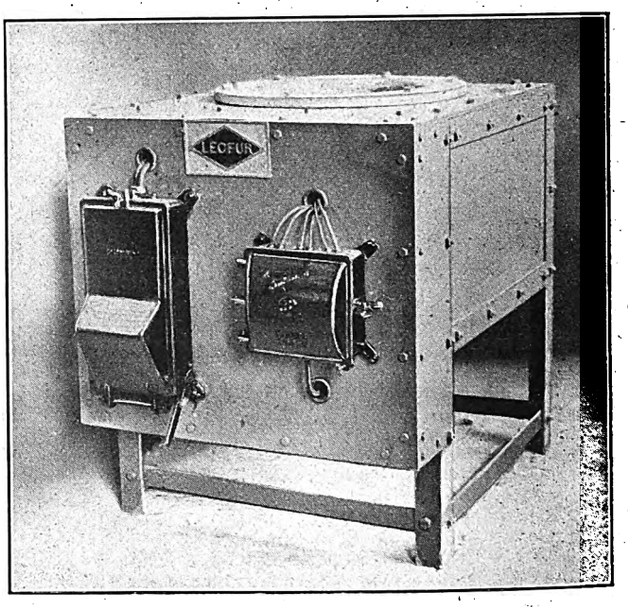

Fig. 5.—"Lecfur" Melting Pot.

heated electric furnace of standard construction, with the heating elements in patent grooved refractory bricks, taking 23 kW (maximum). All the furnaces are provided with control boards, &c., the last-named having automatic temperature control and a time switch. Fig. 7 shows a 23-kW internally-heated furnace similar to the one at the exhibition. It is constructed with an outer case of ⅛-in. boiler plate. The heating elements are of spiralled nickel-chromium running

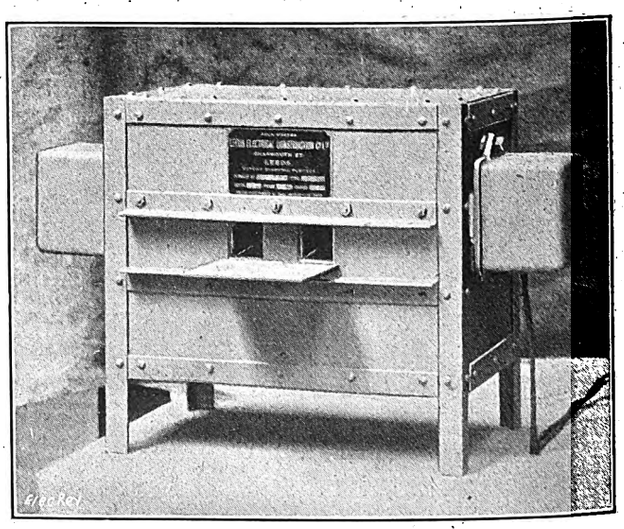

Fig. 6.—"Lecfur" Twin Tool Furnace.

right round the walls, roof and floor. The chamber is 66 in. long, 44 in. wide, and 12 in. high. The losses at 490 deg. C. are 3.6 kW. The furnace is suitable for carburising, annealing, refining, enamelling, and so on.

On the stand of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., was to be seen an induction furnace equipment, fig. 8,

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suitable for melting steel, which represents some interesting developments made by the company. It has a capacity of 5 cwt., and is similar, it is claimed, to commercial installations which have shown themselves capable of economical production of the highest-quality steels. An important feature is that the furnace operates at only 500 cycles. The equipment includes the necessary motor-generator set and two banks of condensers for power-factor correction; one bank is permanently connected in parallel with the furnace coil,

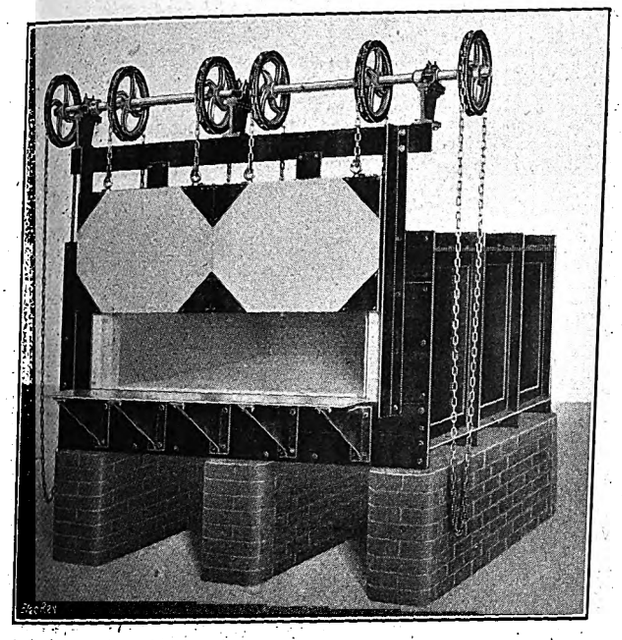

Fig. 7.—Internally Heated W-B Furnace; 23-kW.

and the other bank is arranged in sections for switching in or out as required. The overall power consumption of the furnace is from 700 to 900 kWh per ton of metal. Each afternoon the melting chamber was filled with ingots of steel which were heated by eddy currents induced by coils in the wall of the furnace. The time required for melting the charge was approximately one hour, and five minutes before the melt was poured, a bell resounding throughout the building brought together the bulk of the visitors to watch the interesting and, to many, novel, procedure. Another Metropolitan-Vickers exhibit, the "K" oven, is intended for enamelling, drying, heat-treating, and other industrial baking processes involving the use of temperatures up to 600 deg. F. It is the medium size, and has a baking chamber

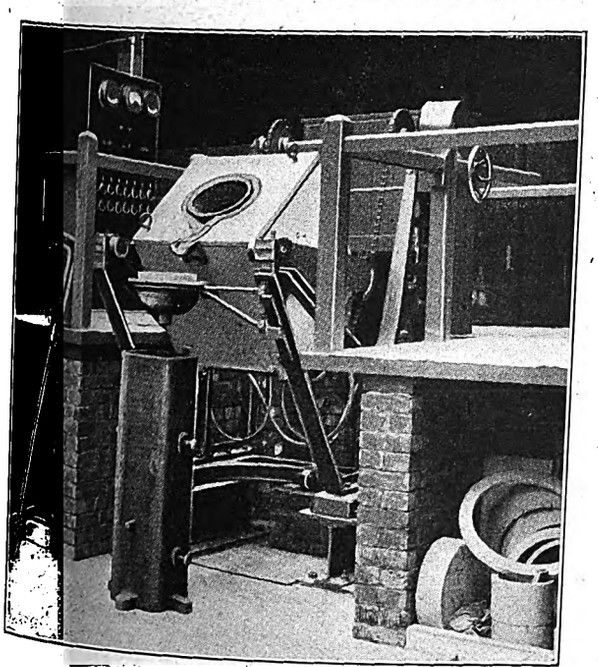

Fig. 8.—"Met-Vick", 5-cwt. H.F. Furnace.

3 ft. 9 in. high, 3 ft. wide, and 3 ft. deep, with a rating of 10 kW. The heating elements operate at black heat and are mounted in the oven bottom. Hand or automatic temperature control can be supplied with the apparatus. A two deck half-sack electric peel-type oven suitable for baking bread and confectionery was also on show on this stand. Each hearth is 4 ft. by 4 ft. in size, and each deck has a loading of 10 kW. The elements are disposed at the top and bottom of each chamber, each group being controlled by a separate three-heat switch. The oven will heat up to 450 deg. F. in about an hour, and thereafter maintain this temperature with a consumption of 5 to 6 kW. Cooking demonstrations were given with this oven during the exhibition by a firm of confectioners.

BRITISH INSULATED CABLES, LTD., displayed a variety of electric welding machines and demonstrated rivet heating, butt and spot welding. A rivet heater shown is a standard machine of 20-kW capacity, suitable for heating up to 1 cwt. of rivets per hour. The chief feature in connection with this machine is the type of electrodes employed; these are of hard-drawn copper and are, it is claimed, easily adjustable and renewable. A small butt welder shown is suitable for welding ferrous and non-ferrous wire of up to 0.25 in. diameter. A larger machine is designed for general purposes, and has a "welding area" of 3 sq. in. This machine is fitted with upsetting gear for either slow or flash welding, and has a single-phase a.c. static transformer of 50-kW capacity for slow welding and 80 kW for flash welding. The two ends of the transformer secondary are connected to two slotted platens, so arranged to avoid passing current through the moving contact faces and to provide a slide which may be oiled to ensure free functioning. Several improvements have been introduced into the 13L welder, and in place of the swivel-type stake is a fixed top stake; this carries the top electrode; moves in a vertical direction, and is actuated by pedal and toggle levers. Thus the maximum mechanical effort can be applied to the job. An improved method of arranging the compression springs which are adjustable is incorporated, and a plug box is fitted to the side of the machine to give eight welding speeds. The machine is provided with two large gun-metal platens for bolting on any type of contact-block clamp. Two B.I. spot welders on this stand include a small machine suitable for welding up to ⅜ in. added thickness (12-kW capacity), and a similar machine in which the top electrode has a vertical movement which enables parts to be welded in boxes and in awkward corners.

Messrs. YOUNG, OSMOND & YOUNG, LTD., showed a selection of their "Unity" electric tubular heaters, including the fol-

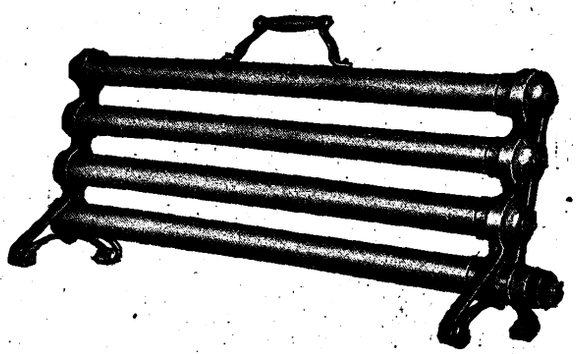

Fig. 9.—"Unity" Tubular Radiator.

lowing:—Skirting heater, for works and factories; two patterns of radiators, fig. 9; heaters for traction work at up to 600 V and 1,500 V; immersion heater for creosote distillation, fuel oil, tar heating, and so on; a gas- and water-tight heater; a heater as supplied for banana ripening; one as supplied for cigar conditioning; thermostats as supplied for the automatic temperature regulation of heating installations employing "Unity" tubes; and a model of a printing works in the Midlands, showing the typical arrangement of "Unity" heaters in the drawing office.

The multi-arc welding equipment of the PREMIER ELECTRIC WELDING CO., LTD., was the first unit of its kind to be publicly shown. This apparatus distributes high frequency a.c. (100 cycles) for welding purposes, has a high power factor, and secures the same efficiency as is achieved by the premier d.c. multiple operator plant. The running costs are stated to be very low. This company also had on view a single-phase transformer welder and numerous semi-automatic welding tools.

At the stand of SULZER BROS. was shown an electrode-boiler and thermal-storage system similar to that installed at the Regent Street Polytechnic. This installation has a loading of 1,800 kW, 6,500 V, three-phase, 50 cycles. The three thermal-storage vessels have a total capacity of 26,450 gal., providing for 185 radiators with 10,450 sq. ft. of heating surface.

There was only one electric drying cylinder for textile purposes, laundries, &c., in the Exhibition, and that was staged by LANG BRIDGE, LTD., a pioneer company in 1857 with the steam-heated drying cylinder. The electric cylinder consists of a stationary inner cylinder mounted on a hollow shaft. A thin outer shell rotates round the stationary cylinder. The robust heating elements are mounted on the surface of the inner stationary cylinder, which is insulated to keep the heat in the ¼-in. annular space.

Messrs. MARRYAT & PLACE showed some butt and spot welders and other small apparatus.

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A Theatre Heating Installation.

The new Shaftesbury Kinema at Leeds is equipped throughout with "Unity" heating tubes supplied by Messrs. Young, Osmond and Young, Ltd.

AN interesting electric heating installation has just been completed at the new Shaftesbury Theatre, Leeds, which has auditorium accommodation for over 1,500 persons. "Unity" low-temperature tubular heaters made by Messrs. Young, Osmond & Young, Ltd., are employed, 295 tubes being installed, with a total length of 4,028 ft., and a maximum loading of 218 kW. In the auditorium, fig. 1, there is a total length of tubes of 2,521 ft., representing a maximum loading of 125 kW, and the tubes are placed under the rows of seats. In the foyer there are eight tubes having a total length of 48 ft. and a loading of 5.88 kW; on the stage there are 14 tubes, 180 ft., and 10.80 kW; whilst in the five dressing rooms there are five tubes, 29 ft., and 1.74 kW. In the crush hall beneath the stage there are eight heaters, having a total length of 104 ft. and a loading of 6.24 kW. In the board room three tubes represent 37 ft. and 2.22 kW, and in the lounge twelve heaters have a total length of 198 ft. and a total loading of 10.88 kW. In addition to a ballroom, there are refreshment and cloak rooms, and so on, all heated by the same method.

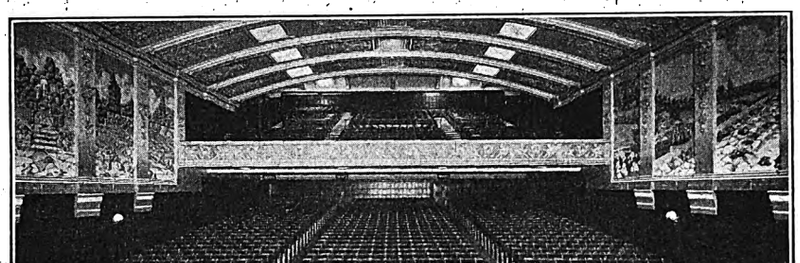

Fig. 1.—Auditorium, Tubes under Seats.

Fig. 2 is a view of the entrance hall, showing the tubes running along the skirting boards. All the tubes fitted underneath the rows of seats in the auditorium are loaded at 50 W per ft., so that the occupants of the seats can all enjoy the benefit of local heat, without the possibility of feeling excessively hot. All other tubes throughout the building are loaded at 60 W per ft.

The auditorium has been designed to maintain a temperature of 50 deg. F. when the building is empty and the outside air at freezing point. Whilst this temperature might appear at first to be somewhat low, it will be appreciated that even a comparatively small audience will cause a considerable rise in the temperature. The crush hall, cloak rooms and main entrance are also all designed for 50 deg. F. with the outside air at 32 deg. F., while the board room, lounge and refreshment room are designed for a temperature of 60 deg. F. on the same basis, and the ballroom and shops for a temperature of from 55 to 60 deg. F.

A transformer chamber has been installed by the City of Leeds Electricity Department in the basement of the kinema, and two four-wire services, 346 V, 3-phase, 50 cycles, are laid into the intake room. Two oil-immersed triple-pole circuit breakers, fitted with overload and no-volt trips, control the main supply, and are arranged for push-button operation in a case of emergency.

The heating tubes are so controlled that it is impossible to put an unbalanced load of more than 15 A on to the supply. The control switches are fixed in a small room in the foyer, and there are 28 triple-pole 30-A ironclad switches mounted on seven specially constructed ironclad panels. Mounted at the top of each panel are four tell-tale lamps which indicate the functioning of the switches. Two of the switches serve as master apparatus for local switches fitted on the tubes in the manager's office, board room, pay boxes, orchestra pit and dressing rooms. The remaining 26 switches afford the only means of control for the apparatus in the rest of the house.

The wiring has been so arranged that it is possible to have on circuit alternate tubes in all parts of the house, so that the distribution of heat is under all conditions kept as even as possible. Any section may, however, be warmed as may be required, independently of any other section. It will be seen, therefore, that the switching system gives very flexible control to the entire installation, and the area of heating surface can be varied at will, according to the requirements of the house. Special care also has been devoted to planning the wiring, and cables of five different colours have been used, so that it is possible to see at once which is phase 1, 2, 3, neutral, or earth. Special junction boxes, designed by Messrs. Collinson Bros., who were responsible for all the wiring work, have been used to obviate the use of loose porcelain connectors where the individual tubes are supplied from the circuit wires. These are cast-iron boxes, 9 in. by 4 in., with grooves into which are fitted a number of "Tufnol" slabs, each slab being provided with ¼-in. brass bolts and "Ross Courtney" terminals. The boxes also have lettering cast on their lids, to indicate the maximum pressure between any two terminals. From these boxes cables are run in conduit to the heating tubes, the conduit being screwed directly into the terminal cover of each tube. In addition to the earth obtained by means of the conduit, an insulated earth wire is run from the earthing terminal in the junction box to the earthing terminal provided inside the terminal cover of the heating tube, thus providing a dual earth to each unit. Although there are heaters under each row of seats in the auditorium, it was possible to wire up the whole of the tubes in this section with only one trench in the concrete floor down one of the centre aisles.

It is claimed that the tubes attain to within 10 deg. F. of their maximum surface temperature within ten minutes of being switched on, and that the heat is distributed evenly over almost the entire floor area. Once the desired initial temperature has been attained, assuming a fair attendance, the greater portion of the heaters may under average conditions be switched off for the remainder of the performance.

Fig. 2.—Entrance Hall, Heaters along Skirtings.

Adequate ventilation is provided for the kinema by means of a powerful suction fan situated in the roof and a system of ducts for drawing vitiated air from beneath the ceiling and the gallery.

Area Gas Supply.

The Board of Trade has appointed a committee to undertake the investigation recommended by the National Fuel and Power Committee in its report of September, 1928, respecting the technical and economic aspects of an area gas supply system, comprising an interconnecting network of pipe lines fed by a number of gas works, coke ovens, and the like.

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Telephone and Power Engineering.

The Anticipation of Demand, and the Economic Selection, Provision and Lay-out of Plant.

(*Abstracts of Papers read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

Telephone Systems.

By Capt. J. G. HINES.

THE paper describes the methods employed by the British Post Office in making telephone development studies, framing lay-out schemes and determining the economic periods for which to provide plant. Without attempting to encroach upon the province of the power engineer, the following are given as some of the main points on which there appears to be similarity in power and telephone systems:—The necessity to obtain as accurate a forecast as possible of the number and distribution of subscribers that will exist in an area after certain periods; the provision of a lay-out which will ensure an efficient service at least cost when calculated over the period for which it is found economical to plan; the establishment of centres at which, in the one case, energy is generated or transformed and, in the other case, telephone switching is effected; determination of the most suitable positions for the centres, and the type and size of buildings to erect and plant to install; the determination of the economic planning period for various types of plant; the provision of link or junction cables between centres, and also of networks radiating from distribution points; and the problem of the peak load or, as it is termed in telephone parlance, the "busy hour."

It may also be well to state some important differences: although the telephone engineer supplies current to subscribers for telephone purposes, he is not primarily concerned with the generation and distribution of electrical energy, but with the provision of speech and signalling facilities; the limits of speech on the conductors normally used is reached long before the current in the line is sufficient to affect its temperature appreciably; a telephone subscriber has the exclusive use of a pair of wires from his house to the public exchange, and as a consequence of this it follows that if there is a shortage of pairs on any part of the route the applicant must remain without service until the deficiency is rectified; telephone subscribers' needs have not necessarily been met when they have been given service to the local exchange, even if that exchange has a large margin of spare capacity, nor is it sufficient to consider the effect on the outlets to the nearest trunk exchange; when a house has been fitted with electricity supply it is probable that there will always be a user in that house. The time may arrive when this is true of telephones, but at present it is unfortunately the fact that in an appreciable proportion of cases, especially in private dwellings, a change of occupier results in the telephone circuit serving the premises being given up.

The forecasting of the probable number of subscribers to be obtained in an area is not carried out by the engineering staff of the Post Office, but is entrusted to the contract branch, which is also responsible for canvassing for new subscribers; the two branches, however, work in close co-operation. The engineer is responsible for the provision of plant to meet the expected growth and for calculating the period for which it is economical to make provision. He also watches the rate at which the plant is being taken into use and determines when it is necessary to take preliminary steps to augment.

The data furnished by the contract officers is used for a number of purposes, an obvious one being that of determining the amount of local plant required in an area and the most economical method of laying out that plant.

Before any further progress can be made it is desirable to prepare what may be described as labour-saving devices in order to reduce the amount of investigation work. These devices take the form of a series of graphs on which are plotted average figures representing all the variable factors which need be taken into account.

The problem of the "busy hour" is somewhat similar to that of the load factor in power systems. It is found that about one-sixth of the telephone calls are made during the "busy hour," so that five-sixths of the calls are spread over the remaining 23 hours.

After a new exchange area has been mapped out it is necessary to find the point in the area at which the telephone exchange should be located to secure the lowest average cost of subscribers' and junction lines. The forecast development data are utilised to ascertain the theoretical centre of the expected subscribers' lines in the area, *i.e.*, the point from which the average length of line laid to each subscriber would be at a minimum. The number of subscribers are added up vertically and a line is so drawn that the number of subscribers on the right and left of the line are approximately equal. A similar count is made horizontally and the intersection of the two lines indicates the approximate telephone centre.

Before an exchange building can be designed or plant laid out it is necessary to know for what period it is economical to provide in advance of actual requirements. A recent investigation indicated that the site for a telephone exchange should normally be large enough to allow the erection of a building which would accommodate the telephone lines estimated to exist 30 years after its erection, and that, if possible to do so at reasonable terms, sufficient space should be obtained to extend the building to accommodate twice the number eventually. The additional space, if obtained, will serve a useful purpose for the accommodation of stores, trucks, ladders, drums and other similar items until it is required for building upon.

The essential feature of overhead work from the economic point of view is the low cost at which a certain standard of telephone transmission can be obtained, compared with the cost of obtaining a similar standard on underground wires. Overhead conductors have a better transmission value than underground conductors of the same gauge; less expensive materials and methods of construction are required for overhead work; and wires can be provided as the need for each circuit arises, instead of being provided in groups as in the case of a cable. It would not, however, be economical to provide open wires in all cases, even if facilities for their erection could be easily obtained. If a large number of additional long-distance circuits were required it would probably prove desirable to lay an underground cable.

It is probable that the telephone engineer finds the problem of connecting consumers at the lowest average expenditure for plant more difficult than his colleagues in other branches of engineering, on account of the fact that it is only in telephone work that a separate channel is required from each subscriber's premises to the exchange. All telephone administrations have given a great deal of attention to the subject of flexibility and many methods have been tried, but no method has yet been evolved which is generally agreed to be suitable in all circumstances. There are two well-defined methods of dealing with the problem. One of these methods is fully described by Mr. E. S. Byng in a paper entitled "Telephone Work in the United States.* Briefly stated, it is a system of teeing individual pairs of wires in a main cable to pairs in two or more branch cables, so that the main pairs can be brought into use at alternative distribution points. The second method is to select points upon which to converge the main and distribution cables, and to provide at these points a means for redistributing the main cable pairs between the various branch cables with a minimum disturbance of working pairs.

Power Systems.

By Capt. J. M. DONALDSON, M.C.

The paper shows that the problem of dealing with growth in the electricity supply industry is radically different in nature from that of the telephone service, and gives an instance to illustrate the nature of the difference. To make a fair comparison with a telephone system covering a considerable area, it is assumed that for comparative purposes one may deal with an area having a radius of 10 or 15 miles from the generating centre, and that an alternating-current system of distribution is adopted. The problem divides itself into three main heads: distribution; feeder system; and generating plant. The starting point in regard to development must, of course, be the connections to the distribution system, and it is here that difficulty arises at once. Demands for power may arise in unexpected places and be of unexpected magnitude, and it is not possible in any event to deal with these from an ordinary distribution system. Similar conditions occur in new suburban areas where what was once a large estate with a single house is cut up for building purposes into a multitude of small plots. Such developments may be unexpected, and the form the development would take would not necessarily be known in advance, and it is not practicable to make initial distribution arrangements which will deal with such a situation. These considerations involve the use of a system so flexible that it may readily be adapted to suit the conditions, and it is for this reason that it is suggested in this paper that a secondary high-pressure system should form the backbone of the main distribution system. A pressure slightly under high pressure, *viz.*, 3,000 volts, is advocated and has the following advantages: high-pressure cables are relatively cheap

* *Journal* I.E.E., 1922, Vol. 60, p. 85.

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and entirely reliable, in fact, it may be said that they are less vulnerable than the ordinary low-pressure distribution system; the switchgear and sub-stations can be of the simplest possible character and the transformers themselves can be usually readily protected on both sides by fuses; the interposition of a second transformer with its reactance has the effect of reducing any shock on the main system when a fault occurs on the low-pressure side; it is possible, between the h.p. busbar in the main transforming centre and the feeders, to have some arrangement which will enable the pressure on the local system to be varied independently of the main pressure in a very cheap and simple manner.

The author attempted to find out by actual measurements in some five or six suburban distribution areas what the maximum load was likely to be (1) for a group of consumers taking lighting only, (2) for consumers taking a considerable amount of current for other domestic purposes, *i.e.*, heating and cooking, and (3) in a shopping centre where the lighting load would predominate and where the load density would be expected to be highest. He was not surprised to find, however, that it was almost impossible to get any figures which were worth reproducing, because it is very difficult nowadays to find streets of houses where lighting only is used, while, on the other hand, it is no easier to get complete blocks of houses of the "all-electric" class.

The main feeder system has been assumed to be at 11,000 volts from the generating station to suitable centres in various areas. Whereas in the case of the distribution system it is a sound policy not to overload the capital cost in the early stages with exceptionally heavy cables, it must be borne in mind that the feeder system will not be extended in the same way and with the same frequency as is necessary with the distribution system or the subsidiary feeder system. Consequently, one has to be prepared to put in considerably larger cables than the immediate necessities warrant. The author is inclined to favour a 0.1-sq. in. 11,000-V cable as a very useful size, and it has a reasonable carrying capacity, *viz.*, about 3,000 kVA.

When we come to the question of generation, it is very much easier to forecast the probable course of events, and it will be found that in most cases a record of the maximum kW dealt with from year to year lies in the form of a regular curve and that possible deviations from the normal rate are easy enough to forecast, at any rate sufficiently nearly for practical purposes.

The load on a particular generating system supplied by two power stations normally run in parallel, is probably typical of what has been going on in most districts throughout the country. In the pre-war period the load was slow in growth—about 1,250 kW per annum. During the war period the load grew at twice the rate. The next five years were subject to great variations of rush and slump but, on the average, the increase was less than in the war period. Since that time the progress has been regular and much more rapid—over 8,500 kW per annum.

The earlier equipment consisted of three 1,000-kW sets at one station and a miscellaneous collection, averaging about 600 kW, at the other station. By 1925 the plant installed was only about 50,000 kW, and for the next two years an increase of load had to be dealt with from outside sources, while, in 1928, a new station with two 25,000-kW sets was put into commission.

It might be said that some 25 years ago 99 per cent. of the stations which were put down were designed on lines about one-tenth of what they might have been—it is perhaps hardly fair to say *should* have been. Although the replacement of reciprocating engines by turbines has made it possible in many cases to accommodate in the original engine room considerably larger units in turbine sets, it is not always possible to do this without considerable modifications to the engine room, while the boiler house almost certainly has to be reconstructed. Whereas the distribution system can be extended and reinforced very cheaply without wasting money already spent, it is not possible to make a first-class station out of one which has been begun on too small lines. Again, the first section of a power station covers certain items—such as land, buildings and certain auxiliary works—which are independent of the size of the units used in the first place, and therefore the extra cost of starting with larger units is not relatively so great as might at first appear.

In making these remarks it is not overlooked that the running-plant load factor may be much improved by using units on what has been called the geometrical scale, but, with the increase of night load and the great improvements which have been made in turbine design, it by no means follows that it pays to run a smaller machine of an old type instead of a larger machine of a modern type, and it may well be that a modern machine is just as efficient at quarter load as is a much older machine at full load.

In general, the telephone problem bears little relation to electric supply conditions. It is by so much the harder, inasmuch as there is no diversity factor and, therefore, each consumer has to have his individual and separate nexus, at any rate with the first exchange. It is, however, simpler in that a telephone connection is, so to speak, a defined article, whereas, as far as the supply is concerned, one has to think in kW for lighting, in tens of kW for heating, cooking and water heating, and in hundreds or, perhaps, thousands of kW for factory power.

The essence, therefore, of the electric supply system is to have an arrangement which is flexible and without a large unfruitful expenditure in spares or spare ducts and the like. Such a system as is almost universally used now is ideal for the purpose, and it may be made still more flexible by the use of a subsidiary high-pressure feeder system.

Discussion.

Col. T. F. PURVES suggested that each of the authors of the two papers had shown a tendency to minimise the difficulties of the heavy-current or the light-current engineer, as represented by the other paper. He thought that the power engineer had perhaps the more flexible system to deal with; if a cable were too large, the excess copper would lessen the volt-drop—if it were too small, a certain amount of overloading was permitted. The telephone system was the biggest sufferer as regarded peak load; he did not know of an exchange which had been filled up without leaving some cables not fully utilised.

Mr. H. BRAZIL said it was difficult for the power engineer to find much basis for comparison in the two sides of electrical engineering. He suggested that 3,000 V was too low for the intermediate pressure; 5,000 V or 6,000 V would have the same advantages, and there would be a tendency for 3,000 V to be "swamped" in some places. Capt. Donaldson's idea of connecting distributors through reactances had been put into practice with good results. He criticised Capt. Donaldson's paper in its lack of provision for continuity. He thought it advisable to have as many "subs" as possible on two supplies, not necessarily from different sources, but through reactances. On the l.p. side breakers should be capable of remote control; some should be made automatic, so as to close when a fault cleared. That had been done in America with a great saving of time. He could visualise the operating engineer controlling faults from a central point by means of push buttons.

Mr. E. S. BYNG said that remote-control systems, &c., had proved the link between the two branches of engineering. Both had to deal with the same main problems of distribution, feeders and generation, and the greatest economy in each case could be made outside. Telephone engineers had, no doubt, made many mistakes in estimating for 20 years ahead, but they would have made more if they had not studied on those lines. The actual question of economy had been dealt with more in the telephone paper than in the power paper. Until they knew how to study finance they must have rule of thumb methods. He had never found the power engineer who studied finance along the same lines as the telephone engineer.

Mr. P. J. HAY felt that the telephone engineer was more advanced than the power engineer in economics. The question for the meeting was how could both sides control capital expenditure to the most advantage; the point of minute currents *versus* heavy currents was not the issue. Capt. Donaldson had shown that the power engineer was aware of the visible annual charge, and when he said that 0.1 was the economic cable, the speaker felt there was a more obscure reason. The telephone engineer could estimate for main cables, but not for feeders, and the problem of the power engineer was much the same. But they all knew that "unallocated" developments would come, and could be provided for up to the street corners. He thought that the problems of the two classes of engineer were parallel rather than remote—the power engineer had to think in terms of large currents, and the telephone engineer in terms of exchanges of large numbers of lines.

Dr. A. EKSTRÖM advocated the use of the "change-circuit" system, and gave some figures relative to a scheme he had prepared for an area in England.

Mr. E. WILLIAMS thought that estimating 20 years ahead was too long, in view of the cost of copper. While the telephone engineer had to pay far more attention to research, the power engineer could afford to defer his decision.

Mr. W. B. WOODHOUSE said that fundamentally the problems of the two services were the same—at a minimum of expense to give the maximum of service in a number of years. He hoped that in time the power engineer would have enough data to enable him to follow along the lines of the telephone engineer. Data were more easy to get now, and should be sent to the Electrical Development Association, or a similar body. He agreed with Capt. Donaldson on the principle of the intermediate pressure. Twenty-five years ago in Yorkshire they had 11,000 V and 2,000 V.

Mr. D. J. BOLTON pointed out that in one case the wiring was paid for by the consumer, while in the other case the Post Office paid for it, and suggested that that might have a bearing on the question of the consumer leaving his house. He thought the matter might be adjusted in the tariff. Regarding the refined and rough methods of the telephone and the power engineer, respectively, he thought they might be accounted for partly by the fact that the telephone engineers were under one authority and the power engineers under many.

Mr. J. W. WHEELER said that the estimation of any quantity depended on what was charged for it; if the charge for telephones was brought down the P.O. estimates would be found to be wide of the mark.

Mr. A. B. HART, commenting on the fact that both authors had stressed the point that the telephone engineer required two wires per service, suggested that the final solution in both power and telephone engineering would not necessarily

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embrace two wires. In this and other countries telephone service was being given over power wires, and wireless service could be obtained from electric-light wires.

Both authors replied briefly to the discussion. Capt. HINES said that there had been very little talk on economics by the power engineers. He wanted to know how the power engineer found out the economic positions for his sub-stations, &c. In many cases the Post Office used more copper than the power service. In the London area £1,000,000 per year was being spent on copper. It was uneconomical to put down plant for only five years. Regarding the suggestion that the light-current engineer was not concerned with "growth" of the already-established consumer, he quoted one instance of a site in Cheapside where an old building, with 12 telephones, was pulled down and a new building erected, requiring 500 telephones; there were many such cases.

Capt. DONALDSON pointed out that his paper dealt with an "area"—not with a city. The city was a problem on its own. Referring to the accusations that the power engineer did not consider economics, he showed that in electricity supply the problem was different in that the actual loading varied between very wide limits indeed—from small lighting loads to large power supplies; that was not so with the telephone service. The selection of sub-station sites was not a question for economical consideration because of the cost of land. Broadly, he advised power engineers not to put down cable too small. His choice of 0.1 sq. in. for feeders had been brought about by experience. He had found 3,000 V quite suitable for the intermediate pressure, but no doubt higher voltages would be more suitable in some places. Providing for 6,000 V, but initially using 3,000 V, was certainly worth consideration.

A Small Supply Undertaking.

The new Power Station at Wick, Scotland, is Equipped with Oil-Engine and Water-Turbine Plant.

RECENTLY at Wick, Scotland, was established a new generating station for giving a public supply of electricity in the town. The power house, which is constructed of reinforced concrete, was designed by Mr. J. E. McEwan, consulting engineer, and has been developed on his design by the Indented Bar & Concrete Engineering Co., Ltd.

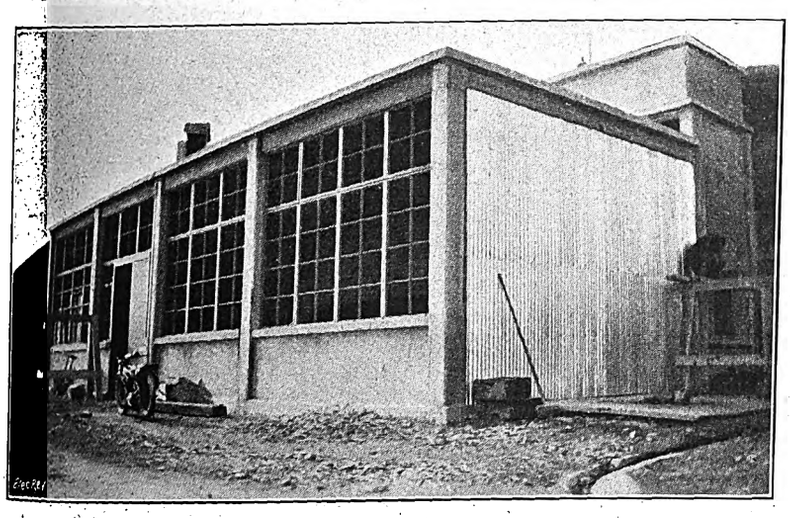

Fig. 1.—Wick Power Station, Exterior.

In comparison with the plant the amount of floor space taken up is very small. The front of the building is practically all glass, fig. 1, with steel window frames by Messrs. Gibbon & Co. Mr. Alex Miller, a local builder, was given the building contract. The station will eventually house two main sets, one of which has already been installed. This is a 132-h.p. crude-oil engine by Messrs. Ruston & Hornsby, Ltd., directly coupled to a dynamo supplied by the English Electric Co., Ltd., fig. 2. The engine can be started from rest by compressed air, and can, it is claimed, be put on full load in five seconds. The foundations are in for a second set, which will be provided as soon as the load warrants its installation.

In addition to the main sets there is also installed a water turbine which is supplied with water by means of a mill dam and is capable of developing a maximum of 60 b.h.p. The turbine runs at 1,000 r.p.m., and is coupled to a dynamo made by the Electric Construction Co., Ltd.

Off the main engine-room there is a small room in which are housed an air starting bottle for the oil set, a motor-driven compressor, a motor-booster battery-charging set, and a service fuel tank. Directly above there is situated a battery room with accumulators of sufficient capacity to take the night load, and on top of that there is a concrete water tank of 2,000 gal. capacity which is used to supply the cooling water for the engines. The water required to fill the tank is drawn from the turbine supply, and there is also a stand-by supply from the main. At the end of the building is situated an oil-storage tank capable of carrying 800 gal. of fuel. One end of the station is temporarily sheeted with corrugated iron to allow for further extensions.

The whole supply is governed by means of a 9-panel switchboard situated behind the power sets, which was supplied by the Edison Swan Electric Co., Ltd. The main panels are fitted with automatic protective gear for the dynamos. Two feeders at present leave the station and supply to distributing pillars in the town. A third feeder is to be put in soon to connect up with a main at present laid.

The late Mr. Arnott was the engineer appointed by the Council at the commencement of the scheme, and practically the whole of the work has been developed from his original plans, which were outlined just before his death. The supply, as stipulated by the Electricity Commissioners, is standard at three-wire d.c., 460-230 V. The majority of the main cables are laid underground, and the remainder of the distribution has been planned on the overhead system.

It is interesting to note that the new regulations issued by the Electricity Commissioners will considerably reduce the estimated figure for the future overhead work.

The public-lighting system is fairly standard. In streets where cables are laid underground, the old gas-lamp standards are utilised to carry a special top, and where overhead distributors are employed a bracket is fixed to the poles. By the use of a separate switch wire all the street lights are controlled from the main generating station, but at certain important street corners the lights are controlled by time-switches. The setting of the switch at the station is done automatically to suit the lengthening or shortening daylight periods, so that no manual labour is required except for cleaning or replacing globes.

Commenting on the use of overhead lines by the undertaking, in the light of the Commissioners' new regulations, Mr. McEwan said that smaller poles would be permitted for future extensions. One of the great advantages of overhead wires was that one could start with a light wire and, when the load increased, put up a heavier wire at little cost; increase of capacity in the case of a cable meant heavy expenditure.

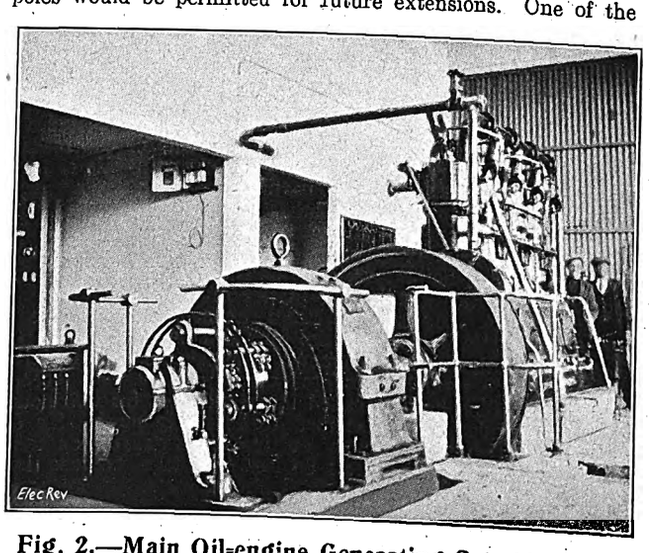

Fig. 2.—Main Oil-engine Generating Set, 132 h.p.

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Domestic Electrical Appliances.

Report of a meeting of the London Local Technical Group of the Electrical Power Engineers' Association.

IN a paper read before the London Local Technical Group of the E.P.E.A., on January 8th, Mr. F. H. H. BELLAMY discussed the design of some of the domestic electrical appliances and the latest developments that were taking place in connection with them, and indicated what he believed would be the trend of future development. At the invitation of the group, a number of members of the Electrical Association for Women were present at the meeting, over which Mr. W. J. Oswald presided.

Dealing with electric irons, Mr. Bellamy said they were highly efficient, but a large percentage of energy was wasted by the user; irons had been introduced having thermostatic devices incorporated in them, which kept the operating temperature of the iron within very close limits. He described various protective devices for kettles intended to reduce the heavy maintenance costs, due, for the most part, to allowing them to boil dry. Coffee percolators were also fitted with safety fuses or automatic thermal protective devices.

Mr. Bellamy expressed the view that electricity supply authorities had not given the electric washing machine as much attention as they should have done, no doubt owing to the fact that the quantity of electricity consumed thereby was practically negligible, most of the machines being operated by a ¼-h.p. motor, which was used four or five hours per week. Apart from the extraordinary amount of labour this machine saved, however, it had a great educational value in persuading the housewife of the many other ways in which electricity could assist her. In his view the revolving drum type was not as efficient as the type which had a gyrator fitted in the wash tub. The latter type was also quicker in operation, and it was significant that most manufacturers were now producing models on these lines. In an average family of six people the weekly wash could be carried out very efficiently with an electric machine in two or three hours, and the running costs were negligible.

Stressing the importance of the electric water-heating load, he said he had heard that it was of even greater value to supply undertakings than the cooker load. The tendency appeared to be in favour of a well-lagged tank with a heater of not more than 700 or 800 watts loading, controlled by an automatic switch.

After discussing the various types of electric radiators available, he dealt with electric cookers, and stated that in one area last year over 45 per cent. of the total energy sold was for heating and cooking; the load curves showed that there was very little difference in the character of the Sunday and week-day station loads. With regard to diversity factor, he was informed recently by a supply station engineer that on a small housing estate of 120 houses, each of which had a cooker installed, representing a total connected load of approximately 500 kW, the maximum recorded load was 93 kW.

Dealing with the construction of boiling plates, he said that the general opinion seemed to be in favour of the totally enclosed type as being the best.

Discussion.

Miss C. HASLETT (director of the Electrical Association for Women) said that at all the public meetings that she attended she was asked whether a perfect dish-washing machine had been produced; how long must they wait before such a machine was available? She also suggested that the design of electric kettles might be improved; often the lids were too small. With regard to safety, Miss Haslett advocated the more liberal use of insulating material. One of the reasons why washing machines were not used more in this country was that drying was difficult, particularly in small flats, and it was preferred to send the clothes to the laundry. Although many women longed to use more electrical appliances in the home, they were very often in difficulties owing to the small number of plug points available, and Miss Haslett urged the supply authorities to take this matter in hand.

Mr. W. E. ROGERS laid stress upon the importance of providing really robust material for the connections from the terminals to the internal elements of apparatus, and exhibited a sample of a specially insulated wire made by the Liverpool Cable Co. which he had baked up to red heat for two hours, but the insulation still seemed to be fairly good. He did not agree with the policy of putting extra gadgets on coffee percolators and various safety devices on kettles, because these introduced complications. Free maintenance of apparatus should be adopted universally.

Mr. A. F. HARMER, speaking with regard to vacuum cleaners, suggested that the safest type was that in which the nozzle was fitted to a rubber tube, so that the user was more or less insulated from the electrical part of the machine. He considered that the electric cooker and iron were the two most useful apparatus in the home, and his experience showed that with gas at 8d. per therm and electricity at ¾d. per unit the latter scored all round.

Alderman Mrs. HAMMER (Hackney) complained that manufacturers did not give sufficient instructions to householders as to the proper use of their apparatus. She herself was frequently in trouble through over-oiling her apparatus; when a machine began to make a funny noise, she naturally thought that it needed oiling, but apparently that was wrong. She had never been told when to oil and when not to oil. Again, the vacuum cleaner was sparking on one occasion, and upon examination she found that there was no brush left, but she had never had any instructions as to the renewal of brushes.

Mr. EDINBURGH said the effect of the chemicals used in washing was to cause corrosion of aluminium; one way of overcoming the trouble was to nickel the inside of the washer. If magnesium oxide crystals were used to insulate the elements of boiling plates, the crystals dove-tailed into one another; a plate of that type, with a loading of 2,000 watts, had been proved to have an efficiency of 50 per cent., whereas the efficiency of the plate in which magnesium oxide powder was used for insulating was 45 per cent.

Mr. DARLING said they must ask the manufacturers of electrical apparatus to provide a boiling element which would carry out its function as reasonably and as economically as gas could do it. In respect of the oven and the grill they had the gas industry beaten. With regard to irons and kettles, he urged the necessity for keeping their price down.

Miss NORVICK said that in France, in some cases there were two irons, so that while one was in use the other was being heated to the correct temperature automatically; when the temperature of one iron became too low one changed it for the other.

Mr. W. E. ROGERS said that nearly 20 years ago in Marylebone that type of iron was used. The iron was pushed on to live contacts in a shielded chamber, and the arrangement had worked admirably.

Mr. GRAVES suggested that boiling rings might be replaced by a heating element to be placed inside the cooking utensils, as in the case of the element in a kettle. The added cost would be more than counterbalanced by the added efficiency.

Mr. SKINNER suggested that the flex attached to an electric iron should enter at the side instead of at the back, to avoid risk of shock to the user in the event of a short. A kettle should be supplied with each cooker, as part of a complete unit, and the replacement of elements should be made more simple.

Captain DURTNALL suggested that if more moderate temperatures were used, the efficiency of the apparatus would be greater. He considered it dangerous to have 220-volt alternating current on domestic premises; at a pressure of 50 volts a higher thermal efficiency would be obtained in cooking, and the apparatus used would be stronger. Thermal storage was adopted to a great extent in Italy, and houses were let at prices which included the cost of lighting and heating, the current being on continuously. During the night heat was stored in the thermal storage stoves, and that heat was used for cooking breakfast. One stove which he examined had insulation 1 ft. thick.

Mr. THOROGOOD pleaded for the organisation of a domestic electrical exhibition in London at which electrical apparatus only would be exhibited.

Mr. W. F. ANDREWS (hon. secretary of the Group), who possessed a semi-electrical house, mentioned some of his experiences. Electric heating in his opinion was still too expensive. With regard to the cooker, he had not the solid type of element, and in the course of two years he had experienced a fair amount of trouble with the grill. The oven, however, had been a complete success all through, and he imagined that the electric oven was cheaper to use than the gas oven. For water heating he had used a 100-watt Bastian heater which was always in circuit, and had found it of very great value; if extra heat was needed the wattage could be increased to 300, and it heated five gallons of water.

Mr. BRYAN had found that a 4-kW immersion water heater with a three-heat switch, in a 15-gallon lagged tank, enabled about 25 gallons to be obtained at half temperature in about an hour. His practice was to put on the low-heat switch at night, and when the high-heat switch was turned on in the morning, one could get a bath within three or four minutes.

Mr. BELLAMY briefly replied.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Keeping Mains "Alive."

Can any of your readers speak with authority on the following matter?

At a recent informal discussion amongst a party of works maintenance engineers, the pros and cons of keeping feeders and mains alive during the week-end and at holiday times when no energy whatever was being taken from them, were thrashed out.

One of those present stated that he understood that it had been demonstrated that there were distinct advantages to be gained by this procedure (apart from the lessened risk of

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moisture creepage), but was unable to give further details. The factory, in his particular case, is a normal industrial concern with a total connected load of about 1,800 kW, distribution being at 440/220 volts, 3-wire, direct current.

The general opinion was that, except for the lessened risk of moisture creepage, no definite advantage could be gained, and certainly it would not be worth while running a small pilot set for the week-end for the sole purpose of providing this pressure.

Maintenance.

January 10th, 1929.

Hiring Schemes.

It seems to be an accepted idea that once an appliance is installed, the only further attention that need be given to the consumer is the prompt delivery of accounts.

Although the electric cooker has gained a better name for itself in the way of reliability, further sales and hiring contracts are dependent on the "lady next door" who has a cooker installed, and on whom the corporation or company depends for advertisement. The public is rapidly becoming aware of the superiority of electricity over gas and coal for economy, cleanliness, and speed, and this must be fostered by the consumer having a guarantee as to an efficient repair and maintenance service.

To all those venturing into hiring schemes I would suggest a motto: "A cold cooker brings the quickest smiles from the 'enemy' (the gas company)."

F. Swarbrick.

New Malden, *January 12th*, 1929.

Wind Pressure.

The letter by Mr. C. H. Brazel in your current issue is of interest if only in presenting the peculiar conditions occurring with *wind accompanied by rain*. This condition is not generally allowed for in line design, owing to the high factor of safety which the English regulations prescribe and which has been shown in practice to be ample for normal conditions.

Under the abnormal gale conditions recently prevalent, it is possible that the wind pressure on supports and wires has been of such a value as to cause these components to be stressed to a maximum at times, and it is under these conditions that the additional force imposed, due to the momentum possessed by the driving rain particles, normally a force which may be ignored, may be such as to cause collapse. This would especially apply to the lighter classes of pole, designed for a resultant force at the pole top of the order of 200-500 lb. For a rain precipitation equal to 0.2 in. per minute driven by a 90-m.p.h. wind, it is estimated that the effective pole moment of resistance is equivalently reduced by 8-15 per cent., due to the force exerted by the driving rain.

It is probable also that other abnormal conditions, such as the generation of high static charges set up by the friction of the driving rain, dust particles, &c., arise, and the writer would be interested to know whether any quantitative observations have been made under such conditions.

John A. Sumner, A.M.I.E.E.

Northwich, *January 7th*, 1929.

Lamp Trading.

Messrs. J. H. Noble and A. Milne raise a point of considerable interest to manufacturers in other branches of the trade than lamps alone. In our own line (small motors) discounts are demanded by all and sundry, and are usually, I fear, granted. At any rate, if one refuses them one invariably loses the order, so the presumption is that some other manufacturer is more compliant. Practically anyone with a printed letterhead can get some sort of discount from almost all motor makers.

This kind of thing is very bad for trade generally, for retailers, knowing that their customers can get nearly, if not quite, as large a discount as they themselves, naturally refuse to sell motors if they can avoid it. This very much diminishes the wholesalers' chance of doing any business in the line, and an important channel for the sale of his goods is closed to the manufacturer, even though he offer large discounts available to the wholesaler only. The manufacturer is forced to find his customers for himself, which is an expensive affair in the case of those small casual buyers whose business ought really to come to the manufacturer *via* retailer and factor, and which, by increasing his selling costs, tends to keep prices high.

The remedy, which is not so easy as it sounds, is for the manufacturers to agree on a schedule of trades to which discounts are to be allowed, and also, if possible, on the amount of those discounts. Unfortunately, so far as I know, there is no machinery whereby such agreement could be reached as regards motors. Existing associations seem to be concerned mostly with the maintenance of price-levels (net prices) and the elimination of competition, to which we are absolutely opposed. I hope that someone will be able to correct me on this point.

R. E. A. Mallet,

Director, NORMAND ELECTRICAL CO., LTD.

London, *January 11th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

15,983. "Hydro-electric motor." Compagnie Internationale des Freins Automatiques Soc. Anon. June 17th, 1926. (272,928.)

19,132. "Multiple thermionic valves." Dr. S. Loewe. July 19th, 1926. (274,514.)

19,432. "Thermionic amplification of line or cable signal potentials or potentials subject to a slow rate of change." Creed & Co., Ltd., and E. O. Symonds. July 21st, 1927. (302,706.)

21,522. "Electrically-operated traffic warning signal lamps for use at road-traffic control points." Automatic Telephone Manufacturing Co., Ltd., and P. J. Robinson. August 16th, 1927. (Cognate application, 35,410/27.) (302,622.)

21,848. "Electric fuses." Brookhirst Switchgear, Ltd., and J. O. Knowles. August 19th, 1927. (302,623.)

24,160. "Electrically-heated self-feeding water boilers." H. Hargreaves. September 14th, 1927. (Cognate applications 26,254/27 and 27,738/27.) (302,617.)

24,251. "Electrically-heated dental cauterising appliances." O. H. Pieper and A. F. Pieper. December 16th, 1926. (282,345.)

24,596. "Radio signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). September 19th, 1927. (302,634.)

24,639. "Generation of electric power." W. D. Fletcher. September 17th, 1926. (277,698.)

24,670. "Telephone circuits." P. B. Healey and Telephone Manufacturing Co., Ltd September 19th, 1927. (302,638.)

24,918. "Electric circuits employing thermionic valves." Collinson's Precision Screw Co., Ltd., and F. E. Collinson. September 21st, 1927. (302,715.)

24,926. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. September 21st, 1927. (Addition to 221,175.) (302,716.)

26,204. "Electric gas-purifying plant." Siemens-Schuckertwerke Akt. Ges. October 5th, 1926. (278,710.)

27,244. "Electric switches, fuses, and the like." Brookhirst Switchgear, Ltd., and J. O. Knowles. October 14th, 1927. (302,754.)

28,327. "Electrical gramophone-pickups." T. Hough. October 25th, 1927. (302,764.)

28,706. "Electric switches and switchgear." Switchgear & Cowans, Ltd., and G. H. Neep. October 28th, 1927. (302,768.)

28,752. "Electrical terminal plates for electric motors and the like." F. S. Blakey and A. Williamson. October 28th, 1927. (302,769.)

29,519. "Recording-instruments." B. Dunglinson and Electroflo Meters Co., Ltd. November 4th, 1927. (302,777.)

30,755. "Electric accumulators." C. M. E. Trotter. (Legal representative of G. H. Trotter, deceased.) November 16th, 1927. (302,784.)

33,923. "Relays particularly applicable to automatic regulating-apparatus for alternating currents." Brookhirst Switchgear, Ltd., and G. Rattenbury. December 15th 1927. (302,799.)

33,944. "Devices for discharging static electricity from machinery." W. H. Cox. December 15th, 1927. (302,800.)

1928.

1,691. "Electric light standards." British Mannesmann Tube Co., Ltd., and E. S. Smith. January 18th, 1928. (302,825.)

6,385. "Thermally-actuated electric cut-outs and other thermally-responsive electric elements." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). February 29th, 1928. (302,840.)

6,986. "Thermionic valves." F. Holweck. March 7th, 1927. (Addition to 206,155.) (286,649.)

11,701. "Method of preventing back ignitions in metal-vapour rectifiers having insulated anode sheaths." Brown, Boveri et Cie Akt. Ges. May 23rd, 1927. (Addition to 253,097.) (291,003.)

11,715. "Explosion-proof housing for electric apparatus." Siemens-Schuckertwerke Akt. Ges. May 27th, 1927. (291,085.)

13,171. "Electric stop-motion for drawing-boxes for wool, worsted, and like fibres." W. J. Scott. May 4th, 1928. (302,855.)

13,400. "Manufacture of sound records." International General Electric Co., Inc. May 5th, 1927. (290,171.)

14,629. "Remote control of electric power sub-stations." Associated Telephone and Telegraph Co. October 11th, 1926. (Divided application on 278,746.) (290,644.)

16,042. "Means for indicating synchronism between alternating electric voltages." British Thomson-Houston Co., Ltd. June 6th, 1927. (291,731.)

16,448. "Indicating instruments." British Thomson-Houston Co., Ltd. June 13th, 1927 (292,101.)

22,023. "Telephone systems." Associated Telephone and Telegraph Co. October 18th, 1926. (Divided application on 279,058.) (294,885.)

28,630. "Multiple thermionic valve." Dr. S. Loewe. July 19th, 1926. (Divided application on 274,514.) (298,205.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 9th:—

Columbia. No. 480,993. Class 4. Lighting carbons for electrical purposes, &c.—National Carbon Co., Inc., New York. (British representatives: Marks and Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Permivar. No. 495,365. Class 5. Unwrought and partially wrought ferro-magnetic metals.—Electrical Research Products, Inc., New York. (British representative: F. C. Tomlins, Bush House, Aldwynch, W.C.2.)

Lux. No. 493,879. Class 6. Machinery of all kinds.—Electrolux, Ltd., 153-155, Regent Street, W.1.

Duco to. No. 494,353. Class 8. Radio-telephonic apparatus, parts and accessories, &c.—Dulcetto-Polyphon, Ltd., 2-3, Newman Street, W.1.

Silentnite. No. 496,853. Class 8. Component parts of radio-telephonic apparatus.—J. Wilson, 32, St. James' Street, Church, near Accrington.

T.R.E. (lettering and design). No. 496,891. Class 8. Radio-telephonic instruments and apparatus.—J. Dorn, 91, Charlotte Street, W.1.

Tuna, No. 496,903, and Plaza, No. 496,904. Class 8. Pocket lamp batteries and high-tension batteries.—E. H. Baisher & Co., Ltd., 4, Attneave Street, W.C.1.

Electrovisor. No. 497,502. Class 8. Apparatus for use in transmitting views, scenes or images, and sounds to a distance by telegraphy.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Snake (design only). No. 488,993. Class 11. Electrical massage apparatus for surgical and curative purposes.—O. Sinanide, 53, Sloane Street, S.W.1.

Beta. No. 496,093. Class 13. Electric lamps (ordinary).—J. W. Naylor, 45, Whiteley Wood Road, Sheffield.

Raifixa (lettering and disegn). No. 496,665. Class 13. Electric lamp fittings of ordinary metal.—F. Grinstead, 1, Hill's Place, Oxford Street, W.1.

Kymore. No. 495,083. Class 17. Poles made principally of concrete for use in the transmission of electrical power.—Kymore Syndicate, Ltd., Balfour House, Finsbury Pavement, E.C.2.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYLESHAM (DOVER).—Roman Catholic church; Archibald, Archer & Price, architects, Sandwich; G. Browning, builder, Canterbury.

BARNES (SURREY).—Church hall (£3,887), for Holy Trinity Parish; W. H. Gaze & Sons, Ltd., builders, Kingston-on-Thames.

BECKENHAM.—Highways depot (£9,000); F. Liley & Sons. buildings, Langley Court; Wellcome Physiological Research Laboratory.

BEXLEY (KENT).—Development of Long Lane estate for residences, for Cox Bros., Maidstone.

BLACKBURN.—Additional 200 houses for the T.C.; borough engineer.

BLACKFORDBY.—Church for the Wesleyan trustees; A. E. Lambert, architect, 28, Park Row, Nottingham.

BRADFORD.—Girls' Grammar School, Ladye Royde Estate; Education Committee.

BRISTOL.—Twenty-six houses, Brooklyn Road, Bedminster Down; W. J. Kew.

BUTTSBURY.—School for Essex C.C.; director of education, Chelmsford.

CHELMSFORD.—Additional 70 houses for the R.D.C.; surveyor. Houses (500), Springfield, for the Allied Building Corporation, Monmouth.

CHELTENHAM.—Thirty-four houses, Kipling Road; borough engineer.

CHERTSEY.—Electric light installation, institution, for the B.G.; F. J. Wareham, clerk.

DARLINGTON.—Central repair depot for the United Automobile Services, Ltd.

DARWEN.—Senior elementary school, Avondale Road (440 places), deposit £3 3s.; borough engineer.

DERBY.—Asylum nurses' home (£17,000), for the T.C.; borough surveyor.

DEWSBURY.—Basket works, Highfield House, Soothill Lane, Batley (Institution for the Blind); W. Hainstock & Son, architects, Branch Road, Batley. Tenders to: Allen Sykes, secretary and manager, Institution for the Blind, Daisy Hill.

DONCASTER.—Conversion of St. Catherine's Hall, Balby, into mental institution, for the South West Yorkshire Joint Board, for mental defectives; C. L. des Forges, clerk, Rotherham. Aerodrome; borough engineer.

DUNDEE.—New church for St. David's U.F. Church (£8,000); the minister.

EASTBOURNE.—Fifty houses, Gilbert site; borough engineer. Forty-eight houses, Hampton Park, for Southern Railway Co.; P. D. Stoneham & Son, architects. Extensions, 'bus depot, Pevensey Road, for Southdown Motor Services, Ltd.; P. D. Stoneham & Son, architects.

FARNWORTH.—Housing scheme (30), Daffodil Road and Fern Street, for U.D.C. (deposit £2); F. Ashton, engineer and surveyor, Town Hall.

GLOUCESTER.—Reconstruction of stores, Eastgate Street and Brunswick Street, for the Co-operative and Industrial Society, Ltd.; secretary.

HALIFAX.—Block of shops, Ovenden Road, with electrical work, for the T.C.; borough engineer (returnable deposit of £1 1s.).

HAMPTON.—Ninety-one houses, Hill Field; E. Craig & Son.

HOLMFIRTH.—Housing scheme (56), with electrical work, for the U.D.C.; surveyor (returnable deposit of £1 1s.).

HULL.—Extensions, central library (£16,305), for the T.C.; borough surveyor.

LEEDS.—Physics Department, adjoining Woodhouse Lane, for Council of University (deposit £3 3s., January 31st); Lanchester, Lucas & Dodge, architects, 19, Bedford Square, London, W.C.1. Erection of hostel for male students, Regent Court, Headingley, for the Leeds University (deposit £3 3s.); John C. Proctor and F. L. Charlton, architects, 40, Clarendon Road. Erection of three-storey workshop, Pontefract Lane, and Keeton Street; Fred Mitchell & Sons, 5, Upper Fountaine Street, Albion Street.

LIVERPOOL.—'Bus garage, for the Ribble Motor Services, Ltd. Cinema, North Hill Street (£15,000), for R. D. French. Cinema, Stanley Road and Falstaff Street, for Harold Platt. Roman Catholic (temporary) church, Fazakerley; Rev. Jas. Duffy, priest-in-charge.

LONDON (EAST HAM, E.).—Factory, High Street; Burgoyne, Burbridges & Co., Ltd.

(PECKHAM, S.E.).—Shops, corner of Peckham Rye and Barry Road; Andrew & Peascod.

MAIDENHEAD.—Hospital extensions with diphtheria block for the T.C.; borough surveyor.

MALDON.—Grammar school extensions, including assembly hall and library, for Essex E.C.; director of education, Chelmsford.

MANCHESTER.—Proposed extension of Midland Hotel; London, Midland & Scottish Railway. Elementary school, Gorton (£12,500); Education Committee. Extensions, Central School, Higher Ormond Street; Tinker and Young, Manchester. High School for Boys, Burnage; Education Committee. Disinfecting station and garage, Monsall Hospital; Moston Brick & Building Co., Ltd.

MORETON-IN-MARSH.—Rebuilding, after fire, Little Compton Manor (Mansion), for Mrs. Laverton Harris.

NORTHAMPTON.—Bazaar premises, Abington Street, for F. W. Woolworth Co., Ltd., Kingsway, London. Extensions, Engineering Works, Balmoral Road; Advance Motor Manufacturing Co., Ltd. Aerodrome, Hardingstone; Corporation and Air Ministry.

OLDHAM.—Housing scheme (200), Limeside site (deposit £2 2s.); borough engineer, Town Hall. Town Hall extension; borough engineer.

OTLEY.—Extension of sewage disposal works (deposit £3 3s.); C. F. Hodgson, surveyor to U.D.C., Council offices.

PETERBOROUGH.—Additional 52 houses (part of a scheme for 354), for the T.C.; city engineer.

READING.—Rebuilding business premises, Broad Street, with electric passenger lifts, for Wellsteeds, Ltd., drapers.

REDCAR.—Primitive Methodist Church, Zetland Park; trustees.

SALFORD.—Roman Catholic school: rector, Mount Carmel Roman Catholic Church.

SANDY (BEDS.).—Housing scheme (32), for the U.D.C.; surveyor.

SCUNTHORPE.—Cinema, Gilliatt and Chapel Streets; H. J. Thompson, Ltd., architects, 2, Gilliatt Street.

SEDGEFIELD.—Housing scheme (56), for the R.D.C.; James Stones, surveyor (returnable deposit of £3 3s.).

SHEFFIELD.—Modern store for Roberts Bros., Ltd., drapers, Rockingham House, The Moor.

SOUTHAMPTON.—Congregational hall and schools, Swaythling; trustees

STARCROSS.—Mental hospital for 800 patients; Devon, Dorset and Somerset County Councils.

STIRLINGSHIRE.—New church at High Bonnybridge (£6,000); Rev. W. Grant, Falkirk; Linlithgow and Falkirk U.F. Presbytery Home Mission Committee.

STRETFORD.—Municipal office accommodation; Special Committee of U.D.C. Public hall and library, Trafford Park; U.D.C. architect. Works, Chester Road; Manchester Cellulose Finishes, Ltd. Cable shops, United Road; W. T. Glover & Co., Ltd.

SUTTON.—Nurses' home, Downs Hospital (£30,000); Metropolitan Asylums Board.

TAUNTON.—County offices (£80,000), for Somerset C.C.; E. Vincent Harris, collaborating architect, 29, St. James' Square, London.

TORQUAY.—Hotel and shops, Victoria Parade; A. Haarer and Son. Extensions, Palm Court Hotel, including 86 bedrooms, resturant, &c., for Mr. Purkis.

TRURO.—Forty houses, Trennick Lane; city engineer.

TWICKENHAM.—2 500 houses, Jubilee Farm Estate; Barnes, Kirkwood & Woolf, architects.

WAKEFIELD.—Forty houses at Netherton and Upper Crofton, for the R.D.C. (deposit £1 1s., January 29th); Massie & Holdsworth, architects, Yorkshire Buildings, Wood Street, tenders to Walter Bruce, clerk to the Council, 18, St. John's North.

WARRINGTON.—'Bus garage, Bank Street; tram manager. Library extensions (£3,750); borough engineer.

WIGAN.—Restoration of central premises (after fire), for the Wigan and District Equitable Co-operative Society, Ltd.; W. Thirlwall, secretary, Standishgate (returnable deposit of £1 1s.). School, Pemberton, for the Borough E.C.; borough engineer.

WREXHAM.—Additional 150 houses for the R.D.C.; J. Herbert Edwards, engineer.

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The

Electrical Review

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Electrical Research.

IN anticipation of the annual meeting of the British Electrical and Allied Industries Research Association, which is to be held on February 8th, the annual report has been issued for the period ending September 30th last. As usual, it contains a survey of the investigations which have been in progress during the year, covering a very wide field and dealing with matters which are certainly, as claimed by Mr. R. W. Paul, chairman of the Council, "of prime importance to the electrical industry." At a Conference of all sections of the industry which was held in June, under the chairmanship of Sir Richard Glazebrook, it was unanimously agreed that the Association had achieved results of great benefit not only to industry in general but also to the nation, which could have been secured in no other way, and that efforts should be made to extend the scale of its operations, by increasing the expenditure from £25,000 a year to double that amount within five years.

Provided, of course, that the money is spent as wisely as it has been in the past, we hold that the greater the expenditure the better, for the return obtained vastly exceeds the original investment. It is regrettable that the burden still falls mainly upon the shoulders of the manufacturing section of the industry, seeing that the electricity supply section is directly benefited by the work of the Association, and in his turn the consumer gains by the reduction in cost of electrical energy. A Committee was appointed to carry out the policy initiated by the Conference, and we hope it will be able to present a satisfactory report to a second Conference which will probably be summoned at an early date.

It may not be generally realised that, in addition to the efficient staff over which Mr. E. B. Wedmore presides, and the large Council of eminent men representing the six leading electrical associations, the organisation comprises 16 sections, each under the control of a comprehensive committee, and some 50 sub-committees and panels dealing with specific subjects; 80 per cent. of the huge personnel engaged in this work is provided by the manufacturing section of the industry, and we feel that the electrical fraternity is under a great debt to this large body of voluntary workers who sacrifice their leisure for the common good. The most practical way in which it can express its appreciation of their labours is to provide them with ample funds to carry

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out researches on an ever-increasing scale. The assistance hitherto derived from the Department of Scientific and Industrial Research, at a diminishing rate, comes to an end next year, and though the Department has in contemplation a scheme for the further assistance of research in general, it is imperatively necessary for the electrical industry to place its Research Association on a sound basis of assured financial resources. The best researchers cannot be attracted into this professsion unless their future is guaranteed.

Turning from the Association itself to the industry which it serves, we note with regret the statement that in some cases it appears that the information contained in its reports fails to reach the hands of the persons who could most profitably make use of it. This is a matter which should have the attention of the managers of the manufacturing concerns and electricity supply undertakings to which the reports are addressed; to have the information available and not to make full use of it is deplorable.

Climate and Overhead Lines.

IN the admirable paper presented to the Overhead Lines Association last week by Mr. C. W. Molle, a number of important facts were brought out with regard to the climatic conditions under which overhead lines operate in this country; the author had obviously expended a great deal of time and labour in examining the records of the Meteorological Office, and information derived from other sources, and in reducing the results of his observations to a compact and intelligible form. His paper is abstracted elsewhere in this issue, but the members of the Association will receive a more extended report of it, and will thus enjoy the full benefit of his researches.

Amongst the many interesting points that emerged were the facts that wind-pressure near the ground is less than at greater height, consequently lower safety factors should be used for shorter poles; that while gust-pressure may be double that of the steady wind, the effect of a gust is purely local; and that wires of 0.03 sq. in. or greater cross-section do not break under wind-pressure alone. But, as the president, Mr. W. Fennell, pointed out, the most important conclusion was that the wind pressure under ice-loading conditions had been over-estimated—to such an extent that, in Mr. Fennell's opinion, the wind pressure experienced in the absence of ice-loading not improbably exceeds the wind-pressure exerted on wires loaded with ice. By far the most likely condition in snowy weather, says the author, is a wind of 12 miles per hour or less; and the lowest temperatures always occur with winds of 12 m.p.h. or less.

As we have remarked on previous occasions, the overhead-line regulations have been drawn up on the assumption that a high wind, a low temperature, and a coating of ice on the wires will occur simultaneously, whereas in point of fact all these adverse conditions do not coincide. Mr. Molle suggests that it would be perfectly safe, in the case of wires of not less than 0.03 sq. in. cross-sectional area, to allow only for the maximum wind-pressure of the particular district where the wires are to be erected, without any other load, at a temperature of 30 deg. F.

Clearly there is a great deal to be learnt yet with regard to overhead lines and the conditions that they have to meet, and such papers as this are valuable contributions to our knowledge of the subject.

Electrical Export Trade.

No doubt many thoughts on export trade have been provoked by our article of last week on the urgency of overseas development, and others will originate from consideration of the import and export electrical trade statistics which are tabulated and commented upon in this issue. Though weather conditions such as we have been passing through lately may colour the view of those who are temperamentally susceptible, they have no effect upon actual facts and upon figures, whether of volume or value or rising or falling prices. But whatever deductions we may be inclined to make in our calmest moments, from past trade events, we cannot go far wrong at the moment if we once again stress the necessity for electrical and allied firms to put forth their utmost endeavours in the overseas markets. There is not only business to be obtained in the ordinary course of Colonial and foreign travel, or through agents, that is, the sort of business that concerns all of our firms and companies, but there is big work which cannot easily be handled by the average company single-handed. While some of our readers, including men of considerable standing and importance, have been looking askance at recent amalgamation movements, neither they nor anybody else is blind to the fact that large combined concerns must possess considerable power abroad and cannot fail to be advantaged in the negotiation of big business, even business with attendant risks such as may characterise transactions with Russia and certain other countries. It may be that by reason of those very international connections which occasion concern to some who are naturally anxious for the continuance of British interests unimpaired, these amalgamated interests may find it possible to so operate that from time to time big slices of business will be secured to help to keep our factories in full, and therefore in economic, operation. Yet there appears to be plenty of scope for scores of other electrical manufacturing concerns to trade profitably in face of foreign competition, and on a larger scale than hitherto in Colonial and foreign markets, if they will come together in groups. The largest undertaking of the kind that received much notice was the big co-operative engineering company which was at work in Russia and Siberia when the war occurred. Circumstances over which the company had no control were its great source of trouble. but our recollections of the plan are very vivid regarding the great scope that there seemed to be. Other such combined efforts have taken place in Egypt, China, and other parts of the world, and are continuing to-day. Failing any other thorough-going form of export trade co-operation here, it would seem that there ought to be an opportunity for a big British Empire electrical development and trading company in which various interests could unite on a business basis, making such an investment jointly as would be comparatively easy for each without running too large financial risks. We might then witness something effective and impressive in the way of united travel, visiting and reporting electrically upon the great overseas markets.

The Faraday Centenary.

ON August 28th, 1831, Faraday discovered the phenomenon of electro-magnetic induction, upon which rests practically the whole art of electrical engineering; for even those branches of it which could to-day be practised in a small way without the use of induction, such as electric lighting and electroplating with primary batteries, have attained their present advanced stage of development with the aid of the dynamo. That epoch-making discovery was but an episode amongst Faraday's monumental achievements in many other branches of physics and chemistry—but to our industry it was his crowning triumph, and he himself, with prophetic insight, attached great importance to it. His work was done at the Royal Institution, and the Managers of that fortunate organisation have rightly taken the lead in calling together a conference, embracing the leading electrical associations and the British Association—whose centenary also falls in 1931—to discuss proposals for the adequate celebration of the Faraday Centenary. It is thought that many other bodies concerned with pure or applied science will be interested in the proceedings and will wish to take part in the arrangements, and it is suggested that the opportunity would be most appropriate for "a review of the great contributions which British workers have made to the scientific and industrial advances of the past century"—a record which will certainly astonish those who are apt to decry their country. Needless to say, we shall cordially support the movement to celebrate the Faraday centenary in due form.

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A Large Hydro-Electric Scheme.

The Grimsel, Switzerland, project is claimed to incorporate one of the largest and most elevated structures in the world.

By G. A. de MESTRAL.

THE consumption of electrical energy for households and industrial purposes is increasing rapidly in Switzerland from year to year, and from the point of view of national economy it is clear that falling water is the source on which the country must rely for its supply of power. Neither coal nor oil is to be found in the soil, and every ton of coal has to be purchased abroad; hence the Government railways and industries have turned their attention increasingly to the production of hydro-electric energy on a large scale.

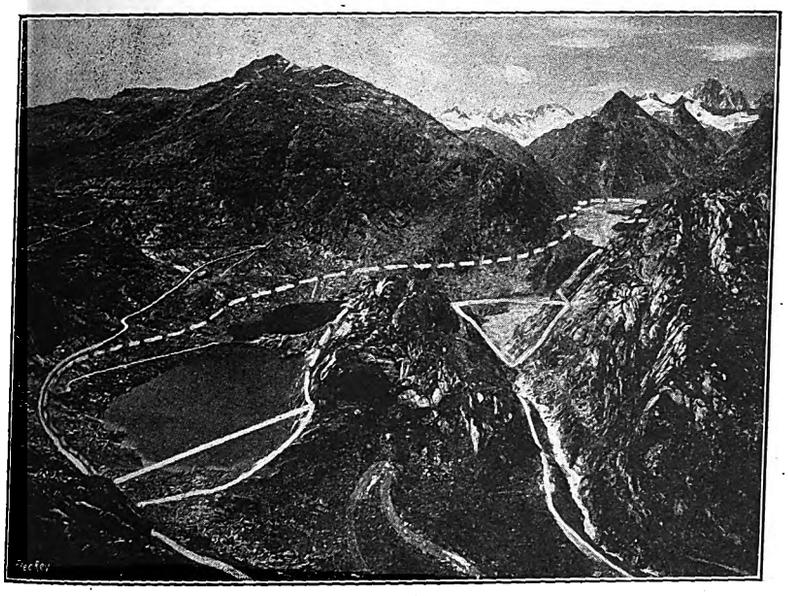

Fig. 1.—Grimsel Pass, with Indications of Projected Dams and Storage Lake.

Fortunately Switzerland has an abundant supply of water power, "white coal"; the Rhine, Rhone, Aar, and Reuss are all deep and rapid streams, but they are subjected to one great drawback as regards the economical production of electric power. Throughout the five or six months of the winter season, when the consumption of power is greatest, the flow of water is at its minimum, and it is impossible to meet the demand, while in the summer, when the demand is lessened, the flow of water is increased by the melting of the snow on the higher Alps. The only remedy is to construct large reservoirs or artificial lakes high up in the mountains to retain the summer supply of water for use at the power stations during the winter.

A typical example of such a storage scheme is in connection with the enormous power stations now being erected in the upper valley of the Aar river. This plant is being built by the Kraftwerke Oberhasli, a daughter company of the Bernische Kraftwerke. The Grimsel pass, from which this power plant gets its name, rises to an altitude of 7,130 feet above sea level and allows communication between the valley of Hasli and the Rhone valley. About 1,000 feet below the top of the pass, hard by two tiny lakes, is situated the famous Grimsel hospice, a solid building which for over a century has afforded a refuge to many tourists. At this point Nature favoured the construction of an artificial lake by providing a rocky hill in the midst of the narrow valley. From the accompanying illustration, fig. 1, showing the wild scenery in its natural state, it is evident that a large drainage area may be closed up by erecting two dams, as shown by the full lines. Twelve million cu. ft. of concrete will be required to build the higher dam to the right. It is to be curved at a radius of 294 ft., and will be 360 ft. high, 815 ft. long at the crest, and 210 ft. thick at the base. The dotted line indicates the level of the pool which is to be created by the dams. It will extend up stream for a distance of about three miles to the mouth of the Unteraar glacier. With a drawdown of 270 ft., the lake will have a storage capacity of 3,500 million cubic feet available for plant operation.

Fig. 2 illustrates the great change which has taken place on Grimsel since 1926. The hill, formerly barren, is now covered with men's barracks, with buildings sheltering stone-breakers and concrete mixers, and with steel structures for cable cranes and conveyors. A new hospice has already been erected 260 ft. above the old one, as the latter will be engulfed in the waters of the lake. It was hard work to lay out an aerial cable-way a distance of 11 miles through a valley subjected to

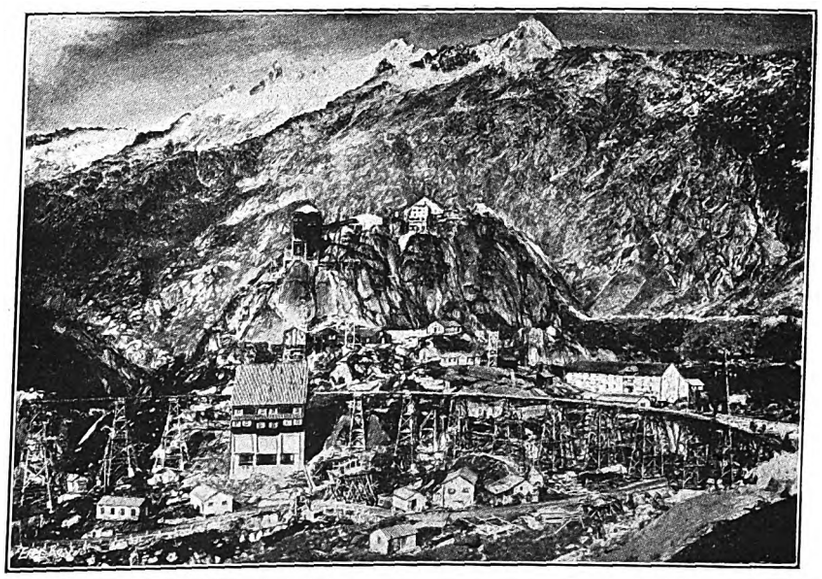

Fig. 2.—Developments at Grimsel since 1926.

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heavy storms and avalanches; but only by this means of conveyance is it possible to transport in a short time the enormous quantities of cement needed at Grimsel.

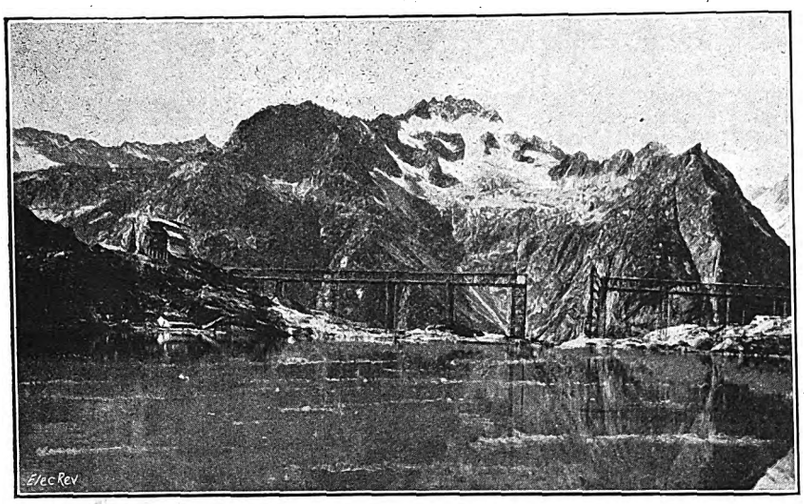

Fig. 3.—Lake Gelmer, showing Steel Bridge.

Fig. 4 gives an idea of this cable-way as it runs over big spans above precipitous glens.

Near the dam on the lake side is located the intake of a pressure tunnel, which has been driven through the rock for a distance of 3.2 miles in order to conduct the water to another small lake, the Gelmersee. Not far from the inlet at Grimsel the tunnel enlarges to a chamber equipped with safety gates and three motor-operated butterfly valves. This room may conveniently be entered from the guard's dwelling house on top of the mountain by means of a lift, running down through a vertical tunnel to a depth of 427 ft. Figs. 3 and 5 depict Lake Gelmer, the level of which is also to be raised by another dam, in order to increase its capacity. When finished, the water impounded will have a volume of 460 million cu. ft. A steel bridge has already been erected, from which the concrete will be poured. The cable railway for the transport of the material to Lake Gelmer is shown in fig. 6. Half-way up the slope may be seen a wood structure supporting the cables of the aerial cable-way crossing this line.

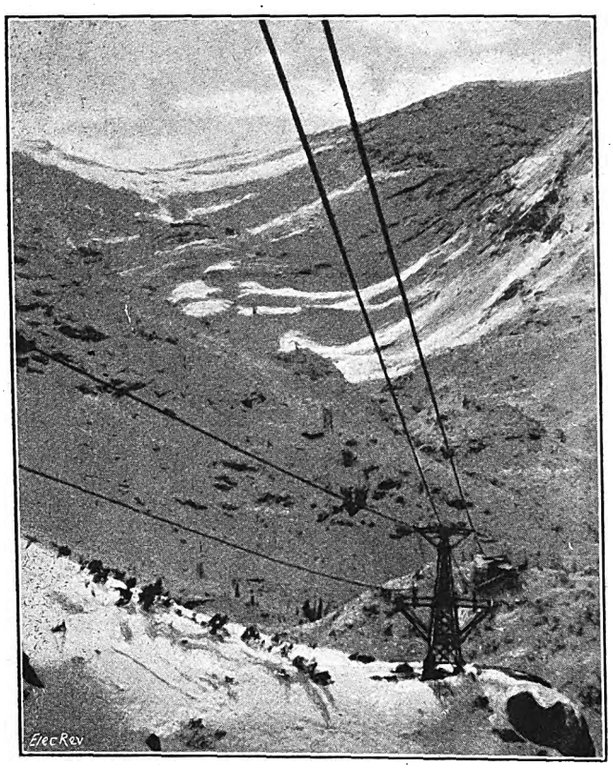

Fig. 4.—Part of Aerial Cable-way.

The water from these two high reservoirs will be conducted through a pipe-line tunnel to the power house Handeck. The pipes of 7 ft. 6 in. clear width on the upper part of the penstock, and the banded pipes of 6 ft. 10 in. internal diameter on the lower part of it, are all welded together electrically, and eventually the line will be entirely embedded in concrete.

The power station is equipped with four generating sets, each rated at 30,000 h.p. when operating at 500 r.p.m. under an effective head of 1,770 ft. The hydraulic turbines, built by the Escher Wyss Manufacturing Co., are of the vertical-shaft impulse type, provided with two nozzles. Much care has been taken to protect the machinery against possible damage by the burst of a high-pressure pipe or a gate. Although an automatically-governed butterfly valve allows the penstock inlet to be shut practically at once, the water issuing at a velocity of about 330 ft. per second would be able to occasion serious damage before the outflow was stopped. Therefore, the turbines, with their inlet and nozzle pipes, are arranged below the floor level, the latter being protected by a heavy covering of reinforced concrete; each turbine will be separated from the other and from the gates by a thick concrete wall.

The generators located in an entresol are directly connected with the turbines. These were built by the Maschinenfabrik Oerlikon, and are designed for loadings of 28,000 kVA. On top of each turbine are mounted an exciter and an auxiliary exciter, both extending over the main floor of the power house. The main generators will supply at 11,000 volts, and the pressure will be raised to 50,000 volts by means of step-up transformers for transmission to Innertkirchen, a distance of eight miles. On account of the prevalence of avalanches on both sides of the valley, it has been decided to conduct the current by cables, which are laid in a tunnel. A small railway running through this cable-tunnel will allow authorised persons to reach the power house during the winter without being exposed to the severe climatic conditions.

At Innertkirchen, where the valley presents a more pleasurable aspect, are situated the offices of the Kraftwerke Oberhasli A.-G. A large outdoor station will be erected at this point to raise the pressure from 50,000 to 150,000 volts. The step-up transformers and the high-pressure switches are to be supplied by the Brown, Boveri Manufacturing Co. From there the outgoing lines will distribute the power to the

Fig. 5.—Lake Gelmer and Power House.

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load centres of the Bernische Kraftwerke and the city of Basle. As it has been planned also to utilise the water power between Handeck and Innertkirchen, as the result of the growing demand, the installation of the power house, Handeck, means the first step in the construction of the most powerful hydro-electric plant in Europe. All the design and construction work is under the supervision of Mr. A. Kaech, director and chief engineer of the Kraftwerke Oberhasli A.-G.

Naturally the Grimsel has become an attractive spot for those people who take an interest in great engineering works. During the summer the place is within easy reach by motor car, driving between Meiringen and Grimsel-Hospice. It may be that visitors will regret that the solitude of this rocky defile is disturbed while the work of construction is going on, but, nevertheless, they will be struck by the giant structures which man has provided to harness Nature's power. For those who live in these high Alpine valleys, electricity means cheap power for home industry and consequently a better standard of life. Hitherto many have been driven to emigrate overseas, as the summer was too short for the development of flourishing agriculture. For town-folk electric power means cheaper living, greater cleanliness and healthier conditions.

A report recently drawn up by Dr. Carl Mutzner, director of the Swiss Department of Water Economy, shows that there are now over 6,000 hydro-electric plants in operation in Switzerland, with a total capacity of 2,565,405 h.p., or 0.648 h.p. per head of the population.

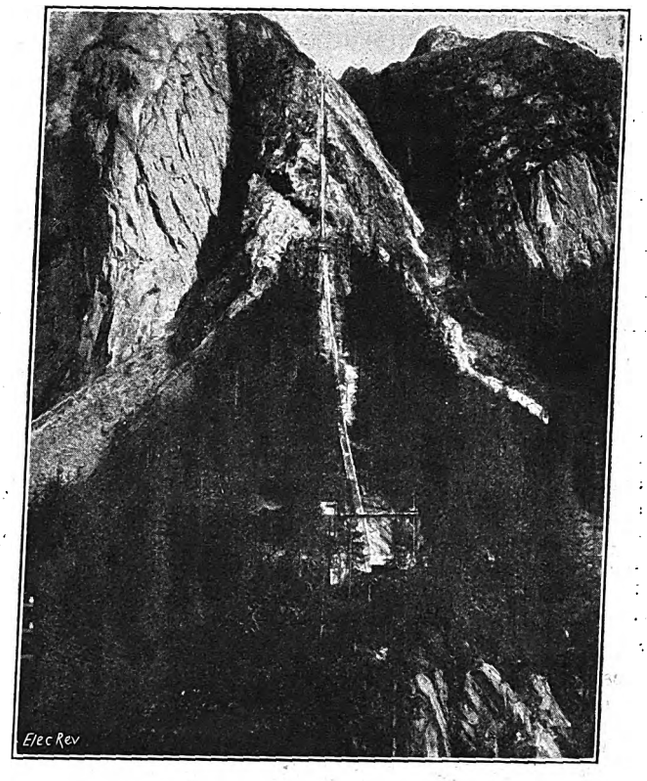

Fig. 6.—Cable Railway to Lake Gelmer.

Gramophone Reproduction.

An indication of what the electrical reproduction of gramophone records can be like under proper conditions, how the latter can be obtained, and whether the result is really worth while.

By ERNEST W. BRAENDLE, A.M.I.E.E.

THE advent of the thermionic-valve amplifier and loud-speaking telephone method of reproducing broadcast speech and music aroused interest in the possibilities and advantages of the much-advertised electrical "pick-up" for gramophone record reproduction by means of such devices instead of a normal sound box.

The several reasons for employing the electrical method include the fact that dance music can be amplified, several loud-speakers may be used to generalise the sound, needle scratch can be largely eliminated, &c.; but it is feared that in a great many cases its use is mainly dictated by a desire for novelty, which statement is not intended to imply that electrical "pick-up" is not worth while, but certainly that the quality of the "pick-up" is more often than not ruined during the subsequent processes of amplification and reproduction.

A normally safe criterion is that if the same amplifier be employed for broadcast radio-telephone reception as for gramophone record reproduction, then only that volume and that quality which are obtained in the former case will be available in the latter, however good the "pick-up" may be. A recent direct check between the best commercial mechanical gramophonic reproduction available and the best commercial electrical reproduction, of equal intensities of output, barely permitted of adequate comparison. Mechanical reproduction still suffers from that sense of restraint which, whilst being most elusive of expression, is so serious in its effect. Pianoforte especially, as well as violin and other solos, are very good, but they are not the same as the extremely realistic reproduction from the same record obtainable electrically. It is suggested that the defect may be due to the fact that, apart from the more true reproduction of both the upper and lower registers by the electrical method, the mechanical sound-box, requiring greater energy for its operation, fails to register many of the finer fluctuations of the record track, with the result that the true musical decrement is not maintained, so that overtones and beat notes, due to the overlapping of sustained frequencies, are not reproduced.

Briefly, the old mechanical method of recording consisted of collecting the varying air-pressures of the sounds required and concentrating by means of a long horn their energy for cutting vertical, or lateral, grooves in a rotating wax surface. By electrolytic processes, metal was deposited on the wax surface, from which a die was eventually made to produce replicas in suitably hardened wax. In order to produce sufficient mechanical energy for the initial cutting, it was essential that either the artists or the source of sound be sufficiently close to the recording apparatus, and this involved the serious disadvantage of crowding orchestras and bands into uncomfortably small areas.* In the case of certain instruments, such as the violin (other

* "Methods of High-quality Recording and Reproducing Music and Speech," by Maxfield and Harrison, *Journal*, A.I.E.E., March, 1926.

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than solo), it was necessary on occasion for the artist to utilise a special instrument fitted with a sound-box and horn in order to create sufficient intensity of sound, which meant that more often than not the artist played on an unfamiliar instrument, which did not tend to improve the spontaneity of the performance. Besides such obvious defects, mechanical recording suffered from extremely peaky response characteristics, which created the familiar "thin" gramophony tone, together with a total lack of bass notes.

With the new electrical recording methods, since the initial energy available can be amplified to any desired level, not only is it possible for artists to perform in a more natural atmosphere, often in the actual building with which they are familiar, but also more than one point of "pick-up" (some form of microphone) may be employed and, if necessary, corrective devices inserted to bring about a proper balance between bass and treble. Helmholtz demonstrated that the audible quality of any tone depends entirely on the amplitude of the harmonics, not on relative phasing; therefore, it is essential for the true reproduction of any note that not only the initial frequency be unimpaired, but that the relative amplitude of the harmonics and overtones

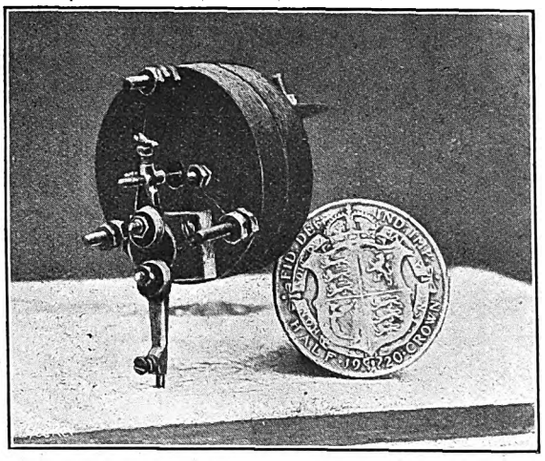

Fig. 1.—Electrostatic "Pick-up," Differential Characteristic.

of that note be unimpaired also. It is interesting to note in this respect that with the advent of electrical reproduction it has been found possible to insert an artificial echo where desired, by superimposing the "pick-up" of two microphones, disposed in such relation to the source of sound that a lag is introduced between the two, causing the necessary phase displacement.

The operating time of the records is dependent on two factors: the speed of rotation and the pitch of the guiding track. Assuming that both factors are fixed, then if the record is made with a lateral cutting stylus, the permissible amplitude of cut, so as not to cause damage to the neighbouring track, must be definitely limited. Now, the amplitude of the wave-form for a constant sound energy is inversely proportional to the frequency; therefore, if equal balance of treble and bass are to be maintained, the amplitude of the stylus cut must be much greater in the latter case than in the former. In practice it is not possible to attain to the ideal, and a compromise is effected by recording with a "constant energy" characteristic down to about 150 cycles per second, and thence with a "constant amplitude" characteristic; in other words, from 150 cycles upwards to about 5,000 the amplitude of cut for a given energy is made inversely proportional to the frequency, and below 150 cycles it is made constant, giving the resultant energy output a rising characteristic.

Modern gramophones are designed for a reasonably high efficiency over the musical scale, and manufacturers now make use of a definite electrical analogy when designing their mechanical and acoustic systems. Since an idea of the equivalents may be useful later they are given below:—

Force (dynes)	Pressure (volts)
Velocity (cm. per sec.)	Current (amperes)
Displacement (cm.)	Charge (coulombs)
Impedance (dynes per cm./sec.)	Impedance (ohms)
Resistance	Resistance (ohms)
Reactance	Reactance
Mass (grammes)	Inductance
Compliance	Capacity

In the mechanical reproduction of gramophone records, neglecting the record itself, many factors affect the accuracy of the sounds reproduced; such as correct governing of the turntable speed, the accoustic properties of both sound-box and horn, the position of the gramophone in the room, &c., and they apply equally well to electrical reproduction, only the sound-box and horn are superseded by the "pick-up" amplifier, and loud-speaker. Although this would appear to create complications, the fact that the amount of energy taken from the record by the "pick-up" need be very small indeed, compared with that taken by the sound-box (approximately 1/100th), permits the "pick-up" to be designed in such a manner as to allow almost perfect tracking of the stylus needle, a most important factor when accurate separation of sounds is required, not to mention its beneficial effect on the life of the record.†

The "pick-up" is that part of the apparatus which is employed to convert the mechanical impulses imparted to the needle by the record into electrical impulses of as nearly as possible identical form, the two most important methods of doing which are the electromagnetic, wherein the fluctuations of a reed of ferrous metal in the air-gap of a permanent magnet are made to induce electric currents in suitably disposed coils, and the electrostatic, wherein the needle is made to cause fluctuations in the capacity of a small condenser. It is generally appreciated that the electrostatic method has theoretically many advantages over the electromagnetic, but hitherto it has not been commercially practicable, owing to the necessity for quite large moving areas in order to obtain even moderate sensitivity. However, a recent design not only permits of the use of considerably reduced moving areas of electrostatic devices, but permits them also to be made with a differential characteristic. The experimental model shown in fig. 1 operates on the differential principle, and is equal in sensitivity to the best commercial electromagnetic unit available when polarised with a total of only 60 volts. Since, however, the electromagnetic type is the most common, indeed the only one available to the public, only that type will be dealt with.

So many different types of magnetic "pick-up" are manufactured by firms of considerable repute that it is almost impossible to attempt a criticism of all, but it is essential to note that with only rare exceptions has attention been paid to other features than quality, or quantity of output, one of the exceptions being that made by a firm of well-known gramophone manufacturers. Whilst fully admitting the absolute importance of both factors, manufacturers should not lose sight of the excessive, in some cases fatal, wear which a badly designed "pick-up" causes to the record. Record wear may be divided roughly into two parts: that due to the pressure of the needle on the record, and that due to the lateral reaction of the needle in the track. Lateral reaction may be divided into three sections: that due to resilience (compliance), which causes the lateral velocity of the stylus to lead that of the track; that due to mass causing the stylus velocity to lag behind that of the track; and that due to the mechanical resistance offered to the motion of the stylus, which is in phase with the track and therefore, except when caused by excessive damping, is doing useful work and is unavoidable. In any case, quite independent of the conditions of resonance, which apply, of course, when the reactions of both compliance and mass are equal for

† "Progress in the Recording and Reproduction of Sound," by A. Whitaker, M.A. *Journal* of Scientific Instruments, Vol. 5, No. 2. February, 1928.

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any given frequency, the damage to the track is considerable; although obviously, if serious resonance effects are not to take place, some degree of damping must be employed. Rubber is usually employed for this purpose, but it requires extremely careful design to introduce rubber so that its damping qualities may preponderate over its stiffness. Fluid damping is the ideal and has been employed in the case of at least one commercial "pick-up" with considerable success, resulting in very little record wear, compared with that of an ordinary mechanical gramophone of the latest type.

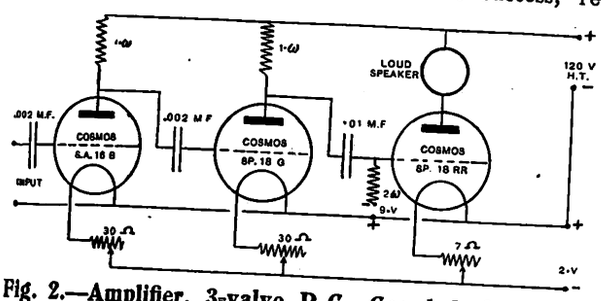

Fig. 2.—Amplifier, 3-valve R.C. Coupled, for Home Use with Batteries.

The chief objection, then, to electrical "pick-up" is the possibility of excessive record wear, and prospective purchasers would be well advised to satisfy themselves that the stylus arm, whilst amply retaining reasonable freedom of movement, is adequately "dead," or non-resilient; also the presence of considerable masses of metal on any portion of the stylus is to be deprecated.

The amplification deserves attention: almost any type, whether transformer, or resistance coupled, by careful design of both circuit and components, can be made to provide a moderately level characteristic between 30 and 10,000 cycles. Since, however, it is claimed that for gramophone reproduction it is not desirable to exceed 5,000 cycles owing to the presence of excessive surface noise, or needle scratch, at or above this frequency, and since the "cutting off" at this frequency would not be noticed by the great majority of listeners, it is desirable from a commercial point of view, not only to ignore the higher frequencies, but even to insert a filter to eliminate them entirely.

Unfortunately, however good the design of the circuit may be, unless that of the components is equally good, the result may lack perfection and, although the quality of the components on the market has undoubtedly improved in the last few years, the only satisfactory condition is to design and build both circuit and components together. This is to be particularly emphasised in connection with transformer coupling, since, with only one or two exceptions, makers of commercial intervalve transformers appear to pay little or no attention to serious electrical design, and even the exceptions are only really suitable if sufficient data were supplied wherewith to correctly design the rest of the circuit. Resistance coupling, although, perhaps, not giving quite such a high degree of amplification per stage, does permit of more simple design and construction, besides which reasonably good components with sufficient data are available. It has been the author's experience that, except for very special conditions, transformer coupling is not necessary, or desirable, for the general user; both the initial and upkeep costs are greater, not to mention the increased consumption of the valve anode circuit, causing a still greater drain on an already overtaxed battery, or, if an eliminator is used, increasing the load on the mains "smoothing" devices with a consequent increase in ripple.

Two designs of three-valve resistance-coupled amplifiers are shown: fig. 2 is for ordinary home use, employing battery-heated valve cathodes, and fig. 3 employes valve cathodes which are indirectly heated by an internal heating element fed with alternating current. The latter design, with 200-volt anode supply, is suitable for reasonably filling a large room, but at 300 volts will supply sufficient volume for small dances. For more pretentious apparatus, such as that suitable for large halls and theatre work, it is advisable to approach a reliable manufacturer of such apparatus with definite ideas as to exactly what is desired. Certain manufacturers are only too willing to co-operate in maintaining the efficiency of their apparatus, it being indeed in their own interests to do so, since, although the apparatus is most simple to operate, being a sensitive and delicate musical instrument, it does require periodical supervision and adjustment if its high standard of reproduction is to be maintained.

Loud-speakers of the moving-iron, or "reed" type, have not, so far, seriously competed with the moving-coil pattern, either as regards capacity for handling volume, or for the reproduction of the musical scale. Moving-coil loud-speakers of several types are now available commercially, the most interesting being the Rice-Kellogg free cone, the H.M.V. stretched-diaphragm, and the coil-driven diaphragm working into a horn (as developed by the Bell Telephone Laboratory's staff); each of them has its own advantages, although the horn type is, perhaps, necessary for handling extremely large volume.

A very important factor in relation to loud-speakers is the mode of coupling them to the last stage of the amplifier. In the case of a small output, a reed-driven speaker may be satisfactorily connected in the anode circuit of the last valve as shown in fig. 2. For coil-driven speakers and for larger power it is essential that some form of coupling between the anode circuit and the speaker windings be inserted in order to filter out the d.c. component of the anode circuit. There are three main methods of accomplishing this: the resistance-capacity, the choke-capacity and the transformer. From fig. 3 it will be seen that the transformer method is adopted as being the most satisfactory, although it is to be regretted that to the author's knowledge a really good output transformer is not yet available as a commercial component.

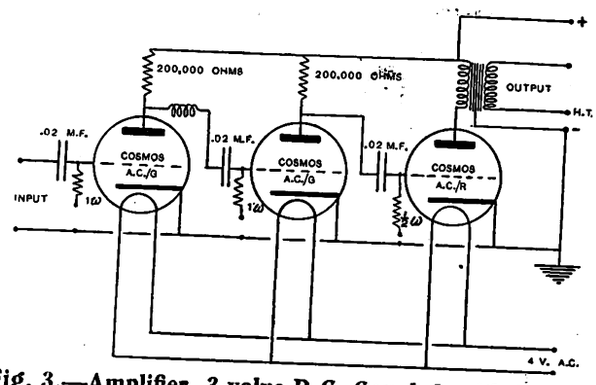

Fig. 3.—Amplifier, 3-valve R.C. Coupled, with 300-volt A.c.-fed Anodes.

A somewhat wide view has been taken in our attempt to consider all the factors governing the good reproduction of gramophone records, and the reader may well ask "Is it all worth while?" The answer is that if he has a first-class and up-to-date mechanical gramophone, he will require extremely good and powerful amplifying gear to obtain the beneficial results that are available from electrical reproduction. If, on the other hand, he has reasonably good amplifying gear and a good, though old, gramophone, considerable improvement is available from electrical "pick-up." It should be emphasised, however, that it is not generally appreciated what a considerable volume of sound is produced by a good mechanical gramophone, even the smaller models, and if similar volume is required from electrical reproduction, it is essential that the whole of the amplifying and loud-speaking equipment be capable of handling that amount of power, quite independent of the type of "pick-up" employed.

In conclusion, the author would like to thank the Gramophone Co., Ltd., and others, for much useful information.

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The Physical Behaviour of Lead Sheaths in Relation to Failures of High-Voltage Cables.

The author suggests that the alleged creation of voids in normal cables as a result of permanent distension of lead sheaths is a view which distinctly lacks foundation.

By C. J. BEAVER, M.I.E.E.

(*Continued from page* 98.)

There are one or two well-known facts regarding impregnating oils and compounds which bear yet further on the actual values of internal pressure producible in a cable. For example, in mineral oils the coefficient of expansion increases with decreasing density, while in resinous compounds it decreases with increasing resin content, so that the more viscous impregnating materials of either type are at an advantage from this point of view.

It is a very old principle that when a subject is hampered by theoretical assumptions which are likely to be erroneous, research upon it should be conducted in a manner which leaves the results to be decided entirely by experiment; and it will be apparent from the foregoing that in the case under consideration, exact and reliable information can only be obtained from practical quantitative experiments on commercially manufactured cable under conditions which closely simulate the working variations of temperature. In the course of a research in this field, a brief reference to which may be found in the I.E.E. *Journal*, Vol. 66, No. 380, p. 832, the writer devised a simple apparatus, illustrated diagrammatically in fig. 3, which can be used to demonstrate with an adequate degree of accuracy what happens in a given cable under such conditions. It consists of a length of iron pipe, capable of accommodating a two-yard length of 33-kV, three-core, paper-insulated lead-covered cable, which is sealed at its lower end. At its upper end the lead sheath is wiped on to a two-way fitting, one way being connected to a filling pipe, terminating in an airtight valve, and the other to a central-zero pressure and vacuum gauge. The containing pipe, fitted with band-type heaters and thermometers, is connected by a small copper pipe to a graduated glass tube, which is open to atmosphere at its upper end. After tightly bolting up the flanged joint at the top of the tube, transformer oil is poured in, so as to fill the annulus between the cable and the iron pipe, and all the remaining space up to the zero mark on the graduated glass tube, which functions as an oil-level indicator. A certain amount of the cable-impregnating medium is of necessity lost in making the end connections to the cable, and in order to make this good with absolute certainty, the pipe and its contents are put through a few daily cycles of heating and cooling. Any deficiency is easily observable on opening the valve when cool; the cable is filled with hot oil or compound, the valve is tightly closed, and further cycles of heating and cooling are performed on the cable. This is repeated until there is no doubt as to the cable being completely filled, when the valve is permanently closed, and the apparatus is ready to run on heating and cooling cycles of any desired duration.

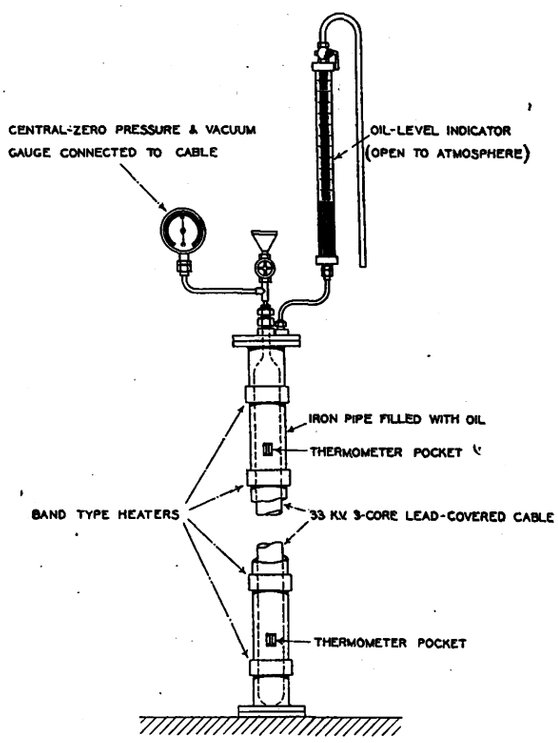

Fig. 3.—Apparatus for the Physical Behaviour of Cable under the Influence of Temperature Cycles.

With the apparatus and the contained sample length of cable thus prepared, let us consider for a moment the conditions which obtain during a cycle of heating and cooling. It is clear that the tube, the cable, and the oil will expand at different rates on heating, and as a net result a certain amount of the oil will be expelled from the containing pipe into the graduated glass tube, the quantity varying, of course, with the temperature. As the ratio of the coefficients of expansion of the transformer oil and the pipe containing it is of the order of 23 to 1, the rise of level will be appreciable. In the cases to which figs. 4 and 5 relate, it amounted to about 5.2 in. for a rise of temperature from 65 deg. F. to 140 deg. F. (18 deg. C. to 60 deg. C.). Included in the net volumetric expansion represented by this rise of level is an increment due to the thermal expansion of the cable and its internal pressure. Neither the actual values of the components (cable, oil and containing tube) nor their algebraic sum are, however, of moment from the point of view of determining the permanent distension, if any, of the cable sheath.

If on cooling to the datum temperature the oil level returns to its datum level, it is obvious that no permanent volumetric alteration to any component of the apparatus has been produced. On the other hand, if an increase in the oil level is found, it must correspond to an alteration in volume due to the cable alone, for it is beyond question that the iron tube will not have suffered distension, nor will the transformer oil have been decomposed at the low temperatures concerned, and these are the only contingencies which could affect their volumes. Conversely, it follows that if no permanent elevation of the oil level is produced, the cable must have behaved as an elastic body under the stresses resulting

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from the applied temperature conditions. (In the cases hereafter referred to the volume proportions of cable and oil were such that an alteration of .0001 in. in the cable sheath diameter produced a difference of .1 in. in the datum level of the oil in the gauge glass; in other words, an expansion of 1 mil in the cable diameter produced a rise of one inch in the graduated tube.)

In the discussion on Riley and Scott's I.E.E. paper on "Insulating Oils for High Voltage Cables,"[11] the writer showed that in a given case a 0.15-sq. in. 33-kV diatrine impregnated three-core belted-type cable, perfectly elastic behaviour was consistently indicated on the above mentioned basis when the cable—under the conditions described above—was subjected to repeated daily and weekly cycles of heating and cooling, the steady temperature conditions during heating being appreciably higher than maximum operating temperatures. Further experiments have since been conducted on other sample lengths of cable, in which the temperature conditions

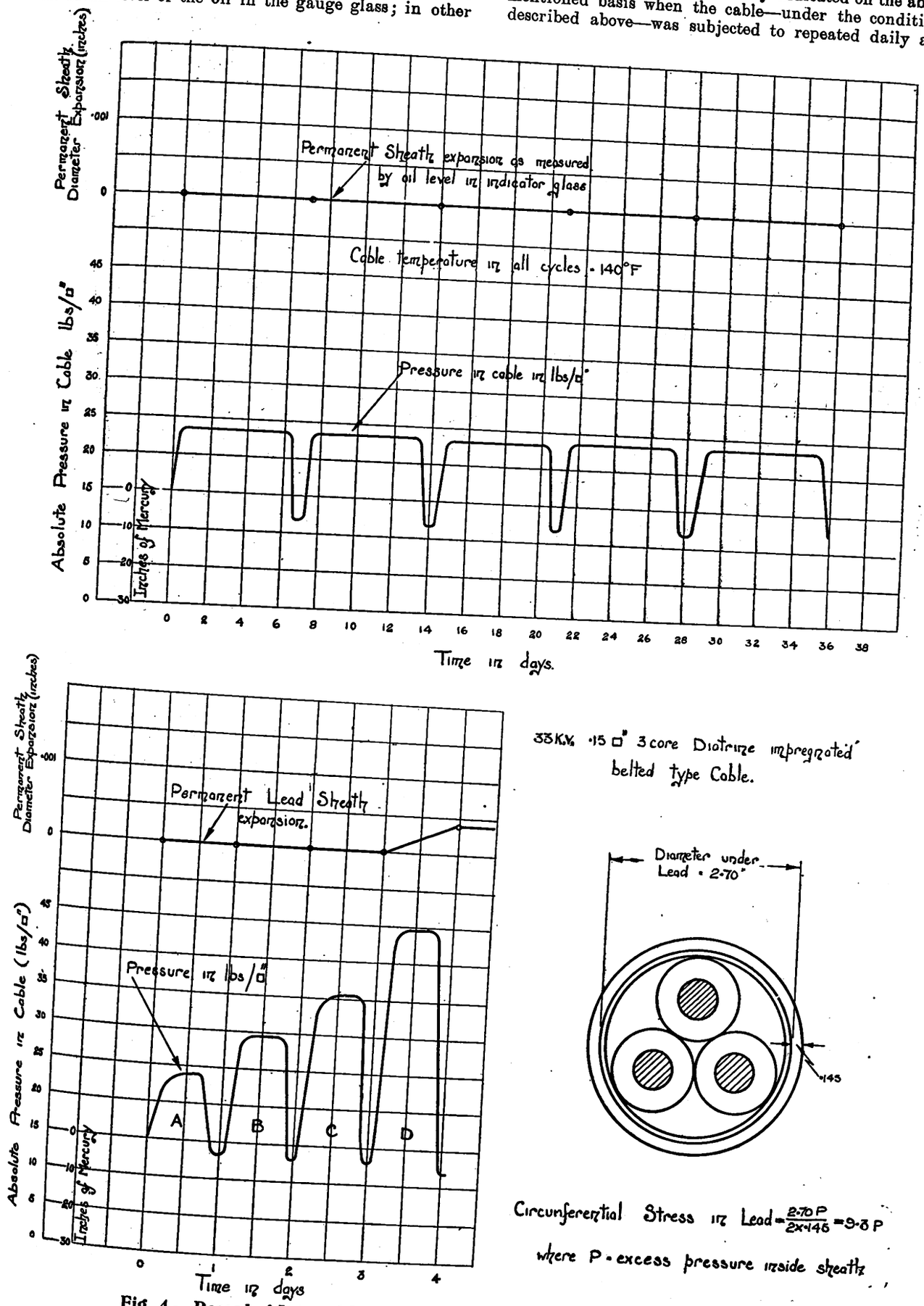

Fig. 4.—Record of Internal Pressures and Lead Sheath Distension in Cable A.

[11] *Ibid.*

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have been raised to values at which the corresponding internal pressures *have* produced permanent distension of the lead sheath. Positive evidence has thus been obtained as a check on the negative results above referred to.

Fig. 4 gives data relating to a diatrine (prior) impregnated three-core belted-type cable, and fig. 5 records corresponding data for a three-core H-type cable made by the vacuum (*en masse*) process. For easy reference the former will be called cable A, and the latter cable B. It will be noted that for the purpose of the experiments the difference in type—belted or H—is immaterial, the salient interest lying in the different effects produced internally by the different impregnating materials and dissimilar methods of manufacture. The belted diatrine cable was taken at random in the works with which the writer is connected, and the H-type from an ordinary length made in another factory.

With regard to the various temperatures referred to in the following notes on the cycles of heating and cooling to which the sample lengths were subjected, and their relation to practical operating conditions, R. W. Gregory states[12] that "Cable makers both in this country and on the Continent are now very conservative in their figures of maximum temperature, and I doubt whether any of them would agree to 60 deg. C. on a 33-kV cable. At the present time, manufacturers of super-tension cables tend towards a maximum temperature-range of 25 deg. C., which in practice means a maximum temperature of 40 deg. C." (104 deg. F.)

[12] *Journal*, I.E.E., Vol. 66, No. 380, p. 837.

Höchstädter and Bowden,[13] in an article embodying a suggested specification of factory and installation tests for 33-kV cables, recommend 50 deg. C. (122 deg. F.) as the maximum temperature to which the cable should be raised for the purpose of a stability test having as its criterion a comparison of the power factor/voltage characteristics before and after heating. Presumably the temperature-range in such a test would exceed the working range, so that the maximum working temperature would be, by inference, less than 50 deg. C. (122 deg. F.).

It must also be noted that specifications of cable temperatures are usually conductor temperatures, and that in practice the lead sheath is always appreciably cooler, because of the temperature gradient which is essential to the operation of the cable, and without which the heating due to copper and dielectric losses would become cumulative, and result in the destruction of the cable. In the experimental heating runs about to be described, the cables were in no case heated to less than 140 deg. F. (60 deg. C.). Moreover, by reason of the extra expansion of the dielectric material over that of the lead sheath, the external method of heating adopted in the experiments entails appreciably more severe conditions,[14] as regards internal pressure, than those which obtain in practical operation. The theoretical deduction given in the appended footnote* has been confirmed experimentally.

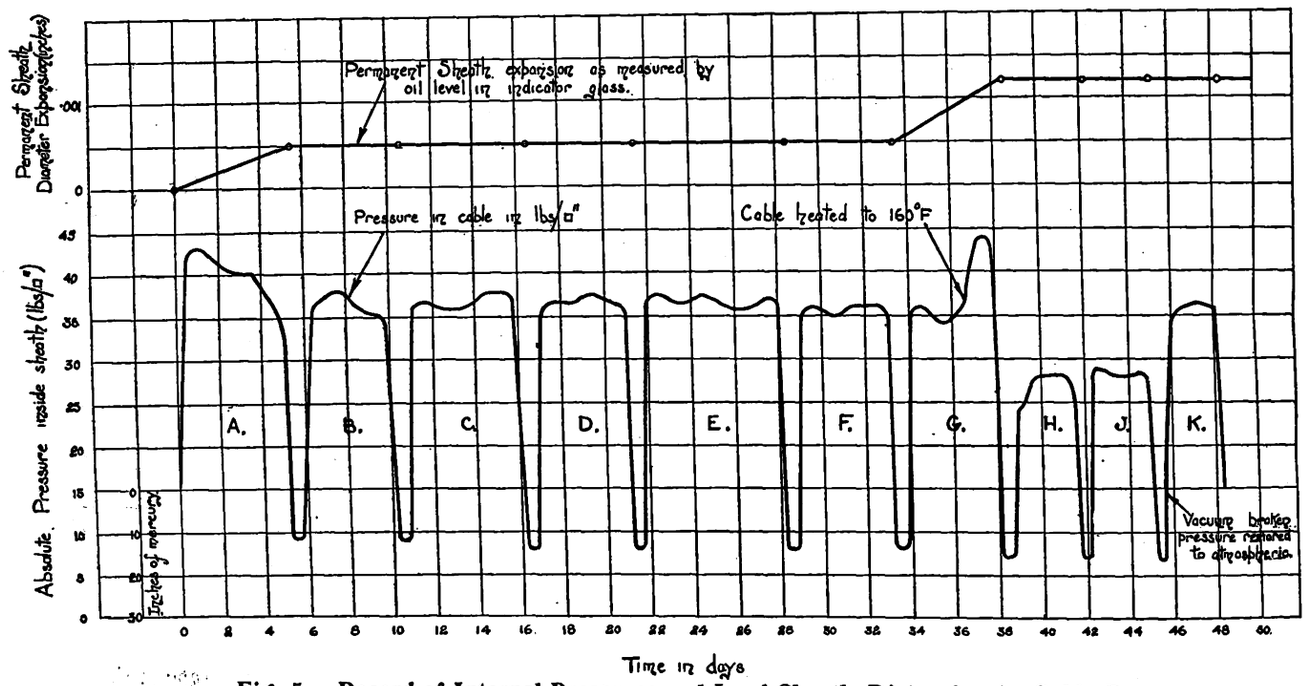

Fig. 5.—Record of Internal Pressures and Lead-Sheath Distension in Cable B.

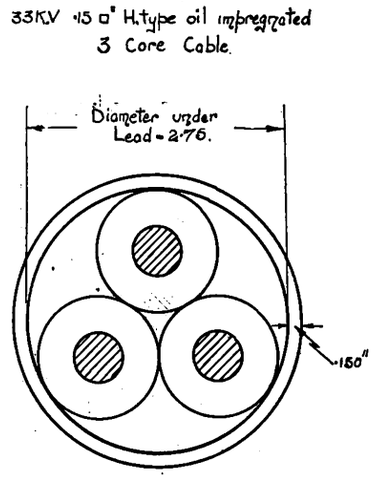

Fig. 5.—Circumferential Stress in Lead = 2·75 P/2 × ·150 = 9·2 P, where P = excess pressure inside sheath.

Reference to fig. 4 will show that in the case of the diatrine impregnated belted cable A, after five weekly temperature cycles, during the heating periods of which a temperature of 140 deg. F. (60 deg. C.) was steadily maintained, daily cycles were carried out at increasing temperatures. Up to and including a temperature of 170 deg. F. (76.5 deg. C.)—cycles B and C—producing an internal pressure of 35.5 lb. absolute per sq. in., no permanent distension of the lead sheath occurred, but at 180 deg. F. (82 deg. C.)—cycle D—with a corresponding internal pressure of nearly 45 lb. absolute per sq. in., it was distinctly measurable. The elastic limit of the lead sheath, therefore, lies between these values and is approximately deducible from the data shown.

From fig. 5 it will be seen that the oil-impregnated H-type cable B developed an internal pressure of 43 lb. absolute per sq. in. at the first application of a temperature of 140 deg. F. (60 deg. C.), and its lead sheath sustained a slight permanent distension. This permanent set allowed successive heatings at 140 deg. F. (60 deg. C.)

[13] ELEC. REV., November 25th, 1927, p. 894.

[14] Riley, Discussion on Mercier's paper, "Notes on the 60-kV Underground Network of the Union d'Electricité." *Journal* I.E.E., Vol. 65, No. 365, p. 513.

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to be applied without further alteration to the dimensions of the sheath, by reason of the resultant readjustment of the internal pressure conditions. After five more cycles of a few days each, B to F, during which the internal-pressure values consistently followed the cable temperature, an excess temperature of 160 deg. F. (71 deg. C.) was applied, cycle G resulting in a further expansion of the sheath and a further readjustment of internal pressure conditions.

Finally, after cycles H and J under conditions produced by cycle G, the internal pressure in the cable was released, and it will be seen that in cycle K the pressure range was raised so that its minimum value was approximately atmospheric, but its amplitude was the same as that of H and J—this constituting further confirmation of elastic behaviour.

These later cycles of cable B illustrate characteristic features of the internal pressure readjustments following on the production of a permanent distension of the lead sheath.

These features are (*a*) an appreciable reduction in the amplitude of the pressure variation over the temperature range, and (*b*) lowering of the pressure range —consequent upon (*a*)—such that the maximum pressure is appreciably lowered with little corresponding effect on the minimum pressure. This relief to internal pressure—and consequently to stress in the lead sheath —clearly precludes the possibility of the expansion of the lead sheath (to which it is due) being cumulative, as Höchstädter and Barrat[15] purport to show. Further, the manner of the effect of (*a*) on (*b*), *i.e.*, by lowering the maximum pressure of the newly established range without appreciably affecting the minimum, avoids the production of a high vacuum, which is contrary to the popular idea.

Comparison of the characteristics in the two cables A and B brings out two main points. Firstly, that for a given degree of heating the amplitude of the pressure range is considerably lower in cable A than in cable B, and this would appear to be due to the lower coefficient of expansion of the impregnating medium; the actual relation is nearly 1:2. This advantage is, of course, due to the prior impregnation process, which allows a practically free hand with regard to the physical properties of the impregnating medium. Secondly, as regards the internal pressure values (and consequently the sheath stress values) required to produce permanent distension of the lead sheath, there is good agreement between the two cases, as exemplified in figs. 4 and 5.

It should be noted that while the order of amplitude of variation of pressure in each case represents that which would obtain in practice (because the pressures depend on the specific properties of the different impregnating media), this is not necessarily the case with regard to the position of the range of absolute pressures concerned. In factory lengths of the vacuum-impregnated type represented by cable B, the range is likely to have a lower datum level than the approximately atmospheric pressure which will obtain in the prior impregnated cable A. This is due to the fact that ordinary vacuum-impregnated cables are normally sheathed while hot, and as pointed out by Emanueli,[16] the subsequent contraction on cooling tends to produce "empty spaces." In actual practice a vacuum of several inches is often measurable in cables of this type, even after being put into service. This disadvantage is avoided in the prior impregnated type, because the cable is at approximately atmospheric temperature when it enters the lead press.

From the aspect at present under review, however, the effect of lower initial pressure is to provide a greater margin for the avoidance of the critical stress at which the lead sheath suffers permanent distension. In the tests recorded in figs. 4 and 5, the two samples were necessarily—by reason of their short length and the conditions of their preparation—on approximately level terms with regard to initial pressure, so that as regards their respective pressure ranges, the absolute values for cable B were probably higher than would exist in practice, while those for cable A would be approximately normal. The foregoing is simply noted in the interests of practical accuracy, the point of real importance being that already noted, *viz.*, the agreement regarding internal stress conditions necessary to produce permanent distension of the lead sheaths.

(To be concluded.)

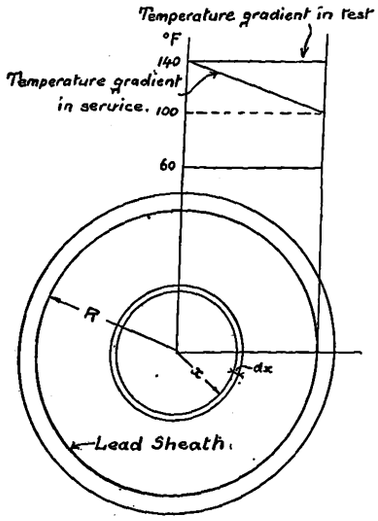
[15] *Ibid.*

* The difference between the temperature gradients in the test and under actual service conditions is shown in the figure below, where R=inner radius of lead sheath, and L=length of sheath in the same units.

Now, the volumetric coefficient of thermal expansion of the lead sheath=0.000047 per °F.

The increase in the lead sheath volume due to heating it to 140° F. instead of 100° F.

$$=\pi\ R^2L\times(140-100)\times0.000047=0.0059\ R^2L.$$



Now, taking a low value of 0.0001 per °F. for the thermal coefficient of expansion of an impregnated paper dielectric, the increase in the expansion of the dielectric due to the difference in the temperature gradients—

$$=\int_{x=0}^{x=R} 2\pi x L\,dx \times \left(\frac{x}{R}\cdot 40\right)\times 0.0001 = 0.0081\ R^2L$$

which is greater than the corresponding extra expansion of the lead sheath, and hence a larger internal cable pressure is produced under the test than under the service conditions.

[16] *Ibid.*

A Speed-Variation Scheme.

As a means of obtaining speed variation for a temporary job, the author suggests employing a slip-ring motor as a frequency changer for supplying the driving motor.

By G. F. HEATH.

ONE of the few disadvantages of the induction motor is that its normal operating speed is definitely fixed by the number of poles contained in the stator winding and the frequency of the supply, according to the well-known formula:

Revs. per min. (synchronous)=(cycles per second ×60)/number of pole pairs in stator winding.

The speed of any slip-ring induction motor can, of course, be reduced by inserting external resistances in the rotor circuit, and, in the case of an ordinary squirrel-cage machine, by resistance in the stator circuit, but both these methods are inefficient, the latter obviously, whilst with the slip-ring motor there is practically no difference in the power input to the stator at

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normal and reduced speeds, as the energy corresponding to the difference in output is dissipated in the form of heat generated in the resistances. There are several types of variable-speed a.c. motors manufactured, but the cost of each is relatively high, compared with that of the induction motor, and for this reason they are usually only installed for specific duties where induction motors would not serve the purpose. The case often occurs in practice where a motor possessing a wide range of speed variation is desirable, but the temporary nature of the work does not warrant the purchase of a variable-speed motor, and owing to the frequency of the supply and the polarity of the available induction motors, the desired range of speed may be thought unattainable; it is in such a case that a slip-ring induction motor can be used, with advantage, as a frequency changer to drive another induction motor, the speed of which can be varied within very wide limits.

When a two- or three-phase a.c. supply is switched on to the stator of a suitable induction motor, a rotating magnetic field is set up around the stator core, the speed of rotation being the synchronous speed of the motor. If the rotor is held stationary, this rotating field will cut the conductors therein and, assuming the usual practice of the rotor possessing an equal number of phases and poles as the stator, it will induce a voltage having similar characteristics of phase and periodicity as the supply in these conductors. Further, if the rotor revolves at the same speed and in the same direction as the stator's magnetic field, the latter will not cut the rotor conductors and, in consequence, no voltage will be generated, whilst at any intermediate speed of the rotor, the periodicity of the induced voltage will depend upon the difference in speed between the stator's revolving field and the rotor conductors. If the rotor is driven mechanically in a direction opposite to that of the stator's field, the speed of rotation of the latter, relative to the rotor conductors, will be greater than when the rotor is held stationary, so that frequencies lower than that of the supply can be obtained when the rotor revolves in the same direction as the stator's field, and higher, when the rotor is driven against this field. The synchronous speed of any induction motor connected to the slip-rings of the mechanically-driven rotor will therefore depend upon the speed and direction of rotation of the latter, the frequency of the rotor voltage being given by the formula:—

$$f_R = f_S \left\{ \frac{(\text{R.P.M.}_S \mp \text{R.P.M.}_R)}{\text{R.P.M.}_S} \right\}$$

where f_R = frequency of rotor voltage.
" f_S = frequency of stator voltage (*i.e.*, of the main supply).
" R.P.M._R = rev. per min. of rotor.
" R.P.M._S = synchronous speed of motor (or speed of stator's rotating field).

The − sign is employed when the direction of rotation of the rotor is the same as that of the stator's magnetic field, and the + sign when the rotor is driven against the field.

Perhaps one or two examples will make the above formula more clear; let us take the case of a 6-pole slip-ring induction motor, and a supply at 50 cycles per second. The synchronous speed of this motor would be:—R.p.m. (synchronous) $= 50 \times 60/3 = 1{,}000$ r.p.m. Let us drive the rotor in the direction in which it would run normally (with the stator's rotating field) at 600 r.p.m.

The frequency of the voltage induced in the rotor would then be given by:—

$$f_R = 50 \times (1{,}000 - 600)/1{,}000 = 20 \text{ cycles per sec.}$$

With the same motor and supply, let the rotor be driven against the stator's field at a speed of 200 r.p.m.; the rotor frequency would then be:—

$$f_R = 50 \times (1{,}000 + 200)/1{,}000 = 60 \text{ cycles per sec.}$$

For a required frequency of rotor voltage, the necessary speed of the rotor can easily be calculated; it should be noted that for a frequency either below or above that of the supply, two speeds would give the same result, one above and the other below the synchronous speed of the slip-ring motor; for instance, suppose a frequency of 60 cycles were required:—

$$60 = 50 \times (1{,}000 + \text{R.P.M}_R)/1{,}000 \quad \therefore \text{R.P.M.}_R = 200$$
$$60 = 50 \times (\text{R.P.M.}_R - 1{,}000)/1{,}000 \quad \therefore \text{R.P.M}_R = 2{,}200$$

The lower speed would naturally be used.

The question now arises as to the amount of power required to drive the rotor of the induction motor at the necessary speed. As long as the rotor is driven in the same direction as the stator's rotating field, the amount of power required of the driving motor is that taken from the slip-rings by the other motor, plus the copper losses which occur in the slip-ring rotor windings. When the rotor is driven against the stator's field, a certain proportion of the output is supplied by the slip-ring motor, which acts as a transformer, the remainder coming from the driving motor. An example best illustrates this:—

Using the same slip-ring motor and supply, let us assume that we desire a 4-pole squirrel-cage motor to run at a synchronous speed of 2,100 r.p.m. The necessary frequency is:—

$$f_R = \frac{(\text{R.P.M.} \times \text{pole pairs})}{60} = \frac{2{,}100 \times 2}{60} = 70 \text{ cycles per sec.}$$

This frequency is higher than that of the main supply, and the slip-ring rotor will therefore have to be driven against the stator's field:—

$$70 = 50 \left\{ \frac{(1{,}000 + \text{R.P.M.}_R)}{1{,}000} \right\} \quad \therefore \text{R.P.M.}_R = 400.$$

The total power taken from the slip-rings would therefore be contributed in the proportion:—

$$\frac{1{,}000}{(1{,}000 + 400)} = \frac{5}{7} \text{ by the transformer action of the slip-ring motor;}$$

$$\frac{400}{(1{,}000 + 400)} = \frac{2}{7} \text{ by the motor driving the rotor.}$$

It is not suggested that this method of frequency changing should be employed to obtain a special speed from a large unit in constant use; doubtless this case would be better met by the purchase of a special motor, or, if the required speed was reasonably near and below the maximum synchronous speed directly obtainable from a slip-ring motor, by reduction of the speed through the use of resistances in the rotor circuit; however, it would be of interest to ascertain the effects of variation of frequency upon an induction motor.

The fundamental equation for any a.c. machine is:—

$$E = (K\phi Z f)/10^8$$

where E = volts per phase, ϕ = flux per pole, Z = conductors per phase, f = frequency, K = a constant.

If, therefore, the flux and the frequency are variables, the former will vary inversely as the frequency,

i.e., ϕ varies as $1/f$.

In the case of an induction motor, the torque varies directly as the flux, so that if the frequency is doubled, the synchronous speed of the motor is doubled; but the flux, and therefore the torque, is halved, so that the motor output is theoretically unaltered. The decreased flux at the increased frequency will result in a decrease in the magnetising current, and since there is practically no change in output, this will result in a higher power factor, whilst the stator copper losses will probably be decreased. It is, of course, necessary to remember that the centrifugal force to which the rotor components are subjected varies as the square of the speed, so that doubled speed means quadrupled centrifugal force.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Wall Socket and Plug.

In order to meet a demand for a 5-A wall socket and plug of somewhat smaller dimensions than the usual type, the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has placed on the market an attractive accessory, fig. 1, which complies, it is claimed, in all respects with British Standard Specification No. 73-1927. The socket is designed to supersede the company's 5-A old pattern, which measured 2⅛ in. in diameter, with 1¼-in. projection. By a re-arrangement of the tubes and terminals, the new socket, which is of English vitreous porcelain with a polished bakelite drop-on cover, measures only 1 11/16 in. in diameter, with ⅞-in. projection. The new socket has a much neater appearance than its predecessor, with a perfectly smooth surface devoid of dust-collecting ridges. The plug is also an improved type. Its

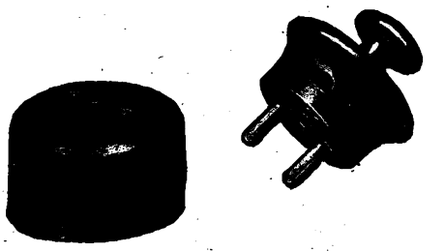

Fig. 1.—New "Magnet" Socket and Plug.

chief features are solid hexagonal terminals and circular pins (turned from the hexagonal bar); terminals bedded in recesses moulded into the bakelite disk (replacing the orthodox fibre disk); and a Home Office pattern hand-shield top which can be rotated to four positions, for reception of the disk, and therefore allows for any one of five different sizes of flexible to be connected and gripped externally between the disk and cover.

A Battery Hydrometer Set.

An American production for which Messrs. FREDK. J. GORDON AND CO., LTD., 92, Charlotte Street, W.1, have been appointed sole agents for the British Isles is the "Break-Not" battery tester, fig. 2. The bulb and tip of the container are made of good-quality red Para rubber, and the capacity is such

Fig. 2.—Hydrometer Outfit.

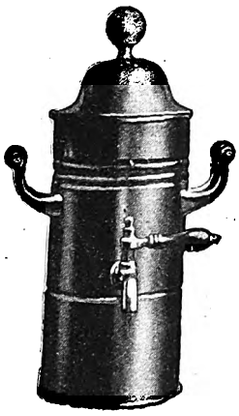

Fig. 3.—"Elect" Ambulance Urn.

as to prevent spilling. Provision is made for hanging the apparatus up—tip upwards—and also for preventing it from rolling. The hydrometer proper is claimed to be scientifically accurate, and it is printed in three different colours to facilitate reading. Other claims for the apparatus are that it contains much less glass than some models, that it will not leak, and that the hydrometer itself will not stick.

New Lighting Fittings.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2, are introducing a comprehensive range of new commercial and industrial lighting fittings. Some of the commercial fittings will be known by the trade name of "Phililite," and the accompanying illustration, fig. 4, shows type "DB," which is made in two sizes, suitable for 40-100-W and 100-200-W lamps, respectively. The advantages claimed for "Phililite" fittings are: ease of erection, they are sent out wired complete and only one screw need be tightened to secure the bowl to the gallery; very low light absorption, three-ply glass being used; the chain suspension is of a new patent design, both

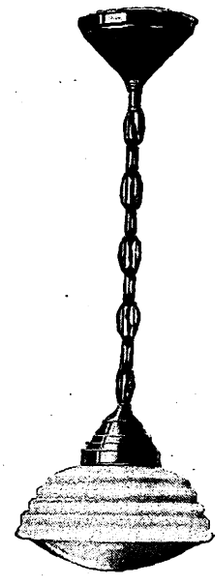

Fig. 4.—"Phililite" D.B. Fitting.

attractive in appearance and essentially practical; and it requires only a few moments to remove or add links for the purpose of shortening or lengthening the chain.

An Ambulance Urn.

An electric urn, recently introduced by the ELECTRIC HEATING CO., George Street, Croydon, is designed to meet the demand for a small appliance for emergency use in ambulance stations. This, "Elect" urn, fig. 3, has a low loading of 100-200 W, so as to allow a steady 24-hour service of water, and its water capacity is half a gallon. The apparatus is constructed of stout copper sheet, and is highly polished.

A Cable-laying Machine.

Included in the uses for which a mole plough recently introduced by the AUTO-MOWER ENGINEERING CO., LTD., Norton St. Philip, near Bath, is claimed to be suitable is cable laying. When used for this purpose the mole is equipped with a special connection by means of which, should an obstacle be encountered, the mole automatically releases itself from the cable and rises to the surface. The size of the mole and the working depth can be varied according to requirements. The plough works in conjunction with a tractor on the cable-haulage principle, special anchoring arrangements being provided for the tractor. This is equipped with a 20-h.p., 4-cylinder, water-cooled engine.

A Brush and Commutator Trouble Chart.

A "Carbon brush maintenance and trouble chart" which is being issued by MARTINDALE ELECTRIC CO., LTD., The Hyde, Hendon, N.W.9, should prove useful to motor-maintenance men. It shows in readily discernible form the causes of brush and commutator troubles, and also the effects and evidence of such troubles.

Submarine Signalling.

Messrs. Schneider & Co., of Le Creusot, France, have recently secured the French rights in the new system of signalling developed by the Submarine Signal Corporation, of New York. It is stated that the system enables acoustic signals to be transmitted and received from below the surface of the sea, also enabling the direction and distance of the source of the signals to be determined.

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Electric Cooking and Heating Developments.

The Fourth E.D.A. Salesmanship Conference of the 1928-29 Session.

AT the Salesmanship Conference of the Electrical Development Association held at the Royal Society of Arts on January 18th, Mr. C. H. Rayner, sales manager to the Manchester Corporation Electricity Department, read a paper in which he dealt generally with recent developments in electric heating and cooking, with special reference to what has taken place in Manchester. Captain J. M. Donaldson (North Metropolitan Electric Power Supply Co.) was in the chair.

Mr. RAYNER said that it was not until 1908 that cumulative records were taken of the heating appliances connected to the Manchester mains, the number then being 643. Ten years afterwards the figure had grown to 5,353, whilst to-day it was 43,500. The cooker hire scheme was inaugurated in June, 1923, and at the end of that year there were 173 hired cookers installed. The number, however, had been steadily increasing at the rate of 18 or 20 per week, and at the present time, including a small number of privately-owned appliances, 5,500 cookers were connected, aggregating 33,665 kW. A fairly comprehensive review was given of the early difficulties associated with the manufacture of heaters, and Mr. Rayner said that modern heaters were thoroughly reliable and cheap to buy and operate. He referred to a system which was about to be introduced into this country by which energy was supplied at 6,600 V to electric boilers for heating large buildings and for factory processes, a system which, if successful, would undoubtedly help towards the night use of electric water-heating appliances during off-peak hours. Indicating some special uses for small heaters, Mr. Rayner mentioned that a certain firm in the Midlands was at present carrying out a contract for some hundreds of feet of heating tubes to be used on the covered top decks of the cars owned by an important tramway undertaking. In Manchester, also, as in some other towns, 600-W heaters were being installed in the police boxes. A useful loading for space heating in public places such as theatres, churches, &c., was 0.6 to 1 watt per cubic foot of space. In sitting rooms and similar apartments, a more liberal allowance was desirable, and 1.25 or even 1.5 watts per cubic foot would generally be found to be required in order to provide a comfortable heat at short notice. The amount of window space and construction of the window frames had to be taken into account. A favourite and apparently effective position for tubular heating was a few inches from the floor immediately under the window as by this means any current of air coming through crevices in the window frames was heated as it entered the room. Finally, Mr. Rayner said that there was a considerable field for activity in electric heating, and a large amount of business might confidently be anticipated in the near future as the result of the efforts now being put forward by makers of appliances.

Passing to electric cooking, the speaker pointed out that manufacturers had recently made important improvements in construction, particularly as regarded hot plates, the disposition of switches and fuses, the enamelling of hobs and oven interiors, and a more pleasing and convenient design. Although it could not be said that the perfect electric cooker had yet been evolved, we were well on the way towards it. There was still room for speeding up hot-plates, which was perhaps the most pressing need of the moment. Much could be done, however, to educate the user in this matter by stressing the importance of slow boiling and steam cooking. Much controversy had centred around the respective merits of the open and closed types of hotplates, but the verdict appeared to be decidedly in favour of the latter. Discussion was still being carried on with regard to top and bottom heat or side heat in the opens. In the northern districts where so much bread baking was carried out in the home, bottom heat appeared to be popular, but the inclination of the cook was the deciding factor as a rule.

Speaking of tariffs, Mr. RAYNER suggested that the most popular one was the two-part tariff, for both domestic and industrial purposes. A special "all-in" tariff had been adopted in Manchester which consisted of a yearly charge of 20 per cent. on the 1914 or equivalent ratable value of the property plus ½d. per kWh for all energy consumed. Although it might not be perfect it formed a convenient and fairly equitable method of assessing the standing charge to meet the fixed costs of supply, and its popularity in Manchester was seen in its adoption by 8,500 consumers. By this system of charging, consumers were encouraged to make full use of electricity for all purposes and average costs of 0.6d. to 0.7d. per kWh were common figures.

In a final review of the factors entering into the sale of electric cooking and heating appliances, the advantages of showrooms and demonstrations in the home were emphasised, but greatest stress was laid upon the disinclination of architects and builders to design houses with sufficient outlets for electric heating and cooking. It was suggested that the E.D.A. should take up the question of lectures before the architects' and builders' societies and institutions.

The attendance at the meeting was unusually large, and there was a lengthy discussion; we give below a summary of the principal points.

Discussion.

Major GRIERSON said it would be interesting to have figures of the revenue per domestic consumer in various parts of the country because these would emphasise the importance of encouraging the further uses of electricity beyond mere lighting. It cost just as much for a meter reader to read the meter of a consumer using 7s. 6d. worth of energy as one using £20 worth. Speaking of the general development of heating and cooking, he said that confidence was the root of the business. From this point of view he supported the ratable value method of charging because the consumers could understand it, whatever its defects might be. Nothing created distrust more than a system of charging so complicated that the supply authority often could not give a simple explanation. On the same question of confidence, he mentioned several instances in which consumers had been asked to pay, as a lump sum, amounts varying from £210 to £450 before the supply could be given. There was no question of a percentage on the cost of the main spread over a period of years; it was a definite lump sum payment without any indication as to how it had been arrived at. In one case, when it was ascertained that the probable maximum demand was 15 kW more than had been stated at first, the original figure of £140 had been increased to £210. What was the use of all the propaganda of the E.D.A., if that sort of thing went on?

After advocating a low running charge—not more than ½d. with, if necessary, a higher fixed charge—Major Grierson spoke on the need for standardisation of consumers' voltage throughout the country, the absence of which was often a deterrent to people buying electrical apparatus which they knew would be useless when they moved to another district.

Mr. GREGORY expressed the view that the standing charge in the two instances mentioned by the author was too low, and doubted whether they really covered the actual fixed charges involved.

Mr. HOWELL suggested that there had been little improvement in electrical cooking apparatus for a number of years, and suggested that more good would come from standardising voltage before apparatus. He asked how many electrical people adopted electric cooking. It was impossible to be convincing to a potential user of electric cooking if one did not use the apparatus. Manchester seemed proud of its 5,500 hired electric cookers in five years, but how many gas cookers had been installed in the same period? In conclusion, Mr. Howell defended the supply authorities' making charges for laying cables to give a supply, and mentioned a similar complaint in his own area which, however, concerned a block of flats held on monthly tenancies; one person who asked for a supply and was told that he must contribute £15 towards the main, had admitted that he proposed to move as soon as he found a suitable house elsewhere. Yet he complained of the demand of the supply authority.

Mr. BROWN (Hackney) analysed the figures given in the author's examples, and suggested that the actual overhead charges and maintenance on an average cooker installation plus the cost of the energy would only just balance the fixed charge made, so that electricity was really being supplied free of charge.

Mr. STEELE, as the owner of an all-electric house, said that it was unnecessary to have a running charge of ½d. per kWh. His total cost was 1.1d. per kWh, and he was quite satisfied that he was doing his cooking, heating, lighting, and everything else more cheaply than he could by any other method.

Mr. JACKSON said a difficulty was experienced in getting cookers put in where the consumer had to pay an initial sum of £5 on account of installation. One undertaking in London included in its hire charge free installation.

Mr. WATTS (Epsom) expressed the view that electric heating and cooking development depended mainly on the tariff. The ratable value and similar tariffs were extremely useful and he was thinking out a three-part tariff. He did not think a charge of ½d. per kWh need be made, as a higher figure would often get the business. In the case of two small housing estates in his area the average revenue per consumer through slot meters was £10 per annum.

Mr. BIRKS said he represented a small supply company purchasing its energy in bulk, but the charge made to him for the

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bulk supply was such that he could not recommend his consumers to adopt electricity for continuous heating. In such cases as his own, it was necessary to reduce the maximum demand of the cooker owing to the time this load came on, and he suggested that there would be no hardship to the consumer if the wiring of the cooker was so arranged that the grill could not be switched on at the same time as one of the hot plates. This would reduce the demand and perhaps save £1 per annum in the fixed charge.

Several speakers referred to the advantages of electric cooking, and the suggestion was made that supply authorities should place bulk orders for cooking and heating apparatus in order to get lower prices.

Lt.-Col. W. A. VIGNOLES (Director, E.D.A.) reminded the meeting that these conferences were Salesmanship Conferences and that the tendency for one side to blame the other for lack of development was beside the point. The thing to be done was to apply salesmanship to the selling of heating and cooking apparatus, because electricity would not sell itself. He was living on a new housing estate which had been wired in a most up-to-date fashion, but there were not a dozen electric cookers among the 200 or 300 houses. When he first went there he was immediately approached by the gas company with an offer to do anything for him, and it was undoubtedly the keenness of the gas company in getting in gas cookers and other apparatus before the householders were approached by the electricity supply people that had brought about that position. Therefore, salesmanship and good organisation were necessary. The only two things which the gas interests could allege against electric cooking was high price and slow boiling, but it was not difficult to refute those arguments and, at the same time, produce such points as the danger to health from the products of combustion from a gas oven in a room and the general danger of gas. The E.D.A. was considering how to approach architects and builders with regard to a larger number of points in new houses.

The CHAIRMAN remarked that those who said there had been few improvements in electric fires and cookers during recent years could not be aware of what had really taken place. He himself had been using electricity for cooking for 20 years, and although at one time there was always something going wrong, to-day he hardly ever had to touch anything and he was using 20,000 kWh per annum.

Mr. RAYNER, in the course of a brief reply to the discussion, said that if the fixed charge at Manchester was too low the re-assessment of premises under the new Act would put that right. At the same time, it must always be borne in mind that something must be allowed for propaganda and frequently, by virtue of low charges, other apparatus was installed which would not otherwise be used.

Reviews.

An Introduction to the Theory of Eddy-Current Heating. By C. R. BURCH and N. RYLAND DAVIS. Pp. 72; figs. 15. London: Ernest Benn, Ltd. Price 12s. 6d. net.

This little book is remarkable in several respects. It is, indeed, scarcely a book, but rather a very limited monograph, since it deals only with furnaces of the coreless type, eddy current furnaces in which iron cores are used being curtly dismissed in a dozen lines. The reason is obvious. The coreless type of furnace lends itself to an intensive mathematical treatment which the varying permeability of an iron core would render far more complicated, if not altogether unmanageable. So, having first disposed of this troublesome core, the authors can proceed to handle the remaining problem with all their mathematical skill, displaying in the process a wide knowledge of functions and much ingenuity in exploiting them. Such work is significant, as being a mark of that new school of University trained men now appearing in the engineering industry, and in this respect the book is an augury.

Chapter II contains the theory of induction heating and begins with an argument from dimensions alone wherefrom a relationship is deduced between the power dissipated by an induction furnace, the linear dimensions and resistivity of the heated material and the so-called "pulsatance" of the applied field. Why the authors adopt the hideous word "pulsatance" for $2\pi f$ is unexplained. It is to be hoped that others will not follow their example. Then ensues a literal transcript of the paper published two years ago, which is developed in some detail, but ultimately leads to the former conclusion that for high efficiency the external radius of the charge is dependent upon the ratio $\sqrt{\rho/f\mu}$, where ρ is the specific resistance of the charge, μ its permeability, and f is the frequency of supply.

The next chapter, dealing with such matters as the optimum dimensions of the inductor and the charge, arrives at the general deduction that the length of the inductor should be about equal to the diameter. Academic exercises are here indulged in concerning such problems as the heating of a magnetic sphere, the corrections for short inductors, &c. Early in Chapter IV consideration is given to practical matters, such as the state of division of the charge, but later the attention devoted to hollow charge formulæ seems out of all proportion to the importance of the subject. The chapter concludes with a short but useful discussion of heating by non-periodic currents and of magnetostriction.

In the final chapter the design problem is approached, and here the few conclusions gleaned from the mathematical investigation are to some extent used as a basis. The determining parameters are stated to be frequency, thickness of lagging and inductor length and turns per cm. But the chapter is somewhat unconvincing and breathes the air of uninvestigated compromise. The work concludes with an interesting comparison between prediction and test upon a small furnace.

It has been said that the book is remarkable as showing a tendency of modern engineering education. It is also remarkable for the price at which it is published. Twelve shillings and sixpence is high for a book of 72 pages, with 14 diagrams and no index, especially when the most useful part of the work has been previously published. To justify such a price, conclusions should be reached of great novelty and importance. The reader may reasonably ask whether the results vindicate the long and intricate mathematical work involved. We think that the answer is in the negative; and our conclusion is supported by the few deductions available for use in Chapter V. But there is a third direction in which the book is remarkable, *viz.*, in its omissions. No engineer has done so much to develop coreless induction heating as E. F. Northrup, and, indeed, the authors in a footnote refer to two of his early patents. Yet they omit all reference to Specification No. 243,694, bearing the convention date 1924. Surely they must have been aware of its existence, since it antedates some of their own work by two years. In it is to be found a discussion of the chief factors upon which the design of a coreless induction furnace depends, together with an example showing the application of the principles. It is true that Northrup's mathematical methods are by comparison crude and elementary, but he should at least be given credit for first developing many important relationships and especially those existing between radius of charge, specific resistance and frequency. Other omissions of a similar kind may be quoted. For example, there is no reference to Northrup's article in the *General Electric Review* of November, 1922, nor to his Specification No. 247,519 of 1925. The last is of importance as giving the second relationship arrived at by the present authors, *viz.*, that the diameter and height of the inductor should be about equal; and it also deals fully with the economical size of condensers. Such omissions suggest uncomfortable reflections on the fact that Messrs. Burch and Davis are employed by a firm presumably in commercial competition with Northrup's Company. But surely text-books should be above such rivalry, and we prefer to believe that these lapses are due to ignorance of the documents quoted, rather than to commercial exigencies.

The book is well produced, and on the whole remarkably free from misprints. The authors should, however, have known that Professor Elihu Thomson does not spell his name with a "p."

Elements of Alternating Currents and Alternating Current Apparatus. By J. L. BEAVER, E.E., M.S., Associate Professor of Electrical Engineering, Lehigh University. Pp. xii+393; figs. 309. London: Longmans, Green & Co. Price 18s. net.

The first eight chapters of this book deal with the principles of alternating currents and the laws governing the flow of such currents. The remainder of the book is chiefly concerned with an account of alternating current machines, though the two final chapters deal with instruments and transmission lines respectively.

The standard of treatment can be conveyed by stating that the book deals with the subject to a much greater extent than is necessary for the purpose of the Ordinary National Certificate, but not so deeply as would be required for a Higher National Certificate or for a full-time day course in our universities or large technical colleges.

A characteristic of the early chapters is the great detail with which elementary problems of current flow are considered. A particularly interesting feature is the attention given to the symbolic method of treatment (though no great use is made of the method in the later parts of the book), and this necessitates the introduction of the ideas of conductance, susceptance and admittance to a much greater extent than is usual in books of this type.

The treatment of transformers, synchronous machines, induction motors and convertors, in the later portions of the book, while adequate for the end in view, is broader and less detailed.

The book is accurately written, though on page 261, when dealing with the synchronising of three-phase machines, we find a statement to the effect that one disadvantage of a lamp synchronising device is that it gives no indication as to whether an incoming machine be fast or slow. As a matter of fact, it is possible to secure this indication in a very simple manner. A point of note in connection with converting plant is the omission of any consideration of the motor-convertor, a type of machine which has many advocates in this country.

The line diagrams are usually drawn with care, but the curves of power in certain wave diagrams in the early chapters are of poor shape and the lettering in certain vector diagrams is so small as to lead to indistinct reproduction.

Finally, mention should be made of the considerable collection of questions demanding descriptive answers and problems, to which numerical answers are given, with which each chapter is concluded.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The "Electrical Review" Index.

The Index to Vol. CIII (for the half-year ended December 31st, 1928) is now being printed, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes, or wish to retain it for reference. Application should be made to the Publisher, 4, Ludgate Hill, E.C.

New Companies in 1928.

In their annual statistical report for 1928 Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C.2, analyse the companies registered during the past year. From this it is observed that 838 public companies and 8,174 private companies (total 9,012), with an aggregate capitalisation of £220,506,126, were formed. In 1927 8,399 companies were registered, their total capitalisation being £173,162,271. Under the heading "Electricity, gas and water" there were 29 public companies (capital £3,669,400) and 239 private ones (capital £783,221), giving a total of 268, with an aggregate capital of £4,452,621.

For Sale.

The West Central Merchandise Mart will sell by auction on January 30th, at York House, Southampton Row, W.C., stocks of electrical fittings, accessories and cables. (See our advertisement pages to-day.)

A Banker's View of Industry.

In accordance with the usual practice at the annual meetings of bank shareholders, Mr. F. C. Goodenough, chairman of Barclay's Bank, Ltd., made an interesting commentary on current financial, economic and industrial conditions in his speech last week. Regarding industry, he recalled that a year ago the prospects were more hopeful, but said that, unfortunately, expectations were not realised. There had certainly been a slight improvement in the iron and steel industries and certain allied trades, but the coal industry remained in a very bad state, as did certain sections of the Lancashire cotton industry. On the other hand, the "finishing sections" of certain industries, the "luxury" trades, and certain of the newer industries were in a much more satisfactory condition. The country was maintaining its reputation for skilled manufacture, but as yet, with few exceptions, had not proved itself to be entirely suited for mass production. This was mainly because we had not such a large home market as, for instance, the United States. Although last year our exports of manufactured goods had increased, the depression in our heavy industries was so bad as to create a general feeling that our industrial organisation was not what it should be. In his opinion, however, there were grounds for confidence in the great efforts which were being made to place the depressed industries on a more satisfactory footing through great industrial combinations. Much more was being done to develop new outlets for trade and to improve the marketing of our goods. There were still no signs of a reduction in tariff barriers if taken as a whole. Those barriers tended substantially to reduce international trade, and it seemed that if we were to regain our full pre-war volume of foreign trade, steps must be taken to reorganise upon more economical and efficient lines many of the industries which were specially subject to foreign competition. Owing to the weight of our national liabilities, it was of great importance that prices in this country should be maintained as far as possible at the present level, and that there should not be any appreciable reductions in the general level of prices or in wages, which would have the effect of increasing the real burden of the National Debt. On the other hand, it was essential in the interests of industry and trade that the price levels prevailing here from time to time should not be higher than those in other countries.

Sir Herbert Hambling (deputy-chairman), who also addressed the meeting, said that without doubt there was a better feeling between capital and labour, and there were developments along the lines known as "rationalisation." If rationalisation meant the reorganising of industry on more economical and efficient lines, then it was far better than the quack doctrine of tampering with our credit and currency system. If industrial peace and rationalisation continued he was optimistic with regard to the future.

New London Showrooms.

New showrooms were recently opened by Messrs. Best and Lloyd, Ltd., at 40, Great Marlborough Street, W.1, and an informal "house-warming" was held on January 17th. The new premises, which consist of two floors of considerable length, have been designed by Mr. V. O. Rees, A.R.I.B.A. The frontage has an attractive appearance and is in black mahogany, the company's title being in bold red lettering on a glass background, which can be illuminated. The tasteful interior decorations include cream pilasters, warm grey canvas walls, brown grey hangings, and carpet, with a black border. As is natural with a firm that specialises in lighting fittings, these predominate, and the display covers almost every type of fitting. In the front of the showroom, on the top floor, installations of the modern type are shown, and models of fittings installed in various public buildings are interesting examples of the company's products. One of its specialities is "Firelight" glass, which is tinted a delicate orange merging into amber, giving a pleasing light. At the rear of this floor period fittings of many designs are shown. A prominent development is the "Rippleray" electric fire, which gives an impression of great heat by passing light through bubbling water. The lower floor is set apart for the display of fittings of a more general type, and two storerooms are also included. The showrooms are in the charge of Mr. H. S. Benwell, London manager for the company.

An Electrical Carnival.

An Electrical Carnival is being promoted in Newcastle under the auspices of the Electrical Development Association and the Electrical Association for Women. It will be held in the Oxford Galleries, New Bridge Street, Newcastle-upon-Tyne, on Thursday, February 7th, and the guests will be received by the Lord Mayor and Lady Mayoress. We are pleased to hear that the function promises to be a most successful electrical effort, and that a large number of firms manufacturing electrical apparatus have together very generously provided a large selection of prizes. These will be awarded for treasure hunts, treasure dances, balloon dances, and many other novel competitions that have been arranged for the night. The surplus moneys from the carnival will be given to the Hospitality Fund of the Electrical Association for Women to entertain the delegates at their Conference at the North-East Coast Exhibition. We understand that there is a big demand for tickets (5s. each). Mr. W. F. T. Pinkney, of Carliol House, Newcastle-on-Tyne, is chairman of the E.D.A/E.A.W Dance Committee.

Conditions in Sweden.

The *Swedish Economic Review* says that during the third quarter of 1928 the average employment figure was "better than moderately good." The mechanical and electrical industries showed a slight decline in comparison with the second quarter, but can still be included among the branches of industry in which employment is best. The exports of electrical machinery during the first ten months of the year were valued at 36,692,000 kr. (about £2,000,000), as compared with 25,899,000 kr. (about £1,430,000) in January-October, 1927. The exports of telephone and telegraph apparatus rose from 7,217,000 kr. (about £390,000) to 11,144,000 kr. (about £600,000).

Cable-Selling Concentration in Belgium.

It is announced that the company known as Les Fils Isolés Belges, of Brussels, has entered into arrangements with native producers of cables and insulated wires for the sole sale of a part of their production. The firms concerned are the S.A. des Ateliers de Constructions Electriques de Charleroi, the Société Belge pour la Fabrication des Cables et Fils Electriques, of Brussels, the S.A. Manufacture de Cables Electriques et de Caoutchouc, of Eupen, the S.A. Cabléries de Seneffe, of Seneffe, and the S.A. Cabléries et Corderies de Hainaut, of Dour.

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Bankruptcy Proceedings.

C. H. MARCHANT, 42, Ashdown Road, late of 9, South Street, Tarring, Worthing, Sussex, electrical engineer.—The public examination of this debtor was held on January 16th at the Court House, Brighton. The debtor presented a statement of affairs showing liabilities of £887, against assets of £39, and he stated that he entered into a partnership with another in July, 1926. Each provided £60 capital, the debtor borrowing his share from his father. The business was a failure, and the partnership was dissolved in 1927. The partners divided the stock between them, each receiving about £10 worth, and the partner took over the liabilities, amounting to about £5. In June, 1927, the debtor entered into an agreement with another, commencing as wireless and electrical engineers and dealers. Their joint capital was £60, of which the debtor provided two-fifths. This business was not successful, and the partnership was dissolved in May 1928, after which the debtor continued on his own account, but had to discontinue after two months. He stated that he had removed £150 worth of stock to a store room, intending to return it to his creditors who supplied it, but it was sold by the high bailiff. The examination was adjourned for closing.

G. M. WILSHAW and G. SHARPE, trading as Wilshaw and Sharpe, 320, Padiham Road, Burnley, Lancs., electrical dealers. —The public examination herein was held on January 15th, at the County Court House, Burnley. Debtors' statement of affairs showed liabilities of £763 and a deficiency of £516. They attributed their failure to lack of capital, and experimental work in battery eliminators and loud speakers, which had not proved successful. They started business in April, 1925, with a capital of about £86. The business was fairly successful until March, 1928, but then the takings had fallen considerably. They stated they were aware of their position in July, 1928. The examination was adjourned.

H. J. BROWNHILL, back of 48, Whitehouse Street, formerly 94, Broadstone Avenue, Leamore, and 181, Bloxwich Road, Walsall, Staffs., electrical engineer.—The receiving order in this matter was made on the debtor's own petition. The first meeting of creditors was held recently at the Official Receiver's office, Wolverhampton, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Electrical Conduits, Ltd.	53	Walsall Hardware Mfg. Co., Ltd.	39
Jones, D.	35		

C. K. GOVETT (K. Govett & Co.), electrical contractor, 179, Albany Road, Cardiff.—First meeting, January 25th, at 34, Park Place, Cardiff; public examination, March 7th, at the Law Courts, Cardiff.

J. G. RITCHIE, electric lamp dealer, 54, Woodsley Road, Leeds.—First meeting, January 24th, at 24, Lower Bond Street, Leeds; public examination, February 5th, at the County Court House, Albion Place, Leeds.

S. S. KELLY, electrical contractor, 59, North Road, Durham. —Last day for receiving proofs for dividend, January 26th. Trustee, Mr. H. J. Armstrong, 2, Saville Place, Newcastle-upon-Tyne.

W. G. HOLMES, wireless and electrical engineer, 42, Walcot Street, Bath.—First and final dividend of 2s. 11½d. in the £, payable January 21st, at the Official Receiver's office, 26, Baldwin Street, Bristol.

N. H. WOOD, electrical engineer, 32, Highway Avenue, Thornton Heath.—First and final dividend of 1s. 10d. in the £, payable on January 25th, at the Official Receiver's office, 29, Russell Square, W.C.1.

S. STEIN & SONS, electricians, 36, Warwick Street, Glasgow. —Estates sequestrated by the Court of Sessions, January 16th. A meeting to elect a trustee and commissioners is to be held to-day (Friday) at the Faculty Rooms, St. George Place, Glasgow. Proofs of debts are to be submitted by May 16th. Agents, Messrs. D. & J. H. Campbell, 31, Moray Place, Edinburgh.

H. BUCKLEY, electrician, 23, Asylum Road, Old Kent Road, S.E.15.—Receiving order made January 15th on a creditor's petition. First meeting, January 28th; public examination, February 20th, both at Carey Street, W.C.2.

H. F. LAWRENCE, electrical engineer, 43, Canterbury Road, Margate.—Receiving order made January 16th on debtor's own petition.

E. D. JONES, electrical engineer, Royal Sportsman Hotel, Portmadoc, Carnarvon.—Last day for receipt of proofs for dividend, February 2nd. Trustee, Mr. I. D. Hooson, Official Receiver, St. Peter's Churchyard, The Cross, Chester.

W. A. HAMMOND, wireless dealer, 31, Middle Street South, Great Driffield, Yorks.—First and final dividend of 10s. 8d. in the £ payable January 25th at the Official Receiver's office, 37, Scale Lane, Hull.

Company Liquidations.

KEYSTONE INVESTMENT TRUST, LTD., Bank Chambers, Market Square, Kingston-on-Thames—The statutory first meetings of the creditors and shareholders of this company (in liquidation) were held on January 17th at Carey Street, W.C. Mr. J. Barwick Thompson reported that the company was registered in April, 1923, to carry on the business of an investment and trust company and all kinds of financial and commercial business. It was promoted by the late Wilfred Henry Butler, whose real name was stated to have been Walter Henry Brown, and who for some years had carried on the business of an outside broker in conjunction with another person at Kingston-on-Thames, under the style of Glover & Butler. So far as it had been possible for the Official Receiver to ascertain the fact, it appeared to be clear that the management of the affairs of the Trust were entirely under the control of Butler, and he regretted to say that owing to the death of that gentleman in October last (his body was recovered from the Thames) and the absence of written-up books since December, 1926, there was no prospect of any statement of affairs being received or reliable figures being prepared. According to the returns filed at Somerset House, 81,134 shares of £1 each had been issued for cash, and practically the whole of the Trust's capital had been utilised in financing a number of companies which were promoted by Butler. Among the number was the Pinnacle Switchgear Co., Ltd., which was promoted in April, 1925, with a nominal capital of £21,000 divided into 20,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each, and was formed to carry on business for the manufacture of electric switches and fuses to be supplied principally to the Admiralty. It appeared that the company was a reconstruction of the Wholesale Electric Co., Ltd., which carried on business at Weybridge, and was stated to have been originally promoted by two undischarged bankrupts. The Trust acquired 250 shares of the Electric Co. in January, 1924, and subsequently took up debentures to the nominal value of £2,800. Part of these debentures were disposed of, and in July, 1925, the Trust was the registered holder of the 250 preference shares and debentures for £2,050. The Electric Co. went into voluntary liquidation and a reconstruction scheme was carried through under which the Trust was allotted 4,720 £1 preference shares and 19,993 deferred shares in the new company (Pinnacle Switchgear Co., Ltd.). Further shares were acquired by the Trust, some of which were subsequently sold. On December 31st, 1926, the books disclosed that the Trust held 3,110 preference and 19,283 deferred shares. Loans amounting to £3,060 were also made by the Trust, which loans were still unsatisfied. From information obtained by the Official Receiver, it appeared that the Switchgear Co. created debentures for £3,000 in March, 1927, and on August 15th following the debenture holder appointed a receiver, who carried on the business for a short time, and subsequently disposed of it for an amount insufficient to discharge the sum due under the debentures. The loss to the Trust in connection with the Switchgear Co. was £6,899.

Another company in which the Trust sunk £11,874 by way of loans and purchase of shares was the Tidal Power Syndicate, Ltd., which Butler registered in July, 1924, under the title of Weaver Tidal Power Syndicate, Ltd., the name being changed in November, 1925. The object of the syndicate was to acquire certain land at West Mersea, Essex, with a view of utilising the rise and fall of the tides for the production of power for electricity. It was the intention that the syndicate should promote a large public company in order to carry through the original scheme for the development of tidal power, but difficulties arose in connection with reports on the property and in August, 1927, the funds of the syndicate were exhausted and the mortgagees commenced proceedings for payment of a mortgage for £16,000 and interest. The syndicate was stated to be without funds or assets of any kind, and its operations had been suspended.

The chairman added that the books of accounts to the end of 1926 showed profits and dividends were paid in 1924, 1925, and 1926, absorbing £13,881. It was perfectly clear that none of the profits disclosed in the accounts were earned by the Trust, and that in each case the dividends were paid out of capital without any justification whatever.

Dealing with the present position, the chairman said that apart from a claim for £1,000 in respect of income tax, only a few debts of nominal amount had been notified to the Official Receiver, but he understood that various sums amounting to £9,000 had been advanced to the Trust in connection with the promotion of the Tidal Power Syndicate, and they might be liabilities of the Trust. There appeared to be no tangible assets, and as the whole of these financial ramifications had been controlled by the late Butler, it was utterly impossible in the absence of books and records since December, 1926, for anyone to attempt to unravel them. It was clear, however, that no return could be paid to either the creditors or the shareholders. The liquidation was left in the hands of the Official Receiver.

MULTIRAY WIRES & ALLOYS, LTD., 34, Ludgate Hill, London, E.C.—Under a winding up order made against this company on December 10th on a creditor's petition the statutory meetings of the creditors and of the shareholders were held on January 16th at Carey Street, W.C. A statement of affairs was submitted showing ranking liabilities of £1,103, net assets of £14, and a total deficiency of £3,089 with regard to the shareholders. It appeared that the company was registered on March 17th, 1927, with a nominal capital of £2,000 divided into shares of £1 each, its objects being to take over from Thomas Brown his formulæ for the manufacture of nickel chrome alloy billets to be drawn into wire for use in the construction of electrical fires and stoves, &c., and generally to carry on business as founders. Eric Pickard was the promoter of the company and he had stated that there was and still is a great commercial demand for a pure nickel chrome

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alloy for use in electrical heaters. On March 23rd, 1927, an agreement was entered into between Brown and the company whereby for a consideration of £1,050 to be paid in shares of the company Brown sold to it his formulæ. As a result of an apparent misunderstanding the company was carrying on business with insufficient capital from the outset. Both during negotiations with a Swiss company for the acquisition by that company of the right to manufacture and sell the products of the alloy in Switzerland, France, and Italy, and to supply to the company such quantities as it had demand for in Great Britain, and also afterwards, the company carried on business in the manufacture, sale of castings, &c., in nickel chrome alloy and also experimented with a special product in stainless iron. It appeared to have obtained some extremely good orders but did not possess the capital to carry them out profitably. An overdraft was obtained from the bank on the guarantee of the directors, and one of their number advanced small sums from time to time to enable wages to be paid. According to the books of accounts sales had amounted to £6,473, resulting in a gross profit of £813 and a net loss of £1,019. Shortly before the petition to wind up was presented various judgment creditors levied execution on the company's effects, and on the seizure and sale of them by auction the company's business came to a standstill. The total assets were unlikely to prove enough to pay the costs and expenses of the liquidation and petition. The failure and insolvency of the company was attributed to the shortage of working capital occasioned by the failure of the projected arrangement with the Swiss company the fulfilment of which was calculated to provide the company with ample capital and be the source of considerable profit in the sale of the nickel chrome wire. The meetings resulted in the liquidation of the company remaining in the hands of the Official Receiver.

MOHAWK RADIO, LTD., wireless dealers, 252, Fratton Road, Portsmouth.—The statutory meeting of the creditors was held on January 15th, at 50, Gresham Street, E.C. Mr. A. A. Reeves, I.A., of Bradford, the liquidator, occupied the chair. The statement of affairs submitted showed ranking liabilities of £2,220. The net assets were £392, and there was a deficiency of £1,828. The estate showed approximately 3s. 6d. in the £. The liquidator stated that the principal cash creditor was Mr. T. O. Peet, who had advanced the company sums totalling £742, whilst Mrs. Peet had lent £300. The Mohawk Service and Fitting Station, Ltd., were also creditors for £356. The issued capital of the company was £800, all of which was fully paid. The business was commenced in December, 1926, as the Mohawk Radio Co. During the half-year to June, 1927, the turnover was £936, with a gross profit at the rate of 45 per cent., and there was a net profit of £106. The company was registered on December 10th, 1927, but it took over the business as from June of that year. During the year to June, 1928, the sales were £1,882, but the gross profit was only at the rate of 11 per cent., and, after allowing for all the expenses, there was a net loss of £973. Since June of last year the sales had only been £740, with a gross loss of £421, and a net loss of £1,270. In reply to a question, the chairman said that the gross loss during the last six months must have been brought about through the company being obliged to cut prices. A creditor asked what had happened to the business, and the liquidator replied that he had been hoping to sell it as a going concern. He was afraid, however, that that was not possible. He had, however, been continuing the business and realising the stock. No definite resolution was passed, but the opinion was expressed that the voluntary liquidation of the company should be continued, with Mr. Reeves as liquidator.

MUNICIPAL CONTRACTS, LTD.—A meeting of members is called for February 18th at 3, Warwick Court, Gray's Inn, W.C.1, to hear an account of the winding up from the liquidator, Mr. A. H. Partridge.

FLUORADS, LTD.—Meeting of creditors held January 21st. Particulars of claims to be sent to the liquidator, Mr. W. Elles-Hill, 41, Bedford Square, W.C.1, by January 30th.

IMPROVED APPLIANCES, LTD.—A general meeting of members is called for February 21st at 43, Fetter Lane, E.C.4, to hear an account of the winding up from the liquidator, Mr. H. R. Reid.

COUNTY ELECTRICAL & WIRELESS STORES, LTD.—A petition for the winding up of this company has been presented to the High Court, and will be heard by Mr. Justice Romer on January 28th.

Dissolutions of Partnership.

LANSING EQUIPMENT CO., electric truck manufacturers and agents, 96-98, Victoria Street, S.W.—Messrs. F. E. Bagnall and H. F. Anns have dissolved partnership. Mr. Bagnall will attend to debts and continue the business.

NELSON & FLEET, electrical engineers, 38, Fylde Street, Preston.—Messrs. J. H. Nelson and S. Fleet have dissolved partnership. Mr. Fleet will attend to debts and continue the business in his own name, while Mr. Nelson will commence business under his own name at 36, Ribble Bank Street, Preston.

Private Arrangements.

LAWFORD CARR HUTTON, trading as The Sports and Radio Stores, Queen's Parade, New Southgate, N.11.—This debtor executed a deed of assignment for the benefit of his creditors in September, 1926. Under this deed Mr. Charles Latham, of the Wireless and Radio Trades Guardian Association, Ltd., acted as trustee, and the business has since been carried on under his supervision, and is still being continued. Dividends have been distributed from time to time, and it is now stated that a final dividend of 5s. in the £ is being paid, making 20s. in all.

Receiver Appointed.

ATTAIX, LTD.—Mr. H. C. Merrett, 32, Finsbury Square, E.C.2, has been appointed receiver for the debenture holders, and the business is being offered for sale as a going concern to-day (Friday).

Trade Announcements.

The offices of the BRITISH PERLIT IRON CO., LTD., have been removed from London to 9, Rumford Street, Liverpool. Mr. J. A. Smeeton has resigned the managing directorship, but continues as a director. Mr. F. G. Martin, B.Sc., F.I.C., has been appointed technical manager.

On Tuesday last, Messrs. J. W. RUSSELL, LTD., electrical engineers and contractors, moved to new premises at 18, Queen's Road, Watford, where they have opened showrooms.

The WELSBACH LIGHT CO., LTD., states with regard to recent Press announcements relating to the sale of the freehold of its premises in Gray's Inn Road, that no move in the immediate future is contemplated.

Mr. W. C. SNOOK, trading as the Central Electric Service, has opened new premises at 42a, Portland Street, Brighton; he asks for price lists, &c., from radio manufacturers.

New Catalogues and Lists.

Messrs. DREW, CLARK & CO., whose showrooms are at 19, Ludgate Hill, E.C.4, have issued a reduced price list of extension ladders, &c.

MESSRS. LANDIS & GYR, LTD., North Acton, W.3.—Illustrated list describing their "Trivector" new kilovoltampere meter.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Special Publication No. 7976/0-1, containing excellent illustrations and descriptive particulars of various electric locomotives that have been supplied by the company during the last year or two to the North-Eastern and Metropolitan railways at home, and to Indian, South African, Brazilian, and other railways overseas.

OMEGA LAMP WORKS, LTD., Rodney Place, London, S.W.19.—Price leaflet relating to "Omega" lamps.

BRITANNIA MANUFACTURING CO., LTD., Britannia Street, City Road, N.1.—Circular tabulating various pieces of electrical service work done by them for many classes of works and customers, and the money value of each contract.

MESSRS. NASH & HULL, LTD., 87, New Oxford Street, W.C.1.—Booklet describing the company's illuminated "Flexlume" and other signs, controllers, and so on. Illustrated.

VERITYS, LTD., Aston, Birmingham.—Stock list of "Verity Heemaf" high-torque motors, January, 1929.

VULCANISED FIBRE, LTD., Broadford Mills, Shalford, Guildford.—16-page booklet containing an illustrated description of the company's mills at Guildford, and tabular particulars of their "Castle" fibre for electrical and other purposes.

MESSRS. SMITH METERS, LTD., 186, Kennington Park Road, S.E.1.—Booklet describing the new Smith type A single-phase meter.

SIMMS MOTOR UNITS, LTD., Percy Buildings, Gresse Street, Rathbone Place, W.1.—Booklet describing Simms-Jurid link couplings. Illustrated.

ELECTRICAL APPLIANCES (BLACKPOOL), LTD., 5, Bloomfield Road, Blackpool.—An illustrated catalogue giving details and prices of switch-plugs, lampholders, &c.

MESSRS. J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham.—Folder A.4, containing illustrations and prices of the company's two- and three-pin plugs and sockets; and Folder S.8 describing, with illustrations, "Tucker" cooker control units.

THE STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, E.C.4.—Catalogue 1,075, dealing in a very thorough manner with mechanical draught and cinder elimination. Illustrated.

Licence Refused.

The Public Control Committee of the London County Council decided last week not to renew the licence of the Russell-Hart Co., Ltd., to carry on an employment agency at Goschen Buildings, Henrietta Street, Strand, W.C. The company's application was opposed by the National Union of Commercial Travellers.

Spanish Import Duty Modifications.

The *Board of Trade Journal* for January 10th gives details of modifications in the Spanish Customs tariff which took effect on January 1st. The "second column" tariff is revised and re-established as the minimum tariff applicable to countries in treaty relations with Spain. Among the classes of goods affected are steam turbines, generating plant, motors, switchgear, fusegear, telegraph and telephone apparatus, electric locomotives, &c. In practically all of these cases the new minimum rate represents a reduction.

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The Electrical Contractors' Dinner.

The annual dinner of the E.C.A. Allied Associations took place at the Savoy Hotel, London, on Tuesday evening last. Mr. W. H. Walton (president) took the chair, and the principal guests were Col. Wilfrid Ashley, M.P., Minister of Transport; Lt.-Col. K. Edgcumbe, president of the Institution of Electrical Engineers; Mr. T. P. Wilmshurst, M.B.E., Electricity Commissioner; and Mr. Frank Hodges, member of the Central Electricity Board. The company numbered nearly 300. A report of the speeches will appear in our next issue, but we may say now that Col. Ashley in his speech expressed the hope that a body with which he was personally acquainted would be able, in the near future, to select a rural area and offer electricity to the inhabintants on favourable terms for the purpose of discovering whether there was an earnest desire for electricity among the rural population of the country. Afterwards, in reply to our representative, he said that this should not be taken to mean that the Government would make a grant.

Employment during December.

The January *Ministry of Labour Gazette* states that employment in the engineering industry during December was slack on the whole, but showed an improvement in all districts and in nearly all sections. Conditions were good in the electrical engineering branch. As compared with December, 1927, employment showed a decline. The total number of unemployed in the engineering industry as a whole was 87,511, and the proportion was reduced from 9.6 to 8.9 per cent. In the electrical engineering branch there were 3,732 unemployed, the proportion falling from 5.2 to 4.7 per cent. The electrical wiring and contracting industry reported 991 unemployed, the proportion remaining at 6.4 per cent. There was an improvement in the electric cable, wire and lamp manufacturing group, the number of unemployed falling to 4,202 and the proportion from 5.2 to 4.9 per cent.

Calendar.

A bureau blotting book with artistic cover and calendar for 1929 has been issued by the BOSTON AND DISTRICT ELECTRIC SUPPLY CO., LTD.

Social Events.

The increasingly popular annual staff dinner of the Osram-G.E.C. Lamp & Glass Works and M.O. Valve Works, which was held on Friday last, as usual, at the Café Royal, Regent Street, was this year something in the nature of an experiment, both female and male members of the staff being present. The function seemed to be none the less successful for the mixing of the sexes. Mr. Chris. Wilson, director of the works, occupied the chair, and was supported by a number of directors of the General Electric Co., Ltd. Sir Hugo Hirst, chairman of the company, was prevented from attending for the second year in succession; on this occasion he was abroad with the Economic Mission in Australia. After the loyal toast, Mr. W. G. Woodward proposed "The G.E.C." Speaking of the good relations which existed between the employers and employés, he remarked that the company had paid £150,000 into the superannuation fund since its inauguration. The appointment of Sir Hugo Hirst to the Economic Mission was a compliment to the company and its staff generally. In reply, Mr. Max Railing, director of the company, briefly traced the development of the company since its inception in 1893. Commenting on present-day activities, he mentioned that among recent contracts obtained by the company were those for the Embankment lighting and for the telephone transmission from Cairo to Alexandria. Mr. F. P. Driver warmly welcomed the visitors, and Mr. W. H. Williams replied. Mr. D. Rusden proposed "The Chairman," and Mr. Wilson's reply concluded the first half of the programme. The rest of the evening was devoted to musical and other items by selected entertainers.

The third annual staff dinner and dance of the Enfield Cable Works, Ltd., was held on January 19th, at the Midland Grand Hotel, St. Pancras, the Earl of Verulam, chairman of the company, presiding. Mr. A. B. Collins, in proposing the toast of the "Enfield Cable Works, Ltd.," said that four or five years ago the company was referred to as the puppy of the industry, but this appellation had since been shorn of its implication. Thanks were due to the "skipper," Mr. Plutte, who more than anyone else had been responsible in guiding the company safely through many waters. He referred with regret to the death in the latter part of 1928 of Mr. Frank Richardson. In responding to the toast, the Earl of Verulam said the past year had been one of neither great success nor anxiety, but if 1929 bore out the promise of the opening month, the company would be faced with the problem of an excess of orders. This problem could be solved, however, with the co-operation of the staff, and such social functions were of great assistance in gaining this end. Mr. W. Fraser proposed the toast of "The Chairman," and was supported by Mr. F. Plutte. During the evening excellent musical items were rendered by Messrs. P. F. Deakin and E. C. Pentney, Mr. and Mrs. Collins, and the Berts Cabaret Dance Band; a successful function was concluded with dancing.

On the invitation of Mr. and Mrs. Robson, the employés of Messrs. Robson & Coleman, their wives and friends, were entertained to a whist drive, supper and dance at the Minories Assembly Rooms, Newcastle, on January 18th; about 100 were present. During the evening Mr. Turpin presented Mr. and Mrs. K. Smith with a timepiece and set of vases on the occasion of their marriage. Music was supplied by Mr. J. P. Anderson's Orchestra.

The first annual dinner of the Elliott Long-Service Association (Elliott Bros. (London), Ltd.), was held on January 11th, at the Green Man Hotel, Catford. Forty-one of the 48 members were present, illness being responsible for the absence of the others, including the president, Mr. W. O. Smith (chairman of the company). The vice-president, Mr. G. T. Cooper, was chairman for the evening. The toast of "Absent Members" was proposed by Mr. L. W. Smith (a director). Mr. J. Sandeman proposed the toast of "The Company," and Sir Keith Elphinstone, K.B.E., replied. The health of "The Chairman" was proposed by Mr. W. F. Beaden, and Mr. Cooper briefly responded. A musical programme was interspersed between the speeches.

On Friday, January 4th, the A.T.M. Male Voice Choir acted as hosts to a party of over 300 of the poorest children in the Fairfield district of Liverpool. The venue was the Strowger Works Canteen, which was gaily decorated for the occasion, and housed a giant Christmas tree. Here a substantial meal was served, followed by an entertainment. Before leaving, each little guest was handed a toy by Mrs. J. Nixon, wife of the works manager, and, as a parting gift, received three new pennies and a bag of fruit from the hosts.

Recent Contract.

The ENGLISH ELECTRIC CO., LTD., has received orders from the Bradford Corporation tramways for 11 complete single-deck four-wheel electric trolley omnibuses and six complete double-deck top covered six-wheel electric trolley omnibuses. The single-deck vehicles will each have a seating capacity for 34 passengers and will be equipped with a 60-h.p. motor, and the double-deck vehicles will each have a seating capacity for 56 passengers and will be equipped with two special 40-h.p. motors. Both types of vehicle will be equipped with "English Electric" standard foot-operated controller and rheostatic braking. The company has previously received orders for 16 electric trolley vehicles from the Bradford Corporation.

Canadian Preference Stipulations.

The Canadian Government has been receiving a series of vigorous representations from different British manufacturing interests about the probable effects of the recent Customs order which ordains that goods seeking the British preference should contain 50 per cent. of Empire labour and material. Manufacturers of the coarser cottons and firms which use copper as a raw material are complaining that the change will have the result of curtailing the preferential privileges, and are asking for a list of exemptions such as Australia allows. Firms which import half-finished goods from the European Continent and perform the final processes in Great Britain in order to get the advantage of the preference are also protesting. The Government has arrived at no decision.

Wages in the Engineering Industry.

The report of a special committee on wages policy is stated to be under consideration by the executives of the trade unions of the engineering industry. According to Mr. W. Sherwood, president of the Federation of Engineering and Shipbuilding Trades, after studying the report the unions will decide whether to put forward another claim for a national increase or concentrate upon obtaining higher wages in the more prosperous sections of the industry.

Unemployment.

There was a decrease of 68,130 in the number of registered unemployed during the week ended January 7th. At that date the total was 1,452,600, as compared with 1,520,730 on December 31st, 1928, and 1,232,070 on January 9th, 1928.

Australia and the Economic Mission's Report.

The Melbourne correspondent of *The Times* says that little discussion has so far been excited in Australia by the report of the British Economic Mission (summarised in our last issue, p. 121). It is thought that this may be due to the holidays. There has been some criticism of the report in Labour circles. Both agreement and disapproval have been expressed regarding the Commission's remarks upon compulsory arbitration.

Philips Lamps in Belgium.

The Belgian company La Lampe Belge proposes to increase the share capital from 2,000,000 fr. to 10,000,000 fr. by the issue of 8,000 shares of 1,000 fr.

German Cable Syndicate.

A meeting of representatives of cable manufacturers was held recently in Berlin for the purpose of attempting to revive the former syndicate for conductor wires. It was generally admitted that the present selling prices of insulated wires were below the costs of production, and that therefore measures were necessary for raising the level of prices, but the discussions failed to reach the desired result owing to the quota demands on the part of some makers.

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An American Supply Company and Appliance Sales.

At a New York luncheon on January 9th, Mr. M. S. Sloan, president of the New York Edison Co., announced that his company was beginning a new policy of direct merchandising of electrical appliances instead of merely displaying and demonstrating appliances and receiving orders from manufacturers and dealers. He said that the company was entering the merchandising field honestly, honourably, and fairly; it would not cut prices or do anything else, directly or indirectly, to place any contractor or dealer under unfair competition. It would endeavour to stimulate that branch of its business by advertising, as it did other branches, and he believed that this would be beneficial to others who dealt in electrical appliances.

Incorporated Municipal Electrical Association.

An advertisement appears under our "Official Notices" today for a secretary (male) for the above Association to act under the instructions of the honorary secretary. The salary offered is £700 per annum.

Central Electricity Board Contracts.

The Central Electricity Board has placed contracts, amounting in all to approximately £400,000, for the construction of the 132,000-volt transformers for the area of the South-East England scheme, with Messrs. Ferranti, Ltd., Hollinwood, and the Fuller Electrical and Manufacturing Co., Ltd., Chancery Lane, London.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price Jan. 22	Fortnight's inc or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) "	£52	...
a Bisulphide of Carbon ... ... "	...	...
a Borax ... ... "	£25	...
a Copper Sulphate ... ... "	£25 10s.	...
a Potash, Chlorate ... ... per lb.	8¾d. to 4d.	...
a " Perchlorate ... ... "	5½d.	...
a Shellac ... ... per cwt.	£18 10s.	...
a Sulphur, Commercial ... ... "	£11	...
a " Roll ... ... "	£11	...
a Soda, Chlorate ... ... per lb.	3d.	...
a " Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	3¾d.	¼d. inc.
METALS, &c.		
b Aluminium, Ingots ... ... per ton.	£95 to £100	...
b " Wire ... ... per lb.	1/1 to 1/9	...
b " Sheet ... ... "	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£200	£2 dec.
Grade II ... ... " "	£140	£1 dec.
Grade III ... ... " "	£75	£1 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	10⅝d.	...
c " Tubes (solid drawn) ... ... "	1/0¼ to 1/0½d.	¼d. dec.
c " Wire, basis ... ... "	10⅝d.	...
c Copper Tubes (solid drawn) ... "	1/2¼	¼d. dec.
c " Bars (best selected) ... per ton.	£102	...
c " Sheet ... ... "	£102	...
c " Rod ... ... "	£102	...
d " (Electrolytic) Bars ... "	£78 15s.	70/- inc.
d " " Sheets ... "	£148 10s.	...
d " " Wire Rods "	£88 15s.	70/- inc.
d " " H.C. Wire per lb.	11s.	1/16d. inc.
f Ebonite Rod ... ... "	2/8 to 2/6	...
f " Sheet ... ... "	2/8 to 2/6	...
n German Silver Wire ... ... "	2/2	...
h Gutta-percha, fine ... ... "	nom.	...
h India-rubber, Para fine ... ... "	11¾d.	¾d. inc.
l Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
l " Wire, galv. No. 8, P.O. qual. "	£21	...
g Lead, English pig ... ... "	£23 10s.	...
g Mercury ... ... per bot.	£22 2s. 6d. to £22 7s. 6d.	2/6 to 7/6 dec.
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e " " medium "	4/- to 8/-	...
e " " large ... "	10/- to 20/- & up	...
p Phosphor Bronze, plane castings "	1/8¾	...
p " " drawn bars & rods "	1/8¾	...
p " " rolled strip & sheet "	1/8¾	...
p " " wire... ... ... "	1/4¾	...
o Platinum ... ... per oz.	£14 5s.	£2 dec.
d Silicium Bronze Wire ... ... per lb.	1/-	¾d. inc.
r Steel, Magnet, in bars ... ... "	7¾d.	...
n Tin, Block (English) ... ... per ton.	£222 to £222 10s.	£3 to £3 5s. dec.
n " Wire, Nos. 1 to 16 ... ... per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on the lead position on January 19th, Messrs. James Forster & Co. stated: "There is no fresh feature to report this week. Home demand has been a little better, the recovery in prices mid-week being probably due to this fact. Arrivals are fairly full. Conditions on the Continent remain quiet. No real revival in demand is in sight yet, and until that makes itself felt we must expect the market to remain in its present apathetic state."

Lighting and Power Notes.

Australia.—VICTORIA.—The ninth annual report of the Victorian State Electricity Commission covering the year ended June 30th last shows a total revenue of £1,511,471, as compared with £1,180,993 in the preceding year. Operating expenses were £756,214, interest £533,832, and depreciation £219,553, leaving a net profit of £1,872, as compared with a loss of £196,654 in 1926-27. According to the *Electrical Engineer of Australia and New Zealand*, this is the first year the Commission has been able to show a profit. The capital expenditure increased from £9,568,182 to £11,147,772. The electrical energy generated at Yallourn increased from 238,757,302 to 319,656,450 kWh, and the amount at Newport B station from 45,438,629 to 54,103,425 kWh. The sales of electricity increased from 245,752,546 to 319,282,728 kWh. Extensions are to be made to the briquette factory, and orders have been placed for additional plant, including four water-tube boilers and two 10,000-kW turbo-alternators. The total cost of the extensions is estimated at £725,000, and the new plant is to be in operation by the end of 1930. Extensions to be carried out at Yallourn include three 25,000-kW turbo-alternators and 12 additional boilers. During the year the Commission's hydro-electric scheme on the Rubicon River was put into operation. Preparations are being made to extend the supply into the north-western portion of the State, and the Commission proposes to take over the local undertakings in the cities of Ballarat and Bendigo when the franchises expire in 1931. A ring main is to be constructed from Melbourne through these cities. Already construction has been commenced on the first portion of this line, running to Castlemaine *via* Kyneton. Negotiations are in progress with a view to the Commission operating the electric tramway systems in these cities, and also at Geelong when it takes over the electricity supply.

Barnsley.—CHANGE-OVER.—At a recent meeting of the Corporation Electricity Committee, the borough electrical engineer reported upon a proposal for laying h.p. feeders in the borough in connection with completion of the change-over from d.c. to a.c., and the Committee decided to apply for sanction to a loan of £2,322 to cover the cost of the first portion of the scheme.

Birkenhead.—ELECTRICITY IN BULK.—The town clerk has reported to the Corporation Electricity Committee that the agreement for a bulk supply of electricity to the Hoylake and West Kirby Urban District Council has been approved by the Electricity Commissioners.

Bradford.—STREET LIGHTING.—The Corporation Street Lighting Committee has decided to establish electric street lighting at Tong, a district hitherto lighted by gas. The conversion involves the erection of 600 electric lamps.

Bury St. Edmunds.—ASSISTED WIRING SCHEME.—The Town Council has adopted an assisted wiring scheme, and a loan of £1,200 to cover the cost is to be applied for.

Canada.—ELECTRICAL DEVELOPMENT.—On November 28th, the Ontario Hydro-Electric Power Commission brought into operation the new 110,000-V transmission line linking up Smith Falls, Brockville, and other centres in eastern Ontario with the generating plants of the Gatineau Power Company on the Quebec side of the Ottawa River. Following upon the linking up of the Paugan Falls plant on the Gatineau River with the city of Toronto by the 220,000-V transmission line placed in commission on October 1st, the opening up of the new power line ranks as second in importance in the supply of hydro-electric energy for use in the Province of Ontario. The new line from the Farmers' Rapids plant on the Gatineau River crosses the Ottawa River at Remic Rapids, west of the city of Ottawa, where delivery is made to the Ontario Hydro-Electric Power Commission under a contract calling for the delivery of 60,000 h.p., in minimum annual increments of 6,000 h.p. over a period of ten years, and with an additional 40,000 h.p. in reserve.

Chesterfield.—LOAN.—The Corporation Electricity Committee has received sanction to the borrowing of £4,700 for the extension of the overhead equipment to New Whittington.

Clydebank.—ALL-ELECTRIC HOUSES.—The Town Council, at its last meeting, decided that the 346 houses to be erected by the Corporation on the Park Hall site shall be "all-electric."

Continental.—AUSTRIA.—A new hydro-electric power station has recently been completed at Pernegg by the Styrian Electric Supply Co. The plant comprises three vertical shaft Francis turbines and generators, each of 8,000 kVA capacity, generating electricity at 5,200 V at 150 r.p.m., and three transformers for stepping up the energy to 20,000 and 60,000 V.

Dalkeith.—SALE OF UNDERTAKING.—It is reported that the Town Council has agreed to the sale of its electricity undertaking to the Lothians Electric Power Co., Ltd. The company undertakes that the price of electricity in Dalkeith will be reduced to the same rates as those ruling in the adjacent area of the county, the alterations to be given effect to immediately the sale is completed. The undertaking was purchased by the Council from the Electric Supply Corporation, Ltd., about three years ago, at a cost of £18,000, and £12,000 has since been expended in changing over from d.c. to a.c., and in extensions of the system.

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Eaglesham (Glasgow).—INAUGURATION OF SUPPLY.—A supply of electricity was switched on by Mr. Thomas Wallace, J.P., on January 11th. The streets are lighted by 26 lamps, and the system, with the exception of one street, employs overhead lines. The installation has been carried out under the superintendence of Mr. Johnstone, engineer to the Clyde Valley Electrical Power Co.

Guildford.—INQUIRY.—Colonel T. C. Ekin held an inquiry on January 15th respecting electricity schemes for the rural portions of West Sussex, Hampshire and Surrey. There were seven applications for Special Orders, three by the Aldershot Gas, Water and District Lighting Co., and others by the Power Development Co., Ltd., the Steyning Electric Light Co., Ltd., the Alton District Electricity Co., Ltd., and the Petersfield Electric Light & Power Co., Ltd. The Aldershot Co. stated that its proposed charges were 9d. per kWh for lighting, and 5d. per kWh for heating and power. There was opposition on the part of the Thakeham Rural Council, which suggested that the Aldershot scheme would not lead to the proper development of the area. The West Sussex County Council doubted whether the company could give supplies within the period; the Horsham Rural Council requested the Commissioners to carefully consider the merits of the competitive schemes; and the Billingshurst Council considered that the maximum prices were excessive, and that overhead lines would destroy the beauty of the countryside. The Godalming Gas, Light & Coke Co. also objected on the ground that it was not expedient for one gas company to compete with another, and that there was no demand for electricity in the parishes of Chiddingfold, Hambledon, and Witney, but it was pointed out that the Hambledon Urban District Council had asked for the extension of the mains to its district. Petersfield Rural District Council supported the Aldershot Company's scheme in preference to the Petersfield Electric Light Company's scheme. The inspector intimated that if mains were not laid in three years, the Ministry of Transport had power to revoke the Order.

Hastings.—LOANS.—The Town Council has applied for sanction to loans of £2,500 for services, £1,000 for mains and overhead lines, and £500 for transformers.

Leicester.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has made an agreement with Boots' Cash Chemists (Eastern), Ltd., for the supply of electricity for the lighting of 34 and 36, Gallowtree Gate, subject to a fixed annual charge of £600 per annum on a connected load not exceeding 50 kW, and an additional annual charge of £12 per kW for every kW over 50 connected, plus a charge of 1½d. per kWh for all electricity consumed.

London.—BERMONDSEY.—The Borough Council Electricity Committee has been asked by the L.C.C. to undertake the wiring of the new flats in connection with its housing scheme in Hankey Place. The Committee has agreed to do this on condition that the buildings do not include gas lighting.

ST. PANCRAS.—The Electricity and Public Lighting Committee has recommended that a bulk supply of electricity be given to the L. & M.S. Railway Co., at Euston Station, and that, providing the company accepts the terms, h.p. mains be laid at an estimated cost of £4,300. The proposed terms are £3 16s. per kW, and ¾d. per kWh up to 1,000,000 kWh, and beyond this ½d. per kWh. The company's maximum demand would be 600 kW, representing a consumption of 1,576,800 kWh per annum for a period of seven years. The revenue from the company would be approximately £4,496 per annum.

Manchester.—PROGRESS DURING NOVEMBER.—During the month of November the Corporation electricity undertaking showed an increase in connections of 1,268 kW, bringing the total up to 367,663 kW; and the number of applications received for supply, including those for additional supplies, was 1,463, representing a total of 2,412 kWh. The number of hired cookers connected increased by 63, bringing the total actually on circuit to 4,947. Applications for the hire of cookers totalled 94. The maximum load recorded was 152,200 kW, but this was exceeded on December 11th, when the maximum load reached 155,940 kW. Two new sub-stations were put into commission at the works of the English Sewing Cotton Co., Ltd., and the L. & N.E. Railway Co., and additional plant was installed at six existing sub-stations.

Middleton.—SUPPLY TO HOUSING ESTATE.—The Town Council has had before it two schemes for giving a supply to the Mainways housing estate: (1) Laying a h.p. cable to a new sub-station, and l.p. distributors to the 70 new houses, the cost being £3,470; and (2) erecting overhead l.p. lines and the necessary distributors at a cost of £1,500. The Council has decided that although the first scheme will entail an annual loss it has more to commend it than the other. It has, therefore, been adopted.

Otley.—ELECTRICITY SUPPLY.—The Urban District Council is to change over the street lighting from gas to electricity, and has accepted a draft agreement submitted by the Electrical Distribution of Yorkshire, Ltd.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

ST. HELENS.—The advance on the pre-war charges for lighting and power reduced from 35 to 20 per cent.

BRIERFIELD.—Lighting: A reduction of ½d. per kWh.

FORMBY (LANCS.).—Lighting: From 7d. to 6½d. per kWh.

The Weald Electricity Supply Co., Ltd.—Lighting: From 11d. to 10½d. per kWh.

Richmond (Surrey).—CHANGE-OVER.—The Richmond (Surrey) Electric Light & Power Co., Ltd., has notified the Borough Council of its intention to alter the system of supply from d.c. to a.c.

Stockton-on-Tees.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £10,000 for prospective expenditure for mains and services.

Sittingbourne.—ELECTRICITY SCHEME.—The Kent Electric Power Co. has informed the Urban District Council that under its existing statutory powers it has decided to provide a supply of electricity for the town and Milton Regis. Steps are being taken to provide transmission lines, a sub-station, and other works, with a view to a supply being available before next winter.

Special Order.—Application has been made to the Electricity Commissioners by Messrs. P. W. Harries and T. J. Harries for consent to establish a generating station at Clyfon Mill, St. Clears, and to distribute electricity in the districts of St. Clears and Laugharne.

Torquay.—LOAN.—The Corporation Electricity Committee is applying for sanction to a further loan of £13,000 required during the next twelve months for the provision of mains and services throughout the area of supply.

PURCHASE OF UNDERTAKING.—The Committee has received a letter from the Teignmouth Electric Lighting Co., Ltd., intimating that it is prepared to sell the Buckfastleigh undertaking to the Corporation for the sum of £12,500. The Committee has decided that it cannot recommend the Council to make any offer which the company would be likely to accept, and it therefore recommends that the price be decided by arbitration and the town clerk has been authorised to engage an expert witness, and if need be counsel, to advise the Corporation in the matter.

Uttoxeter.—ELECTRICITY IN BULK.—The Urban District Council has arranged to obtain a bulk supply of electricity from the Burton-on-Trent Corporation electricity works.

Wigan.—FRINGE ORDERS.—The Rural District Council has given its consent to the application of the Corporation for three Fringe Orders to supply electricity to Wrightington Hall, the Grove Chemical Works, Appley Bridge, and to St. Joseph's College, Upholland, prior to obtaining Special Orders for Standish and Upholland. The Corporation will supply electricity for lighting at 5d. per kWh, as compared with 5½d. in the borough, and for heating at 1½d. per kWh, as against 1d. per kWh. Power prices will be the same as in Wigan, but not subject to the same deductions.

Tramway and Railway Notes.

Aberdeen.—PROPOSED RAILWAY ELECTRIFICATION.—The question of the electrification of the Aberdeen suburban railways which has frequently been discussed has again been raised. It is pointed out that there are about 300 trains leaving the joint station daily.

Bradford.—RAILLESS CARS.—The Corporation is seeking powers to establish railless-car services on 40 routes, 10 of which will be outside the borough area.

Continental.—SWEDEN.—A *Reuter* message from Stockholm states that no fresh electrification programme will be carried out this year, but an inquiry is being made into the possible electrification of the Stockholm-Upsala, Hallsverg-Oerebro and Stockholm-Malmoe lines, all of which have considerable traffic. The electrification of the Stockholm-Gothenburg line has apparently had good results from the economic point of view, although a complete report on the first year of full traffic is not yet available.

New Light Railways.—According to *The Times*, the Southern Heights Light Railway, authorised by the Ministry of Transport confirmation of Order, dated December 29th, will be a single-track from the junction of the Southern Railway main line at Orpington to a point near the junction with the Croydon and Oxted branch of the Southern Railway near Sanderstead Station. The line will pass through the Kentish parishes of Farnborough, Keston, Downe, Cudham, and Westerham, and the Surrey parishes of Tatsfield, Titsey, Chelsham, and Warlingham. It will touch the highest points in Kent and Surrey, and the total length will be 15½ miles. It is intended to electrify the new line. The opposition entered at the Ministry of Transport inquiry by the local authorities and landowners has been withdrawn or settled on agreed terms. There will be no level-crossings over public roads, but 23 bridges will be built. The length of the contract will be from 18 months to 21 months. The capital of the company will be £400,000 in ordinary shares and £250,000 in preference shares. The Southern Railway will work and maintain the line and will take 75 per cent. of the receipts. The engineer and promoter of the scheme is Colonel H. F. Stephens.

The Minister of Transport has recently made the Jarrow East End Light Railway Order, 1929, authorising the construction of a light railway in the borough of Jarrow in the County of Durham.

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Telegraph and Telephone Notes.

Argentina.—WIRELESS TELEPHONY.—The International Telephone and Telegraph Corporation has made formal application to the Minister of Posts and Telegraphs for permission to establish a wireless-telephone service between Buenos Aires and New York.—*Reuter's Trade Service* (Buenos Aires).

Dutch East Indies.—WIRELESS TRAFFIC IN 1928.—The wireless-telegraph traffic between Holland and the Dutch East Indies (direct and *via* America) yielded during the fourth quarter of 1928, so far as the Dutch portion of the revenue is concerned, roughly 462,800 florins, compared with 328,000 florins during the corresponding period of the previous year; figures for the whole year 1928 were 1,663,950 florins, compared with 1,107,000 florins in 1927, being an increase of over half-a-million florins, or just over £40,000.—*Reuter* (Amsterdam).

France.—NIGHT TELEPHONE SERVICE.—Under new arrangements which lately came into operation, all telephone exchanges throughout France with more than 200 subscribers are now provided with both night and day services. No fewer than 170 exchanges are affected by the new order, bringing the total provided with a 24-hour service up to over 300 exchanges.

International Telephony.—POLAND.—A direct telephone service between London and Warsaw is about to be established.

Jugo-Slavia.—TELEPHONY AND TELEGRAPHY.—It is reported from Vienna that the Belgrade Government intends to lease all the telephone and telegraph services to private companies.

Railway Communication.—WIRED-WIRELESS.—In a review of the progress of the Great Western Railway during last year it is mentioned that a system of wired-wireless has been adopted, giving an additional channel of communication between Reading and Swindon. Transmission from Reading is on a wave-length of 6,000 metres, and from Swindon of 7,000 metres.

South Africa.—RADIO-TELEPHONY.—The South African Wireless Telegraph Co. decided on January 8th to order equipment for a radio-telephone service with England, which is expected to be in operation within nine months.

According to the *Daily Mail*, the British Post Office is awaiting the end of negotiations in the respective Dominions before beginning tests between England and Australia, South Africa and India; for these services a new receiving station is to be built this year at Baldock, near Hitchin.

Sweden.—TELEPHONE PATENTS.—A patent case of international importance, between the L. M. Ericsson Telephone Co., of Stockholm, and the Automatic Electric Co., of Chicago, U.S.A., has been decided by the magistrates' court of Stockholm. The Chicago Automatic Co. in 1924 sued the Swedish concern for infringement of a patent for a coupling device with automatic line-selection, used when a subscriber is connected with the central exchange by several lines, but has only one call number. The investigation now made of the patent showed that it is not valid, owing to the fact that such automatic arrangements were previously known through descriptions published in technical publications in England and America. The court found that for this reason the patent in question is void, and should not have been granted by the Swedish patent office, and the American concern was ordered to defray the costs of the Swedish company to the extent of 9,000 kronor. In addition to the annulment of the patent, effected through a countersuit brought by the Swedish company against the American one, the L. M. Ericsson Co. proved that even if the patent had been declared valid there would have been no infringement, as it had not been used by the Swedish company, which has branches, affiliated companies, agencies, and factories in 18 different countries.

The "Telfograph."—A TELEPHONE RECORDER.—Great possibilities are claimed for an invention that has been patented under the title of "an improved transmitter and remote recording system and apparatus therefor." Simple in the extreme, it consists solely of a small instrument, a few inches square, which acts either as a transmitter or a receiver of written messages, the connectin medium being either a telephone wire or wireless circuit. Its cheapness (the inventor, Mr. Archibald E. Telford, and the owner of the patent rights, Mr. W. J. Bullimore, stated to the *Morning Post*) supports the claim that it could be used by every telephone subscriber for receiving and transmitting written messages. The instrument contains a small typewriter of one key only, and a revolving drum on which the letters of the alphabet are arranged in suitable formation; a person can tap out the required letters, which are typed on tape automatically at either end of the telephone line. Should the engaged signal be given, the operation can still take place, and a message collected later by people when they return home.

Radio Notes.

Dutch East Indies.—NEW BROADCASTING CO.—The commercial agent at Batavia (Mr. H. A. N. Bluett) has informed H.M. Department of Overseas Trade of a report that the Nederlandsch-Indische Radio-Omroep Mattschappij (Netherlands Indian Broadcasting Co.) will shortly be formed. The company will be established in Holland, and will be represented locally by two delegates. The capital required is f. 600,000, of which f. 300,000 has been promised by Messrs. Maintz & Co., Radio-Holland, and the Philips group in equal shares. The broadcasting station will be built in the neighbourhood of Batavia; it is estimated that it will cost f. 400,000.

Germany.—LICENCES.—The number of subscribers increased during the final quarter of 1928 by 301,314, bringing the total to 2,635,567 on January 1st, 1929. The increase during 1928 was 625,725. Bavaria, in spite of its four transmitters, perhaps owing to the scattered peasant population, has not been able to boast of any great number of listeners, having only about six million inhabitants. According to *World-Radio*, they total now exactly 174,102, against slightly over 151,000 on October 1st. Every listener canvassing a new listener and giving his name and address to a Bavarian radio paper obtains a premium of 2 marks, the cost of a month's licence in Germany (24s. a year). The simultaneous transmitter at Berlin-East, which uses the same wavelength as Stettin and Magdeburg, has begun experimental transmissions.

Jamaica.—BROADCASTING.—Mr. Russell F. Pike, of the Radio Corporation of America, intends to form a wireless broadcasting corporation to be controlled and operated by Jamaica and also that the capital shall be raised on the island. He has received assurances of support from 12,000 Jamaicans of good standing.—*Reuter's* (Kingston).

Russia.—LICENCES.—The number of individual listening licences in the Soviet Union now exceeds 304,000, says *World-Radio*, of which roughly 264,000 represent dwellers in towns, the remaining 40,000 being villagers; the number of crystal-set users is 255,000, and the balance (49,000) have valve sets, and, of the latter, 13,000 have loud-speakers. Thus, 87 per cent. of the receiving sets are in towns and 13 per cent. in the country; 10,000 crystal sets and 300 loud-speaker sets are being used in "houses of detention" (the Soviet substitute for prisons). A Russian expedition has established a radio transmitting and receiving station on the Caucasian mountain Kazbek. Experiments are being carried out at various altitudes up to 5,300 metres. The leader of the expedition is the director of the most northerly station, Tiflis. The Chief Hydrographical Department of the U.S.S.R. has decided to establish a radio station on Cape Jelanyi, 77 degrees of northern latitude, to observe the movement of ice fields and also carry out scientific meteorological observations. It will be the most remote northern station in the world, and, together with those on Matochkin Shar and Yougorsky Shar, will serve the Polar seas.

Siam.—BAN EXPLANATION.—The Prince of Kambaeng Bejra, Minister of Commerce and Communications, explains that the law banning wireless apparatus is designed to protect the pocket of the Siamese citizen. Experiments are under way which are designed to test broadcasting conditions in Siam to find out what type of apparatus is most suited to the climate, the *Evening News* announces. As soon as they are completed, says the Minister, announcement will be made of the type of broadcasting contemplated for Siam and the type of wireless sets most suitable to receive it. Then the ban will be lifted.

Thermionic Valve Impedance.

A paper read before a recent meeting of the Physical Society of London by Mr. L. Hartshorn, A.R.C.S., B.Sc., D.I.C., of the National Physical Laboratory, described the application of the Wheatstone bridge to the measurement of the anode circuit admittance (or impedance) and the mutual conductance of a valve under actual operating conditions. Current of telephonic frequency is used, and the measurements can be made for grid bias of any desired value, while both methods can be made direct-reading. The results of measurements with a few typical valves show that although both anode circuit resistance and mutual conductance vary very considerably with the grid bias, the product of the two, which gives the voltage factor of the valve, is approximately constant. The anode circuit admittance consists of conductance associated with comparatively small capacity, but the latter is larger than the inter-electrode capacities of the valve when the filament is cold. The increase in the effective values of the inter-electrode capacities is explained by the presence of the space charge, which also has the effects of making these capacities vary with the frequency and of giving them a comparatively high power factor, especially at low frequencies.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—February 26th. Posts and Telegraphs Department. Induction coils and registers for telephone work. (B.X. 5031.)*

March 18th. State Electricity Commission of Victoria. Insulators and accessories. (B.X. 4997.)*

Aylesbury.—Electricity Department. 11,000-V switchgear. (January 18th.)

Basingstoke.—January 29th. Electricity Department. One heavy oil engine with a 800-kW, 3-phase, 50-cycle alternator. (January 18th.)

Batley.—February 4th. Electricity Department. L.p. cable. (See this issue.)

Belfast.—January 29th. Public Health Committee. Installation of automatic telephones in the Infectious Diseases Hospital, Purdysburn. (January 11th.)

Belgium.—GHENT.—February 11th. Municipal Council. 16 electric portal cranes. (A.X. 7398.)*

Carlisle.—Electricity Department. One 15,000-kW turbo-alternator and condensing plant. (See this issue.)

Cheadle and Gatley.—February 1st. Electricity Department. H.p. overhead line and outdoor type transformer. Specification from Mr. R. W. Willis, electrical engineer, 37, High Street, Cheadle.

Croydon.—February 7th. Electricity Department. 14,000 tons of coal suitable for use on chain-grate mechanical stokers. (See this issue.)

Denny and Dunipace.—Town Council. Electrical work in connection with the Council's housing scheme. Particulars from Messrs. J. Strong & Wilson, architects, Falkirk.

Dublin.—January 30th. Controller of Stores, Department of Posts and Telegraphs. 6,000 stay rods, fitted with ratchet nuts and washers. (See this issue.)

Egypt.—CAIRO.—March 27th. Ministry of Interior. Supply and installation of an electric lighting system for the town of Fashu. (B.X. 5037.)*

Glasgow.—January 28th. Corporation. Electrical and heating installation at additional police headquarters. Specifications, &c., from Public Works office, 64, Cochrane Street (deposit £3 3s.). Offers to town clerk.

Grimsby.—February 6th. Electricity Department. H.p. steam pipes and valves, circulating-water pipes and valves, water-service pipes and valves. (See this issue.)

Halifax.—February 4th. Town Council. Electrician's work required in erection of 64 houses, Moor Road. Specifications, &c. (deposit £2 2s. each) from Mr. A. C. Tipple, borough engineer, Crossley Street.

India.—February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

London.—CENTRAL ELECTRICITY BOARD.—February 15th. 66,000-V cables (London area) in connection with the South-East England Electricity Scheme. (January 11th.)

February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (January 11th.)

March 4th. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area), and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (January 18th.)

LONDON COUNTY COUNCIL.—February 4th. Wiring and fittings for electric lighting, heating and cooking in 86 tenements on Ossulston Estate. H.p. and l.p. cables, core re-actors, control battery, &c., for Greenwich power station. (January 18th.)

February 7th. Wiring and fittings for electric lighting at the Coroner's Court, Bethnal Green, and the Weights and Measures Office and Coroner's Court, Clapham (about 80 wiring points). (See this issue.)

Leeds.—February 4th. University. Electric wiring, &c., of the mining section of the University. (See this issue.)

February 15th. Electricity Department. Annual contracts for stores. (See this issue.)

Liverpool.—January 31st. Electricity Department. Approximately 190,000 tons best quality 1½-in. or 1¼-in. steam slack, suitable for use on chain grate stokers; also 60,000 tons fine slack, suitable for pulverising, required during year ending March 31st, 1930. Specification from city electrical engineer, 24, Hatton Garden, Liverpool.

Lough Derg, Pettigo (Co. Donegal).—February 14th. Supply, delivery, and erection of two 10-kW heavy oil engine generating sets, storage battery, and switchboard. (January 18th.)

Newmilns (Ayrshire).—February 9th. Town Council. Electrical wiring in connection with the Council's housing scheme. Specifications from the burgh surveyor.

New Zealand.—WELLINGTON.—March 12th. Posts and Telegraph Department. Switchboard cords. (B.X. 5017.)*

April 9th. Public Works Department. Induction voltage regulators for Lake Coleridge scheme. (B.X. 5018.)*

Otley.—February 1st. Urban District Council. Electrician's work required in erection of 40 houses, Westbourne estate. Specifications (deposit £1 1s. each) from Mr. C. F. Hodgson, surveyor to Urban District Council.

Portsmouth.—February 6th. Tramways Committee. Insulating materials, lamps, motor windings, overhead line materials, &c. (January 18th.)

Sheffield.—February 14th. Electricity Supply Department. Turbo-alternator, condensing plant, evaporating and steam preheating plant, water-tube boilers, chimneys, superheaters, stokers, or pulverised fuel firing equipment, economisers, &c., wagon tippers, conveyors and elevators, cooling towers, electrically and hand-operated travelling cranes. (January 11th.)

South Africa.—JOHANNESBURG.—February 14th. Town Council. Two 1,080-kVA transformers. (B.X. 5005.)*

CAPE TOWN.—March 15th. City Council. Metal-clad switchgear. (B.X. 5004.)*

Staines.—February 9th. Board of Guardians. An additional 168 lighting points, including cables, at the Institution, London Road, Ashford, Middlesex. Specifications from Mr. J. H. Tyars, architect, 28, Victoria Street, Westminster, London, S.W.1.

Wandsworth.—February 2nd. Board of Guardians. Reorganisation of the engineering plant at the Tooting Hospital. (See this issue.)

West Ham.—February 18th. Education Committee. Installation of electric lighting at South Hallsville new school, Agate Street, Tidal Basin. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—MELBOURNE.—The *Exchange Telegraph* reports that the British General Electric Co., Ltd., has received the contract for the installation in Sydney and Melbourne of apparatus for the telegraphic transmission of pictures.

Barnes.—Urban District Council. Accepted:—
Supply and maintenance of departmental telephones at the Council House.—Reliance Telephone Co., Ltd.

Bedford.—Electricity Committee. Recommended:—
Two Lea coal meters (£75).—Lea Recorder Co., Ltd.
Electroflo temperature outfit (£30).—Electroflo Meters, Ltd.

Brighton.—Lighting Committee. Accepted:—
New battery at North Road sub-station.—Tudor Accumulator Co., Ltd. (£6,812).
Two 200-kVA transformers (£277).—Ferranti, Ltd.

Dublin.—G.P.O.
Electric lamps.—Edison Swan Electric Co., Ltd.

Edinburgh.—Education Committee. Accepted:—
Installation of electric light at the Leith Academy secondary school (£3,952).—Robert Edgar & Co.

Government Contracts.—The following Government contracts were placed during December, 1928:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Battery.—D.P. Battery Co., Ltd.
Cable.—Anchor Cable Co., Ltd.; British Insulated Cables, Ltd.; Edison Swan Cables, Ltd.; Enfield Cable Works, Ltd.; Pirelli-General Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; India Rubber, Gutta Percha

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and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.
Electrically-driven h.p. air compressors.—G. & J. Weir, Ltd.; P. Brotherhood, Ltd.
Electric jib cranes.—Wharton Crane and Hoist Co., Ltd.; Sir Wm. Arrol & Co., Ltd.
Motor-generators.—Newton Bros. (Derby), Ltd.
Electric lamps.—General Electric Co., Ltd.
Switches, cubicles, &c.—Johnson & Phillips, Ltd.
Electric travellers.—Sir W. Arrol & Co., Ltd.; J. Adamson & Co.
W./t. valves.—Mullard Radio Valve Co., Ltd.

WAR OFFICE.

Electric lamps.—General Electric Co., Ltd.
Cable.—Johnson & Phillips, Ltd.; W. T. Glover & Co., Ltd.
Inert cells.—Siemens Bros. & Co., Ltd.

AIR MINISTRY.

Internal wiring (Boscombe Down).—Cox, Walkers and Partners.
Dynamometers.—Electric Construction Co., Ltd.
Fans.—James Keith & Blackman Co., Ltd.
W./t. valves.—A. C. Cossor, Ltd.; Edison Swan Electric Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Telephone Mfg. Co., Ltd.
Cable.—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover and Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Union Cable Co., Ltd.
Loading coils.—General Electric Co., Ltd.; Siemens Bros. and Co., Ltd.
Conduit.—General Electric Co., Ltd.; Walsall Hardware Mfg. Co., Ltd.
Telephone cords.—Reliance Electrical Wire Co., Ltd.
Ducts.—Albion Clay Co., Ltd.; Oates & Green, Ltd.; Standard Brick and Terra Cotta Co., Ltd.
Electric lighting fittings.—Engineering and Lighting Equipment Co., Ltd.; Revo Electric Co., Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Taylor, Tunnicliff & Co., Ltd.
Electric lamps.—Edison Swan Electric Co., Ltd.
Motor-generators.—Electro Dynamic Construction Co., Ltd.
Flameproof wire.—Macintosh Cable Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Preston-Blackpool No. 2: British Insulated Cables, Ltd.
Electric lighting and power wiring Manchester Central Telephone Exchange.—W. J. Furse & Co. (Manchester), Ltd.
Alterations to power plant and switchgear, Liverpool head P.O.—Metropolitan-Vickers Electrical Co., Ltd.
Short-wave radio-telephony transmitter No. 3 (Rugby radio station).—Standard Telephones and Cables, Ltd.
Telephone exchange equipment.—Pollards (S.W.), Valentine (Ilford), Egham: Automatic Telephone Mfg. Co., Ltd. Maidstone: Standard Telephones and Cables, Ltd. Sub-contractors: Electric Construction Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Aylesford, Barming, Bearstead, Boughton Monchelsea, Hunton, Otham, Wateringbury: Standard Telephones and Cables, Ltd. Sub-contractors: W. Jones & Co., for ringing machines. Bourne End: Standard Telephones and Cables, Ltd.; Clarke, Chapman & Co., Ltd. (Gateshead-on-Tyne). Cardiff Corporation: Relay Automatic Telephone Co., Ltd. Morningside, Murrayfield, Newington, Edinburgh (Central), Swansea, Hitchin: Siemens Bros. & Co., Ltd. Herne Bay: Ericsson Telephones, Ltd. Sub-contractors: Crompton Parkinson, Ltd., for motor generator; Newton Bros. (Derby), Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Fairfield (Croydon): General Electric Co., Ltd. Sub-contractors: Crompton Parkinson & Co., Ltd., for machines; D.P. Battery Co., Ltd., for batteries.
Telephone repeater station equipment.—Glasgow, Liverpool and Manchester: Standard Telephones and Cables, Ltd. Portsmouth and Tavistock: General Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Battery materials.—India Rubber, Gutta Percha and Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Cables.—British Insulated Cables, Ltd.; Hooper's Telegraph and India Rubber Works, Ltd.
Electric fans.—General Electric Co., Ltd.; Metro-Vick Supplies, Ltd.
Overhead-line materials.—Bullers, Ltd.
Radium and containers.—Watson & Sons (Electro-Medical), Ltd.;
Static transformers.—Bruce Peebles & Co., Ltd.
Telephone switchboards.—Ericsson Telephones, Ltd.
Train-lighting spares.—J. Stone & Co., Ltd.
Transformer kiosks.—English Electric Co., Ltd.
Wireless-telephone scheme.—Marconi's Wireless Telegraph Co., Ltd.

H.M. OFFICE OF WORKS.

Electrical engineering labour.—Birmingham: Harrison and Searle, Ltd. Bristol: R. Whipp & Co. Liverpool: F. Martin.
Cable.—National Physical Laboratory: Power Contracts, Ltd.

Kettering.—Electricity Department. Accepted:—
Cables (£1,194).—Union Cable Co., Ltd.
Transformers.—250 kVA (£185), Crompton Parkinson, Ltd.; 250 kVA (£170), Brush Electrical Engineering Co., Ltd.; 50 kVA (£51), Ferranti, Ltd.

London.—L.C.C. EDUCATION COMMITTEE.—Accepted:—
Electrical work at School of Arts and Crafts (cost, plus 15 per cent. on labour and 10 per cent. on materials).—H. J. Cash & Co., Ltd.
LONDON COUNTY COUNCIL.
Feeder panel switches.—Edison Swan Electric Co., Ltd.
ISLINGTON.—Electricity Committee. Recommended:—
Rental and hire-purchase wiring installations.—M. J. T. Thomas & Co.
KEMPTON PARK.—Metropolitan Water Board. Recommended:—
Two sets of centrifugal pumps, one water turbine driven and one electrically driven, at pumping station (£542).—Worthington-Simpson, Ltd.
CENTRAL ELECTRICITY BOARD.—Accepted:—
130,000-V transformers in connection with the South-East England Scheme (value approximately £400,000).—Ferranti, Ltd., and Fuller Electrical & Manufacturing Co., Ltd.

Manchester.—Electricity Department. Accepted:—
6,600-V feeder from West Didsbury to Charlton.—Callender's Cable & Construction Co., Ltd.
Three-inch weldless-steel tubes.—Stewarts & Lloyds, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Tramway points and crossings (£1,098).—Edgar Allen, Ltd.
Two sets of crossings for the pier tramway (£990).—Titan Trackwork Co., Ltd.
Two six-wheel double-deck top-covered trackless trolley vehicles, with pneumatic tires (£2,000 each).—Richard Garrett & Sons, Ltd.

Stockton-on-Tees.—Electricity Department. Accepted:—
Twelve months' supply of l.p. paper-insulated cable.—W. T. Glover & Co., Ltd.

Torquay.—Electricity Committee. Accepted:—
Overhead 11,000-V, 3-phase transmission line from Ipplepen to Dartington (£2,881).—Johnson & Phillips, Ltd.
Vertical shrouded ironclad switchgear for sub-station at Vicary Mills (£815).—Switchgear & Cowans, Ltd.

Wantage.—Rural District Council. Accepted:—
Installation of electric light and central heating at the old Cottage Hospital (£237).—Callas, Son, & May.

Whitby.—Urban District Council. Accepted:—
Electric lift on the Westcliff (£1,417).—William Wadsworth & Sons, Ltd.

Forthcoming Events.

Birmingham Electric Club.—Friday, January 25th. Grand Hotel, Birmingham. 7 p.m. Presidential address.

Association of Mining Electrical Engineers.—Saturday, January 26th. Joint visit to West of Scotland Branch, Glasgow. Discussion. "H.T. *v.* L.T. 'Underground.'"

Institution of Electrical Engineers.—Informal meeting. Monday, January 28th. Institution, London, W.C. 7 p.m. Discussion on "Mains Testing."

(Meter and Instrument Section).—Friday, February 1st. Institution, W.C. 7 p.m. "Recent Developments in Electricity Meters, with particular reference to those for special purposes." Mr. J. L. Carr.

(Irish Centre, Dublin).—Friday, January 25th. Gaiety Theatre, Dublin. 4 p.m. Faraday Lecture on "How Electricity Does Things." Mr. I.l. B. Atkinson.

(North-Eastern Centre).—Monday, January 28th. 7 p.m. "Recent Developments in Electricity Meters, with particular reference to those for special purposes." Mr. J. L. Carr.

(North-Midland Centre).—Tuesday, January 29th. Hotel Metropole, Leeds. 7 p.m. "The Construction of the Grid Transmission System in Great Britain." Messrs. Johnstone Wright and C. W. Marshall.

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(Western Centre).—Monday, January 28th. Bristol. Faraday lecture on "How Electricity Does Things." Mr. Ll. B. Atkinson.

(Tees-side Sub-Centre).—Tuesday, January 29th. Grand Hotel, Middlesbrough. Annual dinner.

(North-Western Students' Section).—Tuesday, January 29th. Engineers' Club, Manchester. 7.15 p.m. "Electric Locomotives." Mr. D. J. Watkins.

(Scottish Centre).—Tuesday, January 29th. Informal meeting at North British Station Hotel, Edinburgh. 7 p.m. "Recent Extensions to Portobello Power Station." Mr. E. Seddon.

Institution of Engineering Inspection.—Tuesday, January 29th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "Errors in Testing Bulk Supply by Random Selection." Mr. B. P. Dudding.

Royal Society of Arts.—Wednesday, January 30th. John Street, Adelphi, W.C.2. 8 p.m. "The Shannon Scheme and its Economic Consequences." Mr. G. Fletcher.

Institution of Mechanical Engineers.—Thursday, January 31st. Manchester. "Modern Development in Steam-Turbine Practice." H. L. Guy.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Violet-ray apparatus marked "Shelton Laboratories."
S-AN-S wash boiler.

Notes.

The Holborn Explosion.

The Government inquiry into the Holborn explosion of December last was resumed on January 21st, when evidence was given as to the nature of the electricity supply cables in the area, and some interesting views as to the advantages or otherwise of laying high-pressure cables in subways, especially in close proximity to gas mains, were expressed. Major H. Richardson, managing director of the Metropolitan Electric Supply Co., said his company had a 10,000-V main running through High Street, Bloomsbury, and after the explosion this was found to have sagged from 1 ft. to 3 ft. in various parts. Notwithstanding this, the cables continued to function perfectly from the electrical point of view, and the supply was not interrupted in any way. At the same time, there had probably been some mechanical damage to the cables in parts, although it had not yet been possible to ascertain this, as the whole of the cable had not yet been uncovered for inspection purposes. The company had 28 street boxes in the area, each about 2 ft. cube, with solid air-tight covers. These carried low-pressure cables, and were opened up once a week for inspection and ventilation. He preferred the type of box used, with a regular system of inspection, and complete ventilation for a while. For the larger transformer chambers there were suitable means of ventilation of a permanent character. He found it difficult to say whether the gas which accumulated in such boxes was coal gas or not, although, when pressed by the Attorney-General, for the Post Office, he agreed it was possible for a mixture of coal gas and air to accumulate and possibly become ignited. Mr. Miller, K.C., for the gas company, referred to the Electricity Commissioners' Regulations with regard to street boxes, which stated that precautions must be taken to prevent the accumulation of gas in them, and Major Richardson replied that the regulations did not speak of ventilation so far as the small boxes were concerned, and he claimed that the company's system of inspection afforded sufficient ventilation and means for detecting any accumulation of gas.

Answering the Chairman, Major Richardson said he did not agree with laying high-pressure cables in subways close to gas mains. The possibilities in the event of a leak of gas and sparks from one of the cables were terrible to contemplate, and there was also the inevitable interference by one authority with the mains of another.

Dr. S. L. Pearce, chief engineer of the London Electric Power Co., said his company had h.p. mains in the area of the explosion, but the conditions of supply were not interfered with in any way, although the supply was cut off deliberately by request. At the same time, he expressed the same views as Major Richardson as to the possibility of mechanical damage which had not yet shown itself. Similarly, he confirmed the view that high-pressure mains should not be laid in subways, but direct in the ground at a depth of from 6 ft. to 8 ft.

Mr. W. B. Thorpe, chief engineer to the Charing Cross Electricity Supply Co., said his company had some low-pressure distributing mains in the district, but with a minor exception, they were armoured and lead sheathed or concentric and laid solid in earthenware ducts. As with previous witnesses, he said that the explosion did not affect the supply in any way, but a considerable number of street boxes of the non-ventilated type were damaged. Answering the Attorney-General, Mr. Thorpe said there had been one explosion in one of his street boxes due to coal gas, which was ignited by a workman using a blow-lamp. The fact that the old bitumen mains had been done away with had prevented the explosions that used to take place in street boxes, due to the gas caused by the distillation of the bitumen, and there had been no serious troubles from this cause in recent years. He did not agree that the use of open gratings for the ventilation of street boxes would be practicable, as they would permit of dirt and refuse getting in and interfering with the supply.

E.A.W. Activities.

The Manchester and Salford branch of the Electrical Association for Women spent an interesting afternoon at the new showrooms of the Salford Corporation Electricity Department on January 15th, when an attractive programme arranged by the city electrical engineer, Mr. Romero, included an instructive address on "Water Heating" by Mr. Kellet.

At a meeting at the offices of the Bristol Corporation Electricity Department, on January 15th, a new local branch of the Association was formed. The chair was taken by the Hon. Mrs. J. H. Inskip, and the chief speaker was Miss C. Haslett, director of the Association. Mr. H. Faraday Proctor, chief engineer and manager of the Bristol undertaking, spoke highly of the Association, and reminded those present of the service rendered by women during the war, when, with only a few days' training, they took over the running of the sub-stations.

Turbo-electric Ships.

The American Ward Line announces that two turbo-electric driven ships, to cost £2,000,000, have been ordered for the New York-Havana service, to be completed by November, 1930.

New Einstein Theory.

Professor Einstein has handed to the Prussian Academy of Science manuscript the contents of which are stated to be more important than those of his first paper on Relativity. The theme of the new work is the reconciliation of the laws of mechanics with the laws of electro-dynamics. Professor Einstein has spent 10 years in arriving at the conclusions which he presents, says the *Daily Mail*, but the whole work occupies only five typewritten pages. The manuscript will be published by the Academy.

Educational.

A special course of five lectures on "Electrical Sub-stations" is being given on Tuesday evenings, from January 22nd, 7-9 p.m., at the School of Engineering and Navigation, Poplar, by Mr. H. Brazil, M.I.E.E. Fees for the course to persons in the trade and eligible for admission at the London fee are: over 21 years of age, 3s. 4d.; under 21, 1s. 8d.

Scottish Hydro-Electric Schemes.

Professor F. G. Baily, Professor of Electrical Engineering in the Heriot-Watt College, Edinburgh, examines in an article in *The Scotsman* some of the hydro-electric power schemes which it is proposed to carry out in Scotland. The Loch Hourn scheme in West Investness-shire, Professor Baily considers, must attract a factory to an otherwise unsuitable site or fail in its object. Probably a supply to Inverness and Dingwall would cost more at those places than a supply from water power nearer at hand or from a steam power station. The Galloway scheme must show itself to be more economical than a steam station, but as the latter will either be moderate in size and not fully economical, or at a considerable distance, the scheme will be able to stand a higher total cost than the Loch Hourn undertaking, and will be of considerable benefit to the people of the whole valley and of the neighbouring towns. The Grampian group of stations can achieve financial success only if the constructional cost is exceptionally low. There must be a long length of unprofitable line to the Dee and Tay valleys, which can be supplied from Aberdeen and Dundee with lines feeding populous districts all the way. The initial cost of the Loch Luichart (Ross-shire) scheme seems likely to be moderate, and the outlets for power, Dingwall and Inverness, with small towns on the way, are within reasonable distance. Referring to the one scheme in operation, that of Kinlochleven, Professor Baily declares that, owing to many favourable conditions, the complete success of this scheme cannot be taken as typical. Except during the period of construction, these schemes need not cause serious injury to the appearance of the countryside, says Professor Baily. Raw scars on hillsides will soon become green again; pipe lines can be hidden by judicious planting; overhead wires in remote parts will be insignificant, and in populous areas their benefits will outweigh their inelegance.

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Appointments Vacant.

Lady demonstrator and showroom assistant (£160) for the Corporation of Worcester Electricity Department. Secretary (£700) for the Incorporated Municipal Electrical Association. Charge engineer for the Lancashire Electric Power Co. Probationary assistant telegraph engineers for the Government of Nigeria. Shorthand-typist (male) (£95) for the borough of Hackney Electricity Department. Junior technical officer (£259) in the Admiralty Design Section, Portsmouth. Working foreman for the Engineering Department of Worcestershire Mental Hospital. (See our advertisement pages to-day.)

Association of Supervising Electrical Engineers.

The Association will hold its annual dinner on February 23rd, at the Hotel Cecil, when the president, Mr. S. B. Donkin, M.Inst.C.E., will occupy the chair, and will be supported by many guests distinguished in the engineering world.

Automatic Traffic Signals in Glasgow.

The Glasgow Magistrates Committee has recommended that as an experiment a set of Messrs. Barber & Colman's automatically controlled traffic signals be erected in the city, at an estimated cost of £130.

E.P.E.A. Technical Group Dinner.

The London Local Technical Group of the Electrical Power Engineers' Association has arranged to hold a dinner and dance at the New Princes Galleries, Piccadilly, on March 16th. Dinner will be served at 7 p.m., and dancing will end at midnight. The number of tickets to be issued is limited to 250, and they can be obtained from the Hon. Secretary, 14, Violet Road, E.3, price 15s.

The Montefiore Prize Competition.

We have received from the Administrative Council of the Association des Ingénieurs Electriciens, of Liége, particulars of the competition named "Fondation George Montefiore," a triennial event which is to be awarded this year, the prize amounting to 29,000 francs. Particulars were given in our issue of April 6th, 1928; works submitted in competition must be received by the Secretary, 31, Rue Saint-Gilles, Liége, Belgium, not later than April 30th, 1929.

The Bakery Exhibition.

The display of electrical equipment designed for the grocery and baking trades at the exhibition promoted by the Birmingham and District Associations, at Bingley Hall, Birmingham (from January 15th to 24th) was of special interest. It marked a considerable advance in the utilisation of electricity, particularly in bakeries, and it is a noteworthy fact that almost every set of apparatus was electrically driven. A complete all-electric working bakery, including oven and a range and dough-mixing and kneading machines, cake-mixing machines, bun dividers and working tables, was shown by the Artofex Engineering Works (London). Interesting features included a two-deck electric oven, with an electrically-heated prover, and a tempering tank for providing hot water for the dough. The equipment is extremely compact, thus requiring a minimum of floor space and, apart from health considerations in relation to the operative, emphasis was properly laid on the importance of continuous baking. It was pointed out that with the electric oven there was no waiting between the batches; consequently use could be made of a smaller oven for the same output, when compared with fuel-fired ovens; and, moreover, the output is relatively higher.

Another interesting display of apparatus was made by the Peerless Electrical Manufacturing Co., of London, and included cake-mixers and whisks, and high-speed dough mixers, coffee mills, slicers, mincers and dish-washers.

Messrs. Russell & Co., Birmingham, were responsible for a good exhibit, in which electrically-driven cake and whisking machines, dough machines and potato machines occupied an important place.

Automatic electrical refrigerators specially designed for the baking and allied trades were shown by Frigidaire, Ltd., of Birmingham. One of several models was for the storage of cream, liquid eggs, bakery fats, and other perishable foods, operated by a ¼-h.p. air-cooled compressor; another was designed for the needs of the smaller restaurants, caterers, and dairies; a third model, which takes the form of a counter case, provides for efficient refrigeration and suitable display of perishable goods.

Working demonstrations were given by Messrs. John Hunt (Bolton), Ltd., of a pie- and tart-making machine, and a new cold moulding attachment for various classes of confectionery. Some very effective little cake-making machines (electrically-driven) were shown. Messrs. T. Collins & Co., Ltd., of Bristol, showed a dough-making machine of the revolving type, self-contained with tempering tank, sifter, and electric motor. Four models were displayed by Milkanic Emulsors, Ltd., of London, each machine being fitted with its own electric motor to suit the voltage required by any customer.

Other exhibitors were Mr. W. E. Burnell, Leicester; the Hobart Manufacturing Co., London; Mr. G. Tweedale, Leeds; the C. O. Ericsson Engineering Works, Birmingham; Messrs. Berkel & Parnell's Slicing Machine Manufacturing Co., Ltd.; and British Weighers & Slicers, Ltd., Sheffield.

Midland Electrical Engineers' Ball.

As a result of the very successful Midland Electrical Engineers' Ball, held at the Grand Hotel, Birmingham, on November 16th last, the Committee (President, Mr. R. A. Chattock, M.I.E.E., city electrical engineer, Birmingham), has instructed the honorary secretary, Mr. W. Y. Anderson, A.M.I.E.E., to forward the gratifying sum of 75 guineas, for the second year in succession, as a donation to the Benevolent Fund of the Institution of Electrical Engineers.

Short-circuit Capacity.

In an article in the January issue of *Distribution* (Henley's journal) Mr. W. H. Nichols draws attention to the magnitude of the short-circuit currents that are now attainable at consumers' terminals, owing to the growing density of supply and the multiplication of sub-stations. In the case of a consumer close to a sub-station, "with almost unlimited power behind the transformers, and an impedance of only two or three per cent. in the transformers, the short circuit which could be obtained at service terminals only a few yards from the bus-bars would be enormous." Fortunately most faults are of appreciable resistance, and it is seldom that a good solid contact is made between cores. Moreover, the fine wire used in service cut-outs fuses before the short-circuit current has time to rise to its maximum value; but where heating and cooling loads are met with, the cut-outs are more heavily wired. Hence where there is a dense load, only cut-outs of the most reliable type should be installed.

Radio Direction-finding.

In a paper recently published in the I.E.E. *Journal*, Mr. R. L. Smith-Rose, D.Sc., Ph.D., A.M.I.E.E., of the National Physical Laboratory, considers the applicability of the reciprocal theorem to the practice of radio direction-finding with either a rotating loop transmitter or a loop receiver. A description is given of some experiments carried out by the Radio Research Board with the object of demonstrating that the permanent errors to which a rotating-loop beacon transmitter may be subject as a result of condidtions local to its site are similar to those observed on a direction-finder erected on the same site. This similarity has materially assisted in locating the cause of the permanent error associated with the rotating beacon erected at Fort Monckton, near Gosport. From other experiments carried out under suitable conditions, it is shown that the occurrence of night errors is experienced with both systems of direction-finding to approximately the same extent.

Institution Notes.

Royal Institution.

On Thursday (January 31st) Sir William Bragg gives the first of three lectures on the "Early History of X-Rays."

Institution of Electrical Engineers.

INFORMAL MEETING.—At the meeting of the Institution held on January 14th (Mr. W. E. Lang in the chair), Major A. Jenkin opened a discussion on "Trolley Omnibuses." He sketched the evolution of the trolley-'bus up to the latest type of six-wheel vehicle, seating 68 passengers, and pointed out that the system was free from the great disability of the tramcar in that the 'bus could draw into the kerb, and could go round obstructions in its path. The chief advantage over the petrol omnibus was that it had better speed control, much quicker acceleration, and cheaper mileage, and further had the power of the electricity station behind it. In addition, it was anticipated that the cost of electric power would fall or remain stationary, whereas the cost of petrol would probably rise very considerably in the future.

Major Jenkin described in detail the latest developments in the construction of chassis, driving mechanism, the pole and shoe, motor and controller, and the deviation indicator, which steered a path under the trolley wire and enabled a 'bus to keep its course in the densest fog. In view of the trolley-'bus being on rubber tires, and without the earthed rails of the tramcar, insulation was of the utmost importance, and all current-carrying apparatus had to have the best possible protection, especially as regenerative braking was now common practice.

It had been found that contactors, which formerly jerked out, could be relied upon to stay in with pneumatic-tired vehicles. Trolley-'buses were the solution of the troubles of a tramway system faced with the enormous expense of relaying worn track.

Mr. W. A. Stevens described a system of regenerative braking operating most successfully at Wolverhampton with a compound motor weighing 19.5 lb. per h.p. By ingenious use of the series winding the current rise was limited, and did not affect the lamps.

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Mr. C. J. Spencer said he had found contactors unsatisfactory on tramcars and had adopted a "line-switch" that obviated breaking in the controller. He thought regeneration with modern ventilated motors was thoroughly practicable and desirable.

A.M.I.E.E. EXAMINATION.—The results of the associate membership examination held in November, 1928, have been announced. The list of successful candidates shows 44 as having passed the whole examination, 13 as having passed Part I only, and one as having passed Part II only. The next examination will be held on May 29th, 30th and 31st, 1929. Candidates must (*a*) be either students or graduates of the Institution, or (*b*) have lodged with the secretary a duly completed form "E" for election as Associate Member and have been informed that they must pass the examination as a condition of election. Entry forms, which must be completed and returned by April 1st, and particulars regarding election to membership of the Institution may be had on application to the secretary, Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. P. DUNSHEATH, O.B.E., M.A., B.Sc., who has for the past nine years had charge of the research laboratories of Messrs. W. T. Henley's Telegraph Works Co., Ltd., has been appointed research and technical manager at the company's head office, Holborn Viaduct. The control of the laboratories at Gravesend is being taken over by Mr. W. C. Barry, B.Sc.

Professor F. C. LEA has been appointed president of Section G—Engineering, for this year's meeting of the British Association for the Advancement of Science which is being held in South Africa.

Messrs. Credenda Conduits Co., Ltd., Oldbury, Birmingham, have appointed Mr. C. ORRINGE, of Leicester, as their sales engineer for the East Midlands.

Mr. WILLIAM MACFARLANE, of the electricity department of the Glasgow Iron and Steel Co., Ltd., Wishaw, has been presented with wedding gifts by the staff.

Mr. WALTER R. STEAD, tramway inspector at Stockport, who is retiring after 23 years' association with the undertaking, has been presented by the officials with an inscribed gold watch. The presentation was made by Mr. A. T. Eardley, tramway manager.

Mr. E. J. BAKER, having resigned his position of outside representative after 25 years' service with the I.R., G.P. and Telegraph Works Co. (Silvertown Co.), was recently presented by his colleagues with a gold watch, chain and pendant. Mr. Baker is now representing the Lithanode Co., Ltd., of 190, Queen's Road, Battersea, one of the oldest accumulator manufacturers in this country.

The marriage took place last week at Rugby of Mr. E. V. NEWBERRY, chief of the test department at the Rugby works of the British Thomson-Houston Co., Ltd., and Miss HILDA BEATRICE OVER, of Rugby.

The recommendations regarding two new directors of the Bank of England to fill this year's vacancies are of interest electrically, for the names coming before the meeting of the General Court which was called for Wednesday, 23rd inst., were those of Sir BASIL BLACKETT, who is nominated for the chairmanship of the new Communications Company, and Sir A. R. DUNCAN, chairman of the Central Electricity Board.

The Industrial Australian states that Mr. T. MALCOLM RITCHIE, managing director of Metropolitan-Vickers, Ltd., left Sydney for London in December on a combined business and pleasure visit.

Mr. MERVYN SAUNDERSON, second assistant engineer with the Manx Electric Railway Co., Ltd., has accepted an appointment with John Jackson, Ltd., as electrical engineer on the construction of the new naval base at Singapore.

Mr. E. W. HILL, A.M.I.E.E., has been appointed chief engineer of Aron Electricity Meter, Ltd., in succession to Mr. F. A. Nield, M.I.E.E., who is retiring by medical advice on account of ill-health. Mr. Hill has for many years been associated with the electricity meter and instrument branch of the industry in this country and abroad. He was one of the moving spirits of the Meter Engineers' Technical Association, now transformed into the new Meter and Instrument Section of the I.E.E.

The Ioco Rubber and Waterproofing Co., Ltd., announces that Mr. E. J. KIRKLAND has been appointed as its sales representative for the whole of Yorkshire, with headquarters at Leeds, and Mr. J. CURRAN as sales representative for Liverpool and North Wales territory, with his headquarters at Liverpool.

The Hastings Town Council has increased the salary of the deputy electrical engineer from £600 to £650 per annum.

The North Western Branch of the Institution of Mechanical Engineers has elected Mr. H. L. GUY as chairman for the year. Mr. Guy, who was trained at the Cardiff University College, has been for some years Chief Engineer of the Mechanical Department of the Metropolitan-Vickers Electrical Company, and has been responsible for many important developments in steam turbine practice, including the design of some of the largest and most efficient sets which have been built in this country. For his last paper "The Economic Value of Increased Steam Pressures," presented to the Institution in November, 1926, and reproduced in our pages, he was awarded the Hawksley Gold Medal—the premier award in the gift of the Institution. He will present before a meeting of the Institution in Manchester on January 31st, a paper on the subject of "Some Tendencies in Turbine Design." The programme of the Summer Convention of the Institution, which is to be held in Manchester, will include a visit to the Metropolitan-Vickers works.

Mr. W. C. GOMERSALL, A.M.I.E.E., who has been in charge of the Power and Electrical Department of the Jardine Engineering Corporation, Ltd., for nearly ten years, has resigned his position and accepted the post of managing director of the China Engineers, Ltd., P.O. Box No. 1182, 24, Yuen Ming Yuen Road, Shanghai. This is a newly-formed concern, and Mr. Gomersall is now in England to make agency arrangements with manufacturers interested in the China market. His address is c/o Hongkong and Shanghai Banking Corporation, 9, Gracechurch Street, London.

At a recent meeting of the District Joint Industrial Council No. 7 (East Midland Area) for the Electricity Supply Industry, Mr. G. J. HOLLYER (borough electrical engineer of Loughborough) was presented with a gold cigarette case to mark his year of office as chairman of the Council.

Obituary.—MR. J. M. GORHAM.—We regret to report that Mr. John Marshall Gorham, M.I.C.E., M.I.E.E., died last week at the age of 75. Mr. Gorham was one of the sons of Dr. Gorham, of Tonbridge, and served his time in the shops of Messrs. Robey & Co., Lincoln, after leaving Tonbridge School. He carried out pumping and other contracts for them in Spain, and was in charge of their engine plant at the Crystal Palace Exhibition in 1881. Subsequently he was electrical engineer to the King of Rumania, and on his return he was engaged as works manager of the Electrical Power Storage Co. by Mr. Bernard Drake, who was managing engineer of that company. Subsequently he and Mr. Drake founded Drake & Gorham, Ltd., of which he remained a director, though failing health had prevented his taking any active part in the business for many years past. Mr. Gorham was for some time a director of the Daimler Company, which he joined at a critical time in the history of that concern, advancing it the money required to carry on. He was also a director of the D.P. Battery Co., Ltd. Mr. Gorham was an excellent mechanic, and was fond of making models of new scientific apparatus in his leisure time. His unobtrusive kindliness was appreciated by all who knew him.

SIR JOHN BRUNNER.—The death occurred on January 16th, in London, at the age of 63 years, of Sir John Brunner, eldest son of the late Sir John T. Brunner, who, with Dr. Ludwig Mond, founded the famous firm of Brunner, Mond & Co. He succeeded his father in the baronetcy in 1919. He was a director of Imperial Chemical Industries, Ltd., but resigned that position in 1927.

MR. A. H. MOSELEY.—The death occurred recently from injuries received in a motor accident of Mr. Arthur Herbert Moseley, of Finchley, who had for many years been with the British Thomson-Houston Co., Ltd., first at Rugby, and later in London. He entered the service of the company at Rugby in 1900, and during the war managed a large munition factory at Birmingham. He resumed his connection with the British Thomson-Houston Co. in 1924, since which time he had been at the London office.

DR. F. PRASIL.—The death is announced from Zurich, at the age of 72 years, of Dr. Franz Prasil, professor of Engineering at the Swiss Eidgenossiche Technical High School. The deceased was an authority on water turbines for hydro-electric power stations.

MR. F. HARDING.—The death took place on January 12th of Mr. Frank Harding, who was, until his recent retirement, manager of the Derby Corporation Tramways. He was 71 years of age, and commenced his connection with tramway services at Leicester. He subsequently became manager of the Derby Tramways Co., Ltd., and continued in charge when the undertaking was acquired by the Corporation.

Will.—Mr. J. H. JONES, manager of the cable depôt of the Eastern Extension Telegraph Co. at Singapore, left £12,263 gross and £12,031 net personalty.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Chelmsford Radio, Ltd.—Private company. Registered January 11th. Capital, £1,350 in £1 shares (800 ordinary and 550 7 per cent. preference). Objects: To acquire the business of dealers in wireless apparatus, gramophones and electrical goods carried on by H. J. Hawkes and D. C. Clark, at 76, Duke Street, Chelmsford, as the Chelmsford Radio Co. The directors are:—D. C. Clark (chairman), Newhaven, Rainsford Lane, Chelmsford, Essex, engineer; C. J. Deal, The Limes, Kelvedon, Essex, motor engineer and agent. Registered office: 76, Duke Street, Chelmsford, Essex.

Mayfair Enterprises, Ltd.—Private company. Registered January 17th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all kinds of gramophones and radio, musical, electrical and other instruments and apparatus for use with them; public and private contractors, motor, electrical, mechanical or other engineers, &c. The directors are:—T. A. B. Ternan, 44, Oxford Terrace, Hyde Park, W.1; A. Harvard-Watts, St. Martin's Chambers, Leicester Square, W.1. Registered office: 37, Bruton Street, Bond Street, W.1.

Electric News Panels, Ltd.—Private company. Registered January 17th. Capital, £20,000 in £1 shares (10,000 8 per cent. cumulative preference and 10,000 ordinary). Objects: To carry on the business of signwriters, advertising experts and contractors, publicity agents, manufacturers of and dealers in signs, electrical and mechanical engineers, &c. The subscribers (each with one share) are:—F. W. Eve, 101, Salisbury House, London Wall, E.C.2, cashier; G. F. Smallpiece, ditto. Registered office: 31-33, Bishopsgate, E.C.

Vale-Royal Electric Lamp Manufacturing Co., Ltd.—Private company. Registered January 17th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical and wireless engineers, designers and manufacturers of and dealers in lamps, globes, brackets, dynamos, &c. The permanent directors are:—J. Jones, 13, Vale Royal, Islington, N.7; W. E. Pinder, 7, Little Goodge Street, W.1; T. B. Aldridge, 6, Plevna Road, Tottenham, N.15.

M.E.D.A.S., Ltd.—Private company. Registered January 11th. Capital, £3,150 in 2,500 7 per cent. cumulative preference shares of £1 each and 13,000 ordinary shares of 1s. each Objects: To acquire the business of electrical, radio, lighting and heating engineers carried on by A. C. L. Covell and D. J. Quenzer at 185, Hammersmith Road, W., as the Modern Electrical Development and Supply Co. The subscribers (each with one ordinary share) are:—A. C. L. Covell, 185, Hammersmith Road, W.6, electrical engineer; C. L. Porter, 397, Fulham Road, S.W.10, accountant. The first directors are:—A. C. L. Covell and D. J. Quenzer (both permanent). Secretary: C. L. Porter. Registered office: 185, Hammersmith Road, W.6.

British Power & Light Corporation, Ltd.—Private company. Registered January 14th. Capital, £100 in £1 shares. The objects are to promote companies, syndicates and partnerships of all kinds, particularly those to carry on the businesses of electrical and general engineers and manufacturers and maintainers of plant for the generation, accumulation, transmission and supply of electrical energy for the purposes of light, heat and power; to carry on business as bankers, capitalists, financiers, concessionaires, &c. The subscribers (each with one share) are:—T. G. Greenleaf, 36, Sistova Road, Balham, S.W.12, clerk; E. J. Burrows, 29, Lyndhurst Road, Highams Park, E.4, clerk. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.2.

Jerusalem Electric & Public Service Corporation.—Additional particulars of the Jerusalem Electric & Public Service Corporation, Ltd., were filed on January 2nd, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is £P500,000. The company was incorporated in Palestine on July 3rd, 1928, to acquire concessions (1) for generating, supplying and distributing electrical energy, and (2) for supplying and distributing potable water in Palestine. The British address is at 66, Queen Street, E.C.4, where T. K. Anderson is authorised to accept service of process and notices on behalf of the company. The directors are:—W. Shearer, Inglewood, Chislehurst; Sir John H. Brunel, Ardkinglas, Inverary, Scotland; Major Sir Archibald Boyd Boyd-Carpenter, M.P., River House, Walton-on-Thames; L. L. Le Bouvier, Ottoman Bank, Jerusalem; and J. G. B. Stone, Muir House, Broadwater, Worthing.

Official Returns of Electrical Companies.

Attaix, Ltd.—H. C. Merrett, of 32, Finsbury Square, E.C.2, was appointed receiver and manager on December 14th under powers contained in debenture dated May 16th, 1928.

City of Oxford Motor Services, Ltd. (formerly City of Oxford Electric Tramways, Ltd.).—Satisfaction to the extent of £2,000 on December 31st, 1928, of charge dated February 20th, 1914, securing £46,000.

Chloride Electrical Storage Co., Ltd.—Debenture charged on freehold and leasehold property at Clifton, Lancs., and the company's undertaking and property, present and future, including uncalled capital dated December 29th, 1928, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Vactite Wire Co. (1919), Ltd.—Capital, £25,000 in £1 shares. Return dated November 9th, 1928. 15,000 shares taken up. £3 paid. £14,997 considered as paid. Mortgages and charges nil.

Faulkner & Co. (Manchester), Ltd.—Capital, £2,000 in £1 shares. Return dated October 22nd, 1928. 1,900 shares taken up. £500 paid. £1,400 considered as paid. Mortgages and charges nil.

Electric Reduction Co., Ltd.—Capital, £50,000 in 16,200 preference and 33,800 ordinary shares of £1 each. Return dated November 2nd, 1928. 16,200 preference and 28,800 ordinary shares taken up. £18,000 paid on 13,000 preference and 5,000 ordinary shares. £27,000 considered as paid on 3,200 preference and 23,800 ordinary shares. Mortgages and charges, £25,000.

Drake & Gorham, Ltd.—Capital, £125,000 in £1 shares. Return dated November 13th, 1928. All shares taken up. £85,000 paid. £40,000 considered as paid. Mortgages and charges, £12,000.

Rudolph Charles & Goff, Ltd.—F. Hyde, of 34, London Wall, E.C.2, ceased to act as receiver or manager on August 28th, 1928. (Notice filed January 9th, 1929.)

City Notes.

Prospectus.

Einstein's Electro-Chemical Process, Ltd.—On Thursday last week the public was invited by advertised prospectus to subscribe for an issue of 250,000 8 per cent. participating preference shares of £1 each and 250,000 ordinary shares of 4s. each, and the list was closed by 10.30 a.m. on that day owing to oversubscription. The company, whose offices are at 16, St. Helen's Place, and of which Mr. Wladimir I. Einstein is managing director and Mr. James Swinburne, F.R.S., is consulting engineer, has been formed to acquire the world rights available to the vendor of the patent process described in the prospectus, "with all the secret processes used in connection therewith, improvements and future inventions relating thereto." The inventions are for processes enabling "practically all kinds of materials of any shape or contour to be metallised by electrochemical action to any desired thickness." The price payable to the vendor for the world rights is £210,000 (£40,000 cash and the rest in 850,000 fully-paid ordinary shares of 4s. each). He will also receive certain royalties and a percentage of the net profits. It is stated that Mr. Einstein has already expended in the course of the last three years a sum considerably in excess of the cash consideration mentioned. He has equipped the Paris factory and paid the costs of experimental work, and carried out financial negotiations. The issue will provide £210,000 for working capital and general purposes. A report by Mr. J. Swinburne, F.R.S., is printed in the prospectus, from which it appears that the processes consist in the electro-deposition of metals, especially on non-conducting materials, such as wood, glass, porcelain, and textile fabrics; thus the wooden propellers of aeroplanes can be completely encased in metal, greatly increasing their strength, thin fabric can be made gas-tight and non-inflammable, ships can be copper-bottomed, and furniture can be made immune to the attacks of the white ant in the tropics. Glass and porcelain can be beautifully de-

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corated, says Mr. Swinburne, who has seen "the small experimental works in Paris," and states that the capital outlay on plant and the running cost of the process are both very small, whilst the field of application is very diversified. Four British patent applications have been accepted, two of which have been actually granted, and three other applications have been lodged; patents in many foreign countries have also been applied for.

Ward & Goldstone, Ltd.

Notices were issued to the shareholders last week calling extraordinary general meetings for January 24th for altering certain of the Articles of Association respecting the nominal value of the ordinary shares, and the rights of the preference shares to participation in the profits after they have received their 7 per cent. It is proposed to change 100,000 ordinary shares of £1 each into 400,000 ordinary shares of 5s. each, making the capital 100,000 preference shares of £1 each and 400,000 ordinary shares of 5s. each. If these alterations are approved the following resolution will be submitted, and it will be submitted for confirmation at a meeting to be held on February 14th: "That the sum of £8,000, part of the undivided profits of the company, be capitalised and issued as fully-paid ordinary shares of 5s. each, ranking *pari passu* in all respects with the existing issued ordinary shares, and that such shares be distributed amongst the members holding preference shares on the register on April 1st, 1929, in the proportion of four newly issued ordinary shares of 5s. each for every ten preference shares of £1 each held by such members on that date."

Kiesselbach Steam Accumulators, Ltd.

To conform with Stock Exchange requirements, this company published on Monday last a statement of its constitution and objects. It was registered on January 16th with a capital of £220,000 (210,000 "A" shares and 10,000 "B" shares of £1 each). The directors are Brig.-Gen. Sir Henry P. Maybury, G.B.E. (chairman), Mr. J. E. Dunning, Mr. Frank Hodges, Mr. S. Hopkins (managing director, formerly general manager of the Fairfield Howden Ruths Steam Accumulators, Ltd.), Mr. W. Y. Lewis (general manager, late managing director and chief engineer of the British Niclausse Boiler Co., Ltd.), Mr. G. E. Usher (general manager and director, International Combustion, Ltd.), and Mr. H. D. Williamson. The registered office is at 31, Lombard Street, E.C.3. The company is acquiring rights for the manufacture and sale in the British Empire and the United States of thermal storage plants from Messrs. Sach & Kiesselbach and Dr. Kiesselbach. Hitherto the plant in question has been made in Germany only. Negotiations are proceeding for the disposal of the American rights.

Haslam & Newton, Ltd.

This company is an amalgamation of the interests of Newton Bros. (Derby), Ltd., and the Haslam Foundry & Engineering Co., Ltd. The statutory meeting was held on January 15th, when Mr. J. H. Lord (chairman), who presided, said that the "Newton" side of the business was busy and profitably employed, and was looking forward to an increased turnover with satisfactory results. This section of the company had accomplished something of a feat by securing a contract from the German Government for e.h.p. direct-current generator equipment in which it specialised. Certain further developments on the electrical side were under consideration; the management was keeping a sharp look-out for all possible avenues of new business.

Official Notice Re Companies.

The names of the undermentioned companies are to be struck off the Register unless cause to the contrary is shown within three months:—

Bell Battery and Accessory Co., Ltd.
C.A.T. Cable Co., Ltd.
Clayton Motors, Ltd.
Export Electric Fittings Co., Ltd.
Hamilton Wells Electro-Medical Institute, Ltd.
Northern Lift and Electrical Co., Ltd.
Premier Telephone and Wireless Co., Ltd.
Radio Service Co. (Birmingham), Ltd.
Watford Radio Supplies, Ltd.
Wireless Headphone Distributing Co., Ltd.

Brazilian Traction, Light and Power Co., Ltd.

The company announced this week that the Federal Supreme Court of Brazil has upheld the validity of the concession granted some years ago by the City of Rio de Janeiro to the company's subsidiary, the Brazilian Telephone Co. It is stated:—"Some time must necessarily elapse before it can be definitely stated that the question is finally disposed of, but the company's hope is that this time will be reduced to a minimum, so that it may be free to give the public in the City of Rio de Janeiro the telephone service it has long wished to supply."

City of London Electric Lighting Co., Ltd.

This company has presented a petition to the High Court for confirmation of an extension of its objects to enable it to acquire rights and privileges with regard to the Bankside Investment Trust, Ltd., and to guarantee obligations of that company. The petition is to be heard in the Chancery Division on January 28th by Mr. Justice Romer.

S. Smith & Sons (Motor Accessories), Ltd.

The holders of the company's preferred and deferred shares are offered new shares of their respective classes in the proportion of one new share for each three held. The total issue will amount to 50,000 preferred shares of £1 each and 280,000 deferred shares of 1s. each. The issue price of the preferred is 30s. and that of the deferred 3s.

Western Union Telegraph Co.

The earnings report for the past year, with the December figures estimated, shows a gross revenue of $139,244,596, against $134,460,816 in 1927. The available balance is given as $18,983,074 (against $18,614,784), and after deducting interest on bonded debt there is a net income of $15,373,669, as compared with $15,030,453.

Traction and General Investment Trust, Ltd.

The report for the year ended December 31st last records a net profit of £74,432, as compared with £59,980 in 1927. To this is added £31,922 brought forward, making £106,354. The directors propose to transfer £10,000 to the reserve account and to pay a final dividend of 10 per cent. on the ordinary stock, making 16 per cent. for the year as compared with 15 per cent. for 1927. This leaves £35,788 to be carried forward. Meeting: January 31st.

Delhi Electric Supply and Traction Co., Ltd.

An interim dividend of 4 per cent. has been declared.

Stocks and Shares.

MONDAY EVENING.

IT is becoming almost monotonous to refer to the increase of strength that, with rare exceptions, characterises the Stock Exchange markets week by week. Members of the House admit, in talking to each other, that they find a difficulty in seeing where the business comes from, but the fact remains that most of the markets are well occupied with orders, and that the strength of prices is satisfactorily maintained. No doubt can be felt that a good part of the demand arises from America, where, according to commonly-accepted theory, most of the world's money went during and after the war. Of recent months the Americans have developed a strong taste for gambling: many prices have risen 20, 50, 100, or even more points within a comparatively brief space of time. This activity is reflected, to some extent, in shares negotiated on this side, of which the principal, from the market point of view, is Mond Nickel, where there has been an enormous wave of buying, and a remarkable appreciation in the price of the shares. Within the past week or so attention has become more closely riveted than previously upon shares in Rhodesian copper companies, and this, in its turn, served to impart energy to Victoria Falls & Power ordinary and the preferences, which stand at 62s. 6d. and 33s. 9d., respectively.

Electricity Supply Shares.

The capital required by 1936 for the latest scheme published by the Central Electricity Board is set down as being £2,907,000, but further contemplated expenditure is estimated as likely to raise the total to over eight million pounds sterling before the end of 1941—that is to say, within about thirteen years. The market effect of this scheme has been slight, as was the case, also, of the announcement of the previous schemes. It is felt more in the demand for shares in the manufacturing and equipment companies than in those of electricity supply issues. Yorkshire Electric Power ordinary are 1s. 6d. harder at 36s. 6d. The company's 6 per cent. preference, upon which a half-yearly dividend is due, stand at 24s., and the 5½ per cent. redeemable debenture stock is quoted at 102, the next interest being payable two months hence. The provincial list of shares is steady as a whole. Urban ordinary repeated their florin rise of last week, and are now 40s. 9d. Clyde Valley shares have advanced to £2.

London Companies' Dividends.

Electric Supply Corporation shares shed 1s. 9d. of their last week's gain of 7s. 3d., the price reacting to 56s. 3d. Amongst the London issues, County ordinary have gone back to 47s. 6d., and Charing Cross ordinary to 26s. Metropolitans maintained their improvement to 2⅜. Tardy acknowledgment is made of the misleading character of yields calculated upon London electricity supply shares, in taking—as the basis for working out the returns upon money invested—the dividends at present being paid upon ordinary shares in the majority of London electricity supply companies. It is conceivable, of course, that the latter may be able to effect such economies in working, or to so increase their profits that larger dividends than 7 per cent. can be distributed after 1931. Safety demands, however, that the 7 per cent. scale shall be regarded as the probable rate of dividend, and this is a factor which investment must bear closely in mind.

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The Eastern Telegraph Group.

The considerable rises which occurred last week in the stocks of the Eastern Cable quartette have not been entirely held. There are, indeed, falls amongst the leaders of the group, Eastern ordinary going back to 267½, a decline of 2½ points, while the shares of the three associated companies are also easier. The reaction is trivial as compared with the substantial advances which took place beforehand. It is stated in the Stock Exchange market that everything stands ready for the issue of the new securities into which Eastern stock, Eastern Extension and Western Telegraph shares are to be exchanged. At this eleventh hour, shareholders in the three companies are unaware of what they are about to receive. It is assumed that the proprietors will be offered, for each £100 of their present interest, £110 in 5½ per cent. preference stock, £165 in 7½ per cent. ordinary, and £25 in deferred. If the expectation prove correct, and if the further anticipation is realised that the new stocks will be valued at their par levels, a total of £300 is reached. Eastern ordinary, as just mentioned, stands at 267½. Eastern Extensions and Westerns are both 26½. All three allow, therefore, for the margin of uncertainty which exists, both in regard to the precise distribution that will be made, and to the possible market prices of the new stocks when the latter become negotiable.

Wireless Shares.

The element of uncertainty is present still more strongly in the case of Marconi shares. This, coupled with neglect on the part of New York, accounts for the price being practically unchanged at 3⅞. Canadian Marconis are equally languid, and the price is lower at 35s. Burndept Wireless have strengthened to 7s. 3d.

Cables and Telephones.

Stocks and shares in other cable companies are mainly on the up-grade. It looks anomalous to see Anglo-American Telegraph deferred stock quoted at 26½, while the preferred is 103½, for the deferred receives a fourth of the dividend paid on the preferred, and the prices of the stocks should maintain correspondence. The deferred carries, however, 1½ per cent. dividend, which it will be ex on Thursday in this week, when the preferred will have 30s. per cent. taken from its price. The preferred dividend is paid four times, and the deferred once, a year. Indo-Europeans have again forged ahead; at 51½ the price is 2½ up. Great Northerns rose 10s. to 34½. This made a gain of £5 in three weeks. Direct Spanish are better at 10¾. Amongst the telephone shares, United River Plates hardened to 12½, a gain of 7s. 6d., on a jump, started in New York, in the price of stock in the International Telephone & Telegraph Company which offered to take over United River Plate shares in exchange either for cash or for part cash and part of its own stock.

Indian and Foreign.

Atlas Light & Power went back to 23s. 3d. upon the cessation of the burst of American buying which forced up the price to 25s. Brazilian Tractions rallied to 82½, on support induced by the bonus announcement mentioned here last week. The new issue will require about six million pounds sterling for its satisfaction. Calcutta Electric Supply ordinary shares are better at 38s. 6d., and Madras Electrics show a rise at 35s. Burma Electric Supply ordinary changed hands lately at 18s. 9d. The 6 per cent. preference were last dealt in at 18s. 3d., early in December. Cawnpore Electric ordinary marked, a few days back, at 34s. 6d., and Delhi Electric Supply & Traction at 55s. East African Power & Lighting were done last week at 29s.

Manufacturing and Equipment.

The chief feature amongst shares in the manufacturing companies is a recovery in General Electrics to nearly 3. Reports credit the Americans with being responsible for the buying which put up the price. British Aluminium have gone back to 48s. 3d., after the brisk rise that took them to 2½. British Insulated are better at 4 7/16. Metropolitan-Vickers ordinary receded to 35s., Enfields to 5 5/16, Callenders to 4¼. English Electric ordinary rose to 8s. 9d. Everlite shares had a jump to 11s. 6d., then reacted a few pence. A lively business is being done in Ever-Ready Trusts, and the shares, with 10s. paid, command a small premium. Ever-Ready shares drooped to 31s. 3d. on profit-taking sales that followed upon the new issue. On a fairly general buying tip, Automatic Telephones rose to 2 1/16, and International Automatics to 2. It is not unlikely that the prices will go better. American Telephone and Telegraph shares went up to 207½.

Miscellaneous Matters.

Pennsylvania Water & Power at 86½ and Shawinigan common shares are both better. The rubber share market has been good, but prices eased off from the top, on a reaction in the price of the produce to 10d. per lb. Iron and steel shares are steady; Vickers vary narrowly between 12s. 9d. and 13s. Several new companies are contemplated for the exploitation of coal, and of metal processes.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Jan. 21, 1929.	Rise or fall.	Yield. D.C.
Bournemouth and Poole	1	14†	15	68/6	—	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/-	—6d.	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 8 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	22/-	—	5 4 4
Clyde Valley	1	8	8	2	+1/-	4 2 0
County of London	1	7½	7½	47/6	—1/6	3 3 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—1/9	3 18 3
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	47/6	—	3 15 8
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power	1	—	15	2 1/16	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	27/-	—	4 9 0
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	—	4 17 0
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	40/9	+2/-	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/3	+3d.	6 3 8
Yorkshire Elec.	1	8	8	36/6	+1/6	4 7 8

†4% of which was tax free.

HOME RAILS.

		Nom.	Dividend. 1926.	Dividend. 1927.	Price Jan. 21, 1929.	Rise or fall.	Yield. D.C.
Central London Ord. Assented ...	Stock	4	4	73	—	5 9 7
Metropolitan	,,	3	3	67	—½	4 9 7
do. District	,,	3½	4	80	—½	5 0 0
Underground Electric	£1	1½	5	27/-	—6d.	3 14 1
do. do. Income ...	Bonds	6	6	127	—2	4 14 6

TELEGRAPHS AND TELEPHONES.

		Nom.	Dividend. 1926.	Dividend. 1927.	Price Jan. 21, 1929.	Rise or fall.	Yield. D.C.
Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 0
do. Def.	,,	1½	1½	26½	+½	5 13 2
Automatic Telephone	1	10	10	2 1/16	+1/16	4 17 1
Eastern Extension	10	10	10	26½xd.	—½	*3 15 6
Eastern Tel. Ord.	Stock	10	10	267½	—2½	*3 15 0
Globe Tel. and T. Ord.	10	10	10	25½	—½	*3 18 6
do. do. Pref.	10	6	6	11½	+¼	5 9 1
Great Northern Tel.	10	20	20	34½	+½	... ...
Indo-European	25	10	10	51½	+2½	*4 17 1
Marconi	10/-	5	*10	3⅞	—	... ...
Marconi-Marine	1	8¾	12½	3½	—	3 11 5
Oriental Telephone Ord.	1	12	12	2 15/16	+1/16	... ...
United R. Plate Tel.	5	8	8	12½	+⅞	3 4 0
Western Telegraph	10	10	10	26½	—½	3 15 6

*Interim.

HOME AND FOREIGN TRAMS, &c.

		Nom.	Dividend. 1926.	Dividend. 1927.	Price Jan. 21, 1929.	Rise or fall.	Yield. D.C.
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	3 1/16	—	8 14 6
do. do. 5% Deb. ...	Stock	5	5	77½	—	6 9 0
British Electric Traction Def. Ord.	,,	—	—	700	+15	... ...
do. do. Pref. Ord.	,,	8	8	124	—	6 9 1
Brazil Traction	100	6	7	82½	—	2 8 6
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 4 7
Londen & Sub. Trac. 5% Pref. ...	1	Nil	Nil	18/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	79	—	6 6 7
Mexican Light Common	100	Nil	Nil	84½	—	... ...
do. 7% Pref.	100	Nil	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	79	+1½	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

		Nom.	Dividend. 1926.	Dividend. 1927.	Price Jan. 21, 1929.	Rise or fall.	Yield. D.C.
Babcock & Wilcox	1	18	15	3½	—	*4 5 9
British Aluminium Ord.	1	10	10	48/3	—1/16	*4 3 0
British Elec. Transformer Pref. ...	1	7	7	15	—	9 6 8
British Insulated Ord.	1	15	15	4 7/16	+1/16	3 7 6
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4¼	—1/16	3 9 10
do 6½% Pref.	1	6½	6½	1¼	+1/16	5 4 0
Crompton Parkinson Ord.	5/-	—	—	19/6	—	... ...
do. 8% Pref.	1	—	8	25/9	+9d.	6 4 8
Edison-Swan 1st. Pref.	1	7½	7½	25/9xd.	—	5 16 6
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	1	20	20	5 5/16	—1/16	3 15 6
English Electric	1	Nil	Nil	8/9	+1/16	... ...
do. do. Pref	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	10	2 15/16	+3/16	3 8 0
Henley	1	25	25	5⅞	—	4 5 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 3
Met.-Vickers Ord.	1	8	6	35/-	—1/16	... ...
do. Pref.	2	8	8	2¾	—	5 16 5
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	25	—	*4 14 6

*Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Statistics and Comparisons.

THE publication of the foreign trade returns for December enables us to give particulars of that month's electrical exports and imports and also figures for the whole of 1928.

Considering first the December table (I), it will be seen that the exports were £214,159 down as compared with November. This can be accounted for by the Christmas holidays; in 1927 the fall from November to December was about £300,000. Consequently the fall was spread over most of the items, although there were four exceptions. The machinery section, as a whole, showed a decline of £139,466; insulated wires and cables fell by £71,302; and unenumerated electrical goods by £30,449. The greatest increase was recorded for submarine telegraph and telephone cable, while telegraph and telephone apparatus also showed a substantial rise. In the comparison with December, 1927, decreases again predominated. The largest was the fall of £61,660 in the value of exports of telegraph and telephone apparatus, but it may be explained that the exports of this class during December, 1927, were above the average. Insulated wires and cables fell by £16,547, and there was also a decrease in exports of the non-submarine telegraph and telephone class. Against this there was a substantial rise in the fluctuating submarine cable item (£33,160). In the machinery section satisfactory advances in traction motors and unenumerated machinery were partly offset by a fall in "other" motors and generators.

Although the total imports decreased by about £39,000 as compared with the previous month, the total (£620,865) was the third highest ever reached—the first and second being in November and October respectively. Consequently the figure for the last quarter of 1928 was considerably greater than ever before, being £1,931,446. The principal decreases in December, as compared with November, occurred in the cases of unenumerated goods and batteries and accumulators. The largest increase was shown by the machinery class, and there was a general rise in the case of telegraph and

Table I.—Exports and Imports during December, 1928.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Dec., 1928.	Inc. or dec. as compared with Nov., 1928.	Inc. or dec. as compared with Dec., 1927.	Electrical imports for Dec., 1928.	Inc. or dec. as compared with Nov., 1928.	Inc. or dec. as compared with Dec., 1927.	Electrical re-exports for Dec., 1928.	Inc. or dec. as compared with Nov., 1928.	Inc. or dec. as compared with Dec., 1927.
Electrical goods and apparatus (unenumerated)	£216,767	− £30,449	+ £20,499	£135,148	− £28,500	+ £14,801	£7,258	− £1,401	− £1,005
Insulated wires and cables ...	221,449	− 71,302	− 16,547	7,665	− 4,564	+ 6,294	383	− 455	− 1,456
Glow lamps	47,382	− 3,010	− 6,637	2,695	− 765	− 35,191	1,390	+ 605	+ 263
Arc lamps and parts ...	2,133	− 474	+ 993	1,518	− 316	− 1,842	10	− 49	− 382
Batteries and accumulators ...	85,904	+ 2,737	− 3,695	81,248	− 31,110	+ 311	1,815	+ 559	+ 201
Meters and instruments ...	22,100	− 15,238	− 11,388	24,232	+ 2,088	− 4,904	605	+ 267	+ 123
Carbons	411	− 134	− 216	4,863	− 5,778	+ 430	331	+ 262	+ 264
Switchboards (not telegraph or telephone)	5,717	+ 781	− 2,147	154	− 497	+ 82	18	− 193	+ 18
Electrical Machinery—									
Electrical machinery (unenumerated)	309,411	− 54,013	+ 26,301	10,373	+ 14,385	+ 3,473	8,597	− 9,721	− 6,300
Railway and tramway motors	16,986	− 19,266	+ 8,886	—	—	—	—	—	—
Other motors and generators...	186,377	− 66,187	− 10,661	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	56,591	− 21,017	− 13,179	6,698	+ 4,916	− 5,010	8	− 2	− 254
Submarine telegraph and telephone cable	51,137	+ 38,003	+ 33,160	5,950	+ 5,950	+ 5,950	—	—	—
Telegraph and telephone instruments and apparatus ...	213,073	+ 25,410	− 61,660	104,321	+ 5,273	+ 44,346	1,898	− 4,985	− 167
Totals	£1,435,438	− £214,159	− £36,351	£620,865	− £38,918	+ £28,740	£22,313	− £15,113	− £8,695

Table II.—Exports of Electrical Machinery.

Destination.	Dec. 1927. £	Dec. 1928. £		Inc. or dec. £	1927. £	1928. £		Inc. or dec. £
European Countries	59,297	93,364	+	34,067	930,003	1,106,361	+	176,358
Japan	6,858	2,522	−	4,336	318,587	181,779	−	136,808
South America	44,795	37,080	−	7,715	576,961	773,797	+	196,836
South Africa	57,168	53,403	−	3,765	1,041,504	461,944	−	576,560
British India	105,019	118,432	+	13,413	1,152,704	1,512,511	+	359,807
Australia	64,416	54,404	−	10,012	1,254,937	971,995	−	282,942
New Zealand	44,577	28,874	−	15,703	426,738	358,889	−	67,849
Canada	16,666	28,901	+	12,235	238,194	252,758	+	14,564
Other Countries	89,452	95,794	+	6,342	771,189	1,081,450	+	310,261
Totals	£488,248	£512,774	+	£24,526	£6,710,817	£6,704,484	−	£6,333

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telephone cable and material. The importation of submarine cable is a very infrequent event. The December, 1928, imports rose by £28,740 above those of the previous December. The item contributing most to this increase was telegraph and telephone apparatus, although unenumerated goods and insulated wires and

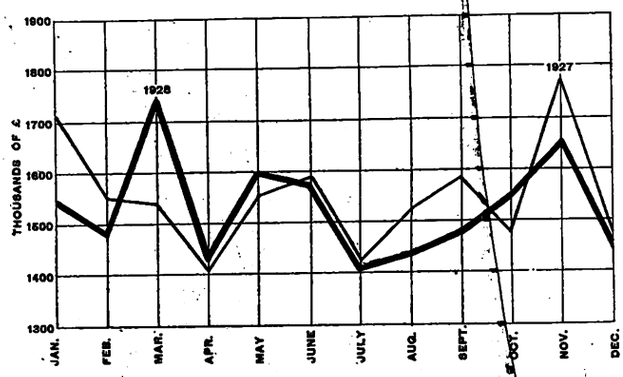
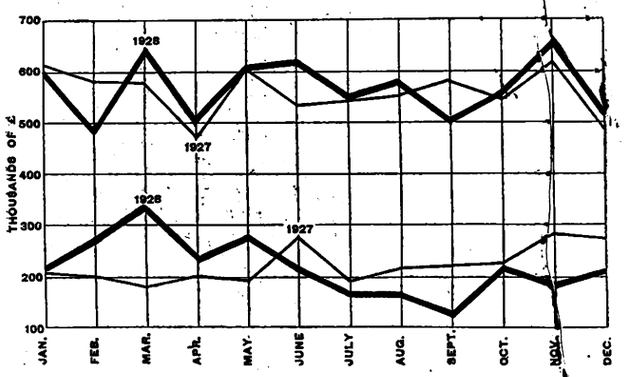


Fig. 1.—Monthly Exports during 1927 and 1928.

cables also showed large rises. A decrease of £35,191 in the imports of electric glow lamps was an outstanding item in this section.

The only details of interest in the re-export section

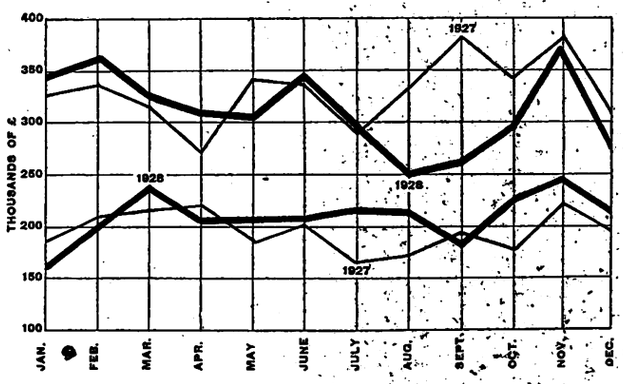


Upper Curves: Electrical Machinery.
Lower Curves: Telegraph and Telephone Apparatus.

Fig. 2.—Two Leading Export Items.

are the decreases in the machinery and telegraph and telephone apparatus classes.

Our second table shows the distribution of electrical machinery exports during December and the whole of the past year. The most prominent fact in the year's list is the reduction of £576,560 in the value of electrical machinery shipped to South Africa; this is another phase of the generally unsatisfactory condition of trade with the Union. The shares of Australia and New Zealand also declined, that of the former by £282,942. We can place against these a rise of £359,807 to the credit of India, which raises her to the first place, *vice* Australia. Japan's purchases fell very considerably, but on the other hand there were larger shipments to South America, Europe, Canada, and other countries. The net result of these fluctuations was a decrease of only £6,333, which, while it indicates a halt, is not unsatisfactory. It should be noted, however, that



Upper Curves: Insulated Wires and Cables.
Lower Curves: Unenumerated Electrical Goods.

Fig. 3.—Other Leading Export Lines.

while the value fell, the weight of the exported machinery rose from 40,878 to 41,274 tons.

Table III sets out the figures for the past year, and it may be said at the outset that the position disclosed is by no means encouraging—a decrease in exports coupled with an increase in imports.

As will be gathered from the above brief survey of machinery exports, the decrease in the total exports for the year was almost wholly due to smaller shipments of goods and apparatus. But in the machinery section itself there were two decreases which were not quite balanced by the rise in exports of "other" motors and generators. Cables were responsible for a large part of the decrease in the total, insulated wires and cables and non-submarine cables showing together a fall of over £260,000. Batteries and accumulators also decreased by £142,653. There were only two substan-

Table III.—Exports and Imports during 1927 and 1928.

	Exports.			Imports.			Re-exports.		
	Electrical exports, 1927.	Electrical exports, 1928.	Inc. or dec. in 1928 as compared with 1927.	Electrical imports, 1927.	Electrical imports, 1928.	Inc. or dec. in 1928 as compared with 1927.	Electrical re-exports 1927.	Electrical re-exports 1928.	Inc. or dec. in 1928 as compared with 1927.
Electrical goods and apparatus (unenumerated) ...	£2,348,043	£2,542,210	+ £194,167	£1,317,460	£1,495,991	+ £178,531	£59,325	£87,500	+ £28,175
Insulated wires and cables	3,030,157	2,868,014	— 162,143	710,221	795,785	+ 55,564	10,298	12,200	+ 1,902
Glow lamps...	593,274	532,586	— 60,688	435,370	424,968	— 10,402	15,067	10,671	— 4,396
Arc lamps and parts ...	19,464	21,041	+ 1,577	37,471	37,234	— 237	1,659	414	— 1,245
Batteries and accumulators	1,233,668	1,091,015	— 142,653	746,620	742,687	— 3,933	6,560	9,288	+ 2,728
Meters and instruments ...	374,181	378,351	+ 4,170	288,182	279,866	— 8,316	9,178	9,227	+ 49
Carbons	24,482	13,726	— 10,756	94,037	128,339	+ 34,302	580	1,456	+ 876
Switchboards (not telegraph or telephone) ...	74,524	72,857	— 1,667	1,252	1,742	+ 490	7	373	+ 366
Electrical Machinery—									
Electrical machinery (unenumerated)	3,862,032	3,784,337	— 77,695	1,598,350	1,723,422	+ 125,072	116,384	143,352	+ 26,968
Railway & tramway motors	495,159	475,191	— 19,968	—	—	—	—	—	—
Other motors and generators	2,353,626	2,444,956	+ 91,330	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	954,772	855,418	— 99,354	108,679	71,917	— 36,762	3,412	827	— 2,585
Submarine telegraph and telephone cable	547,998	630,301	+ 82,303	73	5,950	+ 5,877	—	—	—
Telegraph and telephone instruments and apparatus...	2,677,712	2,623,620	— 54,092	487,468	726,856	+ 239,388	42,288	35,311	— 6,977
Totals	£18,589,092	£18,333,623	— £255,469	£5,855,183	£6,434,757	+ £579,574	£264,758	£310,619	+ £45,861

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tial rises among the "goods and apparatus" items, *viz.*, in unenumerated goods (£194,167) and submarine cables (£82,303). It should be noted that the total value of electrical exports in 1926 was £19,183,355.

In 1927 electrical imports rose in value by £907,527 above the 1926 total; last year there was a further increase of £579,574. Thus the balance in our favour (ignoring re-exports) has fallen from £14,237,418 in 1926 to £12,733,909 in 1927 and £11,898,866 in 1928.

The item which showed the greatest advance in 1928 was telegraph and telephone apparatus (£239,388), coincident with a fall in exports of this class. Unenumerated goods and machinery recorded rises of £178,531 and £125,072 respectively. The only substantial decreases occurred in the cases of non-submarine telegraph and telephone cables (£36,762) and glow lamps (£10,402).

There was a fairly general rise in the re-export section resulting in a net increase of £45,861.

The accompanying curves trace the course of imports and exports month by month.

Fig. 1 shows the monthly fluctuations of the export total during the past two years. Generally speaking, there was an improvement in the earlier part of 1928, but this was not maintained. Each curve exhibits two distinct peaks. In January, 1927, the rise of the curve was due to a large exportation of submarine cable; in November of the same year this was again a contributory cause, but a rise in exports of telegraph and telephone apparatus was mainly responsible. The two 1928 peaks—in March and November—were entirely due to greatly-increased machinery exports, which show prominently in fig. 2. In each of the two years exports reached low levels in April, July, and December; this may be attributed to holiday influences. The curves in fig. 2 illustrate the courses of two classes of exports, namely, electrical machinery and telegraph and telephone apparatus. The former class is represented by the upper pair of curves, and from these it will be seen that machinery exports are fairly steady, most of the points lying between £500,000 and £600,000. The two 1928 peaks have already been mentioned; apart from these, the influence of machinery on the general export curve is not so pronounced as might be expected when it is considered that it represents about a third of the

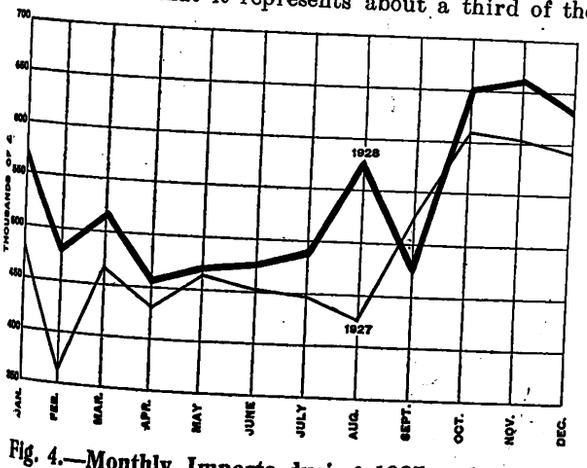
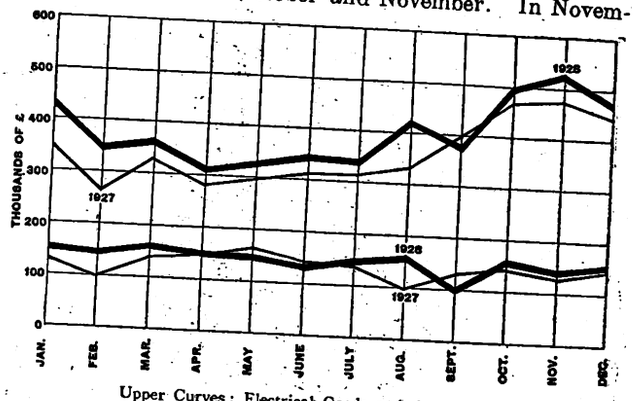


Fig. 4.—Monthly Imports during 1927 and 1928.

total. With regard to telegraph and telephone apparatus, it will be seen that for the first four months of 1928 the curve was above that for 1927, but then fell, and during the last eight months remained below it. Last year's fluctuations were far more severe than those of 1927, the difference between the lowest and highest points being £200,000, against £100,000 in 1927. Two other leading export lines are illustrated in fig. 3. In this the upper curves show the monthly exports of insulated wires and cables, including non-submarine telegraph and telephone cables. The scale is larger than that of the foregoing curves, for convenience, which somewhat exaggerates the fluctuations. During the first half of each year exports were fairly steady, but thereafter there were sudden changes. In 1927 the curve went upwards and fell at the close; in 1928 the movement was downward at first, followed by an upward trend for three months and a large fall in December. Unenumerated goods are represented by the lower curves. In comparison with other items, they show considerable steadiness. In fact, for five months of 1928 they remained at practically the same level. For most of the year they were greater in value than in the corresponding months of 1927.

Monthly import totals are the basis of the curves in fig. 4. The leading characteristic of each curve is the rising tendency throughout the year, culminating in very high values in October and November. In Novem-



Upper Curves: Electrical Goods and Apparatus.
Lower Curves: Electrical Machinery.

Fig. 5.—An Analysis of Imports.

ber, 1928, the monthly import total reached the highest figure yet recorded, and during the whole of the year (except in September) values were higher than in 1927. Fig. 4 shows that such fluctuations as occurred in the import figures were almost wholly due to electrical goods and apparatus (upper curves). Electrical machinery, shown in the lower curves, varied to a remarkably small extent from month to month. In 1928, except for a fall to just below £100,000 in September, the monthly figure never varied by more than £20,000.

Russian Possibilities.

A Moscow correspondent recently contributed an article on Russian affairs to the *Manchester Guardian Commercial* which, while containing little which was new, summarised the position very well. It was aimed particularly at showing the need which Russia has of foreign capital with which to develop her immense resources. The writer showed that while the present Government had repudiated all pre-Revolution obligations, it had always been scrupulously accurate in fulfilling its own. With regard to the magnitude of the commercial debt which Russia could safely carry, the correspondent stated that that probably depended upon the degree to which a liberal credit policy on the part of foreign business firms would hasten the development of Russian export trade up to and beyond the pre-war level and facilitate the increased production of gold and other precious metals within Russia itself. As yet there was no indication that the Soviet Union was likely to receive more credit than its natural wealth and resources would enable it to repay. After foreign trade, concessions constituted the most important commercial link between Russia and the outside world. There was an improvement in concession conditions in the latter part of 1928. The writer concluded by saying that it was questionable whether the more ambitious Soviet projects of rapid industrial expansion within the near future could be fully realised unless economic ties with the outside world, in the shape of foreign trade, concessions, and loans, were broadened and strengthened. But the Soviet Union, despite its comparative poverty, represented an inevitably expanding market for countries with highly developed machine-building industries and a potentially rich field for the daring prospector in mining and other forms of industrial pioneer development.

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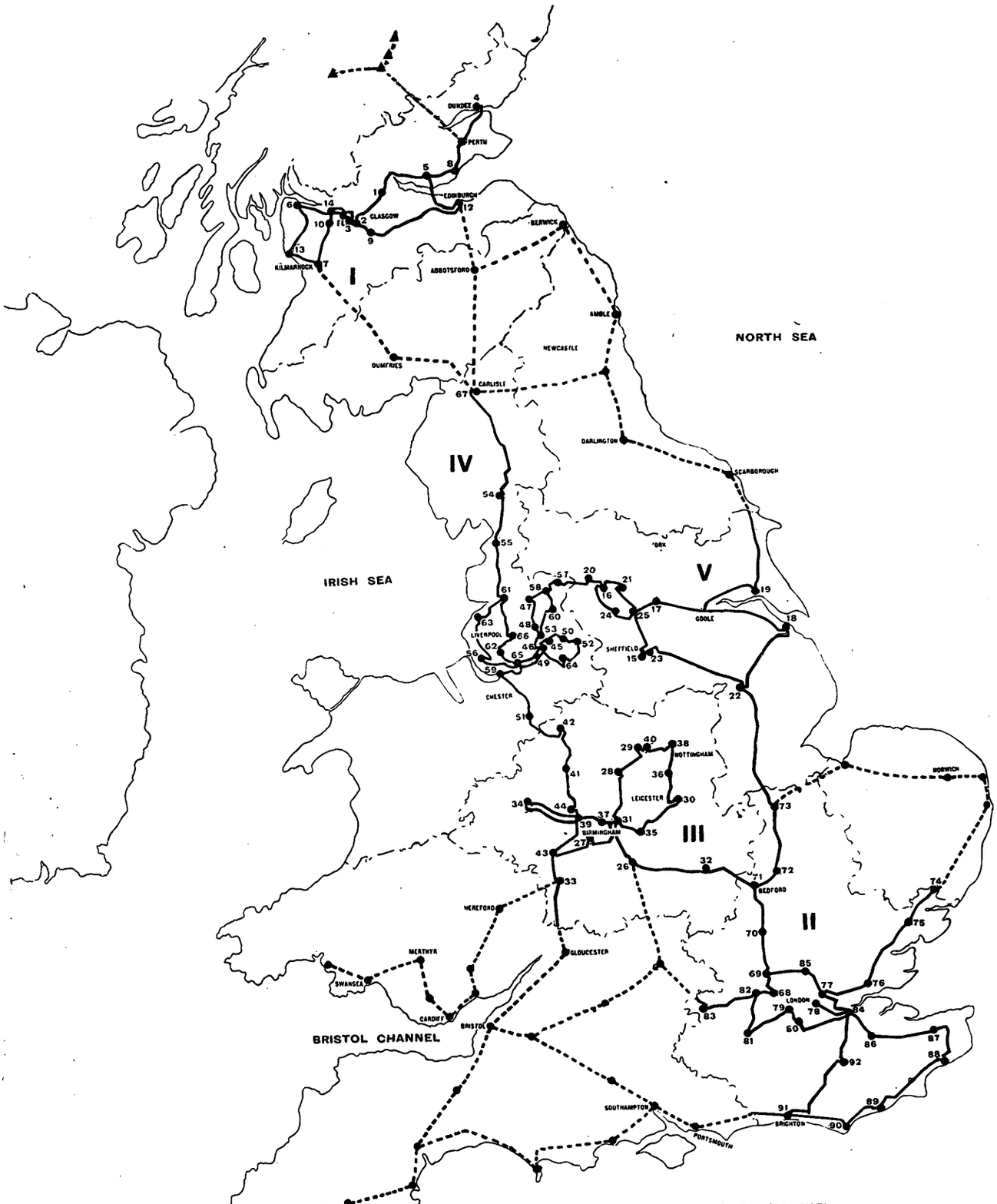
The Electricity Schemes.

An outline of the progress of the Central Electricity Board towards the construction of the national network of 132,000-volt main transmission lines and transformer stations.

JUST over eight years ago, in our issue of January 7th, 1921, we published an article under the heading of "The Electricity Districts," with an accompanying map showing the electricity districts as then provisionally delimited by the Electricity Commissioners for the purposes of Section 5 of the Electricity (Supply) Act, 1919. We have now prepared a map, which is reproduced herewith, showing the areas and primary transmission systems of the first five electricity schemes prepared by the Electricity Commissioners in pursuance of Section 4 of the Electricity (Supply) Act, 1926. The fifth scheme—for Mid-East England—was published only last



The numbered references relate to the tables on p. 169.

Map of the Electricity Schemes.

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week (see below), but the other four have been adopted by the Central Electricity Board, and work has commenced.

The first scheme—for Central Scotland—has a portion of line already erected. Contracts have been let for work in connection with the second scheme, for South-East England, and tenders have been invited in respect of the third and fourth schemes, for Central England and for North-West England and North Wales, respectively.

Some of the estimates given in the "Supplementary Particulars" published with each scheme are given below, although it is evident that the original estimates will be subject to alteration, as the Central Electricity Board has made certain modifications before adopting the schemes. The "Supplementary Particulars" state that the schemes provide for overhead primary transmission lines to be operated at a voltage of 132,000 volts between phases, the carrying capacity of each primary line covered by the estimates being not less than 50,000 kW, and that ring mains have been regarded as an essential feature in the design.

ESTIMATES FOR THE 132,000-VOLT TRANSMISSION SYSTEMS.

Scheme No.	Transmission Lines.			Transformers.	
	Circuit Miles.	Route Miles.	Cost £	Capacity KVA.	Cost £
I	256	228	661 480	810,000	903,050
II	768	511	2,100,975	1 680,000	1,867,630
III	424	369	949,921	1 235,000	1,526,370
IV	384	338	910,150	1,320,000	1,685,200
V	342	324	679 950	590,000	810,580
Total ...	2,174	1,770	5,302,476	5,635,000	6,792,830

The "Supplementary Particulars" also give the following figures for area in square miles, population, and energy sold to consumers in 1927-28:—

Scheme No.	Area in sq. miles.	Population (1921 Census).	KWH sold in 1927-1928 (millions).
I	4,980	3,761,200	730·54
II	8,828	11,392,561	1,726·01
III	7,311	5,218,146	933·95
IV	9,082	6 980,925	1,475·00
V	7,545	4,666,500	854·78
Total ...	37,746	32,019,332	5,720·28

The accompanying map, p. 168, shows the areas comprised in the five schemes which have now been formulated:—

I.—Central Scotland (ELEC. REV., May 13th, 1927, p. 754).
II.—South-East England (October 7th, 1927, p. 604).
III.—Central England (March 23rd, 1928, p. 529; revised, June 8th, 1928, p. 1020).
IV.—North-West England (June 29th, 1928, p. 1130).
V.—Mid-East England (below).

It also shows diagrammatically the layout of the 132,000-volt lines and transforming stations in connection with the above schemes (the "primary transmission system"). Several selected stations are interconnected with the primary system by transmission lines operating at lower pressures, and certain stations working under temporary arrangements are connected to the primary system by secondary lines, which are not shown on the map, but are included in the schemes. Broken lines indicate the assumed lay-out of the mains in the areas for which schemes have not been published (based on the paper by Messrs. Johnstone Wright and C. W. Marshall, read before the Institution of Electrical Engineers).

Transforming stations (132,000 volts) are to be provided (unless otherwise determined by the Board) at the undermentioned places, numbered as on the map.

CENTRAL SCOTLAND.

1 Bonnybridge.
2 Clydes Mill.
3 Dalmarnock.
4 Dundee.
5 Dunfermline.
6 Greenock.
7 Kilmarnock.
8 Kirkcaldy.
9 Motherwell.
10 Paisley.
11 Port Dundas.
12 Portobello.
13 Saltcoats.
14 Yoker.

MID-EAST ENGLAND.

15 Sheffield.
16 Valley Road.
17 Ferrybridge.
18 Grimsby.
19 Hull.
20 Keighley.
21 Kirkstall.
22 Lincoln.
23 Rotherham.
24 Thornhill.
25 Wakefield.

CENTRAL ENGLAND.

26 Avon.
27 Bournville.
28 Burton-on-T.
29 Derby.
30 Freeman's M'w.
31 Hams Hall.
32 Hardingstone.
33 Hylton Road.
34 Ironbridge.
35 Longford.
36 Loughborough.
37 Nichells.
38 North Wilford.
39 Ocker Hill.
40 Spondon.
41 Stafford.
42 Central (Stoke o/T.).
43 Stourport.
44 Wolverh'pton.

N.W. ENGLAND AND N. WALES.

45 Agecroft.
46 Barton.
47 Blackburn.
48 Bolton.
49 Carrington.
50 Chadderton.
51 Crewe.
52 Hartshead.
53 Kearsley.
54 Kendal.
55 Lancaster.
56 Lister Drive.
57 Nelson.
58 Padiham.
59 Percival Lane.
60 Rawtenstall.
61 Ribble.
62 St. Helens.
63 Southport.
64 Stockport.
65 Warrington.
66 Wigan.
67 Willowholme.

SOUTH-EAST ENGLAND.

68 Willesden (L.P. Co.).
69 Watford.
70 Luton.
71 Bedford.
72 Little Barford.
73 Peterborough.
74 Ipswich.
75 Colchester.
76 South Benfleet.
77 Barking.
78 Kidbrooke.
79 Wimbledon.
80 Croydon.
81 Woking.
82 Uxbridge.
83 Reading.
84 Swanscombe.
85 Brimsdown.
86 Maidstone.
87 Canterbury.
88 Folkestone.
89 Hastings.
90 Eastbourne.
91 Brighton.
92 Tunbridge W's.

During 1929 three more schemes will probably be published, *viz.*, covering (vi) North-East England, (vii) South-West England and South Wales, and (viii) a supplementary one for Norfolk and Suffolk (see also East Anglia, ELEC. REV., May 18th, 1928, p. 888). During 1930 the last two schemes will materialise, covering (ix) Northern Scotland, and (x) Southern Scotland.

The Mid-East England Electricity Scheme, 1928.

Prepared by the Electricity Commission in pursuance of Section 4 of the Electricity (Supply) Act, 1926.

THE Mid-East England Electricity Scheme, 1928, was published by the Central Electricity Board on January 19th. It is the fifth of its kind and deals with an area of about 7,545 square miles, covering the East and West and part of the North Ridings of Yorkshire, the Counties of Lincoln* and Rutland, and part of the Counties of Nottingham and Derby. The area had a population at the last census of approximately 4,666,500, and embraces densely populated industrial centres of coalmining, iron and steel making, textiles, and engineering; also wide tracts of agricultural territory, and includes a number of important canal, dock, and harbour undertakings.

* See also ELEC. REV., November 30th, 1928, p. 960.

At present there are 73 authorised undertakers in the area, owning between them 40 public generating stations. The consumption of electricity in 1927-28 was about 183 kWh per head of the above-mentioned population; it is estimated that this figure will increase to an average of 321 kWh in 1934-35.

According to the scheme it is proposed that 18 existing stations will be selected and operated for the Board. It is not anticipated that any new stations will be required, but the scheme provides for three further stations to be worked under temporary arrangements for a few years. There are important sources of waste heat in the area, which the Board may be able to use when the transmission system has been erected. Broadly speaking, five of the selected stations, *viz.*, Ferrybridge, Kirkstall (Leeds), Thornhill, Blackburn Meadows and

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the Prince of Wales station (Rotherham), will carry the base load, while the remainder will be used for meeting the peak load; it is thought that in due course it will be possible to reduce the number of peak-load stations required.

Existing generating stations that have been selected are named in Table I, and 3-phase, 50-cycle, generating plant and boilers are to be added to the undermentioned stations:—

(i) Blackburn Meadows, 25,000 kW for the winter of 1935-36 and 25,000 kW for the winter of 1936-37.

(ii) Ferrybridge, 50,000 kW for the winter of 1935-36 and 50,000 kW for the winter of 1938-39.

(iii) Kirkstall, 50,000 kW for the winter of 1937-38 and 50,000 kW for the winter of 1939-40.

(iv) Prince of Wales, 32,000 kW for the winter of 1937-38 and 50,000 kW for the winter of 1940-41.

(v) Thornhill, 50,000 kW for the winter of 1938-39.

While the scheme is being carried to completion four municipal generating stations, *viz.*, Bridlington, Doncaster, Grimsby, and Whitehall Road (Leeds), will be operated for the Board as a temporary arrangement. There is only one company undertaking in the area.

TABLE I.—EXISTING SELECTED STATIONS.

Barnsley	(Barnsley Corporation).
Barugh, Ferrybridge, Thornhill	(Yorkshire Electric Power Co.).
Blackburn Meadows, Neepsend	(Sheffield Corporation)
Chesterfield	(Chesterfield Corporation).
Foss Islands	(York Corporation).
Halifax	(Halifax Corporation).
Harrogate	(Harrogate Corporation).
Huddersfield	(Huddersfield Corporation).
Hull	(Kingston-upon-Hull Corporation).
Keighley	(Keighley Corporation).
Kirkstall	(Leeds Corporation).
Lincoln	(Lincoln Corporation).
Prince of Wales	(Rotherham Corporation).
Valley Road	(Bradford Corporation).
Wakefield	(Wakefield Corporation).

As is indicated on the accompanying map, the stations will be interconnected by 3-phase, high-voltage, main transmission lines designed to form a series of ring mains for greater security. Incidentally, station interconnection will result in the release for revenue-earning purposes of about 80,000 kW of plant now kept as spare, representing about £1,360,000 of capital.

The principal main transmission system will comprise 324 route miles of 3-phase overhead lines and 11 transforming stations; 13 sections of line will operate at 132 kV between phases and be capable in each case of transmitting 50,000 kW, while the voltage of eight sections of line has yet to be approved by the Commission. Some 17 transforming stations will have an aggregate capacity of 725,000 kVA, the largest being at Ferrybridge (120,000 kVA), and the smallest at Lincoln (10,000 kVA).

The secondary transmission system will involve a further 20 transforming stations; six 3-phase overhead lines will operate at 33,000 volts between phases, or other approved pressure. When such lines cannot reasonably be constructed underground cables will be laid to operate at voltages to be approved by the Commission. Some 12 transforming stations will have an aggregate capacity of 41,300 kVA, the largest at Rotherham (10,000 kVA), and the smallest at Oakham (300 kVA).

As most of the undertakings in the area are efficient, it is not likely that the saving which will result from the operation of the scheme will be as great as in the case of some of the other schemes.

The cost of the scheme to the Board for the erection of the transmission system is estimated at £2,907,156, in addition to expenditure by undertakers of about £1,709,594 on extensions of certain existing stations. It is estimated that the full advantages of the scheme can be secured with a saving of about £2,148,834 on capital expenditure (up to the year 1935-36), compared with the capital expenditure that would be necessary if the present system were continued; after that date the saving on capital expenditure should be progressively greater, compared with individual development.

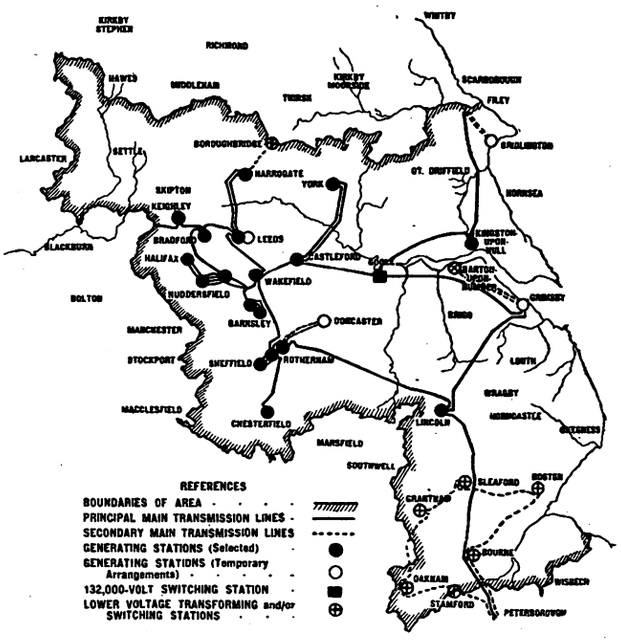
The Commissioners have outlined a provisional plan of working the stations, with the necessary estimates: their suggestions are, of course, tentative, since the working of the scheme, including the fixing of tariffs, is the responsibility of the Board; but, taking the figures as they stand, it is of interest to note that the Commissioners estimate that in the five years 1931 to 1936 there will be a saving to the undertakers in the area of about £1,397,360, or an average of well over a quarter of a millions pounds per annum.

The maximum load in the area at the end of 1927-28 was 372,381 kW, and is estimated to reach 624,892 kW at the end of 1934-35, an increase of about 68 per cent.; by the end of 1940-41 it is estimated to reach 923,000 kW, or 2.48 times the observed maximum load at the end of 1927-28.

The sale of electricity in the area during 1927-28 amounted to 854.78 million kWh, or an average of 183 per head of population and is estimated to reach 1,495.87 millions in 1934-35, which represents an increase of 75 per cent. during the seven years, or an average of nearly 10.7 per cent. per annum based upon the 1927-28 output, and corresponds to a sale in 1934-35 of 321 kWh per head of population based on the 1921 census.

Between 1921-22 and 1927-28, the growth of consumption was from 405.05 to 854.78 million kWh, representing an average yearly increase of 74.95 millions, compared with the average rate of increase from 1927-28 to 1934-35 estimated at 91.58 million kWh per annum. The growing demand for electrical power in the coal mining, iron and steel, woollen, textile and other industries, and the marked increase in the demand for electricity for domestic purposes already observed in parts of the area support this estimate of increased annual growth. The sale of electricity in 1940-41 is estimated to amount to 2,277 million kWh, representing 488 per head of population based on the 1921 census.

So far as the stations of authorised undertakers are concerned, there is practically no generating plant of non-standard frequency in the area, but supplies are distributed at a non-standard frequency in a number of instances; for example, by certain authorised undertakers who derive their supplies in bulk from outside sources, such as colliery undertakings. As the alteration of these non-standard distribution systems is not essential to the carrying out of the proposed transmission



Map of Mid-East England Electricity Scheme.

system of the Board, neither the scheme nor the financial estimates make any provision on that behalf.

Copies of the scheme with map, and of the supplementary particulars with load curves, price 1s. 6d. and 3s. 6d. net, respectively, are obtainable from H.M. Stationery Office.

Water Power in the Canadian Paper Industry.

A recent analysis by the Dominion Water Power and Reclamation Service of the Department of the Interior, Canada, shows that the pulp and paper industry relies almost entirely upon water power for its energy requirements. The pulp and paper industry is Canada's greatest manufacturing industry, its gross value of production being $219,329,735. The water power utilised by the pulp- and paper-mill organisations aggregates 565,362 h.p., of which 283,009 h.p. is supplied directly to pulp and paper machines, and 282,343 h.p. through electric generators. In addition, power is obtained from central stations, and the turbine capacity supplying power to pulp and paper mills in the country aggregates in round figures 1,355,000 h.p., of which 1,071,873 h.p. is hydro-electric and the remainder direct hydro drive. The power utilised in the pulp and paper industry is, therefore, over 28 per cent. of the total hydro power supply in the whole Dominion, and the power purchased in 1927 amounted to almost one-third of all the power produced for sale by the central electricity stations. The advantages of the conversion of hydraulic power to electrical energy appear both in the quality of the product, which is improved by the uniform speed obtained, and in the fact that under modern methods of transmission it is possible to develop power at sites more or less remote from centres of labour and transportation and to transmit it to points where these facilities are available for mill operation. The use of steam as a source of power for the industry is very limited, the total installation amounting to only 190,352 h.p., or 8.2 per cent. of the total power capacity. There is also some slight use of internal combustion engines.

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The Overhead Lines Association.

The British climate's influence on overhead electric lines, based on actual meteorological returns.

IN a paper which he read before the Association in London on January 16th, Mr. G. W. Molle set forth the results of an examination of actual meteorological returns from 238 places, covering all parts of England, Scotland, and Wales, the investigation having been undertaken with a view to discovering what are the actual weather conditions to which British overhead electric lines are subjected. Particular attention was paid to the snowstorm which occurred in December, 1927, and the author's conclusion was that the worst to be expected is an accumulation of ice, or sleet, with a wind of less than 30 m.p.h. (probably about 10 m.p.h.), followed by a high gale, but that snow will not adhere to lines if it accompanies a high gale. The methods in use for the measurement of wind velocities were described in the paper, and such questions as low temperature conditions, the variations of temperature and wind pressure at ground and other levels, &c., were discussed.

Previous writings on the subject, said the author, showed generally that the safety factors allowed for wind pressure were much too high, and that the effect of wind on structures was usually very much over-estimated. Wind velocity was lower near the ground than at greater heights, and it was logical, therefore, to use lower safety factors for shorter poles; for instance, in the case of a pole 10 metres (33 ft.) high, most of the force of the wind acted on the top half of the pole. Gust pressure might be assumed to be twice gale pressure, but the effect of a gust was purely local. It appeared to be well established that wires of small diameter, such as those used by the Post Office, had actually been known to break under lateral wind pressure alone, but it was very doubtful if any power conductor had ever failed in that manner. Wires smaller than 0.03 sq. in. would break under wind pressure alone, but those of 0.03 sq. in. or larger would not. Figures given by Sir William Slingo (late chief engineer, Post Office) in the course of a discussion on a paper on h.p. overhead transmission lines by Mr. G. V. Twiss, before the I.E.E. in 1917, showed that wires of 0.01 sq. in. broke down in every storm, those of 0.02 sq. in. broke down in severe storms, and those of 0.03 sq. in. rarely broke down; all those wires were erected under the same conditions of assumed loading and factor of safety. Mr. Molle added that a distribution system erected very recently at Lairg, in the north of Scotland, withstood perfectly a 100-m.p.h. gale within a few weeks of completion, although many trees were uprooted. There could be no doubt that good pole-foundation work was the most important point in overhead-line construction: a good pole with a bad foundation would go over sooner or later, but a weak pole with a good foundation was far less likely to do so.

He discussed in detail the snowstorm of December, 1927, concluding that snow fell most frequently in coastal districts and highly-elevated places on the west side of the country. Snow undoubtedly fell on occasions in company with gales of velocities of from 24 to 46 m.p.h., *i.e.*, maximum pressures of from 4 to 13 lb. per sq. ft. By far the most likely condition, with snow, was a wind of 12 m.p.h., or less, just enough to keep the snow drifting and allow it to stick; hence the possible danger of a subsequent high gale. The lowest temperatures occurred always with winds of 12 m.p.h., or less. Examination of the figures as to the frequency of snow-falls over a long period showed that it was most frequent in the north and east of Scotland and England.

At heights greater than 4 ft. above ground, temperature fell an average of 1 deg. F. per 1,000 ft.; but on cold, clear, calm nights an "inversion" occurred, and the cold air fell and collected near the ground. Under those conditions a conductor which was radiating heat might reach a temperature of 10 deg. F., or lower. Summarising low-temperature data, he said that in a dead calm overhead lines might be subjected to ice loading and low temperature. With winds of from 0 to 24 miles per hour, ice, low temperature, and wind pressure might occur together, particularly with winds up to 12 m.p.h. With winds of from 31 to 46 m.p.h., snow had been known to fall, but the temperature would not be excessively low, and ice was not likely to form on wires during such a gale.

The personal experience of engineers, local officials, &c., was that snow and ice sometimes accumulated on G.P.O. lines, but not on power lines. There were two purely electrical troubles with power lines due to snow. The piling up of snow, or sleet, on the cross-arm and on tops of insulators caused a flashover which operated the circuit breaker and also removed the sleet sufficiently to allow the line to be switched in again. Where conductors were parallel in a vertical plane, the alternate accumulation and dropping of sleet caused a lower conductor to spring up and make contact with the one above.

The author's general conclusions were that gale pressures reached 18.4 lb. per sq. ft. in Western Scotland, North-West England (especially the Liverpool district), Devon, and Cornwall; momentary gust pressures reached 36 lb. per sq. ft. in those districts. In Eastern Scotland and Wales the corresponding figures were 14 and 28 lb.; elsewhere the limits were 11 and 22 lb. per sq. ft. A severe snowstorm affected the whole country: it was most unusual for snow to be accompanied by a wind greater than 12 m.p.h., equivalent to 0.43 lb. per sq. ft.; very occasionally it occurred with gales of 85 m.p.h., only one such instance having been traced by an investigation of the records from 1880 onwards. The records relating to 238 places at the time of the storm of December, 1927, showed that in only one case was there a wind of even as great a velocity as 50 m.p.h. accompanied by snow. It was safe to say that if the meteorological records of a place showed no instance of the kind up to the present date, no such trouble need be expected in that place. With a wind of 20 m.p.h. (1.2 lb. per sq. ft.) or any higher velocity, no temperature lower than 22 deg. F. need be expected. Winds of lower velocity were known to be accompanied on occasions by snow and temperatures which might be as low as 10 deg. F., depending on the local temperature records.

The new British Overhead Line Regulations prescribe a temperature of 22 deg. F., ⅜ in. of ice, and a 50-mile wind, but the author claimed to have shown that such conditions would never occur simultaneously where power lines of 0.03 sq. in., or over, were used. The ice loading prescribed was nothing but a simple way of expressing the mathematical idea of a wind pressure incident at some angle between the horizontal and the vertical: it was suggested that it was totally unnecessary, except in the case of wires less than 0.03 sq. in. in area, and that in the case of all other wires it would be perfectly safe to allow only for the maximum wind pressure in the district concerned, without any other load, at 30 deg. F.

Discussion.

Major THEODORE RICH said the paper brought out very clearly that it was ridiculous to apply the same regulations in, say, Middlesex and Wick, or for the Scilly Isles and the north-east of Essex. Accumulation of ice and snow upon transmission lines did not occur in this country at the same time as high winds prevailed, and it was interesting to note that the French Government in its latest regulations had given up the idea of simultaneous ice and snow loading and high wind pressure; special provision was now made for light lines in areas where such conditions were not likely to be met. At the same time, the regulations provided for very special arrangements for 120,000-volt lines where the conditions were known to be very severe. The point was that they should not be asked to pile up the capital expenditure where heavy conditions were not met with.

Mr. W. A. TURNBULL (Aylesbury) said the prevailing wind in the South of England was south-west, and he had adopted the plan of strengthening his poles where they were at right angles to it, and not worrying about the poles that were not. In the same way, he was careful to remove trees on the windward side of his lines and did not worry about the others.

Mr. W. R. ERLEBACH referred to the experience gained in connection with aircraft relative to the effect of wind pressure in relation to the form of the structure and the advantage of stream-lining. To speak, therefore, of a wind pressure of so many pounds per square foot did not convey a great deal of information unless the shape of the structure was taken into account. Mr. W. B. Woodhouse, in his recent I.E.E. paper, had drawn attention to that point, and it would be necessary to consider wind pressure in relation to the different types of overhead construction. His own observation in the Lake District showed that ice first began to form on the windward side, but as the ice needles were formed they turned with the direction of the wind. One of the Central Electricity Board's lines was to be carried through the Lake District from Cockermouth to Keswick, and it was to be anticipated that by reason of the action he had just mentioned there would be a tendency for the ice to twist the cables. The formation of ice took place at low temperature and low wind pressures at those high altitudes, but he did not suggest that the same precautions which would be necessary there should also be taken in the South of England.

Mr. W. M. MORDEY was able more or less to bear out what Mr. Erlebach had said with regard to the formation of ice

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needles and what were called "ice flowers" in Switzerland. It was often stated, he added, that ice and snow would not adhere so readily to aluminium conductors as to copper conductors: he had tried to ascertain whether that was actually the case, but so far had not been able to obtain any reliable information on the point. It was claimed as a fact in the advertisements of aluminium conductors, and he had been told by the engineer in charge of the North Wales lines, that no trouble had ever been experienced with ice and snow loading those lines. If it was the fact it would be interesting to know why.

Mr. J. MULHOLLAND (Meteorological Department, Air Ministry) said the conditions favourable for low temperature were light winds and general calm, and they usually occurred during the night. The conditions favourable for the adhesion of ice were the combination of a warm westerly wind and rain falling through cold air on to a surface which was below the freezing point. In the open country the prevailing wind was between south-west and west-south-west.

Mr. C. F. MOUNSDEN suggested that there might be a streamline effect in connection with overhead-line construction which had not been sufficiently taken into account when endeavouring to ascertain the real wind pressure upon those structures; it might have to be taken into account when calculating the size of the pole.

Mr. E. K. SCOTT referred to the corona effect being less with small wires than with large ones, according to experience in the United States, and said that although they did not at present use voltages sufficiently high to make the corona effect serious, they would have to do so eventually.

The President (Mr. W. FENNELL) said it was no use the Electricity Commissioners taking a wind pressure of 50 miles an hour with ice loading into account when such conditions never existed, according to the records, in this country. Personally, he believed the ice loading would have to disappear and that some figure for the maximum wind pressure without ice would have to be worked to. He had been working in the Mid-Cheshire area for some years and had never yet experienced a 50-mile an hour wind with ice, and such conditions did not exist even in the severe storm of last year. There was any amount of wind in that part of the country, however, and he was anxious on that account; at the moment, a wind pressure of 106 miles per hour was the maximum that had been recorded, and that was getting rather close to his factor of safety. He had read some years ago in the ELECTRICAL REVIEW that somewhere in Switzerland they actually passed current through the lines to melt the snow, and, of course, that could be done by inserting a transformer and passing a heavy current at low voltage through. The idea that snow did not adhere so freely to aluminium conductors might have something to do with the fact that they heated up more than copper conductors.

Mr. G. W. MOLLE, in the course of his reply, said that when he was at Grenoble some eight years ago the French Government was then insisting upon the wind pressure and ice loading basis, but he had never been able to ascertain that those conditions had ever existed there, although many miles of aluminium lines ran over the mountains. Personally, he did not believe that they should ever meet those conditions in this country, either with aluminium, or any other type of conductors. As to the effect of the shape of the transmission structures, probably the best form would be pear shaped, but he saw no prospect of poles of that shape being adopted. He believed that in America they sent a heavy current at low voltage through the lines to melt snow and sleet.

The PRESIDENT, proposing a vote of thanks to the author, which was heartily responded to, did not agree with the view that a weak pole on a good foundation was better than a good pole on a weak foundation. Experience had shown that whereas after a storm strong poles in weak foundations shifted their positions, but could be replaced and strengthened, weak poles on strong foundations simply snapped off and cost a great deal to replace.

Load-Levelling Relays.

An attempt to show that their application in conjunction with the service fuses and simple metering installations on consumers' premises, for disconnecting load which can be dispensed with, is a solution of the load-factor improvement problem.

By W. HOLMES, A.M.I.E.E.

(*Extracts from Paper read before the* METER AND INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IT is suggested that in future load levelling will concern the distributing mains, consumers' services, and meter engineers, rather than power-station engineers.

Metering and Tariff Methods.—No attempt is made to completely survey metering methods and tariff systems, but sufficient is said to indicate that all (except flat rates) are devised for the same object, *i.e.*, the levelling of the load on the supply mains, and considerable success has been attained, but it is becoming more and more difficult to adjust tariff rates, and it will soon be unjustifiable to exploit the lighting demand at a high price per unit when lighting no longer represents the peak load. Moreover, supply engineers must

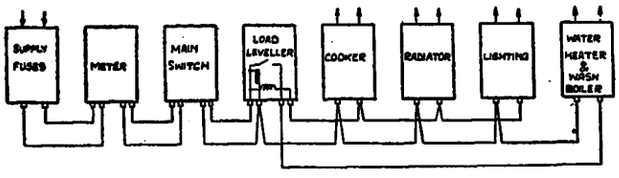

Fig. 1.—Wiring Diagram.

adopt means of levelling up the loads mechanically, or automatically, and not depend upon the consumer.

Control at Generating and Sub-stations.—One of the most interesting schemes yet put forward in a practical way is the Wilkinson change-circuit system.* Unfortunately, it needs additional mains and special gear at the receiving end. The problem of the high-voltage heating element may easily be solved, but the accurate variable-voltage meter will provide another problem.

The control of relays by pilot wires has received very little attention, but radio control of relays has often been suggested. In San Francisco there is carrier-current control of the street lighting and "Olipel" superimposed-current impulse control has already found a useful field for street lighting. The use of time switches may be regarded as control from the generating station.

Off-Peak Loads.—Before attempting to level up the load, it is necessary first to find the off-peak load. The Electricity Commissioners' Report of 1925-6 shows that, for the whole country, 51.4 per cent. of the revenue comes from lighting and domestic supplies, even if we include such large supply systems as those at Newcastle and Manchester, where the domestic load amounts to 4 and 14 per cent., respectively.

The modern electric domestic thermal-storage cylinder will retain its useful hot water more than a week after the electricity supply has been switched off: a 100-gallon storage tank on a 24-hour basis has an overall efficiency of approximately 93 per cent.: its capital cost will be of the order of £60, and its life will be over 30 years.

A secondary battery of 50-kWh storage capacity will have a watt-hour output/input efficiency approaching 80 per cent.; its cost will be of the order of £400, and its life will be under eight years.

Assuming that electricity costs ½d. per unit, and allowing interest on the capital at 5 per cent. (simple, not compounded with depreciation), we get a total cost for *thermal storage* of 0.101d. per unit and for *electric storage* of 1.02d. per unit,† excluding battery service. Thermal storage water-heating, both for water supply and for central heating, therefore supplies the ideal off-peak load. The thermal-storage cooker is used in Norway and Sweden, chemical processes in industry might be developed, and a few illustrations of off-peak load apparatus have recently been published.‡

Load-Levelling Relays.—Intended for installation with the service fuses and meters on the consumers' premises, they will disconnect the loads which, without inconvenience to the consumer, can be dispensed with when the general demand

* ELEC. REV., January 27th, 1928.

† The battery figures are open to wide variation; it is also admitted that stored energy in the form of electricity is more valuable than in the form of heat.

‡ ELEC. REV., 1927, Vol. 101, p. 762; and 1928, Vol. 103, p. 229.

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exceeds a predetermined figure; and will also connect up the loads again when the general demand is reduced, the value of the setting being decided upon by the supply engineer after the general load curve of the district has been examined. Fig. 1 is a wiring diagram, but many other methods of connection may be adopted.

Thermal, electromagnetic, and mechanical devices are utilised in the various types of relay, and a meter and load-leveller may be combined. The standard Ferranti d.c. instrument is illustrated in fig. 2: the main current passes through the heavy winding of the electromagnet E; the gasfilled mercury switch B is rigidly connected to the armature A, and as it is attracted to the core the mercury switch tilts and breaks the circuit to the off-peak load; as the operating current decreases, the switch is restored to its normal position by gravity. The magnetic gap is not completely closed, thus allowing for adjustments to be made. If the off-peak current were passed through the coil the resetting values would be much closer, but there would be danger of hunting. There are no auxiliary contacts, the only circuit to be broken being by the gasfilled mercury tube. The main-circuit coil is wound with heavy-gauge wire, having no movable contacts and a low voltage-drop. The armature is pivoted on ball bearings, and, the only moving part being the mercury switch, there is very little to get out of order. The gasfilled mercury switch used is unique in that the contacts never wear out and no fumes are given off from the arc. Switches of this type are still working satisfactorily after many thousand operations.

The relay can be adjusted within wide limits by releasing the fixing screws and sliding the electromagnet to or from the armature A. The screw R acts as a stop to keep the mercury switch level, thus the adjustments, once set, are rigid.

All these relays are designed to carry double load continuously, and they have a full-load consumption of about 1.0 volt-ampere. The 20-ampere size (40-ampere max.) has a pressure-drop of only 0.05 volt with the normal full load of 20 amperes.

The Ferranti a.c. load leveller is shown in figs. 3 and 4: the driving force is obtained from watt-hour meter elements, the current coil of which carries the current of the controlling circuit; when it reaches a predetermined value the disk armature is caused to rotate. Geared to the disk spindle through a train of wheels is a mercury switch which is caused to tilt when the disk rotates, and thus open the off-peak load circuit. When this current falls below the predetermined value the mercury switch is restored to the "closed" position by means of a spring acting against the torque of the motor meter.

To vary the current at which the load leveller is to operate, provision is made for varying the tension of the above-mentioned spring. In addition, the torque of the driving element may be varied by turning a screw which causes the current-coil core to rotate. To assist the spring to restore the switch to the closed position the meter friction-compensation device is utilised, the driving element being given a backward-shunt running tendency. If the controlling load is inductive the torque can be increased by means of the usual quadrature adjustment. The driving element has a torque of 5 gramme-cm. on the disk armature at normal full load. There is a gear ratio of 157/1 between the disk spindle and the switch arm: therefore, the torque on the switch arm would be $157 \times 5 = 785$ gramme-cm., except that it is balanced by the spring. Between the disk spindle and the staff on which the spring is mounted there is a gear ratio of 20/1, so that the torque on this staff would be 100 gramme-cm. at full load. The watt loss of the shunt coil is about 1.5, and the pressure-drop across the current or operating coil is about 0.075 volt at full load on the 20-ampere load leveller. Referring to figs. 3 and 4, A is the current or operating coil, B the shunt coil, C the mercury switch, D the train of wheels, E the spring, and F the graduated dial wheel. The adjustment is easily made by turning the graduated dial wheel.

Applications.—It is not suggested that relays will replace all other load-levelling means, but it is contended that supply engineers will find them most useful in solving many load-levelling problems.

It is necessary to level the load not only on the generating station and sub-stations, but also on the distributing mains and the consumers' premises, for most of the capital is spent on distribution and services; when domestic supplies are under consideration it is therefore more important to level up the load on the distribution and services, in order to save capital, than it is to level the load at the generating station. It may also be a problem for engineers to decide whether the combined capital charges due to load levellers and of smaller distributing mains are not less than the extra running cost of partly loaded generators. By adding a load leveller the capital cost may be reduced from a 40-ampere service to a 25-ampere service. This may be done—and is done fairly successfully—by means of a time switch, but the load leveller is effective where the time switch does not always do the correct thing; that is, the time switch operates at the time it is set to operate, while the load leveller operates with the load.

The two-way and multiple-way switch may be used for load-levelling, or else the pilot plug, or the key switch. While the two-way switch has a great attraction from the point of view of cheapness, it is doubtful whether the inconvenience caused does not in time prevent electrical developments. To trust to the human element to replace the position of the switch might lead to considerable inconvenience; for instance, the water-heating load might be accidentally left off.

The introduction of another instrument in the form of a load leveller will further complicate the supply service as at present installed, but if it replaces some of the very complicated metering methods used it will be a further step towards standardisation and reduced costs. With the perfect system of load-levelling, the two-part tariff system would become a one-part tariff. It would be possible to go back to the fixed charge per year, or to use demand indicators as a basis, but the integrating watt-hour house-service meter is now so reliable and so cheap that it will hold its own for very many years to come.

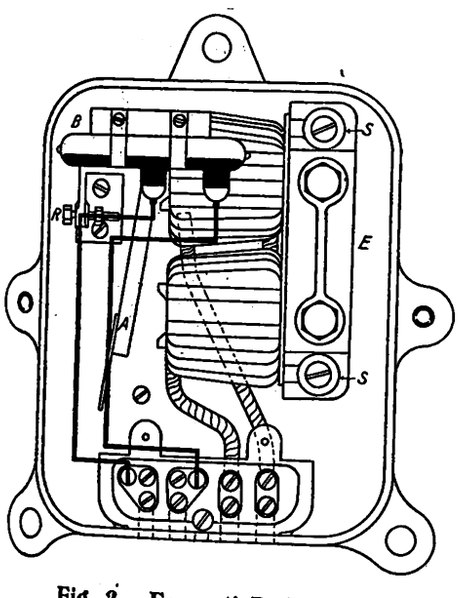
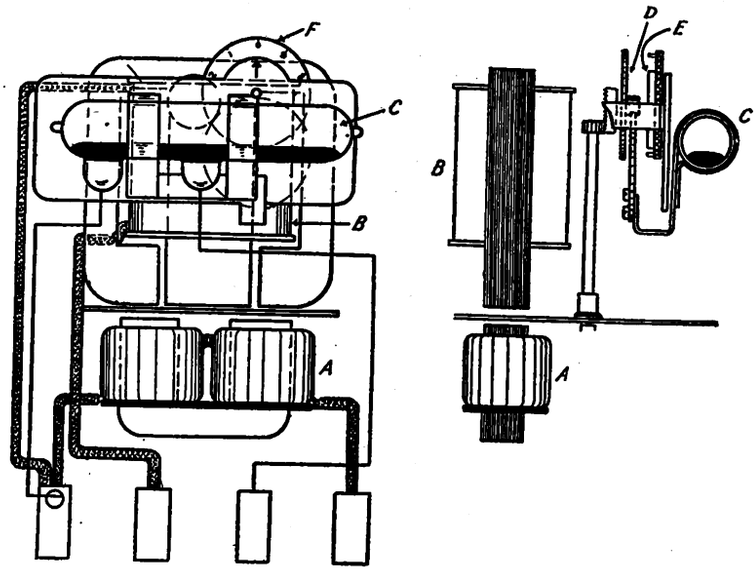


Fig. 2.—Ferranti D.C. Load-leveller.



Figs. 3 and 4.—Ferranti A.C. Load-leveller.

B.E.S.A. Publication.

The British Engineering Standards Association has recently issued revised B.S.S. for three qualities of brass sheet and strip which supersede the specifications first issued in 1926. The numbers of the specifications and the grades covered are as follows: No. 265-1928, 61/39, brass sheet and strip; No. 266-1928, 65/35, brass sheet and strip; and No. 267-1928, soft cartridge brass sheet and strip. The principal modifications which have been made to the specifications are the addition of tolerances on the thicknesses of wide sheets, the revision of certain of the requirements connected with the measurement of these tolerances, the mechanical tests and the tests for hardness and ductility. Copies of the revised specifications may be obtained from the Publications Department of the British Engineering Standards Association, 28, Victoria Street, Westminster, S.W.1, price 2s. 2d. each, post free.

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The Physical Society's Exhibition.—II.

Annual Display of Electrical Instruments and Scientific Apparatus.

British Metallising Co., Ltd.

The exhibit was intended to illustrate present and possible uses to scientific instrument manufacturers of the company's process of producing a metal film, or coating, firmly adherent to a non-metallic base on which, in turn, a large range of non-ferrous metals may subsequently be plated to any desired thickness. Rubber, in many forms, cellulose acetate compounds, wood, &c., are all suitable bases on which silver, gold, copper, nickel, or lead, can be deposited by this interesting process, which depends on a chemical base reaction between the metallising substances and the non-metallic base, as the result of which integration is obtained. The metal surfaces of copper of two commutators of the Fleming type, perfectly uniform, with an excellent polished surface, formed continuous contact pieces on the vulcanite block; the advantages of this method of commutator construction, which eliminates the use of any joins, are obvious. In the case of wireless panels (copper on vulcanite) the whole of the contact surfaces are absolutely rigid without soldered joins or screw connections; a panel or distribution board of this type will stand heavy wear, and is not affected in any way by vibration. Switch plates (copper on cellulose acetate compound) may conveniently be made in any colour, transparent, translucent or opaque, and may be inlaid or easily ornamented with any desired design.

Marconi's Wireless Telegraph Co., Ltd.

In addition to complete naval, military, and aircraft telegraph and telephone receivers and transmitters, the exhibit included the latest type of direction finder, Type 11G, for merchant ships shown in fig. 1; it is used in conjunction with a fixed frame aerial, and possesses a screened valve amplifier and a radio goniometer provided with two scales for reading bearings relative to the ship's head and true bearings, covering a wave-range of from 400 to 1,100 metres.

An instrument of utility to authorities allocating transmitting licences, research workers, and those responsible for commercial wireless stations is the signal-strength measuring set shown in fig. 2. A frame aerial for the reception of the desired signals is mounted on a coupling unit which also contains a means of attenuating the signals produced by a local oscillator, which is capable of being tuned from 14 to 5,000 metres, and is coupled to the frame and to a receiver. By means of the attenuator the signal strength of the local oscillator can be measured and made equal to the received signal. The signals can be equalised by ear or, in the case of rapidly varying signals such as occur in the short-wave

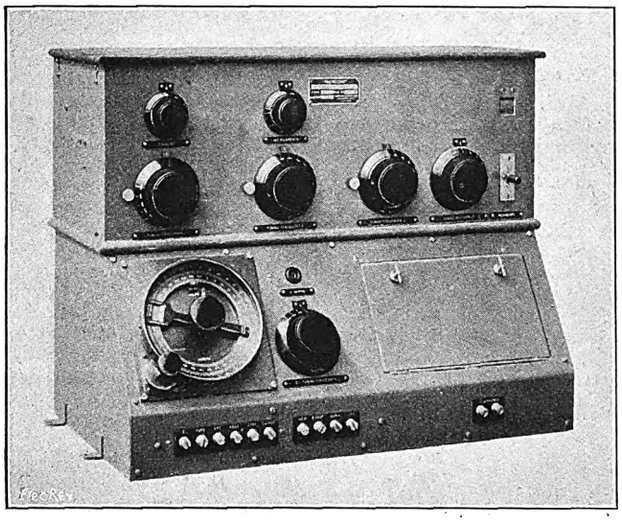

Fig. 1.—Marine Radio Direction Finder.

band, the receiver output can be calibrated on a recording device. The local oscillator output is adjusted to be of exactly the same frequency as the signals to be measured, and the current is measured by a thermomilliammeter. The receiver is a frame, and the set will therefore measure primarily the magnetic field in the wave at the point considered, and the audio intensity of the signal produced is measured by comparison with the known signal strength of the local oscillator. The attenuator and coupling unit, the local oscillation generator, and the battery box are each contained in a heavy metal shielding case, which completely screens them from external interference.

The successful transmission of wireless messages in facsimile has necessitated the development of a means of controlling with extreme accuracy the transmitter and receiver. In the system developed for use on the Marconi beam circuits, speed control is secured by supplying a synchronous motor with current from an electrically-maintained tuning fork which is kept at constant temperature by a thermostat. The tuning fork is made of mild steel with low damping, and it is maintained in continuous vibration by reaction; the whole fork and mounting is placed in a heat-insulating box, and maintained at a set temperature (above that of the room in which the apparatus is used) by means of a toluol regulator, which closes a contact when the temperature reaches a certain pre-

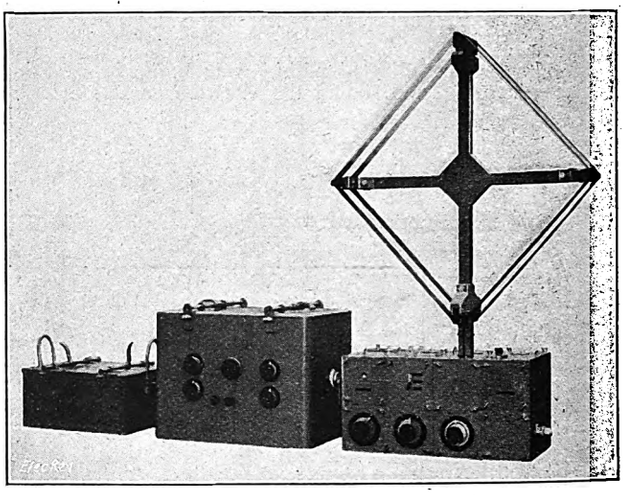

Fig. 2.—Radio Signal-strength Measuring Set.

determined value and by means of a relay switches off the heater lamps in the chamber. As soon as the temperature falls the contact opens and the lamps are switched on, and two fans at the top of the box maintain the air in the chamber in constant circulation to avoid any temperature gradient; thus the temperature of the fork is maintained constant to within about 0.1 deg. F. The weak alternating current from the tuning fork circuit is amplified by a bank of valves, the anode current of which passes through the armature winding of the synchronous motor in the driving machine, thus maintaining it in synchronism with the frequency of the tuning fork, or with that of some selected multiple.

H. W. Sullivan, Ltd.

The modern ultimate standard of radio-frequencies is a valve-maintained turning fork having a frequency adjusted very exactly at 1,000 per second. One of them was exhibited and its N.P.L. certificate indicated that its frequency was 1000.000 and its temperature coefficient $\pm 0.00_0$ cycles per second per degree Centigrade, a truly remarkable fork. With it was exhibited the special phonic wheel (fig. 3) by which the fork frequency can be standardised directly against that of a standard clock. The wheel itself is valve driven; it quickly attains to a high speed with two of its electro-magnets connected to the input and output of a three-valve amplifier. When synchronous speed is reached a small output e.m.f. is taken from the fork being standardised, amplified by another three-valve amplifier, and applied to an additional driving magnet of the wheel, which then runs smoothly as a pure synchronous motor at the frequency of the fork. A contact, operated by the wheel, impulses the pen of a chronograph once every second, the same chronograph record being marked electro-magnetically in exact seconds from a standard clock. Thus the frequencies of clock and fork can be compared within one part in 100,000 with a run of 1,000 seconds' duration.

Substandard wavemeter components of great precision included the Sullivan-Griffiths precision variable air condenser, the original design of which was exhibited last year, when a very marked improvement in overall calibration accuracy was claimed due to the fact that adjacent dielectric air gaps were arranged to be electrically in series and complementary. A series-gap condenser employing a solid metal moving plate, although eliminating capacity errors due to moving system displacement in a direction purely normal to the plane of the fixed-plate surfaces, only partially corrects for plate tilting and uneven rotation. In order to overcome these possible causes of capacity change a new form of moving plate has been de-

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signed in the form of a thick glass plate well proportioned for strength, thoroughly silvered and then copper plated. The metal coating is then sub-divided into a number of insulated "islands" coincident on the two surfaces of the plate. Perfect continuity of plating is arranged between coincident pairs of "metallic islands," either over the outer edges of the plate, or through holes arranged so as not to affect the "law" of capacity variation (fig. 4). If c_1 and c_2 are the capacities from two coincident islands on the upper and lower surfaces of a moving plate, respectively, to adjacent and oppositely connected fixed plates, and c_3 and c_4 are the similar capacities from an adjacent coincident pair of islands: then $c_1 c_2/c_1+c_2$ will be constant irrespective of changes of position of the moving plate in the gap between adjacent fixed plates. Similarly, $c_3 c_4/c_3+c_4$ will remain constant, and, in addition, $(c_1 c_2/c_1+c_2)+(c_3 c_4/c_3+c_4)$ will also remain constant, irrespective of any relation between c_1 and c_3 or between c_2 and c_4.

For association with this condenser, Mr. W. H. F. Griffiths has also designed standard inductances which are extremely constant in value. The temperature coefficient is rendered negligible without increasing the losses of the coil by constructing the various members of the former of insulating materials having different linear expansion coefficients and phase angles, which results in a compensation effect due to unequal thermal expansion in diametrical and axial dimensions without the introduction of material of high power factor in the field between adjacent turns of the winding.

The new Lucas frequency standard is a quartz resonator of extremely constant frequency, due to the patented method of crystal mounting at nodal zones of vibration and in an evacuated vessel (fig. 5), so that stability of

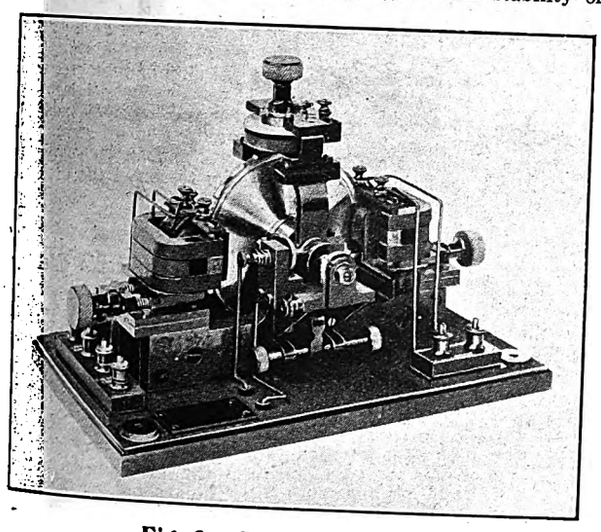

Fig. 3.—Phonic Wheel.

frequency is ensured to within a few parts in a million; and the temperature coefficient is of the same low order.

An exhibit of outstanding importance amongst the audio-frequency alternating-current measuring apparatus was an

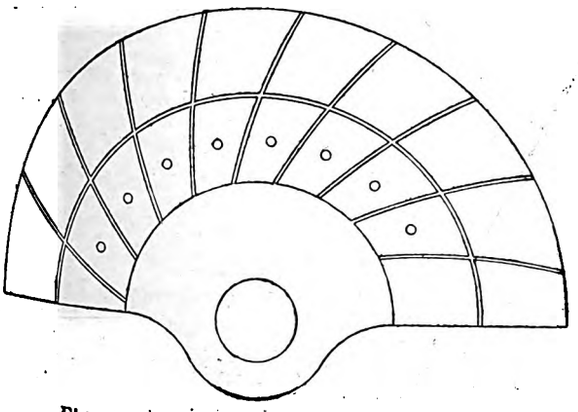

Fig. 4.—Novel Glass Condenser Vane.

adjustable mica condenser having a total capacity of 1 μF, subdivisable in steps of 0.001 μF. The constancy and temperature coefficient of this new condenser have been reduced to such low limits (1 part in 100,000 per deg. F.) that it has been *brought within the category of precision instruments.*

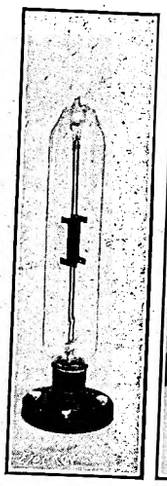

Fig. 5.—Quartz Frequency Standard.

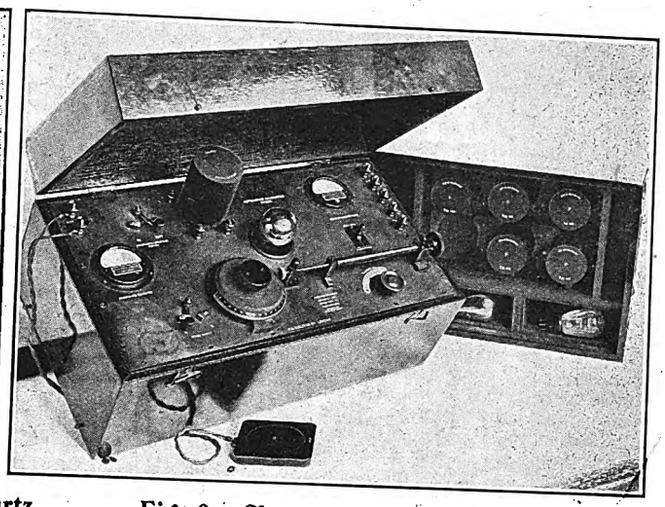

Fig. 6.—Short-wave Heterodyne Wave-meter.

M.O. Valve Co., Ltd.

As its name implies, this company makes Marconi and "Osram" radio valves, and also demonstrated how h.f. current generated by valves can be used for widely different purposes. A portable trolley housing two large oscillating valves generating h.f. current, similar to apparatus used in pumping operations at the valve works, was used to light metal-filament lamps and to boil water by heating inductively a metallic loop immersed in the liquid. A method of displaying the technique of cooled-anode-valve manufacture consisted of a complete oscillating circuit with two miniature cooled-anode valves in parallel, fed with a.c. from the mains through the usual transformers, the anodes being at a potential of approximately 5,000 volts r.m.s. and dissipating approximately 400 watts. The valves (of course, non-standard) were fitted with small jackets and were water-cooled in close imitation of their larger brethren. The high-frequency output of them was used to energise four neon-filled "Osglim" letter lamps, and such lamps placed in the vicinity of the exhibit lit up spontaneously. A machine was shown making valve filament supports entirely automatically; nickel wire from a reel was fed into the machine, which drops down a chute the necessary supports, cut to the correct length, with one end flattened and bent over. A new range of dull-emitter transmitting and modulating valves represented advance in characteristic goodness, coupled with economy in filament consumption; their approximate electrical characteristics are given below:—

	DETI. SW	DET. 2.	DEM. 3.	DEM. 3.
Filament voltage ...	6.0	12.5	15.0	15.0
Filament current ...	2.0	3.0	4.0	4.0
Amplification	8.5	16.0	5.5	16.0
Impedance	5,000	4,000	1,250	3,000
Anode voltage ...	1,000 max.			

An educative demonstration had also been arranged with a view to showing how the dimming of a rectifying-valve filament may lead to serious over-heating of the anode, with consequent loss of filament emission, due to the increased impedance of the valve, which gives rise to a larger voltage drop across the rectifier, causing the anode to dissipate a much higher wattage than the normal.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Salaries of Technically-trained Engineers.

From time to time I have initiated correspondence on the above subject. On the whole, the responses have been meagre, and have given little indication that support would be forthcoming for any scheme of action. Recently, however, although little has been suggested in the way of remedial measures, there appears to be an awakening realisation among electrical engineers that their remuneration is not only unsatisfactory, but is also likely to remain so. To me it is becoming increasingly clear that, despite optimistic views as regards trade generally, there is no room for optimism as regards the position of individual engineers. In fact, it seems impossible to believe that, under present conditions, their position can improve. If this fact could only be brought home to those who are hanging on to a precarious livelihood in the hope of better days coming, and to those who, just deciding on a career,

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believe that there is always a vacant twig awaiting their occupancy at the top of the electrical tree, something might be done. It appears to me that the realisation is sufficiently awake to make this time an auspicious one for launching a new Society of Engineers, the one primary object of which would be to take all the necessary steps to improve the salaries of engineers—chiefly technical engineers—and ensure the possibility of their being able to contemplate spending their declining years outside the workhouse—which, in all seriousness, is the prospective destination of large numbers of engineers at the present moment.

To my mind, the fact of the formation of such a society would, in itself, have beneficial results. It would require a full-time secretary and a small staff at the commencement, and, before launching it, a membership of 800 to 1,000 would have to be assured. I would suggest an annual subscription of £1, and an entrance fee of £1, the latter being remitted in the cases of the first 500 members.

Whilst the work of such a society would naturally develop as necessity demanded, I suggest that its first useful work would be to enlighten the general public, through the medium of the daily Press, as to the prospects of recruits to the engineering industry.

Much more could be written, but it is time for action. I therefore invite all engineers who would be prepared to support some such scheme to send me their names, addresses, occupation, and length of experience. They will be regarded in the strictest confidence. Should a sufficient number respond, I will ask a few of these living in my part of the country to discuss lines of development.

Organise.

January 16th, 1928.

[The Society of Technical Engineers, formed ten years ago with the same purpose as one of its objects, is still in existence; has our correspondent taken this into account?—EDS. ELEC. REV.]

Bottom or Side Heat?

With trepidation, as befits one of the much-maligned corps of electric cooker designers, I would submit an opinion in favour of side and bottom heating for ovens, as recommended by "A Station Engineer" in your issue of the 28th ult.

Manufacturers are mostly awake to the relative advantages of the various systems of oven heating, and in our own case side and bottom heating was adopted only after extensive tests and extended experience, and despite the fact that it is more costly in production than the alternative top and bottom method.

The obvious ideal for which we all strive is perfectly even heating throughout the oven, irrespective of how much or how little food is placed in the oven; but in a well-filled oven this can never be attained by a system that provides no circulation of heated air and merely distributes the heat in stratified formation.

The loading of the oven with food presents, in fact, the greatest difficulty. The baking of a single cake or joint provides no test, but when the oven is filled to capacity, then it is that some system is required that will overcome the retarding effect on circulation. Neither bottom nor bottom and top heat can of themselves overcome this retardation, which will always be present whilst kitchens (and cooking space) continue to decrease in size and the occupiers' appetites remain the same.

Side heating, if the elements are placed behind roomy shields, promotes a good circulation of air despite any load that may be introduced into the oven.

This system alone, however, produces a cool zone at the base of the oven, which we overcome by the introduction of bottom heat. As "A Station Engineer" suggests, this should not be skimped, since circulation induced by the side elements will ensure the even distribution of this heat.

The result of this system is an ideal circulation under all conditions and top heat is *not* required.

Your correspondent, Mrs. Annie Mole, is undoubtedly a splendid cook, but her expressed opinion in the matter must be influenced by her commendable and natural loyalty to her latest *protégé*.

I was privileged to hear Mr. Ellerd-Styles discourse before the I.E.E. on the subject of "Large Electric Baking Ovens," concerning which subject he is undoubtedly well versed, but I feel that he has yet something to learn before he can speak authoritatively on the design of domestic cookers.

The factors of space and production cost are of some importance where cookers are required for hiring at low rentals to small houses. Also the lagging of an oven, which is required to cook meat satisfactorily, may be overdone, so that too long a time must elapse before the temperature at which the meat is "sealed" drops to the temperature at which the meat should be cooked.

In conclusion, may I say that your desire for agreement and uniformity on this vexed question is one which all manufacturers will echo, but the research you suggest should, we think, be conducted by some unbiased body, preferably of cooks.

S. F. Bickell,
Chartered Electrical Engineer,
REVO ELECTRIC CO., LTD.

Tipton, *January 14th*, 1929.

Legal.

Landau v. Wholesale Fittings Co., Ltd.

IN the King's Bench Division, on January 16th, before Mr. Justice Swift and a common jury, Mr. Solomon Landau, electrical engineer, Commercial Road, E., sued the Wholesale Fittings Co., Ltd., Commercial Street.. E., for damages for personal injuries sustained through falling down a stairway at defendants' premises, which he alleged was due to a defective step.

Plaintiff said that after visiting defendants' showrooms he went to the inquiry office for a catalogue, and, as he was coming down the stairway, his right foot caught in a protruding piece of a brass strip which covered the edge of the top step, and he fell to the bottom of the stairs, injuring his ankle. He claimed £96, loss of earnings, in addition to other damages.

Mr. ROWLAND THOMAS, for the defendants, said that the step was perfect, and there was no concealed danger which caused plaintiff's accident and for which defendants were liable.

The jury returned a verdict for the defendants, and his Lordship entered judgment accordingly, with costs.

Marconi's Wireless Telegraph Co., Ltd., v. Attalx, Ltd.

THIS action came before Mr. Justice Astbury, in the Chancery Division, on January 22nd, on a motion by plaintiffs for judgment in default of defence.

Mr. TREVOR WATSON, for the plaintiffs, said the action was brought for an account of certain royalties due under an agreement, an injunction to restrain breach of the agreement, and damages. The defendants had entered an appearance in the action, but had not put in a defence. It was alleged that defendants had sold wireless receiving sets and battery eliminators which infringed plaintiffs' patents. In the agreement entered into defendants acknowledged their liability to pay to the plaintiffs a royalty of 12s. 6d. per valve holder upon all receiving sets, and a royalty of 12s. 6d. on each battery eliminator employing any of the plaintiffs' patents and sold by defendants from April, 1925, to the date of the agreement. The defendants further undertook to render a complete royalty statement, but they had not done so, and had only paid £50 of the amount due under the agreement. Counsel accordingly asked for judgment against defendants and an inquiry as to the damages sustained by plaintiffs by reason of the breaches of the undertaking.

His LORDSHIP gave judgment as asked.

Electroservice, Ltd., v. Northern Wholesale Electric Supply Co.

IN the Southwark County Court, on January 17th, before Judge Moore, Electroservice, Ltd., Waterloo Road, S.E., electrical accessory suppliers, sued the Northern Wholesale Electric Supply Co., electrical importers, Holloway Road, N., to recover £56 2s. for electric heaters supplied.

Mr. EDRIC PHILCOX, for the plaintiffs, said the claim was for what were called "double-ray" heaters. The defendant ordered 1,099 at 5s. 6d. each, and the first agreement was that they should be delivered in three equal consignments, and payment should be made by a three months' bill. Later, at the defendants' request, other terms were arranged, as they only wanted to take small quantities at a time, and asked that a one-month post-dated cheque should be accepted, after the delivery of each lot. This was finally agreed to by the plaintiffs, and, in all, some 366 had been delivered, but the last three consignments, valued at £27 10s., £19 16s., and £8 16s., had not been paid for. In the first case a cheque was given, but the defendants stopped it, but no cheque was given for the other two deliveries.

Mr. A. L. HOLDING, plaintiffs' managing director, said that he previously carried on business as the British Patents and Imports, but he later formed a limited company in the name in which he was suing. The defendants were notified of the change, and thereafter defendants addressed them by the new name. No complaint was made as to the heaters until the action was started, although he had changed a few heaters, as they proved to be defective.

Mr. J. J. MERCER, partner in the defendant firm, asked for an adjournment as his solicitor was unable to attend, and he had all the papers concerning the action. His Honour granted the defendants' application.

English Electric Co., Ltd., v. Crompton Parkinson, Ltd.

IN the Chancery Division last week Mr. Kenneth Swan moved before Mr. Justice Eve for judgment in this action.

Mr. TREVOR WATSON said he opposed the plaintiffs getting the costs of the action. After what the defendants offered the action ought not to have been brought.

Mr. SWAN said the action was for infringement of copyright in three photographs of electrical machinery of the plaintiffs' construction and design. Blocks or negatives of these photographs came into defendants' possession, and they used the photographs for advertising their own goods, by publishing them in electrical journals. The defendants were communi-

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cated with as soon as the advertisements came to the notice of the plaintiffs, and defendants offered an undertaking with which the plaintiffs were not satisfied. It was simply to be given in a letter, and plaintiffs considered they were entitled to an order, and they went to court, and a motion for an interlocutory injunction was moved. Plaintiffs intimated that they were willing to treat the motion as the trial of the action, but Mr. Watson refused to make an end of the matter, and an undertaking was given in terms of the notice of motion, and the costs were reserved. Plaintiffs delivered their statement of claim and defendants their defence, admitting everything alleged in the statement of claim, and setting forth the offer of an undertaking prior to action, and that the proceedings should not have been initiated. In Mr. Swan's opinion the action which plaintiffs took was wholly justified.

Mr. WATSON said plaintiffs did not object to the offer on the footing that they wanted it taken in Court. Their objection to the offer was that they wanted an apology as well, to be given the same publicity as the defendants' advertisement. To that the plaintiffs were not entitled. Defendants were not prepared to allow themselves to be trampled in the dust by the plaintiffs. Neither ought they to be mulcted in the costs incurred after the motion.

Mr. Justice EVE thought the plaintiffs were entitled to their costs of the action, including the reserved costs of the motion. Negotiations having broken down, the plaintiffs were undoubtedly entitled to commence the action. It was much to be regretted that anything took place on the hearing of the motion which resulted in the defendants feeling that they could not, consistently with the attitude they had hitherto taken up, submit to pay the costs. The plaintiffs had to proceed with the action, and he could not see any reason for depriving them of the costs, including the costs reserved.

Charge of Stealing Electricity.

AT the Maldon (Essex) Borough Petty Sessions, on January 15th, Joseph Rudge, electrician, was charged with, between December 10th, 1928, and January 7th, 1929, fraudulently abstracting electricity, the property of the Maldon and District Electricity Supply Co., and feloniously consuming it. Defendant pleaded guilty. For the company it was stated that their representatives, when examining the shilling-in-the-slot meter on December 10th, found eleven shillings in the meter, which did not represent the electricity consumed. It was subsequently discovered that electricity consumed between the emptying of the meter on December 10th and January 7th had not been paid for, the connections having been tampered with. The charge was not pressed, as defendant was understood to be in bad circumstances; it was brought to show people that they must not tamper with their electricity supply. The Mayor commented upon the seriousness of the offence and the severe punishment that might follow it, but said that as the prosecutors did not press the charge the Bench would take a lenient course and bind defendant over in the sum of £5 for one year. He must, however, pay 30s. to the company for the electricity consumed.

Cable Makers' Association v. City Engineers' Supply Co.

A MOTION by the Cable Makers' Association against the City Engineers' Supply Co. was mentioned to Mr. Justice Eve in the Chancery Division on January 18th.

Mr. D. H. CORSELLIS for the plaintiffs said that it was a motion to restrain infringement of three registered trade marks. Defendants were prepared to treat the motion as the trial of the action and to consent to a perpetual injunction, an order for delivery up or destruction of the infringing articles, and to pay the plaintiffs' costs. There would be no order as to damages.

Counsel for the defendants agreed to this course.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

16,770. "Electric annealing-furnaces of the resistance type." Akt. Ges. Brown, Boveri et Cie. June 23rd, 1926. (273,920.)

16,963. "Motor vehicle and other lamps." J. Lucas, Ltd., O. Lucas and W. H. Egginton. June 25th, 1927. (303,033.)

17,437. "Motor vehicle and other lamps." J. Lucas, Ltd., O. Lucas and W. H. Egginton. June 30th, 1927. (303,185.)

22,033. "Electrical time-switch mechanism applicable particularly to moulding and vulcanising apparatus." Dunlop Rubber Co., Ltd., H. Willshaw, W. A. Davis and H. Smith. August 22nd, 1927. (303,075.)

22,512. "Thermionic valves." W. S. Smith and N. McLachlan. August 29th, 1927. (303,037.)

22,575. "Electric incandescent lampholders." A. E. Spencer, P. H. Waller and General Engineering Development Trust, Ltd. August 27th, 1927. (303,039.)

22,901. "Illuminated signs." J. R. Quain. August 31st, 1927. (303,190.)

24,736. "Direction indicators for motor vehicles and the like." H. H. Holland. July 19th, 1928. (303,212.)

24,979. "Electric cut-outs." J. Grossart. September 22nd, 1927. (302,960.)

25,010. "Electric device for driving the windshield-wipers of motor road vehicles." S. & U. Holding Co., Inc September 30th, 1926. (278,350.)

25,061. "Telephone systems." Associated Telephone and Telegraph Co. September 22nd, 1926. (277,988.)

25,108. "Electric current-interrupters." C. E. Bennett. September 23rd, 1926. (277,990.)

25,118. "Protection of dynamo-electric machines." British Thomson-Houston Co., Ltd, P. H. Harding and J. M. Goodall. September 23rd, 1927. (302,973.)

25,125. "Starting and operating luminous discharge tubes." Rainbow Light, Inc. June 9th, 1927. (293,681.)

25,126. "Luminous electric discharge tubes of high candle-power." Rainbow Light, Inc. July 9th, 1927. (293,682.)

25,127. "Argon mercury discharge tubes." Rainbow Light, Inc. July 9th, 1927. (293,683.)

25,142. "Thermionic valves." H. J. Round. September 23rd, 1927. (303,082.)

25,183. "Transformers for high-frequency electric circuits." Radio Instruments, Ltd., and G. W. Hale. September 23rd, 1927. (302,976.)

25,231. "Track signalling systems for railways and the like." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. September 24th, 1927. (302,979.)

25,350. "Control of electrically-operated switches." British Thomson-Houston Co., Ltd., and H. C. Hastings. September 26th, 1927. (Addition to 233,438.) (303,040.)

25,421. "Reception and recording of electrical signals over cables or the like." S. T. Gaskin. September 27th, 1926. (278,014.)

25,423. "Electromagnetic devices operated by alternating or oscillatory currents." J. Hoffmann. September 25th, 1927. (303,085.)

25,469. "Balanced electric protective systems." A. Reyrolle & Co., Ltd., and H. C. Atkins. September 27th, 1927. (303,047.)

25,472. "Electric motors." British Thomson-Houston Co., Ltd., and H. Dreghorn. September 27th, 1927. (303,048.)

25,474. "Luminous signs." C. J. Coleman. September 27th, 1927. (Cognate application 30,306/27.) (303,049.)

25,499. "Electric circuit-breakers or switches." A. Reyrolle & Co., Ltd., J. Mirley and A Allan. September 27th, 1927. (303,051.)

25,508. "Automatic or semi-automatic telephone systems." S G. S. Dicker (Associated Telephone and Telegraph Co.). September 27th, 1927. (303,086.)

25,509. "Telephone systems." Associated Telephone and Telegraph Co. October 18th, 1926. (279,058.)

25,585. "Electric fusible cut-outs." A. Reyrolle Co., Ltd., R. H. Brierly, Yorkshire Switchgear and Eng. Co., Ltd., W. H. Isherwood and R T. Norton. September 28th, 1927. (Addition to 267,593.) (303,090.)

25,718. "Means for interlocking doors or lids of chambers or boxes applicable for enclosing electric switchgear and other apparatus." English Electric Co., Ltd., A M. Pooley and A. A. Heath. September 29th, 1927. (303,195.)

26,014. "Electro-deposition of rubber." S. O. Cowper-Coles. October 3rd, 1927. (303,214.)

26,613. "Remote-control of electric-power sub-stations." Associated Telephone and Telegraph Co. October 11th, 1926. (278,746.)

26,677. "Electric protective arrangements." British Thomson-Houston Co., Ltd., J. G Wellings and C. G. Mayo. October 8th, 1927. (Cognate application to 227,910.) (303,221.)

26,755. "Electric furnaces for heat treatment and forging." A. Imbery. October 10th, 1927. (303,222.)

27,259. "Electric junction-box and switch." J. Bathgate. October 14th, 1927. (303,225.)

29,495. "Electric circuit-breakers." W. H. Illingworth and B. Bell. November 4th, 1927. (303,242.)

30,675. "Shade-supporting arrangements for electric lamps." Siemens Electric Lamps & Supplies, Ltd., and R. Sivyer. November 15th, 1927. (303,247.)

31,022. "Process for the manufacture of cathodes for electric discharge tubes." Vereinigte Glühlampen und Elektricitats Akt. Ges. April 30th, 1927. (289,762.)

32,091. "Thermo-electrically-operated devices for the protection of rotary machines." Electrical Improvements, Ltd., and H. B Poynder. November 29th, 1927. (303,253.)

32,589. "Methods of and apparatus for starting squirrel-cage motors." [illegible] Smith. December 2nd, 1927. (303,259.)

33,567. "Electric furnaces." British Thomson-Houston Co., Ltd. December 29th, 1926. (282,741.)

34,476. "Junction working between exchanges in telephone systems comprising automatic exchanges." Relay Automatic Telephone Co., Ltd., B. B. Johnson and T. M. Inman. December 30th, 1927. (303,267.)

1928.

7,562. "Electric cooking or heating appliance with time-switch device." K. Armin. March 12th, 1928. (303,301.)

7,862. "Electric lighting system." A. E. Spencer, P. H. Waller and General Engineering Development Trust, Ltd. August 27th, 1927. (Divided application on 303,039.) (303,053.)

9,375. "Ignition magnetos for internal-combustion engines." M. [illegible] Cardellino. March 28th, 1928 (Addition to 269,374.) (303,310.)

9,727. "Safety device for overhead contact-arms, as applied to tramways, railless electric cars, and the like." H. Covill and R. Suffling. March 30th, 1928. (303,312.)

11,228. "Electric battery containers." A. E. White (T. R. Palmer). April 16th, 1928. (303,317.)

11,883. "Electrical transformers." G. W. Johnson (Naamlooze Vennootschap W. Smit en Co's Transformatorenfabriek). April 23rd, 1928. (303,[illegible].)

12,795. "Electric signal and control systems." British Thomson-Houston Co., Ltd. June 29th, 1927. (292,993.)

14,175. "Submarine cables." Felten & Guilleaume Carlswerk Akt. Ges. October 31st, 1927. (Addition to 295,923.) (299,762.)

18,399. "Insulating material for electric condensers and the like." J. B. G. Lahousse. August 1st, 1927. (Addition to 275,958.) (294,931.)

20,010. "Knee-control mechanisms for electric sewing-machine cabinets." W. Fairweather (Singer Manufacturing Co.). July 10th, 1928. (303,337.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 16th :—

Jill Frost. No. 496,421. Class 6. Refrigerating machines.—Electrolux, Ltd., 153-155, Regent Street, W.1.

Lissen. No. 493,682. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof.—Lissen Ltd., Friar's Lane, Richmond, Surrey.

Electramonic (lettering and design). No. 492,387. Class 8. Radio-telephonic instruments, &c.—Electramonic Co., Ltd., Bear Gardens, Park Street, Southwark, S.E.1.

Givrite. No. 493,934 Class 8. Electrical resistances, high-voltage cut-outs, rheostats and similar electrical apparatus for use in high-pressure electrical installations, and radio-telephonic and telegraphic apparatus and parts thereof.—La Société Le Carbone, Gennevilliers (Seine), France. (British representatives: D. Young & Co., 11-12, Southampton Buildings, Chancery Lane, W.C.2.)

Apiezon. No. 497,537. All goods in Class 47.—Metropolitan-Vickers Electrical Co., Ltd., Central Buildings, Westminster, S.W.1.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BARNET.—Extensions, girls' grammar school (£15,472), for Herts. E.C.; county surveyor, Hatfield.

BARNSLEY.—Technical college, for the borough E.C.; Briggs & Thornley, architects.

BARWICK.—Elementary school (£7,000); West Riding Education Committee.

BEDFORD.—Stores, for Igranic Electric Co., Elscow Road; I. Daughtry. Welfare centre, Priory Street; borough engineer.

BIRKENHEAD.—Rehousing scheme; Mersey Tunnel Joint Committee. Gas offices and workshops (£17,000); J. A. Milestone & Son, Wallasey, and H. Brocklesby, Birkenhead.

BLYTH.—86 houses, Second and Eighth Avenues, by direct labour; borough engineer.

BOURNEMOUTH.—Town hall extensions; borough engineer.

BRIGHOUSE.—Secondary school and technical institute, Slead House estate (£64,000); West Riding Education Committee.

BROOKWOOD.—Reception hospital at mental institution, for Surrey C.C. (£30,000); W. Townson & Sons, Ltd., Bolton

BURTON-ON-TRENT.—Extensions, Bretby Hall Orthopædic Hospital, block for 32 adults, for Derbyshire C.C.; Martin & Martin and W. H. Ward, architects, 106, Colmore Row, Birmingham (returnable deposit of £2 2s.).

BUSHEY.—Electric lighting installation, Merry Hill school, for Herts. E.C.; county surveyor, Hatfield.

CARLISLE.—Technical school, two central schools, and library and museum extensions, for the T.C.; city surveyor.

CARLUKE.—Extensions, Higher Grade School (£5,780), for Lanarkshire E.C.; director of education.

CHESTER.—Housing scheme (56), for the T.C.; Charles Greenwood, city surveyor, 43, Northgate Street (returnable deposit of £2 2s.).

DURHAM.—Housing scheme (60), Cassop, for the R.D.C.; surveyor.

EASTBOURNE.—Alterations, guardians' infirmary; H. G. Hewitt, architect.

EBBW VALE.—Additional 40 houses, for the U.D.C.; surveyor.

COLESFIELD.—Senior school (£11,000) and extensions at High Green school (£3,000); West Riding Education Committee.

OLESHILL (COVENTRY).—Additional 100 houses, for the R.D.C.; surveyor.

FARRES.—Re-erection of works for Plasmon, Ltd., Farringdon Street, London, E.C. (several thousand pounds).

GRAVESEND.—Housing scheme (30), King's Farm estate, for the T.C.; J. G. Bennett, borough architect, 5, Woodville Terrace (returnable deposit of £2 2s.). Works extensions, Clifton Marine Parade; Imperial Paper Mills, Ltd.

HALIFAX.—Houses (64), Moor End Road, with electric wiring work, for the T.C.; A. C. Tipple, borough engineer, Crossley Street (returnable deposit of £2 2s.). (February 4th.)

HARROGATE.—Secondary school (£65,250); West Riding Education architect.

HINCKLEY.—Re-erection of factories, Factory Road, for John Jackson & Co. and Finn & Dagley.

HORWICH (NEAR BOLTON).—Alterations and additions to Rivington and Blackrod Grammar School (deposit £2); S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

HORNCHURCH (ESSEX).—Houses (43); Lawes, Cherry and Co., Ltd., builders, 47, Victoria Street, S.W.1.

KINGSTON-ON-THAMES.—Cinema, Bridge Approach, for H. E. Cohen. Rebuilding Row Barge Inn, for Hodgson's Kingston Brewery Co.

KNARESBOROUGH.—Tuberculosis sanatorium, Scriven, near Knaresborough, for 300 patients; West Riding C.C.

LEIGH.—Extension of spinning shed, Victoria Mills, for J. and J. Hayes.

LEITH.—Improved coal shipping facilities at Leith Docks (£120,000, including new hoists); the superintendent.

LONDON (HACKNEY, E.).—Power house, Ash Grove Works; W. J. Bush & Co., Ltd. Factory, Southgate Grove; A. J. King, Ltd.

(STOKE NEWINGTON, N.).—Buildings, for Rock Estates, Ltd., Woodberry Down; S. Hunt.

(BERMONDSEY, S.E.).—Clinic for rheumatism, cancer, &c., Tower Bridge Road; borough engineer.

(LEWISHAM, S.E.).—Extensions, All Saints' Orphanage, Granville Park; A. Coldman & Son. Central clinic, High Street; borough engineer.

LOWESTOFT.—Factory extension, Thurston Road; P. W. Watson & Sons, Ltd.

MOTHERWELL.—Additional 108 houses, for the T.C.; burgh surveyor

MUSSELBURGH.—New grammar school (£56,071); clerk, Midlothian Education Authority, Edinburgh.

NEWTON.—School for Isle of Ely E.C.; R. S. W. Perkins, county surveyor, March (returnable deposit of £3 3s.).

NORTHAMPTON.—Three-storey nurses' home (£25,000), St. Andrew's Hospital; Sidney F. Harris, architect; E. Green & Son, builders.

ONGAR.—Housing scheme (44), for the R.D.C.; surveyor.

OTLEY.—40 houses, Westbourne Estate; U.D.C. surveyor.

PAIGNTON.—Dam across Swincombe Valley (£250,000); G. H. Hill & Sons, engineers. 50 houses, Marldon Hill; Willcocks & Barnes.

REDDITCH.—Factory additions, Edward Street; Abel Morrall, Ltd.

RICKMANSWORTH.—Housing scheme (56), Mill End, for the U.D.C.; A. Freeman, surveyor.

ROMFORD.—Cinema, South Street, Harrington & Evans, architects, 10, High Street.

ROTHWELL.—Re-erection of premises for the Faringdon Shoe Co., Avenue Road (£20,000).

RUNCORN.—Housing scheme (30), Stockton Heath, for the R.D.C.; John L. Beckett, surveyor (returnable deposit of £2 2s.).

SALFORD.—Additional municipal office accommodation; borough engineer.

SETTLE.—Hostel, Girls' High School (£10,000); West Riding Education Committee.

SHIPLEY.—109 U.D.C. houses, Albert Road, Thackley Old Road, Wrose Brow Road; H. Dawson, Council's architect, Somerset House; tenders by January 28th, to H. Barnes, clerk to Council.

STAFFORD.—Housing scheme (47), for the T.C.; W. Plant, borough engineer (returnable deposit of £1 1s.).

STAINES.—Additional 168 lighting points in the Institution, with transformer, cables, &c., and 43 lights for Girls' Home; Board of Guardians.

STEWARTON.—Re-erection of hosiery factory, Bridgend, for John Nairn & Son, Ltd. (£15,000).

STOCKPORT.—Extensions, central premises, for the Co-operative Society, Ltd., with constructional engineering work; S. Lloyd, general secretary (returnable deposit of £5 on each of two contracts).

STOCKTON-ON-TEES.—'Bus garage (£5,810), for the T.C.; P. Duffy, builder, Norton.

SWANSEA.—Estate development, Bryn Newydd, Sketty; T. and G. Spragg. Isolation block; Board of Guardians.

SWINDON.—Maternity hospital, for the T.C.; R. J. Beswick and Son, architects, 10, Victoria Road (returnable deposit of £3 3s.).

THORNE (DONCASTER).—Additional 48 houses for the R.D.C.; surveyor. Houses (36), for W. Wilkinson.

TIVERTON (DEVON).—Re-erection of theatre, for the Conservative Club Committee; secretary.

TORQUAY.—Extensions, Municipal Buildings; Bridgman and Bridgman, architects. Additions, Hotel Metropole, Belgrave Road; F. E. Hall. Additions, Bay Court Hotel, Park Street; F. Williams. Additions, Park Hall Hotel, Park Street; Hotel Co.

WALTON-LE-DALE.—Extension of Lostock Hall Convalescent Hospital; superintendent.

WEYBRIDGE.—Re-erection of Brown House, St. George's Hill, residence of Mr. N. Johnson (£10,000).

WEYMOUTH.—Workshop and garages, Abbotsbury Road; S. Jackson & Sons. Premises in Queen Street (£5,000); Crabb & Co. Re-erection of warehouse, Westham Road, for the Co-operative Society; secretary.

YEOVIL.—Housing scheme (50), for the T.C.; borough surveyor (returnable deposit of £1 11s. 6d.). Houses (48), for the R.D.C.; Petter & Warren, architects.

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The

Electrical Review

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Manager and Secretary: E. S. MIDDLETON.

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The "Grid."

THE paper which was read before the Institution of Electrical Engineers last week by Messrs. Johnstone Wright and C. W. Marshall was noteworthy in several respects. In the first place, its presentation bore witness to the disposition of the Central Electricity Board to disclose its plans freely to the electrical engineering profession, and to invite their discussion in public conference—a policy which we cordially welcome. It indicates that a great deal of preliminary work has been accomplished, in reviewing current practice abroad and in selecting and standardising designs suitable for the conditions met with in this country, and includes representative particulars of costs, together with numerous plans and drawings; and it embodies a great deal of labour on the part of the authors, whose hands, we may safely assume, were already well filled with the work involved in the execution of the schemes that are in progress.

In these circumstances, it was unfortunate that, though the theatre of the Institution was filled to the doors by an appreciative audience, the discussion was hardly worthy of the occasion. Mr. W. B. Woodhouse, in opening the discussion, certainly raised a number of interesting points, and incidentally mentioned that with the approval of the Electricity Commissioners he was erecting, in a part of his company's area, an experimental section of four-phase transmission line, in accordance wth the system which he advocated in our pages last year (ELEC. REV., February 17th, 1928, p. 269); but otherwise the debate was disappointing.

Turning to the paper, we note that the authors recognise the fact to which we have drawn attention on previous occasions, that the British "grid" differs from the extended networks which are employed abroad, in that the latter are almost always used for transmitting large blocks of energy from natural sources to remote consuming points; in this country, with sources of energy widely distributed over almost the whole area, there is no need for long-distance transmission, and the functions of the grid are practically confined to co-ordinating the operation of the generating stations with a view to improving load factors, and to reducing the amount of spare plant required locally. These functions are also served by the Continental and American networks, with advantageous results, as evidenced by the fact that in almost every instance those networks have

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been built up in private ownership by gradual extensions; in that respect they are in contrast with the British grid, which is unique in that it has been conceived and will be constructed as a complete national reticulation *ab initio*. It is also unique in its third function—that of acting as the great reservoir into which all the electricity generated will (at least, in theory) be poured and from which it will be resold by the Board; in actual practice, no doubt, the bulk of the energy will as at present be distributed locally, appearing only in the Board's books and not on the grid.

The choice of steel-cored aluminium cables is satisfactory, not only on technical grounds, but also on the score of their constituents being home products. Up to the present the Board has placed all its contracts in this country, and we hope that it will rigidly adhere to that policy. The same remark applies to the steel towers, and we note with interest that the use of reinforced concrete has been considered; whilst the authors very definitely decide in favour of steel for the high towers of the grid, ferro-concrete may well prove worthy of adoption for the secondary lines, and both steel and cement are British products.

A noticeable feature of the paper is the definite tendency towards simplification which is indicated in various relations, and which is highly commendable.

Electrical Progress in the United States.

The first issue of the year of the *Electrical World* is always devoted to an exhaustive examination of the past, present, and future of the electrical industry in the United States, and as that country unquestionably is the world's greatest user of electricity, this annual review contains many items of exceptional interest to all electrical men. No less than 4,576 millions sterling is invested in American electrical undertakings, nearly half of which gigantic sum is allocated to electricity supply, on which 290 millions of new capital was spent last year.

The output of electrical energy generated in 1928 was 83,100 million kWh, an increase of 10 per cent. over the previous year's record; the energy sold amounted to 69,700 million kWh, showing a loss in transmission, &c., of 16½ per cent. Two-thirds of the output was sold for motive power, one-fourth for lighting, &c., and one-tenth for traction; the power sales showed the greatest increase. Sixty per cent. of the total energy was generated from fuel, and forty per cent. from water-power, though the capacity of the hydro-electric plant was only 28 per cent. of the total—the water being, of course, utilised as fully as possible. It is pointed out that whilst the earlier hydro-electric stations cost less than £40 a kilowatt, most of the sites still undeveloped would probably require an average outlay of £80 a kilowatt, as against £18 for steam stations, which could also be built near the centres of utilisation, eliminating the cost of transmission—hence the development of water-power is likely to slow down in future.

The gross revenue of this gigantic industry was 382 millions sterling, of which 56 per cent. was contributed by the lighting branch and less than 30 per cent. by power consumers, almost in inverse ratio to the respective amounts of energy consumed; hence the average price obtained per kWh for lighting, &c., was 3.15d., and for power 0.7d., the average all-round being 1.37d.

It is editorially pointed out that the main problem now before the industry is "to intensify the use of electricity for present services," by the development of domestic business and of electric heating in industry—two fields which we also are cultivating, though by no means so strenuously as we should. There are over 23 million lighting and power consumers in the United States, of whom 19 millions are domestic consumers. The average use of domestic energy per consumer, in the case of a group of 41 "utilities," was 473 kWh in 1927; but it is estimated that the figure can be increased to 3,000 kWh by aggressive sales campaigns. "The refrigerator, range, water heater and other little-used electric services must be sold in volumes hitherto unknown . . . above all, the domestic customers must be educated in the use of the new services."

There are no fewer than 4,063 electricity supply undertakings in the United States, of which 1,910 are municipal and 2,153 are in private hands; the former, however, are of small size, aggregating only 1½ million kVA. As generating undertakings, the municipalities are insignificant, 95 per cent. of the energy used being produced by 1,274 privately-owned undertakings, with plant of over 30 million kVA capacity—an average of 23,700 kVA. Some 2,000 undertakings purchase all the energy they distribute. There are 2,726 undertakings with generating plant of less than 500 kVA.

During the year the number of operating systems diminished by 387, owing to the tendency towards consolidation. It is significant that the internal-combustion engine is credited with the inauguration of new municipal undertakings in isolated communities.

It is estimated that industrial motive power supplied from central stations is 18½ million h.p., nearly half the total horse-power installed in industries, and another 10½ million h.p. is electrically driven. The motive power used in industry is reckoned at over 4.7 h.p. per wage earner, of which at least 3.5 h.p. is electric. Some 350,000 farms receive a supply of electricity—an increase of over 125,000 in three years. Finally, taking the population at 125 millions, the average consumption of central-station energy per capita appears to be about 556 kWh per annum for lighting, power, and traction—probably about twice as much as in this country, from all sources.

The Contractors' Dinner.

The presence at last week's dinner of the E.C.A. Allied Associations of Col. Ashley (who had charge of the Electricity Supply Act, 1926), Mr. Frank Hodges (a member of the Central Electricity Board) and Mr. T. P. Wilmshurst (an Electricity Commissioner) would seem to indicate that the electrical hierarchy is aware of the importance of the electrical contractor to the national electricity scheme. This view was expressed by the speakers to the toast list, who acknowledged the contractor's position as the ultimate connecting link between the supply and manufacturing branches of the industry and the public.

Col. Ashley made reference to the excellent electrical progress made in this country during the last few years, and spoke highly of the work of the E.C.A. in bringing together the various sections of the industry. A large part of his speech was devoted to the subject of rural electrical development, and he intimated that a scheme for testing the rural demand might shortly be put into operation.

The President (Mr. W. H. Walton) claimed that the Association considered that its greatest work was the fostering of good relationships between manufacturers, supply authorities, and other electrical interests. It was also the aim of the Association to raise the standard of installation work. He added, lest it should be thought that the Association was entirely altruistic, that it also endeavoured to secure a fair measure of remuneration for its members. Mr. Walton also stressed the danger of bad installations, and again expressed the view that contractors should be required to possess some definite qualification, or that there should be compulsory regulations.

Lt.-Col. Edgcumbe (president of the I.E.E.) acknowledged that the whole of the electrical industry was dependent upon the contractors—"ambassadors of electricity"; they had a great responsibility to the public, and they were right in insisting on high-grade work. Mr. Wilmshurst, too, stressed the need for every endeavour to raise the standard; in his 30 years of electricity supply work he had frequently met appalling examples of shoddiness.

All well-wishers of the industry will agree with these views and back up the E.C.A. in its efforts, which have extended over more than 27 years, to improve the status of the contractor by insisting equally on good installation work and on adequate payment for it.

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The E.A.W. and its Objects.

OUR readers will have noticed the frequency of our recent references to the events organised by the Electrical Association for Women. The 1928-29 season promises to be the most successful it has had. It may be pointed out that the Association differs fundamentally from all other electrical associations in that its objects are purely altruistic. The only axe it has to grind is that of the common weal: it aims to educate the public, especially the all-important female public, in the application of electricity to the common things of life, and thereby to lighten the labour of the long-suffering housewife. The only benefit that the members themselves secure, apart from the satisfaction of doing others a good turn, is the increase of their own knowledge that results from teaching their friends, and from the lectures, demonstrations, and visits to works and installations which are organised by the Association. Its growth has been phenomenal; already its membership is more than 3,000, and healthy branches have been set up at numerous provincial centres. One was opened last month at Bristol, when Mr. Faraday Proctor appropriately took occasion to remind us what useful service women rendered electrically in situations of responsibility during the war; and another is to be opened at Gloucester.

The work of the Association incidentally, but very materially, benefits the electrical industries also, by inspiring interest in electrical subjects and promoting the use of electricity and electrical appliances. It helps to dispel the mystery which too long has enveloped electrical things, and to enable the housewife to deal with those minor repairs and adjustments from which no public utility service is immune—much easier to effect efficiently in the electrical sphere than, say, the replacement of a broken gas mantle and chimney, or the renewal of the washer in a water tap. In a word, it seeks to popularise electricity; and its members are peculiarly fitted for that task, as they understand the mentality of the housewife and can enter into her difficulties better than any male instructor. They also appreciate the nicer points of the domestic arts of cleaning, cooking, washing, and ironing, and are familiar with the weaknesses and strength of electricity's competitors. To support the E.A.W., therefore, should be a cardinal principle with electrical men.

The Lighting of "the General."

CAN anybody explain why the exterior of the chief Post Office of the metropolis of the world should be so badly lighted? The lack of illumination is particularly noticeable late in the afternoon of any business-day at this time of the year. The rush hours for making counter purchases and for posting in the outside boxes in King Edward Street would seem to call for good lighting not merely for ordinary convenience but for the public safety at the entrance steps as well. It is true that at the edge of the wide pavement there are two gas lamps which serve to prevent one on a foggy day from blundering into the statue close by. There are also two similar standard lamps without burners, while one wall lamp is fixed at the mail van entrance; but surely electric lamps could be placed over the doorways and near the posting boxes, and a better lighting of the thoroughfare generally could be provided. However pleasing the interior lighting, it does not provide suitable outside illumination for those who have every day to make use of this very important building. It is strange, in days when, generally speaking, a brighter London is in vogue and brilliant illumination of shops, stores and thousands of thoroughfares is considered indispensable, that some of our biggest public buildings are still living in the dark ages. There may be good reasons for a great Cathedral remaining in silent and impressive darkness—but a Post Office, *the* Post Office, indeed!

Important Amalgamation.

WE announce in our "Business Notices" to-day another amalgamation of manufacturing companies prominently connected with the British electrical industry. Messrs. Laurence, Scott & Co., Ltd., of Norwich, whose business was established 45 years ago and who have been producing a wide range of electric generating plant and motors, as well as electrical equipment of all kinds for ships, are joining hands with one of the most progressive and reputable producers of electric motor and other industrial plant—Electromotors, Ltd., of Openshaw, which company was formed in 1899. They will operate in combination under the title of Laurence, Scott & Electromotors, Ltd. (L.S.E.), with a total capital of £310,000, all in ordinary shares, and of course therefore with no "charges" whatever thereon. We understand that the underlying feature of this amalgamation is a belief that the future hope of the British engineering industry lies in the continuance of the policy of maintaining that high standard of design and quality for which British producers have hitherto been renowned.

Electrical-Steel Castings.

AT several of the joint meetings of the Glasgow and West of Scotland Branch of the Institution of Mechanical Engineers and the Institute of British Foundrymen held recently, the scope and defects of steel castings have been discussed, and it was pointed out by one speaker that certain Continental foundries were able to maintain a position in the markets of this country; in the case of motor-vehicle parts, such as axle casings and wheels, this market continues in spite of the 33 per cent. import duty. Whether certain differences in technique, such as the use of the electric furnace, are responsible for this state of affairs, or not, it is interesting to note that Messrs. Leyland Motors, Ltd., have installed electric steel-melting furnaces and that there is a brisk demand for the surplus capacity of the furnaces from other branches of the engineering trades.

It is generally agreed that it is possible, and even easy, to spoil steel in the electric furnace: nevertheless, that type of furnace, if well used, is capable of yielding material which is hard to surpass even with the products of the crucible. "In these circumstances," as one expert said some time ago, "it is unfortunate that, partly as a result of trade depression, but also to a considerable extent owing to a set-back on technical grounds, so many of the electric furnaces installed during the latter part of the 1914-18 war period have fallen entirely out of use." For steel melting the arc furnace is in general use, several variations of the arc arrangement being employed. The electric furnace possesses the advantage of being able to maintain a reducing atmosphere as and when required, which, along with marked basicity of the slag, enables a certain degree of sulphur removal to be accomplished with a fair certainty of success, a characteristic not possessed by any other method of melting. Trouble in the electric melting of steel can usually be traced to inexperienced labour; the steel is exceptionally pure and it lacks the fluidity of a steel rich in impurities. Hence, it requires great care and skill to teem a large number of castings without either leaving a skull in the ladle or experiencing stopper rod trouble. It is very bad practice to pour the steel at a very high temperature because the percentage of cracks is certain to be high and, further, fettling becomes a difficult operation because the sand becomes burnt into the metal. The electric furnace, properly used, has no equal for steel melting, except the crucible for small quantities of metal, and the future position of the steel-castings industry should not be much in doubt, because in actual practice British foundrymen have not much to learn from their Continental competitors.

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Development in South Africa.

A review of the activities of the South African Electricity Supply Commission, and notes on the working and equipment of the five undertakings under the Commission's jurisdiction.

By OUR SPECIAL CORRESPONDENT.

THE development of the generation and distribution of electricity in South Africa has undergone a number of changes since the establishment of the Electricity Supply Commission, which came into being as the outcome of the Electricity Act of 1922. The members of the Commission are Dr. H. J. Van der Bijl (chairman), and Messrs. J. R. Fulton, A. M. Jacobs and K. Gundelfinger; their headquarters are at Johannesburg. In 1923 the Commission decided to establish a generating station at Witbank, in the Transvaal, and since then other stations have been established at Sabie in the Transvaal and Salt River in the Cape; other activities of the Commission include the taking over from the South African Railways of the Natal Central undertaking, including a power station of 60,000 kW at Colenso, and the provision of the Congella station at Durban.

In addition to these stations, a very large programme of work has been accomplished in connection with various schemes of local authorities on which the Commission is called upon to report before sanction can be obtained for the adoption of new schemes, or extensions.

The total capacity of the plant at present installed, or on order, for the Commission's five undertakings amounts to 209,000 kW, and is made up of 22 sets varying in size up to 20,000 kW. The total boiler capacity is equal to 2,250,000 lb. per hour, from 35 boilers.

The following table shows the route mileage of the various transmission lines and cables in use at the moment at various voltages:—

	88,000 v.	33,000 v.	22,000 v.	Below 22,000 v.	Total.
Overhead lines ...	275	71	30	8	384
Cables	—	29	8	6	43

Of transformers there is installed a total of 300,000 kVA, while there are 12 traction sub-stations containing 22 sets of motor generators, with a total rated capacity of 44,000 kW, and six traction sub-stations containing 12 sets of rotary convertors, with a total rated capacity of 24,000 kW.

The following table gives the comparisons of the various undertakings to December, 1927:—

Undertaking.	Capital Exp.	Capacity in kW.	Units sold in 1927.
Witbank ...	£1,514,257	60,000	439,061,722
Sabie ...	108,981	1,700	1,938,940
Colenso ...	3,239,920	60,000	104,206,235
Capetown ...	1,247,010	30,000	5,811,836
Durban ...	494,866	36,000	—
Total	£6,605,034	187,700	551,018,733

The Witbank undertaking is situated in the Middleburg district of the Transvaal, near the Great Oliphants River and in the heart of the principal coalfield, so that both fuel and water are obtained at the minimum cost. The station was constructed by the Victoria Falls and Transvaal Power Co., Ltd., for and on behalf of the Electricity Supply Commission, and is operated by it under an agreement between the two parties; the largest consumer is the Victoria Falls and Transvaal Co., which consumes approximately 400 million kWh per annum The station, fig. 2, from which electricity was first supplied in May, 1926, was put into commercial service in July, 1927, the plant consisting of three 20,000-kW Parsons reaction steam turbo sets, generating at three-phase, 50 cycles, 6,600 V, and 12 Babcock & Wilcox boilers, each with an evaporative capacity of 70,000 lb. per hour. A fourth and similar generating set and three extra boilers are now being installed, and will bring up the total capacity of the station to 80,000 kW.

Water for the boilers and condensers is pumped over a distance of approximately 6 miles, with a lift of 900 feet, to a reservoir from which it gravitates into the power station. The requirements necessitated

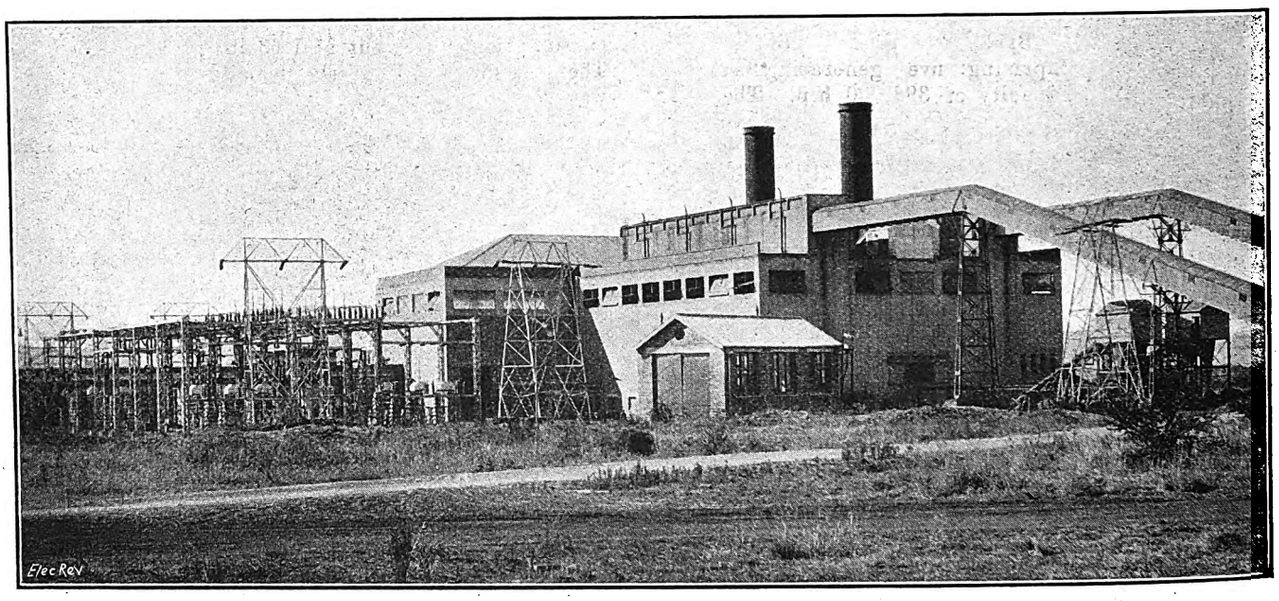

Fig. 1.—Colenso Electricity Works and Step-up Sub-station.

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building a dam across the Oliphants River to give a storage capacity of 1,300 million gallons. The condensing water is cooled in spray ponds, each machine using a pond two acres in extent. The maximum hourly demand on the station in 1927 was approximately 61,000 kW, the load factor being 82.2 per cent., while the coal consumption worked out at 1.75 lb. per unit generated; the average thermal efficiency was 16.2 per cent. Voltage is stepped up at an outdoor sub-station, fig. 2, adjacent to the power station to 132,000 V, for transmission to the Rand through 60 miles of the Victoria Falls Co.'s overhead lines.

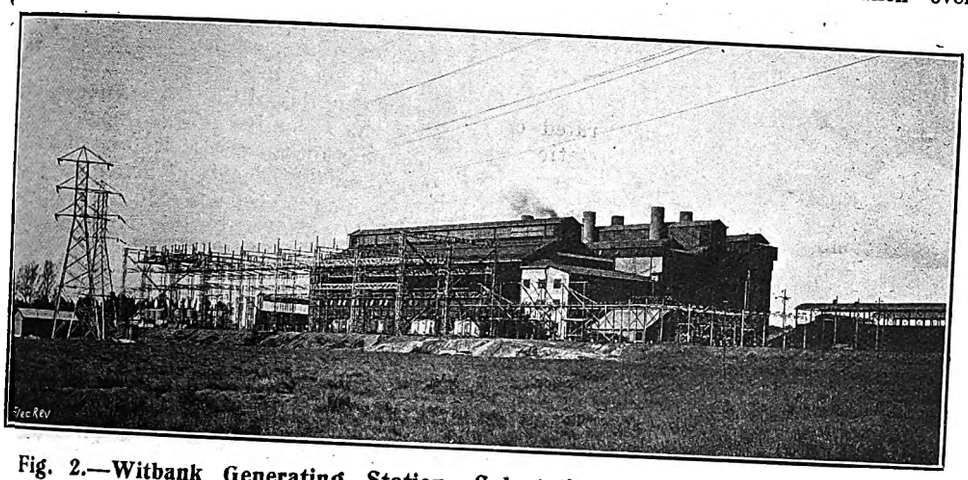

Fig. 2.—Witbank Generating Station, Sub-station, and Transmission Lines.

interconnected at Brakpan, thus establishing a regional system comprising five generating stations with an installed capacity of 398,000 h.p. The other consumers, besides the V.F.P.C., are the Rand Carbide Co., six collieries, and individual consumers in Witbank Municipality, these being supplied from a 21,000-V overhead transmission line 20 miles long and 8 miles of cable.

The standard tariff is as follows:—

(a) A standing charge of £25 per annum.

(b) A charge of £6 per annum per kVA of maximum demand, reduced to £5 10s. since July last.

(c) A charge of .06d. per unit.

The supply to the V.F.P.C. is governed by a special agreement.

The Sabie undertaking is situated in the Pilgrim's Rest district of the Transvaal, about 8 miles from the Sabie township. Though only a small plant it was established to meet the requirements of the group of Gold Mines in that locality, and so urgent was the need for an increased supply that a temporary hydro-electric plant of 350 kW was put down in 1925 until the main hydro plant at the Gorge on the Sabie River was first put into operation in 1927, after which it acted as a stand-by plant for a time. The temporary plant consisted of one wheel taking 8 cusecs and generating at three-phase, 500 V, 50 cycles. The Gorge station, which was put into commercial service in April, 1928, contains three spiral casing reaction turbines, by James Gordon, rated at 688 h.p. each, with a net operating head of 200 feet, each wheel taking 35 cusecs normally. The turbines are directly coupled to 450-kW A.S.E.A. generators, three-phase, 3,300 V, 50 cycles, 750 r.p.m. The site of the dam is about 4,000 feet up-stream, and water is led to the power station through a combination of three tunnels, 1,980, 1,520 and 950 feet long respectivley, two short aquaducts, a flume 1,200 feet long, and a 42-in. penstock about 550 feet long, together with the necessary sand traps, siphons, and so on. Fig. 3 shows the weir and intake of the Sabie Gorge station. Voltage is stepped up to 22,000 V by three single-phase transformers of 400 kVA each, forming a 1,200-kVA bank, feeding into an overhead transmission line running for 7 miles over broken country into the Sabie township, where it is stepped down again in an outdoor sub-station to 3,300 V for local distribution to the near-by Gold Mines.

The Natal Central undertaking at Colenso was first established by the South African Railways Administration in connection with the electrification of the Glencoe-Pietermaritzburg section of the Natal main line, and was taken over by the Commission in January, 1927, together with its 275 miles of overhead transmission lines and 12 semi-automatic sub-stations. The power station, fig. 1, is situated on the bank of the Tugela River, near the Colenso Railway Station, and the plant consists of five 12,000-kW Parsons reaction turbo-alternators, three-phase, 6,600 V, 50 cycles, 3,000 r.p.m., and eight Babcock and Wilcox 60,000-lb. water-tube boilers working at 270 lb. per sq. in. and 700° F. superheat. The coal consumption works out at 1.63 lb. per unit generated. The maximum half-hourly demand for the past year was 25,600 kW, with a load factor of 50.6 per cent. and a thermal efficiency of 16 per cent., which is highly favourable as the railway load is very variable, being subjected to sudden and violent fluctuations of as much as 20,000 kW in a few minutes at any hour of the day. At an outdoor step-up sub-station, fig. 1, located near the power station, the pressure is raised 88,000 V by 13,500-kVA transformers of the International General Electric Co. From this point duplicate overhead transmission lines of a total length of 275 miles extend in two directions, feeding into the various sub-stations for the electrified railway and supplying

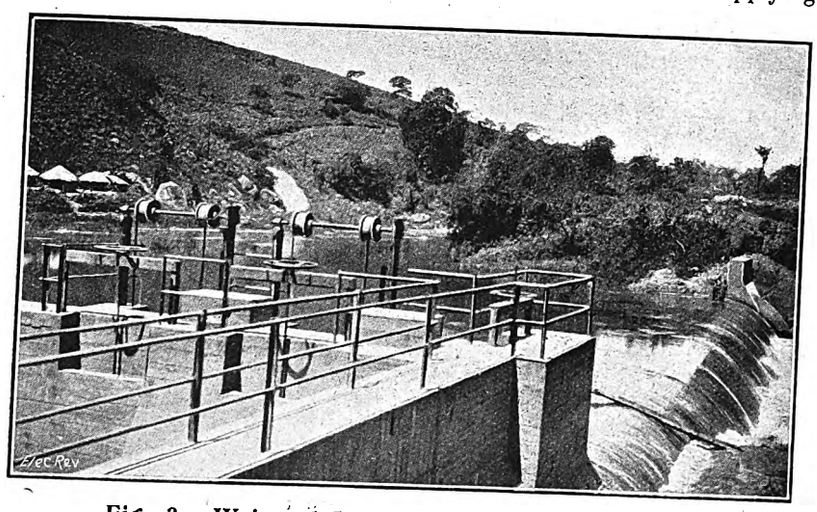

Fig. 3.—Weir and Intake for Sabie Gorge Scheme.

other consumers along the route. The sub-stations, of which there are twelve in number, are situated at intermediate points between Glencoe and Pietermaritzburg; some of them are used also for the supply to Glencoe Local Board, Ladysmith, Estcourt and Pietermaritzburg Municipalities. A few other individual consumers and further applications are now under consideration. The sub-stations are equipped with outdoor step-down transformers for supplying 2,000-kW motor-generators at 6,600 V. These machines give the 3,000-V d.c. supply for the railway. The equipment is

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semi-automatic, with push-button control from signal cabins. Special arrangements have been made for the correction of the power factor, which it is possible to maintain at practically unity at all loads.

The standard tariff adopted is as follows:—

(a) A fixed charge of £150 per annum payable in advance, plus,

(b) A charge of £5 per annum per kVA of maximum demand.

(c) A charge of 0.3d. for the first 1,000,000 units per annum, 0.2d. for the next 2,000,000 units, and 0.15d. for all additional units.

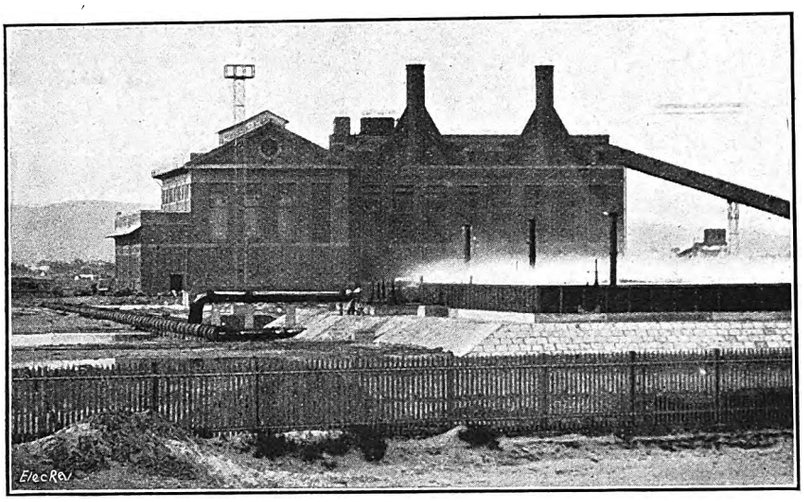

Fig. 4.—Salt River, Cape Town, Commission Power Station.

Special charges are in force for the Railway Administration.

The Cape Town undertaking was established mainly with the object of supplying the Cape Suburban Railways (Cape Town-Simonstown and Cape Town-Sea Point), the Salt River railway workshops, grain elevators and other services at the Docks, as well as a supply for the rural districts, and also to assist in meeting the demands of the City of Cape Town by linking up with the Municipality's Dock Road power station. In connection with the latter, an agreement was entered into between the Commission and the Cape Town Municipality in April, 1924, and to ensure the best co-ordination between the two parties the city electrical engineer (Mr. G. H. Swingler) was appointed the Commission's local manager in charge of both power stations, which are interconnected by duplicate underground cables, the municipal power station having been modernised during the past few years and brought up to a relative high efficiency.

The Commission's power station, fig. 4, is situated at the estuary of the Salt River and within two or three miles of the centre of the City. Condensing water is taken from Table Bay, and its provision presented a very difficult problem, as precautions had to be taken against exposure to the ocean and to prevent sand from entering the circulating water system. Pipes were laid just under the ocean bed 1,300 feet out to sea, communicating with an intake tower through which water is admitted well above the sand level. The station plant consists of three 10,000-kW turbo-alternators, of the Howden Zoelly type with E.E.C. alternators, 12,000-V, three-phase, 50 cycles, 3,000 r.p.m., with surface condensers by Mirrlees Watson and Co., and four 60,000-lb. Babcock & Wilcox boilers working at 270 lb. per sq. in. with 700° F. superheat. The boilers are fitted with tubular type air pre-heaters operated under balanced draught. A step-up substation containing 6,000-kVA outdoor-type transformers raises the pressure to 33,000 V for the supply of power to the Railway Administration for the Cape Town-Simonstown and the Sea Point sections of the South Africa Railways, by means of both underground cables and overhead lines, and the supply is stepped down and converted to 1,500 V d.c. for the railway track at six automatic sub-stations, by means of 2,000-kW rotary convertors.

There is also a 33,000-V overhead transmission line 71 miles in length erected through the rural districts, supply being given to the Paarl Municipality, the Cape Explosives Works at Somerset West, and other industries and local authorities *en route*, while arrangements are now in hand to give supplies to several other municipalities, thus accomplishing the Commission's desirable aim of securing for all electricity consumers in the area the benefits of large-scale production at the interlinked power stations of the Cape Town Municipality and the Commission.

The latest of the Commission's undertakings is the Congella power station at Durban, fig. 5, which is shortly to go into commercial service and is unique in being the first South African plant designed for the use of pulverised fuel. A new station at Congella was erected by the Commission on account of the decision of the Government to electrify the Durban-Pietermaritzburg section of the Natal main railway line, and also because the Corporation of Durban was contemplating establishing a new power station as demands had outgrown its existing generating plant. This section of the railway electrification was, however, deferred at the last minute, it being decided to electrify the northern section of the line first, for which reason the Colenso undertaking was established. In time the stations at Colenso and Congella will no doubt be interconnected, the Commission's existing transmission lines from Colenso terminating at Pietermaritzburg, some 50 miles away from Congella.

An agreement was entered into between the Commission and the Durban Corporation in April, 1925.

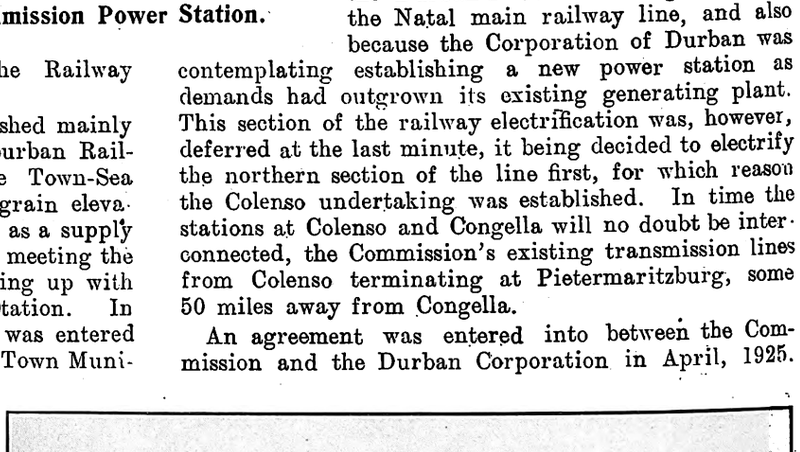

Fig. 5.—Congella Powdered-coal Power Station at Durban.

for 30 years, whereby the Corporation will take a minimum of 60 million units per annum, exclusive of the load required by the Government for its railway workshops, coaling appliances, dock, grain elevator, and so on, with a maximum demand of 14,000 kW. A somewhat similar arrangement was made as at Cape Town, whereby the borough electrical engineer (Mr. John Roberts) was appointed local manager for the Commission as well, but in Durban's case it is the intention to close down the municipal power station as

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soon as convenient, leaving the municipality with the work of distribution, including the town itself and an area within 16 miles radius outside the municipal boundary.

The power station is situated near the head of the Durban Bay, from which circulating water is taken, and is designed for an ultimate capacity of 72,000 kW. The present plant consists of two 12,000-kW Parsons turbo-alternators, 6,600 V, three-phase, 50 cycles, and six 60,000-lb. Babcock & Wilcox boilers generating steam at 270 lb. per sq. in., superheated to 700° F. The boilers are fired on the "Lopulco" system of pulverised coal, and for this reason the efficiency of the undertaking will be watched with great interest by all engineers. As soon as possible after the station goes into operation it has been arranged to transfer to the Commission's power station two 6,000-kW turbo sets from the municipal power station. The tariff to the Durban Corporation is £5 8s. per annum per kW of maximum demand, plus 0.2d. per kWh of electrical energy consumed.

In addition to the larger undertakings briefly referred to in the foregoing, the Commission, up to December, 1927, has reported on no fewer than 117 electricity schemes, and it is interesting to note that there are no fewer than 147 local authorities in the Union, either owning electricity schemes, or with schemes in course of construction.

Heating Metals by Electricity.

A Special Process Adapted for Welding, Hardening, and Other Industrial Operations.

By PAUL HOHO.

ALTHOUGH not well known, there exists an electro-thermic phenomenon in connection with the passage, under certain conditions, of a current of electricity from a solid to a liquid. The phenomenon appears to have first been made known as long ago as 1844 by Fizeau and Foucault in connection with experiments on the intensity of the light produced by the electric arc. Since then various scientists have referred to it, Violle and Chassagny having dealt with it exhaustively at the Société Française de Physique in 1889; reference may also be made to Markrell & Hare, Van der Willingen, Slouginoff, Righi, Colley, & Planté.

During the period 1891-93, Mr. E. Lagrange, in conjunction with the present writer, presented several papers to the Académies des Sciences of Belgium and of France, the purpose of which was to determine the causes and the working of the phenomenon in question and the conditions which brought it about. In the course of our research we found that there were various phases of the phenomenon which, while following one another, possessed distinct characteristics and properties.

Thus, when the solid consists of a metal, it may be heated to any desired temperature; moreover, such metal can be subjected to all operations requiring preliminary heating, such as forging, welding, tempering, annealing, hardening, &c., so long as these operations are carried out under special conditions particularly favourable thereto.

General Principles.

The principle and the essential characteristics of the process may be briefly summarised thus:—If in any suitable vessel, either of glass or refractory material, containing a liquid conductor, such as dilute acid, or a saline solution—sulphuric acid or potassium carbonate—a fairly large metal plate connected to the positive of a source of d.c. electricity is plunged, the plate will become a positive electrode. Take, for example, the case of a liquid consisting of weak sulphuric acid such as is used in accumulators, or a 5 to 10 per cent. (by weight) solution of potassium carbonate, and a round bar of metal from 1 to 2 cm. in diameter; when the latter is connected up to the negative of the source of electricity and is slowly lowered into the liquid to a depth of several centimetres, on slowly increasing the voltage of the current it will be noticed that (1) so long as the e.m.f. does not exceed a certain value, in general, a few dozen volts, according to the conductivity of the liquid, all that occurs is the decomposition of the water, hydrogen being given off on the negative, and oxygen on the positive side. (2) On increasing the e.m.f., at a certain moment sparks will occur between the metal bar and the liquid, together with a slight irregular boiling of the liquid in contact with the metal. During this period the intensity of the current varies between wide limits, the average being relatively high. This may be called the "unstable" period. (3) If the e.m.f. be further increased it will be found at a certain moment that there is formed round the bar of metal in the liquid a gaseous layer or sheath, the sheath being not only luminous, but also clear and circumscribed, forming a distinct separation between the metal and the liquid, across which the current has to pass. In this case, however, the current remains not only steady, but relatively small also. This is the "stable" period. The sheath above-mentioned consists of the hydrogen of the water vapour and the positive element of the salt in solution. The colour of the sheath depends on the nature of this positive element; if it is an acid solution, the colour will be pale violet, owing to there being only hydrogen with the water vapour.

As a result of the action of the nascent hydrogen, some de-oxidisation and scaling of the metal occurs; at the same time the electrical current has another action, removing instantaneously, and in a measure mechanically, all the surface impurities, the surface of the metal undergoing, together with the scaling, a thorough cleaning.

The thickness and stability of the sheath increase with the e.m.f., its electrical resistance and consequently the amount of heat generated by the passage of the current also increasing.

The foregoing results can be obtained with lower e.m.f. in proportion as the conductivity of the liquid is increased. At a certain moment the iron will become red hot, then white, and will finally melt in the liquid. To give a concrete example, with a potential difference of 200 volts at the terminals and an 8 per cent. solution of potassium carbonate, a round bar 1 cm. in diameter can be heated to the melting point in less than two minutes.

The intensity of the heating for a given e.m.f. can be reduced by lowering the conductivity or strength of the liquid. At all times, however, it is possible to regulate the action by simply varying the e.m.f.

In the case outlined above the current density at 200 volts will be about 3 amperes per sq. cm. of the surface of contact between the metal and liquid. By the use of insulators, referred to below, the current can, however, be reduced to 1½ amperes.

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The Use of Insulators.

It is obvious that if part of the surface of the metal plunged in the liquid is covered with an insulator, no current will pass at that part and the protected portion of the metal will not be heated. In this way it is possible to secure "local heating."

It is not necessary that the insulation shall be absolute. To protect a part of the metal against the calorific action, it is sufficient to fix near that part an insulator. For example, a porcelain tube will perfectly protect a metal bar within it if the diameter of the bar is slightly less than that of the tube. This also follows from the fact that the electrical resistance of the liquid is very high. In the above-mentioned solutions and in those employed in practice the resistivity ranges from 1 up to 50 megohms.

In the same way an insulating plate arranged a few millimetres away from a metallic surface will protect the latter almost completely, according to the area of the surface and the distance between the metal and the insulator.

Generally speaking, the insulators may be applied in a multiplicity of ways, according to the portions to be heated, and the parts to be protected; usually they are located in the electrical circuit within the liquid at points where they can reduce the amount of current passing at any predetermined part of the metal. Very often they take the form of screens which reduce the liquid sections through which the current must pass to reach predetermined parts of the metal, or, again, the length of the electrical circuit can be extended.

Thus by the judicious use of insulators not only can the heating be restricted to clearly-defined, predetermined parts of the metal, but the degree of heating at one point or another can also be controlled.

A current of electricity seeks the path of least resistance between the two electrodes. If between the latter is interposed a piece of metal, the current will frequently pass through the metal, which may, indeed, under certain conditions, depending largely on its size, become the seat of calorific action such as that described above without, however, there being any direct connection with the source of electricity.

Before dealing with the practical applications of the process, a few lines may be devoted to the question of the use of insulators. When the insulator is not in direct contact with the metal, there is a certain loss of current between the two bodies, the amount of loss depending on the elements forming the electrical circuit in the liquid, and the electrical resistivity of the latter. When the insulator is simply applied to the metal without being fixed to it—as, for example, an insulating plate fixed above the surface of the metal or an insulating tube surrounding the metal bar—liquid passes into the interstices between the two bodies, allowing the passage of current. However small this may be, it can be reduced by using either on the metal or the insulator a liquid, semi-liquid, or pasty insulating material or powder, such as oil, grease, or even sand, which will partly fill up the space between the metal and the insulator.

Attention may here be drawn to two points. When a bar of metal is plunged into the liquid, heat is generally given off at the point of contact of the metal and liquid; the electrolytic action also causes gas to be given off, this resulting in the level of the liquid being agitated, and being irregularly splashed by the agitation on to the uncovered metal. The result is that momentary contacts are formed between the liquid and the metal, causing waste of electricity by giving rise to parasitic currents. By covering the metal to a certain depth below the level of the liquid by means of an insulator, these currents can be avoided and, as has been shown, the power used can be reduced by half, or in the instance given from 600 to 300 watts.

As the calorific action of the electric current takes place on the surface of the metal, the edges and many points on the latter become heated more rapidly than the remaining portions—a tendency which can be avoided by the judicious application of insulators. Thus the end of a bar can be protected by simply placing it on a small insulating plate, or allowing it to pass a little way into a sufficiently wide insulating tube. Daily practice will reveal to the operator many simple ways, varying according to the circumstances, to overcome the difficulty.

Applications.

From the foregoing remarks it will be seen that the method of heating metals outlined is not only applicable to all metallurgical operations in which preliminary heating is requisite, but in a quite special and advantageous way; indeed, it lends itself to operations hitherto unknown or impossible. To summarise: (1) by the action of the hydrogen formed at the negative pole the metal is heated in an essentially reducing or deoxidising medium, and at the same time is scaled by the action of the electric current; (2) the degree of heat can be adjusted by a hand regulator varying the e.m.f.; (3) the heating may not only be restricted to any predetermined parts of the metal, but may also be varied as desired between one point and another; (4) as the calorific action is brought about within the liquid by the electric current, this can be cut off at any time to instantly stop any further heating, so that it is possible to temper or harden metal capable of such treatment, without any additional handling.

As a result of these special advantages—immediate hardening or tempering directly following the heating without changing or altering the position of the metal—a much wider range of hardening or tempering possibilities than has hitherto been available is secured; not only so, but the control is rendered greater by reason of the possibility of varying at will the heating from one point to another. Indeed, just as the strength of current, and consequently the rapidity of the heating, can be varied, it is possible to switch off the current when the outer portion of the metal to a certain depth has been brought to a red heat, the interior remaining below the hardening or tempering temperature, and its fibrous structure remaining consequently undisturbed.

Electrolytes.

Generally speaking, any conducting liquid may be used, but more especially acids and salt solutions. By the electrolytic action of the current the positive elements of the electrolyte—the hydrogen and metals—are transferred to the negative pole, while the negative elements are carried to the positive, or, as it may be termed, the "passive" pole. In the heating operation hydrogen in a nascent state constitutes the principal element of the gaseous sheath which forms round the metal, and which may burn at the surface. The atoms of the other metals of the electrolyte also enter the sheath in a nascent condition, as is shown by spectroscopic examination. According to their character they may also burn at the level of the liquid round the metal, but, under certain conditions, they may also adhere to the electrode, *i.e.*, the heated metal.

In view of this it is possible to heat iron or steel in solutions of salts of iron, either non-acidulated or acidulated, particularly for welding purposes. Moreover, it is also possible to heat iron and steel for welding purposes in solutions of salts of manganese, nickel, chromium, or other metals, in order to introduce these metals in a nascent state into the operation. The same reasoning may be adopted in connection with the welding of other metals, particularly aluminium and copper, which can be heated in salt solutions of the same metals, or, according to the result desired, in solutions of the salts of other metals.

The point may here be raised whether in welding operations, one or other metal should not be introduced, it being possible that such metal deposited by the electrolyte may play a certain rôle. It is also possible that, in certain circumstances, it may be advisable, before the heating operation, to submit the metal purely and simply to electrolytic action by reducing the strength of the current for a certain period of time during which the metal is only moderately heated, so causing a deposit

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on the metal of particles of any desired metal before the actual welding.

Briefly summarised, the process enables metal to be welded in an atmosphere of hydrogen mixed with atoms in a nascent state of any desired metal. In the second place, it enables the welding operation to be preceded by a more or less prolonged stay of the metal in a similar atmosphere, either cold or at any desired temperature, the latter being controllable at all times by a regulator. I desire to draw particular attention to this point, in view of the difficulty of welding certain metals, notably aluminium and certain kinds of steel.

Voltage.

In principle, the electric pressure to be employed is arbitrary; in practice it depends on the object in view, on the nature of the electrolyte and especially its electrical conductivity; on the kind of electricity available and the dimensions of the parts being dealt with. The pressure employed is always betwen 200 and 500 volts, this being a great advantage over the relatively low pressure required when using an arc.

Some useful practical hints may here be given. The conductivity of liquids increases, generally speaking, with the quantity of the salt or acid in solution, but only up to a certain maximum. For ordinary jobs, although necessitating pressure up to 500 volts, it is better to use weak solutions. A little more care will be necessary as regards insulation, but the cables will be reduced in size and their attachment rendered more simple. In the case of jobs that have to be carried out by hand, a lower pressure, such as 220 volts, with stronger solutions, may be preferred.

Salts other than the alkalis, such as those of iron, manganese, chromium and nickel, require a higher temperature, while similar salts mixed with a suitable acid, or with alkaline salts, can be used with a low or medium pressure according to the degree of concentration of the liquid.

It should also be borne in mind that in making a solution of a certain weight of several salts, the resulting conductivity is greater than the average of the conductivities of individual solutions, each containing the same total weight of one of the salts. To give an example, a solution containing 1 lb. of potassium carbonate, 1 lb. of sodium carbonate, and 1 lb. of ammonium carbonate has greater conductivity than the average conductivities of three solutions, each containing 3 lb. of any one of these salts.

Therefore, to secure a solution of minimum strength to obtain a predetermined conductivity and to work with a given voltage, it is advisable to use a solution of a mixture of salts.

(*To be continued.*)

The Physical Behaviour of Lead Sheaths in Relation to Failures of High-Voltage Cables.

The author suggests that the alleged creation of voids in normal cables as a result of permanent distension of lead sheaths is a view which distinctly lacks foundation.

By C. J. BEAVER, M.I.E.E.

(*Concluded from page* 145.)

Having experimentally determined the order of the internal pressures which may be set up by working temperature conditions, and shown the values thereof which may produce permanent distension of the lead sheath

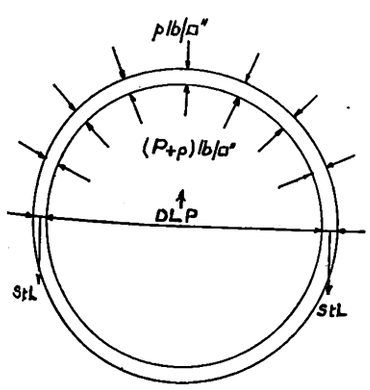

Fig. 6.—Circumferential Stress in Cylinder.

in typical high-voltage cables, the general case may now be considered from the mechanical aspect.

The difficulties of mathematical treatment of the case, due to the indefinite relationship of the various factors, have already been pointed out, and from a general survey it would appear that the longitudinal resultant of the forces due to thermal expansion and solid dilatation is, under average conditions of laying, &c., less important than the diametral component, and probably does not approach the value relative to the circumferential stress (one half) which it would in a plain cylinder subject to an internal pressure.

The question whether the longitudinal stress should be considered to function according to the maximum shear stress breakdown theory, *i.e.*, tending to deform and weaken the lead sheath, or according to the maximum strain theory which infers the opposite effect, would not therefore appear to arise. Under the circumstances it would appear sufficient to consider only the circumferential stress. The ordinary method of computing circumferential stress in a cylinder is illustrated by the diagram, fig 6, where—

D = diameter of cylinder in inches.
t = thickness of cylinder wall in inches.
L = length of cylinder in inches.
P = excess internal pressure in lb./sq. inch.
S = circumferential stress in lb./sq. inch.
p = external pressure.

$$2\,stL = D.L.P.$$

Circumferential stress $S = D/2t\ P$ lb./sq. inch.

Applying this formula to cables A and B, we get $S = 9.2\ (43-15) = 257.6$ lb. per sq. in., and $S = 9.3\ (44-15) = 269.7$ lb. per sq. in., respectively, as the approximate circumferential stress limits of elastic behaviour.

A check on these indications may be directly obtained from the apparatus in another way, *viz.*, by heating the

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cable to a temperature producing a pressure which is predetermined in terms of circumferential stress, and taking readings of the oil level in the gauge glass before and after releasing the internal pressure in the cable. This affords a measurement of the elastic volumetric strain in the lead sheath. Clearly, if a high circumferential stress, such as 260 lb. per sq. in., corresponds

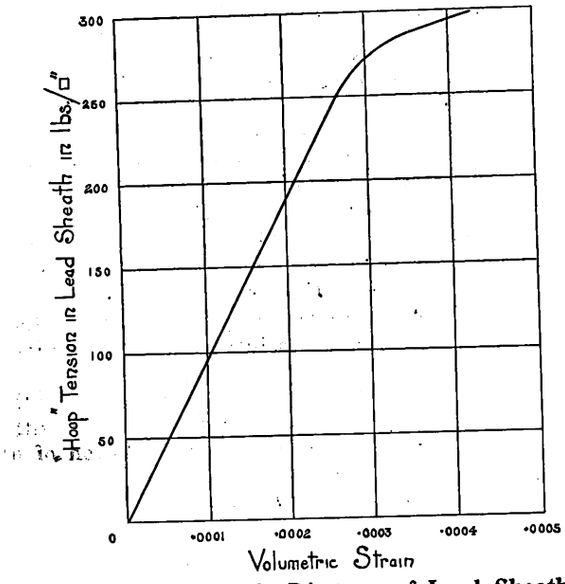

Fig. 7.—Stress-strain Diagram of Lead Sheath.

with an elastic strain, all lower values will lie on a line connecting the point thus plotted with the source. In fig. 7 the calculated "hoop" tension in the lead sheath is plotted against the measured volumetric strain, and the confirmation of results on cables A and B thereby obtained is reasonably complete.

In turn, the approximate elastic limit value arrived at on the lines of these experiments, and as indicated in fig. 7, compares reasonably well with Wertheim's figure for annealed lead of 280 lb. per sq. in.[17]

On the basis of the volumetric strain determined in the foregoing experiment, the modulus of elasticity E of the lead may be evaluated from the formula:—

$$E = \frac{pr}{te}\left(\frac{5}{2} - \frac{2}{m}\right),$$

where E = modulus of elasticity in lb./sq. in.,
p = internal pressure in lb./sq. in.,
r = radius of sheath in in.,
t = thickness of sheath in in.,
e = volumetric strain, and
m = Poisson's ratio (roughly 4).

According to the values pertaining to the above mentioned case, E = 1,900,000 lb./sq. in. as against Wertheim's value of 2,500,000 lb./sq. in. The definite character of the behaviour of the lead sheaths within and around the elastic limit demonstrated in the foregoing should influence the crystallisation of ideas on the actual behaviour of lead under conditions of stress and temperature, and help to destroy the impression which seems to exist that lead is practically plastic and will therefore strain without limit under an attempt to stress it.

The tests described by Emanueli in his paper on "The 132-kV Cable Lines in New York and Chicago,"[18] were prefaced by the following note: "Lead has more the characteristics of a liquid of extremely high viscosity than of a metal, and is deformed under the slightest stress." The author then showed elongation curves of commercial lead, plotted against time in days, at different temperatures, but under a condition of stress considerably exceeding the elastic limit of lead, *viz.*, at 425 lb./sq. in. It is true that in the system the author was describing, the hydrostatic pressure (105 ft. of oil) would probably cause the elastic limit of an ordinary lead sheath to be exceeded, but the experimental results which are the subject of the present article show that there is no justification for statements which infer complete plasticity and ignore the elastic limit of lead.

Again, in Dunsheath and Tunstall's paper on "The Physical Properties of Lead Cable Sheaths,"[19] the authors give the results of a tensile test applied quickly (2,400 lb./sq. in., and 45 per cent. elongation) and after saying "If now, instead of applying a load which will break the strip in a few seconds, we select some lesser load, we find that fracture can be obtained by leaving the sample under test for a long time," they proceed to cite an experiment in which the test piece failed after 230 hours' continuous loading. The tensile stress in this case, however, was about 1,100 lb./sq. in., and no mention is made of the important "failing case" represented by the maximum working stresses which occur in cable sheaths, *i.e.*, stresses below the elastic limit of lead.

The point of the whole matter is that while lead may be properly regarded as having a negligibly low elastic limit for all ordinary mechanical purposes, it is, as shown by the foregoing experimental results, sufficiently high for the worst conditions of normal cable work. Incidentally, it will be obvious from a general survey that where the insulated conductors of a three-phase high-voltage cables are single cables, or separately sheathed three-core cables, the stress values in the lead sheaths will be still further remote from the elastic limit.[20]

Reviewing the conclusions to be drawn from the foregoing, the points which appear to be proved, indicated, or suggested may be summarised as follows:—

(*a*) That under normal working conditions of load in high-voltage cables, the internal pressures produced are insufficient to produce permanent distension of the lead sheath.

(*b*) As the matter is simply one of maximum internal pressure *versus* elastic limit of the sheath, a greater margin (though practically unnecessary) can easily be provided if desired by either employing an increased thickness of lead or substituting for it one or other of the hard lead alloys which are commonly used for cable sheathing purposes; the necessity for external reinforcement does not arise.

(*c*) As regards amplitude of the pressure variation over the temperature range, the prior impregnated solid-compound type of dielectric has the greater margin of safety, because of the physical properties of its dielectric components, albeit its residual compressibility is probably less. As regards range of pressure relative to atmospheric pressure, values are initially of a lower order in the ordinary vacuum (*en masse*) impregnated type, because of subsequent contraction after being sheathed warm, thus tending to counteract the effect of greater amplitude due to larger coefficients of expansion of the dielectric materials.

In both types of cable, therefore, inherent conditions exist which have a restricting rather than an exaggerating influence on the relation referred to under (*b*).

(*d*) As many failures of high voltage cable have occurred where the conductor temperature has not exceeded 140 deg. F., and therefore the elastic limit of the lead sheath has not been approached, it would appear that the alleged creation of voids by permanent expansion of the lead sheath could not in such cases have been a contributary cause.

It follows that the voids (which presumably have been observed in post mortem examinations of cable failures) can only have been due to the aggregation of originally occluded or entrained air or gas, possibly inflated to a slight extent in the breakdown area by gas formed as a result of dissociation under ultimate stress.

Finally, the overriding conclusion which can hardly be avoided is that the general widespread idea regarding the alleged creation of voids in normal cables as a result of permanent distension of lead sheaths is one which distinctly lacks foundation.

[17] "A Handbook of Testing Materials." C. A. M. Smith, M.Sc. Constable, London.
[18] *Ibid.*

[19] *Journal* I.E.E., Vol. 66, No. 375, p. 283.
[20] The cables referred to in Höchstädter and Barrat's R.G.E. article (*loc. cit.*) were single conductor cables.

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Unemployment in 1928.

A review of the state of British Industry during the year, with particular reference to the Electrical Trades.

An investigation of conditions in the various branches of British industrial activity shows that the electrical trades occupy a very favourable position in comparison with most other industries, and this is clearly illustrated in the accompanying curves which show the course of unemployment during the past two years.

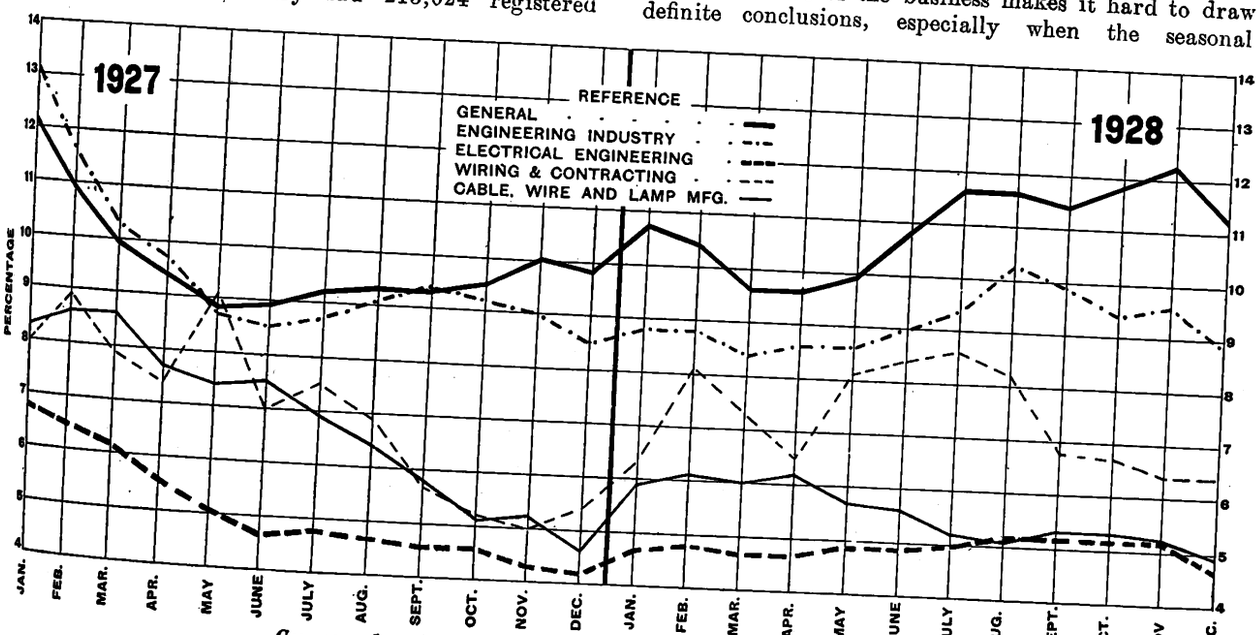
In industry generally, the conditions durng 1928 were unsatisfactory, and towards the end of the year the unemployment figure had risen above the high level which marked the commencement of 1927. At this time industry was still in process of recovery from the effects of the general strike, but during 1928 there were no industrial disputes of any magnitude. The monthly average rose from 9.8 in 1927 to 10.9 per cent. in 1928. Of course the coal mining industry was mainly responsible for the gloomy situation. At December 17th last this industry had 213,024 registered unemployed, the proportion of the total being 19.1 per cent. Several industries showed higher percentages of unemployment, although their actual numbers were not so great; they included shipbuilding and ship repairing (30.3 per cent.); public works contracting (24.3 per cent.); the manufacture of brass, copper, tin, zinc, lead, &c. (19.8 per cent.); and iron and steel manufacture (19.8 per cent.).

The curve for the engineering industry (including electrical engineering) shows that there was an improvement on the whole during 1928. The monthly average of unemployment was 9.1 per cent., as compared with 9.7 per cent. in 1927. The general tendency was, however, for the figure to rise, although in December there was a decided improvement. The marine engineering section, with an unemployment percentage of 15.3 at December 17th, was the most depressed, while electrical engineering (4.7 per cent.) was by far the most satisfactorily placed.

The latter industry, as will be observed from its unemployment curve, enjoyed a remarkable measure of stability during last year, although unemployment was comparatively high during the latter half. The monthly average for 1928 was 4.9 per cent.; in 1927 it was 5.2 per cent. The last point on the curve (December) is 4.7 per cent. In the detailed analysis of unemployment in the last *Ministry of Labour Gazette* only 12 industries out of a hundred were credited with a lower percentage of unemployment; these included the printing and paper trades, tobacco manufacture, &c.

The Ministry of Labour, no doubt for good and sufficient reasons, lumps together the electrical cable, wire and lamp manufacturing industries for the purpose of unemployment statistics. The curve illustrating the course of unemployment in this group shows that a considerable improvement took place during 1928, although actually the percentage of unemployed was higher at the end of 1928 than at the close of the preceding year. The monthly average fell from 6.8 per cent. to 5.5 per cent.

The fifth and last curve is that dealing with the electrical wiring and contracting industry. The seasonal nature of the business makes it hard to draw definite conclusions, especially when the seasonal activities do not occur in corresponding months of successive years. It looks, however, as if a great deal of work is deferred until the end of the year, the lowest parts of the curve falling in the last quarter in each year. On the whole, the position of the industry was not so good last year as in 1927; the monthly average of unemployment rose from 7.0 to 7.3 per cent.



Curves showing Unemployment during 1927 and 1928.

It may be useful to set forth some actual figures (as against percentages) to convey an idea of the numbers employed and unemployed in the industries mentioned. The last available statistics are dated December 17th last. Then the estimated number of insured persons in industry was 11,881,500, including 3,259,600 females. The total number of registered unemployed was 1,333,611, including 78,413 casuals. The engineering industry had 979,050 insured employés, including 88,860 females, and 87,511 unemployed. It included 79,770 insured workers (17,190 females) in electrical engineering, of whom 3,732 were unemployed. The number of insured persons in the electrical cable, wire and lamp manufacturing group was 86,180 (including 32,190 females), and of these 4,202 were unemployed. The electrical wiring and contracting industry covered 15,530 insured persons (1,290 females), and showed 991 as unemployed.

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Domestic Progress and Prospects.

An optimistic forecast, based on sound data, indicating abundant work for the electrical manufacturing and electricity supply industries.

By D. J. BOLTON, Author of "Electrical Engineering Economics."

IT is generally agreed that the statistics of electricity supply form a very useful barometer of the conditions and the prospects of electrical trade generally. This is true to-day, although there are a few pessimists to be found standing round a barometer which is steadily and rapidly rising, shaking their heads and prophesying bad weather. Electrical energy is a little like Shakespeare's description of mercy, "It blesseth him that gives and him that takes." A rise in the quantity of energy consumed each year means at the one end additional business in generation, transmission and distribution gear, and at the other end additional sales of motors, instruments, lamps, and cookers. Electrical energy not only necessitates elaborate and expensive machinery to produce it, it also utilises a very wide range and complexity of apparatus in its consumption. In this respect electricity differs notably from gas, in

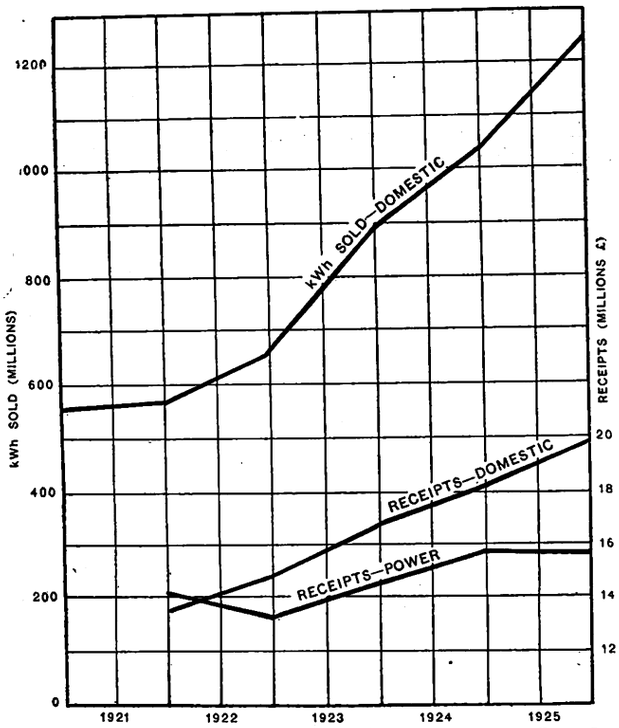

Fig. 1.—Receipts from Domestic and Power Supply, 1920-26.

which the consuming apparatus is a relatively minor item.

As an example of the conclusions which can be drawn from the readings of the electrical supply "barometer," the following calculation is of interest:—The annual increase in the power load during the last few years of which figures are available has been of the order of 400 million units. Neglect for the moment the additional plant necessary to generate and transmit this energy and consider only the additional apparatus necessary to consume it. It will be clear that a steady and continuous rise of this kind cannot be due to a fuller use of existing apparatus such as might account for temporary fluctuations: it can only be due to the installation of new gear. Suppose, as a basis of calculation, that the new gear takes the form of induction motors which are in use on the average for the equivalent of four hours' full load per day and 300 days a year. Suppose also that they have a working efficiency of 80 per cent. The added power load referred to would then involve the installation of 360,000 horse-power of new plant each year. Of course, the new load would not all go in induction motors, but it will all go into some sort of electrical gear. Moreover, the above refers only to the *additional* power load for the year. Even had there been no added load, there would obviously be sales of motors for renewals, replacements, and changes of various kinds.

If the above argument is sound as regards electricity supply as a whole, it is particularly true of the domestic consumption, for two reasons. In the first place, the domestic portion is increasing at a greater rate than any other part of the load. In the second place, the consuming apparatus is in general much more short-lived, so that a given number of kWh in lighting and domestic consumption will usually represent a much more frequent turnover of apparatus than the same magnitude of power load. One has only to compare an induction motor with a life of twenty years or, say, 50,000 hours of use with a lamp having a life of only 1,000 burning hours, to see that a given number of kWh will represent a great many more replacements in the latter case than in the former.*

There are those who sneer at the lighting load in this country as the baby of electricity supply—accounting for only one-fifth of the total from public supplies and a still smaller proportion if the private supplies are taken into account. But it is a sturdy infant and growing fast, so much so that other authorities profess to be afraid of it and wish to see it grow no larger. But whether regarded as a promising youngster or an *enfant terrible*, there is no mistaking its increasing magnitude and importance. If instead of comparing kWh sold one compares the revenue received, it will be seen that, in spite of decreasing prices, the income is steadily growing, and since 1921 the domestic receipts have actually been greater than the receipts for the power load. Fig. 1 shows the receipts from the two main groups of consumers—the domestic and the power group during the years 1920-6. These figures are for the whole of the public supply authorities in Great Britain, and on the same base is shown the number of units sold for lighting and domestic purposes. There is no mistaking either the rapid growth in the domestic consumption or the increasing importance of the revenue derived therefrom.

In dealing with the domestic consumption of electricity, it is natural to compare it with that other form of household supply—gas. Frequently the gas and electrical industries are keen competitors: at best they are friendly rivals meeting similar needs and frequently under the same management. It therefore cannot fail to be of interest to see how the two industries have fared in the same period. Statistics of the gas industry as a whole have not been carried to quite the pitch of perfction that is reached by our own Electricity Commissioners, but in the case of the municipally-owned enterprises plenty of figures are available.

In order to get similar magnitudes, as well as similar managements, the plan has been followed of taking the six largest municipalities owning both gas and electricity undertakings.† In the bottom curve, fig. 2, are plotted the total receipts for the six towns from gas

* According to one estimate made by the writer, an induction motor on an average may be expected to consume something like 100 times its purchase price in energy in the course of its life, whereas a lamp will only consume from 5 to 10 times its purchase price. ("Electrical Engineering Economics.")

† Manchester, Birmingham, Glasgow, Leeds, Edinburgh, Bradford.

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supply in the six years ended March, 1927. On the same base are shown the kWh sold for lighting and domestic purposes in the same towns and the receipts therefrom. (In the case of the last year the figures are estimated from the *total* sales, assuming the same proportions as in the previous year. This portion of the curve is therefore dotted.) It will be seen that, whilst gas receipts have shown no general tendency, domestic electricity receipts have risen steadily. Moreover, gas

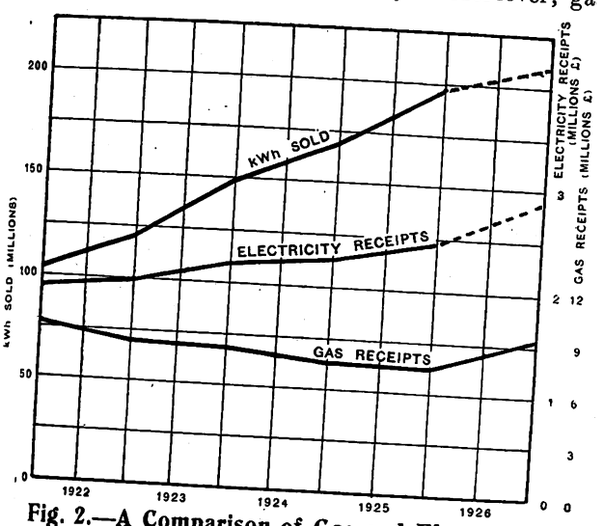

Fig. 2.—A Comparison of Gas and Electricity Supply, 1921-27.

prices, although difficult to compare owing to the change-over in the basis of charge, have not shown any general and considerable drop during the period, so that the curve of quantities sold would not differ very greatly from the curve shown for receipts. But in the case of electricity the prices have fallen so considerably and consistently that when units sold are plotted, the curve shows much more striking progress.

So much for the past: now for the future. In attempting to forecast future developments in this sphere, it must not be forgotten that the increase in the domestic load is a two-dimensional one—an increase in the number of consumers and an increase in each individual's consumption. In the first place, only one house in four or five now uses electric light, and this number is destined to be enormously increased since no one really prefers any other form of illumination. But the load will also increase in the second dimension as these same lighting consumers learn to put electricity to other uses. Many prophecies have been made and many confounded either by being exceeded or by remaining unfulfilled; and the present writer has no intention of adding to their number. For the purpose of this article it will be sufficient to take the estimate made by Colonel Edgcumbe in his I.E.E. presidential address last October, based on a careful survey of all the available figures.

This estimate is illustrated in the diagram, fig. 3. The ordinates on the left represent the total consumption in 1924 from both public and private sources, this being obtained from the Commissioners' figures and the returns from the Census of Production. The total is divided up amongst the different groups of consumers in the manner shown. The ordinates on the right represent the anticipated total for 1940, and this is also divided up into the proportions which it is estimated that the different types of load will then reach. In order to show clearly the expansion which would be involved in such a growth, a column has been drawn on the right of the curve made up of rectangles whose height represents the anticipated consumptions. The lower part of each rectangle is unshaded and represents the 1924 consumption, whilst the upper shaded portion represents the expansion which would result from the new figure.

It will be seen that whilst the total consumption is expected to be doubled, the domestic consumption is to be something like seven times the 1924 figure. (At first sight this may be thought a somewhat extravagant prophecy, but it must not be forgotten that the annual increase during the last few years has been at the rate of some 20 per cent. of the previous year's total. If the same *proportional* increase were maintained, the total in 1940 would be not seven times, but 18½ times the 1924 figure!) It will be interesting to glance for a moment at the implications of such an increase, which may conveniently be considered under two heads—annual consumption and annual growth. Considering the first point, an annual consumption for lighting and domestic purposes of some 8,000 million kWh in 1940 would necessarily involve an enormous sale of consuming apparatus. Even if only a quarter of this were for lighting purposes, then, taking as an average the 40-watt lamp with a life of 1,000 burning hours, this consumption would involve an annual sale of 50 million lamps. The other three-quarters would also be consumed in apparatus of some kind, all of it requiring periodic renewal and replacement.

Consider next the annual growth of load. With a constant utilisation factor, this means a corresponding increase in the apparatus installed. The mean annual increase in the lighting and domestic load involved in the above estimate is about 400 million units. It may be taken that the maximum demand will be about 30 per cent. of the total connected load, and the load factor between 30 and 40 per cent., giving a net utilisation factor of, say, 10 per cent. With this assumption this would mean the purchase and installation of half a million kilowatts of new apparatus each year merely to account for the *increase* in consumption, and without any allowance for depreciation, replacement, and renewals of the gear responsible for the initial value of the consumption.

In conclusion, there is no need to stress the purely supply side of the question. It will be clear enough that

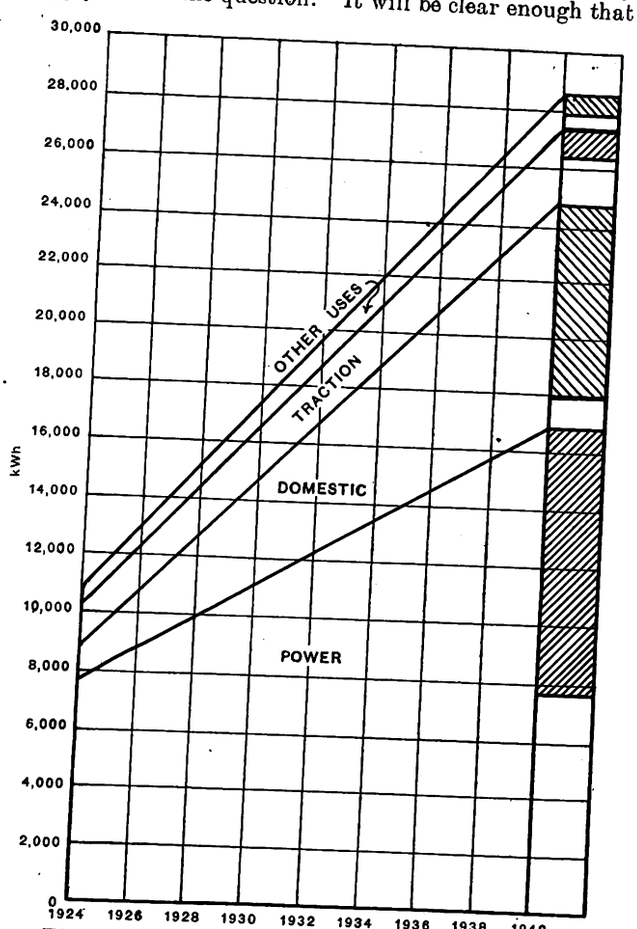

Fig. 3.—A Forecast of the Future Output.

if the total load, and in particular the domestic portion of it, is to grow to anything like the dimensions indicated, there will have to be enormous developments of the generation, transmission, and distribution equipment necessary to supply it. Even if a much more conservative estimate is made of future progress, there would still appear to be abundant grounds for a very considerable optimism.

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Legal.

Lektophone Corporation v. S. G. Brown, Ltd.

JUDGMENT in this action was delivered by Mr. Justice Tomlin in the Chancery Division on January 23rd. The action was heard in December (*vide* ELEC. REV., December 14th, 21st and 28th), and the plaintiffs claimed an injunction restraining infringement of a patent granted to Marcus Clarence Hopkins for improvements in sound regenerating machines. The infringement was alleged to be found in a "Mascot" cone loud-speaker made to the designs of Mr. S. G. Brown, and sold at the Radio Exhibition, 1927.

The defendants denied infringement, asserted that the patent was invalid because of prior user, common general knowledge and insufficiency, and they counter-claimed to have the patent revoked.

His LORDSHIP said the patent was one of a number relating to sound regenerators owned by the plaintiffs, who had granted licences to manufacture under it since 1926. At the date of the patent—1913—sound regenerators had but a limited field, the only instruments calling for them being the gramophone, phonograph, and loud-speaking telephone; broadcasting was unknown. Therefore in 1913 the problem for constructors of sound regenerating machines was how to combine in their diaphragms rigidity with an inertia not too great for the limited power then available.

The first application in England for a patent for Hopkins's invention was made in July, 1914. In his specification Hopkins confined himself to the art affecting instruments which produced vibration by the movement of a stylus over a record. He thought Dr. Eccles was right in saying in his evidence that Hopkins did not appreciate that he could get lower frequencies with a larger diaphragm. As to what Hopkins claimed in his specification, his Lordship said he was satisfied that the claims were for a stylus or record machine with a diaphragm reproducer operating without a sound-box, horn or trumpet, but with a tympanum at least nine inches in diameter, having conical and annular portions, the latter being supported by rings at its outer edge.

This view, said his LORDSHIP, would be sufficient to dispose of the action, as the alleged infringing article was a loud-speaker in the modern sense for broadcasting, and was not built for use on a record or stylus machine. It was impossible for the inventor to claim novelty for a mere increase in the size of the diaphragm, mere rigidity, or mere coning of the diaphragm to secure rigidity. What was novel appeared to rest on a combination of the following: Taking a large diameter, giving it lightness, rigidity and support, and abolishing the sound-box, earpiece, or horn, and by this means producing the radiation of sound waves directly into the air. After examining the prior specifications and documents relied on by the defence he was satisfied that this element of novelty had not been anticipated, and that the patent was not bad for lack of novelty, lack of subject-matter, or insufficiency.

His LORDSHIP said he had seen a number of the loud-speakers manufactured by the plaintiffs' licensees. Many of them seemed to have little resemblance to Hopkins's diaphragm, and he expressed no opinion as to whether any or which of them was constructed according to the plaintiffs' specification. On the true construction of that specification he held that the "Mascot" loud-speaker did not infringe the patent. The result was that both the action and the counter-claim failed, and must be dismissed. On the question of costs, he gave the defendants four-fifths of theirs, and the plaintiffs one-fifth of theirs, and dismissed the counter-claim with costs.

County Electrical and Wireless Stores, Ltd.

A COMPULSORY winding up order in respect of this Company was made by Mr. Justice Romer on January 28th.

City of London Electric Lighting Co., Ltd.

IN the Chancery Division on Monday last, Mr. Justice Romer approved an alteration of the company's memorandum of association, to enable it to guarantee an issue of debenture stock by its subsidiary, the Bankside Investment Trust. Mr. BUCKMASTER, for the company, said that the Trust was formed to acquire properties suitable for sub-stations, &c., and to let out such parts as were not required for this purpose. The Trust proposed to issue £1,000,000 of debenture stock (£700,000 immediately), and it could raise the money on better terms if it had the guarantee of the parent company.

Alleged Fraudulent Use of Electricity.

AT the Birkenhead Police Court on January 25th, Harding Miller, a wireless dealer, was summoned for using electricity through a power meter for lighting purposes. Mr. A. C. SHEPHERD, for the Corporation, alleged that defendant had so fitted wires that the energy from his power meter was used for lighting purposes. The charge for lighting was 4¾d. per kWh and for power 2d. Evidence was given by inspectors of the Electricity Department that the lighting circuit was switched off and that two lights were burning, being supplied through the power meter.

Defendant pleaded that the light in the workroom was a pilot lamp used to indicate that the charging power was in service. It was there in accordance with factory regulations. The light called attention to the fact that charging was going on and to guard against employés receiving shocks.

The magistrates expressed the opinion that in the future there might be some regulation requiring "pilot" lights to be placed on the switchboard and not used separately. They dismissed the summons.

Standard Telephones & Cables Patents.

MR. JUSTICE TOMLIN, in the Chancery Division on January 28th, heard an application by Standard Telephones & Cables, Ltd., for the extension of the period of seven patents relating to improvements in connection with machinery and apparatus used in automatic telephony. The application was based on the loss or damage which the company said it had suffered by reason of the war.

Mr. TREVOR WATSON, for the company, said the patents belonged to the Western Electric Co., Ltd., and Standard Telephones & Cables, Ltd., was simply a change of name. There was no opposition. He read an affidavit by the chairman of the company, which stated that soon after the war broke out the company became a controlled establishment, and the practical use of the patents was postponed for six years because of that fact and also because of the delay in the reorganisation of the telephone service of this country. The company's system was a rotary system, the feature of it being that it was applicable to systems manufactured by other companies. All the companies engaged in this work had pooled their patents for the use of the General Post Office.

His Lordship made an order extending the period of all the patents until February 11th, 1934.

Relay Automatic Telephone Patents.

IN the Chancery Division on January 28th, Mr. Justice Tomlin granted an extension of the period of a number of patents for improvements relating to automatic or semi-automatic telephone exchange systems, for three years from April 23rd next, on the application of the owners, the Relay Automatic Telephone Co., Ltd.

Mr. TREVOR WATSON, for the company, said it was not one of the companies that succeeded in getting its system adopted by the General Post Office, but there would have been a better chance of that if it had not been for the war. The company was a late-comer into the field of automatic telephony, and at the time of its entry into the English market its system was not wholly adapted to the requirements. Every step, therefore, had to be carefully considered. The main reason for the application, however, was loss or damage in the use of the patents occasioned by the war.

Cherry v. London Electric Railway Co.

MR. JUSTICE EVE, in the Chancery Division on January 25th, dismissed a motion by Mr. H. Cherry, costumier, 180, High Street, Camden Town, N., for an interim injunction to restrain the London Electric Railway Co. and its contractors from continuing the construction of an escalator at High Street Station, Camden Town, so as to cause a nuisance by noise and vibration at night.

At the conclusion of the arguments Mr. JUSTICE EVE, in giving judgment, said that he was not satisfied on the evidence that a real nuisance existed; the plaintiff had systematically prevented the defendants from testing the matter in his own house. He did not think it was a case for an interlocutory order. He thought the defendants' statutory powers were being exercised reasonably.

Philips's Enterprise in Germany.

The Philips Glow Lamp Company, aiming at an expansion of its interests in Germany, is reported to have acquired a large interest in the Berlin Lorenz Company, and thus the radio apparatus made by the Dutch company, which has hitherto been exported to Germany, will now be manufactured by the Lorenz company, so that the former will avoid the high German import duties and other charges. In the case of radio valves, the Dutch company is said to have acquired the majority of the shares in the Müller valve works at Hamburg, which affords the possibility of opening up the German market to the Dutch firm. It is hinted that the Philips company will make use of the Lorenz patents for the purpose of a large expansion in the German market and thus compete with the Telefunken Company, without violating the agreement with the latter. It is further suggested that the Dutch company may attempt to embark upon the telephone business, which would be possible through the Lorenz company, which is one of the largest makers of telephone apparatus in Germany.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Amalgamation of Well-known Electric Motor and Plant Companies.

That the appreciation of "rationalisation" is becoming more and more apparent is exemplified by the amalgamation of two of the oldest established electrical engineering firms which, we understand, is now in process of completion, *viz.*, that between Laurence, Scott & Co., Ltd., Norwich, and Electromotors, Ltd., Openshaw, Manchester, under the new title—subject to the approval of the Board of Trade—of Laurence, Scott and Electromotors, Ltd.

Messrs. Laurence, Scott & Co., Ltd.—one of the oldest firms in the industry, established in 1883—have a wide range of manufactures, embracing large generating units with the corresponding range of motors which enables them to electrify the heavier trades. For many years they have specialised in the electrical equipment of ships of every class. They rank amongst the chief suppliers to the British Admiralty, and foreign admiralties, of generating and motive power equipment. They have established a world-wide reputation for their electric deck winches, windlasses, capstans, and the electrical equipment of dockside cargo-handling plant.

Electromotors, Ltd., were established in 1899, and possess one of the finest plants in the country for the manufacture of a specialised range of d.c. and a.c. machines up to 150 horse-power, thus covering the general demand for industrial purposes. Like their future associates they also have a specialised range of motors for driving ships' auxiliaries.

Both firms have built up and maintained a substantial reputation at home and abroad for reliability and good service among the users of electrical machinery. The very low price levels for electrical machinery which set in after the slump of 1921 have been a source of temptation to reduce the quality of materials and workmanship, which both Messrs. Laurence, Scott & Co., Ltd., and Messrs. Electromotors, Ltd., have resisted, and their reputation after this severe testing-time is now as high as ever.

The fundamental idea of this L.S.E. amalgamation is naturally the elimination of redundant output, the concentration in each works of the class of machinery for which it is best adapted, the combination of buying and selling, as well as of technical skill in the advancement of methods of manufacture, and the solution of many problems which in these days of progress confront the electrical engineer, thus in all essentials leading to the reduction of costs, the increase of output and, incidentally, of the number of men employed.

The L.S.E. combination of two such well-known concerns of entirely British capital (for by its constitution foreigners are barred from its register of shareholders) is of peculiar interest to the electrical industry. There is a strong board of directors, including Mr. C. Wilson (chairman), Mr. W. H. Scott (founder), Captain G. J. Scott, and Mr. G. H. Wilson, all of Laurence, Scott & Co., Ltd., with Sir Benjamin Longbottom and Mr. Ernest Greenhalgh, of Electromotors, Ltd. These gentlemen have a life-long connection with their respective firms and are well-known in the industry. It starts its public life with the advantage of having no "charges" of any sort on its capital, the whole of this being in ordinary shares, and as each business has been largely built up by conserving and absorbing its profits, it will be seen that with a total capital of £311,000 and a turnover on last year's business of over half-a-million, it should have great potentialities. The shares are strongly held, and it is not anticipated that many will come into the market, although we understand that a Stock Exchange quotation will be applied for.

The Financing of Industry.

In the course of his speech at the annual meeting of the Midland Bank last week, Mr. R. McKenna (chairman) analysed the advances made by the bank outstanding on June 30th last. By this he showed that the industry which had borrowed the most (12¾ per cent.) was the textile group. Building and land represented 11¼ per cent., and wholesalers and retailers were responsible for a similar amount. The next largest group included the heavy industries—iron and steel and other metal manufacturers, engineers, machinists, shipbuilders, &c. These took 7¾ per cent. of the loans. Conditions in the different branches varied widely; some sections showed marked prosperity, while others were in a state of extreme depression. It was therefore satisfactory for them to find that the loans were widely spread over this field. After dealing with a number of other groups, the speaker came to local authorities and gas, electricity, water and other public utility companies, which together took 3¼ per cent.

In closing his address, Mr. McKenna said: Ten years have passed since the conclusion of the most recent, and we devoutedly hope the last, great war in the world's history. They have constituted a decade of grave difficulties, involving problems of exceptional magnitude and complexity. Disappointments have been frequent; many setbacks have been suffered. But I do not think it will be denied that considerable progress has been made towards a more ordered and prosperous world. At home much has been achieved in improving the relations between employers and employed, and the need for industrial reorganisation has become more widely recognised and accepted. It may be said with truth that the prospects of peace, both international and industrial, have brightened. Peace between nations and within nations is a primary condition of our welfare, and whatever the temporary state of trade, however slow we are in solving the financial and industrial problems which confront us, we still look forward with unshaken confidence to the time when the better relationships now established shall become the foundation of general and permanent well-being.

Central Electricity Board Contracts.

We briefly reported in our last issue that the Central Electricity Board had placed contracts for the transformers for the South-East England Scheme with Messrs. Ferranti, Ltd., and the Fuller Electrical & Manufacturing Co. Messrs. FERRANTI now inform us that their contract is for 60,000-kVA, 30,000-kVA, and 20,000-kVA, 132-kV, 3-phase units, of a total capacity of 1,100,000 kVA. Working in close co-operation with the railway companies concerned, the designers have succeeded in making the largest of the 60,000-kVA units suitable for transport in oil by rail under normal traffic working conditions. The manufacturing facilities at the Hollinwood and Stalybridge factories are such as to enable the company to build these transformers with on-load tap-changing mechanism entirely from the raw material.

In our advertisement pages to-day the Central Electricity Board invites tenders for the following:—South-East England Electricity Scheme.—66,000-V and other transformers (London area).

Recent Contracts.

Contracts for vacuum and gasfilled lamps have recently been placed by the Admiralty with the GENERAL ELECTRIC CO., LTD., SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., and METROVICK SUPPLIES, LTD.

Among the orders recently received by the D.P. BATTERY CO., LTD., are the following: A battery of 115 cells (1,950-Ah capacity) for the B.B.C.'s first "regional" station at Brookmans Park, Potters Bar; and (through Messrs. Wingrove and Rogers, Ltd., and Greenwood & Batley, Ltd.) a total of 52 "Kathanode" batteries for the electric locomotives which are being used in connection with the Mersey Tunnel excavations.

STANDARD TELEPHONES & CABLES, LTD., has received an order from the General Post Office for a main automatic telephone exchange at Newcastle, together with eleven satellite exchanges, representing an immediate total of 20,000 lines, with provision for extension to 42,000. The contract will be completed towards the end of next year.

The Chilean Naval Commission has had British-made cables installed in all its six new torpedo boat destroyers built by Messrs. Thornycroft & Co., Ltd. The installation involves nearly 60 miles of v.i.r. cable and nearly a mile of paper-insulated lead sheathed ring main cable, all of which has been made by the PIRELLI-GENERAL CABLE WORKS, LTD. (one of the associated companies of the General Electric Co., Ltd.).

Unemployment.

The number of registered unemployed declined by 17,600 during the week ended January 14th. The total at that date was 1,435,000, as compared with 1,452,620 on January 7th, and with 1,193,810 on January 16th, 1928.

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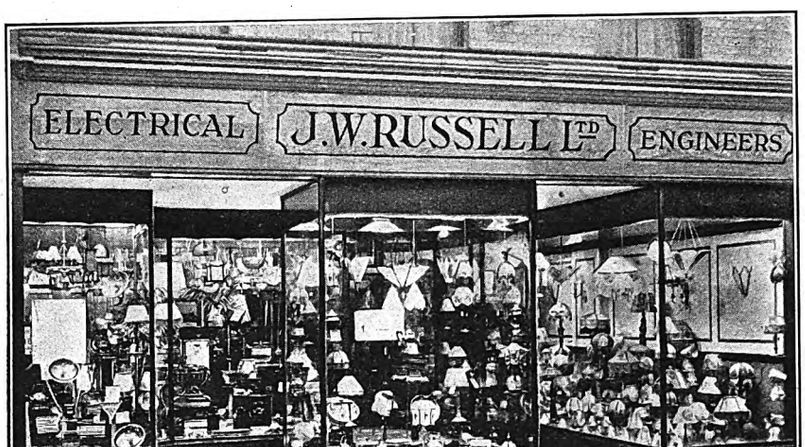
New Showrooms at Watford.

On January 22nd Messrs. J. W. RUSSELL, LTD., electrical engineers and contractors, opened new showrooms in Queen's Road, Watford. The attractive nature of the new premises is brought out by the exterior view, which we produce herewith. The frontage of the premises is 34 ft., the showrooms having a depth of 80 ft. The windows are laid out on the "island" system, and have a total frontage of 84 ft. The ceiling lay-out is on the panel principle, having a flush plug and fitting hook fixed at each panel crossing; each fitting is switched separately, permitting any of the 200 fittings to be demonstrated independently. Different sections of the showrooms are laid out as dining room, drawing room, &c., and at the rear of the main showrooms are rooms fitted out to demonstrate kitchen and bathroom apparatus working under actual conditions. Above the main showrooms are the offices and large stock rooms, as well as a workshop for the repair of all classes of electrical equipment. The opening of the premises was attended by the chairman of the local Electricity Committee, Councillor H. Coates, and the chief engineer of the Electricity Supply Department, Mr. A. W. Barham, as well as representatives of the leading manufacturing firms.



Messrs. Russell's New Showrooms, Watford.

Indian Import Duties.

Some particulars of import and export duties imposed by the Government of India for the current year are given in the *Board of Trade Journal* for January 24th. From this it is seen that electrical control and transmission gear, up to 10 A at 250 V, and certain other apparatus is subject to an import duty of 15 per cent. *ad valorem*. The duty on telegraphic instruments and apparatus for a railway administration is 10 per cent. *ad valorem*. Wires and cables and other parts of a transmission system are admitted free of duty.

Local Exhibition.

WOKING.—The Woking Electric Supply Co., Ltd., is taking a prominent part in the Woking Trades Exhibition to be held from February 6th to February 16th. The General Electric Co., Ltd., is co-operating with the Supply Company in this connection, and has undertaken to equip a five-room electric bungalow, as well as furnishing the Supply Company with a considerable quantity of household appliances for the company's own stand.

Social Events.

The staff of Lighting Trades, Ltd., met at dinner on January 16th, at the Piccadilly Hotel. Mr. H. J. Mitchell, chairman of the company, presided over a gathering of 160, and he was supported by Mrs. Mitchell and other directors of the company. Musical items and the distribution of carnival novelties added to the gaiety. Following the loyal toast, Mr. Mitchell welcomed the staff and the visitors, including Mr. J. R. Yates, the chairman, and several members of the Welsbach Light Co., which was recently acquired by Imperial Chemical Industries, Ltd. Long-service awards, in the form of silver watches and medals, were presented to four members of the staff. After the dinner there was dancing until 12.30 a.m.

The seventh annual dinner and concert of the indoor and outdoor staffs of Messrs. Francis Polden & Co., Ltd., was held on January 19th, at Anderton's Hotel, under the chairmanship of Mr. F. C. Polden, C.C.

The fifth annual works social given by the directors of Heyes & Co., Ltd., Wigan, was held on January 19th. Among those present were Mrs. W. A. Heyes (Mr. W. A. Heyes, the governing director, being absent through illness), Miss Heyes, Messrs. A. V. Heyes (director), J. W. Cartwright (works manager), and J. C. Muir (secretary). The evening commenced with whist, after which the prizes were distributed by Mrs. Heyes. Supper was then served, and dancing, with items of entertainment by Mr. Elsworth, occupied the rest of the evening.

The London office staff of Bakelite, Ltd., held their first dance on January 19th, at the Temple Restaurant, Victoria Embankment.

Venner Time Switches, Ltd., entertained their staff and employés at their annual dinner on January 18th, at Lyons' Piccadilly Corner House. During the evening the bonus award was distributed; owing to last year's good progress the bonus was a record one. Mr. R. C. Graseby, the managing director, in replying to the toast of "The Directors," referred in his remarks to Mr. E. E. Sharp's Australasian tour, and arranged for a cablegram of greeting to be dispatched to him in New Zealand. The function terminated with a musical programme.

On January 19th the staff of Messrs. Ernest F. Moy, Ltd., held their annual dinner at "The Britannia," Camden Town. The chairman of the company, Major C. G. Fox, presided over a company of about a hundred, and he was supported by the managing director, Mr. P. H. Bastie, and a number of guests.

The staff of Messrs. Walker Bros., Birmingham, held their fifth annual whist drive and dance on January 18th at the Priory Rooms, when upwards of 200 employés and friends were present. The arrangements were carried out by the Social Club Committee. Prizes for whist, novelty dances, &c., were distributed by Mrs. G. N. Walker, and the "Swanee" dance band provided the music.

There was a gathering of about 400 at the Town Hall, Dudley, on January 19th, the occasion of the annual dinner of the staff and employés of the Shropshire, Worcestershire and Staffordshire Electric Power Co. Mr. T. E. Boothy, chief generating engineer, presided, and amongst those present were Mr. J. T. H. Legge, chief engineer and manager, and departmental chiefs and district representatives. The visitors included the Mayor of Dudley. The toast of "The Company" was proposed by Mr. S. A. Woodhall, and responded to by Mr. Legge. The Mayor of Dudley also spoke. A concert was given by the "Merry Optimists," and Mr. G. Mountford, an employé of the company.

New Tunbridge Wells Showrooms.

The accompanying illustration is a view of the new showrooms which were recently opened by Messrs. E. Powell, Ltd., Tunbridge Wells. This is the latest development of a concern which commenced electric lighting installation as long ago as 1884, when it had its own generating plant, as well as a portable installation for exhibitions, &c. The new showrooms are situated in the High Street, and are admirably equipped and arranged.

New Showrooms at Tunbridge Wells.

Correction.

In the advertisement of the Sun Electrical Co., Ltd., appearing on page 48 (Supplement) of our issue of January 18th, under the illustration of the "Cosyglo" fire, the loading of that particular price of fire is incorrectly given. The loading should read 2 kW, not 3 kW.

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Bankruptcy Proceedings.

J. W. Turton, Market Place, Banbury, Oxon., electrical engineer.—The public examination herein was held recently at Banbury, when a deficiency of £457 was disclosed. The debtor stated that he commenced trading in August, 1919, with a capital of £20. He entered into a partnership, but that was dissolved in 1923, a sum of £199 being paid to him. With that sum the debtor again commenced trading, but he had been sued by creditors. He had resorted to moneylenders, and had overdrawn at the bank. He attributed his failure partly to ignorance as to the keeping of books. The examination was adjourned.

J. Roysentul, electrical engineer, 45, Woodbury Grove, Finsbury Park, London.—Receiving order made January 17th on a creditor's petition. First meeting held January 30th. Public examination February 26th, at Carey Street, W.C.2.

P. Ford, electrical contractor, Macdonald's Lane, Corporation Street, Manchester.—Trustee, Mr. F. Murgatroyd, Senior Official Receiver, Byrom Street, Manchester, released January 10th.

J. B. Wickstead, R. J. Allen and Lilian Knight, trading as Chas. Cooper & Co., plumbers, electrical engineers, &c., 26, King Street, Stretford.—First and final dividend of 2d. in the £, payable January 28th, at 47, Mosley Street, Manchester.

R. J. Allen (separate estate).—First and final dividend of 2s. 6d. in the £, payable 47, Moseley Street, Manchester.

T. F. Collier, electrician, 64, Union Street West, Oldham, late of 116, Union Street West, Oldham.—Last day for proofs for dividend February 9th. Trustee, Mr. J. D. Turner, Official Receiver, Byrom Street, Manchester.

F. J. Hudson, electrical engineer, 44, Heath Road, Bradford.—Receiving order made January 21st, on debtor's own petition.

W. H. Dickson and A. J. Solomon (Dickson & Solomon), electrical and wireless engineers, 13 & 14, Tavistock Street, Devonport. Trustee, Mr. A. N. Goodman, 11, St. Aubyn Street, Devonport, released January 16th.

W. Heaney, electrician, 12, Market Place, Henley-on-Thames. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C., released January 18th.

Company Liquidations.

Haslam Foundry & Engineering Co., Ltd., & Newton Bros. (Derby), Ltd.—Winding up voluntarily. Liquidator, Mr. H. C. Waddington, Trafalgar House, Waterloo Place, S.W.1, appointed January 15th. (These companies have amalgamated under the title "Haslam & Newton, Ltd.") Meetings of creditors are called for February 6th at the liquidator's offices. Particulars of claims to be sent in by February 20th. (This notice is purely formal. All creditors have been or will be paid in full.)

Motolite Dynamos, Ltd.—A meeting of members is called for February 25th, at Landor Road Works, Shepherd's Bush, W.12, to hear an account of the winding up from the liquidator, Mr. L. S. Challis.

Acocks Green Electrical Stores, Ltd.—A meeting of members is called for March 6th at 3, Warwick Passage, Corporation Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. F. E. Bendall.

Bolton Wireless Installation, Ltd.—A meeting of members is called for February 25th, at 9, Infirmary Street, Bolton, to hear an account of the winding up from the liquidator, Mr. J. Morris.

Private Arrangements.

Mrs. D. Glover (or Johnson), trading as D. Johnson, electrical and wireless dealer, 71, King Street, Wallasey, Ches.—A meeting of creditors was held recently at the offices of Mr. P. S. Booth, Exchange Chambers, Bixteth Street, Liverpool. A statement of affairs was presented which disclosed ranking liabilities of £1,000 and net assets of £450, leaving a deficiency of £550. The debtor had previously, for 15 years, carried on business as a hardware dealer. She started the present business in 1925 with £185 in cash, and a stock of electrical sundries valued at £100, and had traded at a loss. Mr. Booth said that no offer was put forward. He thought that if the turnover could be kept up to £60 a week, the business could be made a paying concern, and sold. A resolution was passed in favour of the matter being dealt with under a deed of assignment, with Mr. Booth as trustee, together with a committee consisting of the representatives of Messrs. Baxendale and Co., Ltd., the Chloride Electrical Storage Co., Ltd., and Rowe Bros. & Co., Ltd. The following are creditors:—

	£		£
Baxendale & Co., Ltd. ...	55	Hathaway, S., & Co. ...	28
Chloride Electrical Storage Co., Ltd.	94	Johnson, W. B.	295
Downes & Davies	34	Owens, J.	28
Electric Lamp Factors	47	Rowe Bros. & Co., Ltd.	46
Ferguson, J., & Sons ...	20	Smith & Cookson	39
		Toubkin, J.	34

P. Jones and J. H. Mercer, trading as the Northern Wholesale Electrical Supply, electrical and hardware dealers, 266 and 268, Holloway Road, N.7.—A meeting of creditors was held on January 24th at the offices of Messrs. Sunderland, Mountstephen & Co., 15, Eastcheap, E.C. Mr. Sunderland submitted a statement of affairs which showed liabilities of £903, and net assets of £1,101, leaving a surplus of £198. Mr. Sunderland said that there were three suing creditors, and as one was in a position to levy execution, a deed of assignment had been taken in order to protect the assets. The business was commenced last March. Full records had not been kept; and the usual trading figures could not be presented. Mr. Jones possessed separate assets, and if the partnership estate did not produce sufficient to pay 20s. in the £, then Mr. Jones's private estate would be liable. A resolution was passed confirming the deed already executed to Mr. Sunderland, and a committee was also appointed. The following are creditors:—

	£		£
A.E.G. Electric Co., Ltd.	55	Spencer, T. E. & S., Ltd.	24
Electro Services, Ltd. ...	40	Toubkin, J.	143
Kapton Engineering Co.	30	Wilkinson, L.	41
Lee, Albert, & Co. ...	42		

Dissolution of Partnership.

Down & Abbott, electrical engineers and contractors, Barnard Castle.—Mr. A. Down and Mr. J. W. Abbott have dissolved partnership. Mr. Abbott will attend to debts and continue the business under the style of Electrical Engineering and Supply Co.

Price Reduction.

The General Electric Co., Ltd., has reduced the price of its "Magnet" two-way adaptor. This is a very useful household electrical accessory—a two-circuit parallel adaptor with bakelite body and a switch integral with it to control the light.

Book Notices.

"Underground Cable Systems." By G. W. Stubbings. Pp. vii+216; figs. 106. London: Chapman & Hall, Ltd. Price 15s. net.

"Omnibus Lighting and Starting." By J. W. Houghton. (Reprint of a series of articles from *Motor Transport*.) Pp. 49. London: The Fanfare Press.

We have received from Mr. J. E. Dodsworth a copy of his "Engineers' Diary," now in its eighth year. It is well bound in black morocco leather, and in addition to the usual diary pages, ample space is provided for memoranda. It also contains a foreword by Sir Robert A. Hadfield, and a considerable amount of statistical information. A number of pages of squared paper add to its usefulness. The diary is published by Charles Letts & Co., and is obtainable at all stationers.

"Electric Drive Practice," by Gordon Fox. Pp. vii+421; figs. 170. London: McGraw-Hill Publishing Co., Ltd. Price 17s. 6d.

"*Mechanical World* Year Book, 1929." Pp. 348+clxvi; fully illustrated. London: Emmott & Co., Ltd. Price 1s. 6d. net.—The new edition of this popular handbook contains several new sections, including a contribution on helical springs. The work as a whole has been revised and brought up to date.

New Catalogues and Lists.

Cheeryhouses, Ltd., 47, Sauchiehall Street, Glasgow.—Three illustrated pamphlets dealing with "Quickfix" lighting units and the "Dome" gallery, which obviates the use of screws. Priced.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet L.4,933, illustrating and describing "Geeko" lighting and starting accumulators. Priced. Also Catalogue Section F (3) containing illustrations, particulars and prices of the company's lighting glassware—bowls, shades, &c.

Messrs. J. G. Statter & Co., Queen Anne's Chambers, Westminster, S.W.1.—An illustrated pamphlet advertising e.h.p. standard oil switches (switchboard type).

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—Brochure No. 50E, containing a well-illustrated description of the construction and operation of La Cour motor-convertors.

Messrs. J. Blakeborough & Sons, Ltd., Woodhouse Works, Brighouse (Yorks.).—List 112, dealing in some detail with the company's revolving screens for power station water systems, &c. Illustrated.

Messrs. Hans Renold, Ltd., Didsbury, Manchester.—An illustrated catalogue of chain drives. Priced.

The Sloan Electrical Co., Ltd., 8-12, Golden Lane, E.C.1.—A 174-page catalogue of all kinds of electrical accessories, bell apparatus, domestic appliances, lighting fittings, &c. Illustrated and priced.

Messrs. Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—Catalogue No. 612, a comprehensive list (243 pp.) of electric lighting fittings. All classes of electroliers, bowls, brackets, shades, pendants, standards, &c., are illustrated, and prices are given in each case. Also Catalogue No. 613, dealing with glass shades for electric lighting.

Messrs. T. B. Morley & Co., Ltd., Jameson Street, Hull.—A price list, fully illustrated in colours, of "Morco" glassware for lighting purposes.

Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.—List No. 48, containing illustrated particulars of the "Venner" solar dial for use with street-lighting, &c., time switches, with notes on its application in various areas of the country. Prices are given.

Messrs. Worthington-Simpson, Ltd., Queen's House, Kingsway, W.C.2.—Bulletin No. WS.1095.B, dealing with the company's centrifugal pumps for condensing plants. Illustrated.

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THE REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, Staffs.—A showcard (12 in. by 17 in.), depicting a lady and her pets basking in the glow of a "Revo" electric fire.

THE BASTIAN METER CO., LTD., Farnham Road, Trading Estate, Slough.—Leaflet O3, containing illustrated details and prices of the company's water heaters, fires, grills, &c.

Calendar.

The calendar of Messrs. GEORGE NOBBS, LTD., 89, Cleveland Street, W.1, bears a very handsome colour drawing on silk by W. H. Margetson.

Proposed Sale of the Shanghai Undertaking.

The Shanghai correspondent of *The Times* reports that negotiations are on foot with a view to the sale, if the ratepayers approve, of the Municipal Electricity Department of the International Settlement to an Anglo-American syndicate of engineering and financial interests, including, it is understood, the Westinghouse Company and Metropolitan-Vickers, among others. One British representative is already in Shanghai, two American engineers are on their way, and Mr. Brooke Smith, formerly the chairman of the Municipal Council, representing one British group, is due there on February 22nd. The capital outlay of the Department has amounted to 35,000,000 taels (about £4,375,000), not including the land, which is most valuable, and the net return, after meeting all loan and other charges, is about 8½ per cent. As, however, depreciation is always allowed on the most liberal scale, and everything is in perfect condition, the value of the property is much greater than these figures suggest. Uncertainties regarding the future status of Shanghai make it desirable to safeguard the Municipal debentures, amounting to about 53,000,000 taels (£6,625,000). A further consideration is the fact that the Council's credit is undeniably affected by recent political events, and while the amount of loans outstanding is not great compared with its resources, considerable commitments, resulting from the rigid parsimony necessarily pursued during the past three years, are inevitable in the near future. These will be more easily met if the present indebtedness is wiped out, and this would be made possible by the sale of the Electricity Department.

Glasgow and Austrian Cable.

Glasgow Corporation on January 24th discussed the placing of a contract for the supply of 50,000 yards of cable for the Watching and Lighting Department. The figure quoted for Austrian cable by the British Electrical and Manufacturing Co., the successful tenderer, was £562 10s., and, according to a member, the lowest British offer was only 14 per cent. above this. For that difference, he said, they proposed to send the order to Austria, where the conditions were admittedly the cheapest throughout the whole of Central Europe. British Dominions gave a preference to British goods; would the Corporation not give the same preference? Allegations of the existence of a "ring" of manufacturers were made by the convener of the Committee, who said that seven or eight firms offered the material at almost identically the same price. By 30 votes to 27 the Committee's recommendation was approved.

Trade Announcements.

From the STERLING VARNISH CO., of 196, Deansgate, Manchester, we have received a New Year advertising novelty in the shape of a British made folding 12-inch steel rule and a pair of callipers in leather pocket case. The company recently floated a small company under the name Sterling Properties, Ltd., to take care of the Sterling Varnish Company's European interests. Mr. Reginald Barker, who has been with the company at their office in Manchester for over 20 years, was appointed manager in March, 1928, and he is chairman of directors of Sterling Properties, Ltd.

The CREDENDA CONDUITS CO., LTD., has appointed Mr. G. C. Wright, 10-11, St. Helen's Road, Swansea, as its agent for the Swansea area, South Wales. He will carry stocks of the company's domestic appliances, conduit, conduit fittings, cable, &c.

The GENERAL ELECTRIC CO., LTD., has opened a new branch at Blackpool. It is situated in Birley Street, and the premises are known as "Magnet House." The Singapore branch of the company has been moved from 5 to 12, Battery Road.

Catalogues Wanted.

Messrs. BAILY, GRUNDY & BARRETT, LTD., electrical engineers, Whithorne House, North Street, Midhurst, Sussex, ask for lists and catalogues.

Foreign Trade Volumes and Values.

In the *Board of Trade Journal* dated January 24th the volumes and values of exports and imports during 1928 are compared with those of 1924. It is shown that although the value of exported electrical goods and apparatus in 1928 was only 94.5 per cent. of the 1924 value, the volume was 115.2 per cent. of the 1924 volume. In the same way, while the value of electrical goods and apparatus imported during 1928 was only 89.3 per cent. of the 1924 value, the volume was 156.4 per cent. of the 1924 volume.

An Egyptian Buyer's Guide.

We have received from Mr. A. Brookes, 3, Mehemet Aly Square, Alexandria, a quarterly publication entitled "Who's the Agent?" In this manufacturers of all classes of goods are shown in appropriate sections, and the names of their Egyptian and Sudanese agents are given. A form enclosed with the guide facilitates the securing of free entries by manufacturers.

The British Industries Fair.

The Prince of Wales is to be present at the Government banquet to be held at the Mansion House on February 18th, the opening day of the British Industries Fair in London and Birmingham. The Prime Minister has also notified his intention of being present, and the chair will be taken by the President of the Board of Trade, Sir Philip Cunliffe-Lister, M.P.

Large American Power Development.

A grouping of the power system in a number of American States representing a capital of two billion dollars is predicted in financial circles as the ultimate outcome of the creation of the "United Corporation" which was announced last week. The new corporation is to have a capital of 260 million dollars and it is learned that its plans include the acquisition of holdings in a number of New York and New Jersey utility corporations. While the grouping will be kept within State boundaries so that the companies affected will each be under the jurisdiction of its own State Public Service Commission, the organisation is expected to extend not only to New York and New Jersey, but also to Pennsylvania, Delaware, Maryland, and a number of New England States.—*Reuter* (New York).

For Sale.

Mr. G. R. Lightfoot will sell by auction on February 14th, at 13, High Holborn, W.C., a quantity of electrical and wireless material. Aberdeen Corporation Electricity Department has for disposal several Babcock & Wilcox brick-built land-type boilers; Manchester Corporation Electricity Department invites offers for a large quantity of 200-V electric lamps. (See our advertisement pages to-day.)

The German Installation Material Industry.

It is stated that the production of electrical installation materials in Germany has for a long time past met with exceptional difficulties. One of the main causes is the overproduction which prevails owing to the lessened possibility of effecting sales abroad, this being reflected in the home market by depressed prices and decreased activity. It is calculated that the future will be still more unfavourable as export conditions have become more difficult through the competition of countries with a depreciated currency and through the high duties now being imposed.

New Zealand's Electrical Imports.

The value of the electrical machinery imported into New Zealand during November last is returned at £164,400, as compared with £155,430 in the corresponding month of 1927.

J. H. Holmes & Co.

The trustees under the deed of assignment report that the businesses of J. H. Holmes & Co. and W. H. Holmes & Sons were carried on by them and eventually sold, with certain exceptions, for £50,000. The debtors are not in any way interested in the new companies, which were formed to acquire the two businesses. There are still many outstanding book debts to be collected, and certain electrical contracts to be completed before the estate can be finally wound up. A meeting of the creditors to receive a report of the winding up was to be held on Wednesday last. It is proposed to pay immediately a first dividend of 6s. 8d. in the £. The trustees are Messrs. J. Miller & Jeffrey Taylor, Gibb Chambers, Westgate Road, Newcastle-upon-Tyne.

The B.E.A. and the "Mond" Conference.

In a long statement issued this week, the British Engineers' Association puts forward its objections to the proposal of the "Mond" conference to form a National Industrial Council to deliberate upon matters affecting industry. It considers that undue influence would be given to the Trades Union Congress, and the result would be that representatives of non-political employers' organisations would be brought into conference with men who are virtually representatives of the Labour Party. The employers would be called upon to supply information regarding their business which has hitherto been confidential. The only means of making such a conference successful would be for the trade union representatives to repudiate the Socialistic policy of the Labour Party.

Prices of Raw Materials.

Reporting on the lead market on January 26th, Messrs. James Forster & Co. stated:—"Conditions are unchanged. Demand from consumers continues to be very moderate; on the other hand, supplies during the next few weeks are not expected to be large. Consumption keeps up well, but shows no signs of expanding at present. According to Board of

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Trade returns the total left for home absorption in 1927 exceeds that of 1928 by 38,453 tons, but seeing that the invisible stocks in this country in the former year increased by about 30,000 tons, whereas last year consumption absorbed at least 20,000 tons of that stock, it appears that consumption actually improved last year to the extent of 12,000 tons, or 1,000 tons a month."

We have received from Messrs. M. H. CAWSON & Co., 60, Gracechurch Street, E.C.3, a chart showing the net average monthly market prices of soft pig lead from 1913 to 1928. This indicates that the average price during last year was lower than in any year since 1913.

Messrs. F. Smith & Co. report, January 29th :—No change in the price for electrolytic copper.

Messrs. James & Shakespeare report, January 29th :—Copper bars (best selected), sheet and rod, £104, £2 inc.; English pig lead, no change.

Messrs. Edward Till & Co. report, January 29th :—India-rubber, Para fine, 10⅞d., ⅝d. dec.

Lighting and Power Notes.

Argentina.—SANTA FÉ.—The municipality of Santa Fé, which supplies electricity to the southern part of the town, is faced with the fact that the existing plant has become inadequate for the load and the extension of the area supplied. The building of a new generating station is for the moment out of the question due to the high cost involved and the present state of the municipal finances. Consideration is to be given to the possibility of improving the distribution system and authorisation is sought to take electricity from outside suppliers while the matter is under review. The remainder of the town, not supplied by the municipal station, is covered by the Atlas Light and Power Co., which has practically completed the installation of a new 12,000-kW power station.

Bexhill.—NEW MAINS.—The Corporation Electricity Committee has recommended the expenditure of £3,300 for a new feeder main and £4,183 for distributors.

Bicester.—ELECTRICITY SUPPLY.—The Urban District Council has received from the Electricity Commissioners an intimation that the application of the West of England Electricity Co., Ltd., for a Special Order has been refused, and that the application of the Wessex Electricity Co. has been granted.

Birmingham.—ELECTRICAL DEVELOPMENT.—The *Birmingham Post* reports that the foggy weather which has prevailed in Birmingham during the last few days has led to a marked increase in the demand for electricity in Birmingham. All previous "records" were broken on January 22nd, when the output from the power stations amounted to 1,750,000 kWh in the 24 hours. These figures represent an increase of 30 per cent. on the corresponding day of last year. At a recent meeting of the Electric Supply Committee it was reported that the sales of electricity during the December quarter showed an increase of 8.8 per cent. over the corresponding period of 1927. An additional 1,063 consumers were coupled up to the mains during last month, representing 12,000 extra lights and about 3,500 h.p. in power supplies. A number of satisfactory agreements for bulk supplies to works were also approved.

Brighton.—NEW SUB-STATION PLANT.—The Corporation electrical engineer has recommended that, to meet the additional business in the Portslade and Southwick areas, the least efficient unit at the local sub-station be replaced by a Bruce Peebles-La Cour motor convertor of 1,000-kW capacity, and that a second unit of similar capacity be installed at a later date. The cost of this new unit is £4,609, with an additional £1,380 for switchgear, &c. The Lighting Committee has authorised the engineer to place orders for the necessary plant, foundations, &c.

NEW SWITCHGEAR.—The engineer has also submitted a report on the installation of new switchgear and the re-conditioning of the present switchgear at Southwick and North Road, suitable for working with the National "grid" system at a total estimated cost of £55,410. The approval of the Electricity Commissioners and the Central Electricity Board is to be obtained before placing contracts for the work.

SUPPLY TO FILM STUDIOS.—The Lighting Committee has made the following agreement for a supply of electricity to the proposed film studios at Whitehawk Valley: The Corporation to erect a new main overhead with underground crossings where necessary from the Kemp Town sub-station to a sub-station to be provided at the expense of the company in a suitable position adjacent to the studios. The supply to be afforded and metered at this point at 8,000 V, 3-phase, 50 cycles. The company to guarantee a minimum account of £3,000 during the first 18 months from the date of connecting up the supply, and thereafter a minimum account of £3,000 per annum for a further four years. The maximum demand which the company will be entitled to make will be 1,000 kW during that period unless the agreement is revised by mutual arrangement. The supply as metered will be charged at the rate of .625d. per kWh, subject to a fuel clause.

Canada.—SASKATOON.—The City Council has approved the final draft of an agreement with the Government of Saskatchewan providing for the sale of the municipal power plant to the Government and the erection by the latter before next autumn of a new 10,000-kW plant, from which electricity will be supplied for distribution in Saskatoon and in the surrounding country districts. The generating station at Saskatoon is expected to become the nucleus of a northern system of distribution of electrical energy in Saskatchewan. The Saskatchewan Power Commission, appointed by the Provincial Government, strongly recommended in a report presented last July, the immediate purchase of the municipal plants at Regina, Moose Jaw and Saskatoon as the initial step in the development of a provincial scheme of power distribution.

Continental.—GERMANY.—Work on the establishment of a new 80,000-kW steam-operated power station near Cosel, Upper Silesia, is about to be commenced.

SWITZERLAND.—The latest report from Argovie says that it is proposed to construct the Klingau works at the same time as those of Wildegg-Brugg. The annual yield of Klingau will be 190 million kWh, and of Wildegg-Brugg 240 million kWh. The former will cost 30 million francs to set up, the latter 40 millions. The seat of the new company will be at Brugg, and the canton of Argovie will be responsible for 35 per cent. of the capital, the Crédit Suisse for 5 per cent., and the electricity works of N-E. Switzerland, of Berne, and of the Motor Columbus for 35 per cent. The Rhenish-Westphalian electric works will receive all the energy from the two stations at 2 centimes per kWh, but whenever the Swiss groups demanded it, they would be obliged to supply two-thirds of the energy for three centimes per kWh. But the matter is by no means settled yet.

FRANCE.—According to a return recently published by *Slectricité et Mécanique*, out of 37,981 small towns and villages throughout France, 19,871, or about 52 per cent., are now provided with an electricity supply.

Costa Rica.—HYDRO-ELECTRIC DEVELOPMENT.—By presidential decree, a National Electric Power Service has been created to superintend the construction of works to generate electricity from water-power. All potential sources of over 500 h.p. will be developed by the Power Service. Existing concessions will be terminated at the end of the period for which they were granted, and the right to grant new concessions for the development of less than 500 h.p. will become the exclusive prerogative of the Power Service. The Service is also authorised to purchase plants now producing 3,000 h.p. or more, construct a plant producing at least 10,000 h.p. to serve the plateau section, and establish other plants in different parts of the State.—*Reuter's Trade Service* (San Jose).

Croydon.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has prepared a scheme for extensions as follows: Works, £4,300; distribution, £47,862; mains, £12,000.

Dundee.—NEW PLANT.—Mr. D. H. Bishop, Corporation electrical engineer, has reported to the Electricity Committee that another pumping station is now required and that the coal handling plant will have to be extended. The load has reached the stage when extensions are absolutely necessary. The estimated cost of the pumping station is £24,700. The amount of coal handled is increasing annually, and the estimated cost of the extension, with equipment for handling coal mechanically, is about £44,000. The question has been raised whether, under the new conditions applying to the supply of electricity, the capital expenditure is justified, but Mr. Bishop points out that the Central Board expects Dundee to generate 108 million kWh per annum, and it cannot hope to comply with the wishes of the Board with the plant at present installed. The Committee has recommended the expenditure of £70,000 for extensions.

East Anglia.—INQUIRY.—The inquiry which was adjourned at Norwich in July last into the applications of Norwich, Great Yarmouth, Ipswich, and King's Lynn Corporations, and Mr. F. R. Hunter, for Special Orders to supply electricity in certain areas in Norfolk and Suffolk, and a scheme prepared by the East Anglian Electricity Supply Co., Ltd., for the development of electricity supply under its Act of 1927, was reopened by Col. Ekin for the Electricity Commissioners at Savoy Court, Strand, W.C., on January 22nd. According to the *East Anglian Daily Times*, in submitting the company's scheme, Mr. Spencer Hawes, consulting engineer, said that there was no provision for a generating station. It rested on the provision by the Central Electricity Board of the main transmission lines as part of the grid in Norfolk and Suffolk, and on the available sources of supply in the district in the meantime. Supplies would be taken from the big towns which would be in touch with the grid. The present system of the company's supply was mostly d.c. This was being changed over to a.c., and when the complete scheme was in operation it intended to change over the whole of its direct-current supply. There would ultimately be a total of 280 miles of 33,000-V transmission line, and alongside part of the line there would be an 11,000-V line as well; these lines were to be tapped immediately at convenient places *en route*. The scheme of h.p. mains indicated by him would give the company a transmission system which would fit in with the grid

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scheme of the Electricity Board when it came along. The estimated cost was £715,000. At the resumption on January 23rd, Mr. Hawes said that Part I of the company's schedule showed 51 parishes in which mains would be laid within two years, and Part II showed 64 other parishes in which the company would lay mains as a reasonable demand arose. By the fourth or fifth year all these places would be receiving a supply. Mr. S. G. Turner, for Ipswich and Norwich Corporations said that these authorities were capable of dealing with the requirements of the areas for which they sought powers to supply. Ipswich Corporation was prepared to go forward with its development at once. For King's Lynn Corporation, Mr. J. H. Thorpe stated that within six months of its securing an Order, the Corporation could supply Hunstanton with electricity. The inquiry was closed.

Forres.—ELECTRICITY SCHEME.—The Town Council is negotiating with a London company for the installation of electric lighting in the burgh. Under the proposed agreement, the company will install the plant free of charge, and the price to the consumers will be 8d. per kWh.

Glasgow.—ELECTRICITY CHARGES.—At a recent meeting of the Corporation Electricity Committee the town clerk reported that it had been remitted to a special sub-committee to consider and report on the whole question of the charges at present made for electricity, and the manager has been asked to prepare a revised scale of charges for consideration at a future meeting.

CHANGE OF FREQUENCY.—The Corporation Electricity Committee has instructed the manager to proceed with the general preliminaries in connection with the change of frequency in No. 2 area (north-west district of the city), and to submit a report on the details of the work.

Glossop.—MAXIMUM CHARGE.—At a recent meeting of the Corporation the town clerk reported the receipt of an Order from the Ministry of Transport fixing the maximum charge for electricity in the borough at 8d. per kWh, and stated that an agreement had been entered into with the Urban Electric Supply Co., covering the other points raised in the recent settlement arrived at between the company and the Corporation.

Grimsby.—EXTENSION OF SUPPLY.—The Corporation Electricity Committee is applying for sanction to a scheme for the supply of electricity to Louth and permission to erect an overhead line in connection with the supply from Holton-le-Clay to Louth, at an estimated cost of £10,160.

Ilford.—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £5,000 for wiring installations on hire.

Inverness.—PRICE REDUCTIONS.—The Corporation Electricity Committee has recommended a reduction in electricity charges from 7d. to 6d. per kWh for lighting, and from 2½d. to 2d. per kWh for power.

London.—FULHAM.—The borough electrical engineer reports that plans are in course of preparation for an underground sub-station at Bishop's Meadow, to relieve the district between the junction of Fulham Palace Road with Fulham Road and Harford Street. The estimated cost of the scheme is £3,000.

In connection with the proposed erection of 44 tenements at Harwood Road, Fulham, the L.C.C. is to consider the possibilities of the installation of electricity for cooking, heating, &c., as well as lighting on lines similar to those at the Ossulston Estate, St. Pancras.

ST. MARYLEBONE.—At the request of the Electricity Commissioners the Borough Council Electricity Committee has considered a proposal to take additional bulk supplies as an alternative to plant extensions, but has decided that, so far as the immediate future is concerned, the extension of plant is desirable. It therefore recommends the following extensions and consequential arrangements at the power station, and that application be made for the necessary sanction: (1) The installation of two 20,000-kW turbo-alternators, together with the requisite boiler plant, &c., at an estimated cost of £471,900, and (2) the scrapping of three 2,000-kW d.c. Parsons' sets, one 3,000-kW Oerlikon turbo-alternator, with auxiliaries, and two boiler feed pumps. The Committee has also recommended extensions of cables, switchgear and transformers, at a total estimated cost of £115,652, made up as follows: Trenching, provision of ducts and re-instatement, £32,347; e.h.p. cables, drawing-in and jointing, £47,544; switchgear at generating station, sub-stations, and transformer stations, £26,291; transformer groups, £9,470. The Finance Committee has recommended that application be made for sanction to loans for the above purposes.

The Committee has recommended that application be made to the London County Council for temporary consent to an alteration of the standard pressure and system of supply to 240 and 415 V, 3-phase, 50 cycles, to permit a change of the system of supply from d.c. to a.c. in the borough, where possible.

HACKNEY.—The Borough Council Electricity Committee has recommended that from April 1st next consumers under the prepayment-meter scheme be given the alternative of 1s. or 1d. in the slot meters, and that one 40- or 60-W lamp be allowed to each consumer under the prepayment meter scheme for each 100 kWh consumed for lighting purposes.

Mexico.—HYDRO-ELECTRIC DEVELOPMENT.—A group of Mexican engineers and capitalists has organised a national co-operative hydro-electric company to supply electricity to agriculture and several small industries. The company, which holds a Government concession, will utilise sources of hydro-electric power in different parts of the country from which it is estimated that 10,000,000 h.p. can be developed; only 300,000 h.p. is being used at present. The company's concession is for 60 years with a variable capital which may be increased to 6,000,000 pesos.—*Reuter's Trade Service* (Mexico City).

Pontefract.—INQUIRY.—The inquiry which is to be held on February 4th into the joint petition of the local Chamber of Commerce and the Town Council for a compulsory revision of the maximum charges for electricity in the borough made by the Yorkshire (West Riding) Tramways Co., Ltd., has now been fixed by the Electricity Commissioners for February 13th.

Stewartry.—OPPOSITION TO SCHEME.—The County Council at last meeting decided to oppose the electricity scheme of the Galloway Water Power Co. The Council stipulates that it should have more favourable terms, and that a supply should be made available at any of the power stations, and also at convenient points on the Company's own transmission lines throughout the county at the same pressure at which the Company supplies electricity to the main lines of the Electricity Board.

Tramway and Railway Notes.

Argentina.—RAILWAY ELECTRIFICATION.—An official notification has been issued authorising the electrification of the Central Argentine Railway in accordance with the proposals of the company.—*Reuter* (Buenos Aires).

Chester.—POLL OF RATEPAYERS.—The City Council is to take a poll of ratepayers on the question of promoting a Parliamentary Bill authorising the substitution of omnibuses for the present tramway system.

Colombia.—NEW RAILWAY.—The Ministry of Public Works announces the Government's intention to proceed in the immediate future with the construction of the remaining 2,400 km. of railway, which will complete a 5,000-km. project. It has not yet been decided whether the railway shall be electric or steam, but the gauge, maximum grades and curves will be such as to guarantee minimum freight rates, high speed and low cost of construction and operation. It is understood that the Government has received proposals from the Société Nationale de Chemins-de-Fer en Colombie, which holds a concession for the construction of the Ferrocarril-de-Nordeste. —*Reuter's Trade Service* (Bogota).

Continental.—ITALY.—The Genoa correspondent of the *Financial Times* reports that the final adjusted results of the State railways for the financial year ended June 30th last show a surplus of 110,145,000 lire. The consumption of electricity for the operation of the electrified lines was 296,695,000 kWh, as compared with 241,696,000 kWh in the preceding year, and the expenditure for electricity was 47,570,000 lire. It is estimated that the haulage of the same traffic by steam locomotives would have meant an increase in expenditure of 22,150,000 lire. The total length of lines now electrified is 1,176 km., and work is proceeding with the electrification of a further 600 km.

SWITZERLAND.—The Swiss Federal Railways have decided to provide their rolling stock, within the next six years, with the Drolshammer new continuous brake, and a very satisfactory demonstration of its use for goods trains has been given on the steep section from Airolo to Castione. This will cost the Government 15 million francs, but as the new brake will do away with brakesmen, it will be a saving in the long run. The Drolshammer has been passed as sound by the Union Internationale des Chemins de Fer, and is in every way suited to electric traction.

London.—BECONTREE FACILITIES.—The Housing Committee of the L.C.C. has considered proposals by the L.M. & S. Railway Co., for improved transport facilities on the Southend line as far as it affects Becontree. The proposals include a service of electric trains by the extension of the existing electrified lines from Barking to Dagenham and the running of electric trains from and to stations on the Metropolitan District Railway. The company would widen this part of the Southend line to obtain two additional tracks equipped for electrical working, which would be capable of maintaining a maximum service of 40 trains an hour. The Committee has recommended that, subject to satisfactory assurances from the company that the works will be carried out with all possible expedition, no opposition be offered to the proposals in so far as they relate to Becontree.

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Tramcar Improvements.—The Highways Committee has recommended that improved and re-arranged seating and other improvements be made on 549 tramcars at an estimated cost of £113,500.

Southampton Row Subway.—At a meeting of the L.C.C. on January 22nd, it was stated that the work of deepening the Southampton Row tramway subway would be commenced in June next, and it would be necessary to close the subway for about 18 months.

South Lancashire.—Parliamentary Bill.—A Bill to authorise the South Lancashire Tramways Co. to provide and run railless cars and omnibuses has been deposited for introduction into Parliament this Session, according to the *Financial News*. Under this Bill the company proposes to provide railless cars along the routes of the tramways and light railways owned and worked by it, and also along other routes in prolongation of the existing tramways in the rural districts of Leigh and Burton-upon-Irwell. Upon the equipment of the apparatus being provided for working the railless cars, the company "may abandon the whole or any part of its tramways upon giving one month's notice to the road authority." The period sought within which to complete the railless-car equipment is five years from the passing of the Act, and if and so long as the services of transport provided by the company shall meet the requirements of the routes it shall not be lawful for any other company or for any local authority or person to run omnibuses along the routes in competition with the services of company. The capital of the company, which is proposed to be hereafter known as "The South Lancashire Transport Co.," is to remain at £1,450,000, with borrowing powers not exceeding £482,600.

United States. — Railway Electrification. — Messrs. Dominick & Dominick, of New York, in the current issue of their *Review* state that the total length of electrified railway actually completed in the United States amounts to about 1,800 miles of railroad and 4,000 miles of track. This is confined to 19 different railroads, however, and represents only 7 per cent. of the entire railroad mileage of the country. Electrification will make it possible to handle a greater volume of traffic in a shorter period of time. The announcement of the Pennsylvania plan pointed out that by 1950 the metropolitan area round New York might extend to New Brunswick on the west and well out on Long Island on the east, and contain 30,000,000 people. There would be a similar development in other cities. Through electrification, the Pennsylvania plans to reduce the number of freight trains 50 per cent. for a given car movement, and increase the speed to any reasonable extent required. This of itself would double the capacity of the freight movement. In addition to the greater capacity of electrical operation completed, projects of electrification have indicated that the actual cost of operation will be less. For example, in 1924, the last full year previous to its electrification, the Virginia Railway had a total operating cost of 40.24 cents per hundred net ton-miles; in 1927, the first full year subsequent to electrification, this cost was 35.74 cents. The decrease in operating cost was 11.2 per cent.

Telegraph and Telephone Notes.

Argentina.—Telephone Development.—The entire telephone network in Posadas (Argentina), consisting of an antiquated exchange in the capital and an overhead line to Candelaria, twenty miles away, has been sold to the Compania Internacional de Telefonos S.A. The system is being entirely rebuilt, and conversion to automatic working is to be completed in March, 1930; the new automatic exchange will have capacity for an ultimate number of 5,000 subscribers, but the initial equipment will provide for only 500 lines. The Cia. Internacional, which operates an automatic system in Asuncion, has extended its lines to several of the principal towns in the Republic. The new system in Posadas is to be linked with Paraguay by means of a cable across the Parana to Encarnacion and thence to Asuncion. Considerable development is expected to take place in the provinces of Misiones, Corrientes, and Entre Rios, and connection with Buenos Ayres is probable within a year or so. The Cia Internacional is also installing automatic systems at Corrientes and Reconquista.

Australia.—Phototelegraphy.—It is reported that the British General Electric Co., Ltd., has secured a contract for the telegraphic transmission of pictures between Melbourne and Sydney, the first experiment of its kind in Australia.

China.—Automatic Telephony.—Automatic telephones in Harbin having proved so successful, it is reported that the Chinese Eastern Railway is considering the installation of similar equipment in other towns along that railway.

Marine Wireless Stations.—Kinnaird Head Beacon.—The automatic wireless beacon at Kinnaird Head, Fraserburgh, which has a range of a hundred miles, has been completed, and the first tests have been successfully carried out by representatives of the Marconi Company. The station may be identified by the call signal MMK, and it operates on a 1,000-metres wave-length. All the machinery is duplicated, and power is obtained from two 5-h.p. kerosine engines and storage batteries.

Spark Stations.—The General Post Office is gradually replacing the spark wireless telegraphy sets at its coastal stations with interrupted-continuous-wave instruments, which have already been installed at Seaforth (near Liverpool), Niton (Isle of Wight), North Foreland, and Mablethorpe. This year the change will be made at Cullercoats, Northumberland, Fishguard, and Wick.

The Telephone Service.—London.—The statement of progress during 1928, prepared for the London Telephone Advisory Committee, indicates that international communication has greatly developed both by cable and wireless; a second transatlantic radio channel was inaugurated, and the total number of Continental and transatlantic calls rose from 288,743 to 424,045. Continental traffic increased by 30 per cent., and calls to and from America numbered 358 in September, 519 in October, and 456 in November. Of the 130 exchanges, 119 were manual, seven automatic, two toll, one trunk, and one tandem. The number of exchange lines was 355,983, the increase being 8.8 per cent., in addition to 15,590 private lines. The total number of telephones (exchange and private) was 614,183, an increase of 8.6 per cent. Over 26,000 private branch exchanges were in use in the London area, 25,920 being manually operated and 124 automatic. The number of call offices was 5,512, the increase being 436, and the number of kiosks erected was 459, the total now being 1,214. Within the inner London area six additional automatic exchanges were opened, *viz.*, Bishopsgate, Sloane, Bermondsey, Monument, Mansion House, and Welbeck, having an equipped capacity of 37,200 lines; during 1929 some 14 other automatic exchanges will be brought into service, with an equipment capacity for 76,100 subscribers. In addition, specifications have been issued for exchanges with a combined initial capacity for 45,000 exchange lines, and the total to be constructed in London during the next five years is 47. New manual exchanges opened numbered 11, and early in 1929 manual exchanges (five) will be opened to afford relief in congested areas pending further developments of the automatic system, and will have an increased initial capacity of 23,000 and an ultimate capacity of 37,000 subscribers' lines. The equipment of 25 of the existing exchanges has also been increased by 20,000 lines, while extensions at 33 other exchanges will give a further increase of 36,500 lines.

The construction of 23 new exchange buildings was in hand (seven manual), and sites had been secured for 21 exchanges, whilst search was proceeding in the case of 14 others. The London telephone directory contained over 330,000 entries. There were approximately 40,000 junction circuits, and the length of conductors in the cables provided for junction service was approximately 350,000 miles. The total mileage of single wire provided for subscribers' lines and local junctions was 2,672,977, an increase of 283,839 miles. There was an increase of 827 miles of conduit, the total being 10,260 miles. The length of open wire in London was 56,239 miles, carried on 5,795 miles of pole line. A fire in the Thames Embankment subway in September resulted in the destruction of 53 of the P.O. Department's cables carrying approximately 200 main trunk and telegraph circuits, 3,000 junction circuits, and 2,500 subscribers' and local circuits. Upwards of 20 of the Department's cables also suffered severely as a result of an explosion in Holborn at the end of December.

A repeater station was opened at Taunton and a similar one at Tavistock will be opened early in 1929; others were brought into service at Halesworth and Glasgow. A considerable demand arose during the year for circuits suitable for picture transmission between London and such provincial centres as Leeds, Manchester, Edinburgh, and Glasgow; they were provided in the main underground system by means of the repeaters already established.

The number of local calls was 592,460,717, an increase of 7 per cent., and the average number of inland trunk calls originated in London daily was 16,754; the increase in night trunk traffic of all classes was 8 per cent., and the average number of calls of all classes passing through the London trunk exchange daily (24 hours) was 65,729, also an increase of 8 per cent. The total daily toll traffic was 50,008, an increase of 7.7 per cent., and the total number of incoming and outgoing lines increased from 1,221 to 1,629.

The Telegraph Service.—Peterhead Station.—The Post Office cable from Peterhead to Russia, which was installed in 1915, has been dismantled, and the property whereon the instruments were fitted has been handed back to the owners. The cable was of great service during the 1914-18 war, and at one time a staff of between forty and fifty was employed at the Peterhead station.

Phonograms.—The number of phonograms dealt with in 1928 was 1,980,000, an increase of 11 per cent. Registrants of abbreviated telegraphic addresses to the number of 3,176 have all their telegrams delivered by telephone, the total number dealt with being 450,000 annually. In addition, about 200,000 telegrams addressed to telephone exchange numbers were delivered by telephone.

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Radio Notes.

Australia.—LICENCES.—The number of receiving licences in force in November, 1928, totalled:—

	Licences in force.	Increase.
Victoria	143,250	1,265
New South Wales	90,177	1,395
South Australia	22,019	505
Tasmania	3,946	91
		Decrease.
West Australia	3,830	14
Queensland	25,235	331
		Increase.
Commonwealth	288,457	2,910

FEDERAL OWNERSHIP.—An agreement has been reached by the Commonwealth Government and the Western Australian Farmers' Broadcasting Co. for the continuation of the "A" class station in Perth, 6WF, under Government ownership. It was known that the company was anxious to sell its interest in the enterprise, which had proved a very unprofitable venture, but the terms under which the Government had agreed to take it over have not been disclosed. The Postmaster-General (Mr. W. G. Gibson) said negotiations for taking over "A" class stations in the other States were being undertaken on behalf of the Government by the Broadcasting Advisory Committee.

Canadian Royal Commission.—VISITS TO EUROPE.—The Commission of Inquiry, which arrived in England on January 15th, is to be joined in this country by Sir John Aird, its chairman, whose sailing from Montreal was delayed. After studying broadcasting conditions in England, the Commission is to visit France, Switzerland, and possibly Germany, says *World-Radio*, before returning to consider the situation in Canada.

Jugo-Slavia.—NEW PLANT.—The 28 rooms in the building of the Academy of Sciences (Nauka) at Belgrade which are to house the new broadcasting company are nearly ready for occupation, and the Marconi apparatus from England is already being placed in position. Dr. Braun, formerly in the service of Ravag, is a director of the new company, and its general manager; tests will begin on February 1st with 6-kW energy, and the two aerial masts, 80 ft. high, are already erected on the roof of the premises. Hitherto South Slavia has been very ill-provided with broadcasting stations, that at Zagreb is only of 0.7 kW, but, according to *World-Radio*, Ljubljana (Laibach) is nearly ready now, with its Telefunken plant of 2.5 kW and masts 400 ft. high.

Licences.—STILL INCREASING.—In reply to a question in the House of Commons, Lord Wolmer, Assistant Postmaster-General, stated on January 24th that the number of wireless receiving licences in force on December 31st, 1926, was 2,178,430; on December 31st, 1927, it was 2,395,106; and on December 31st, 1928, approximately 2,628,000.

Rumania.—RESTRICTION REMOVED.—The ban that has existed since 1925 on the use of transmitting and receiving stations within a zone of 30 km. of the frontier has been removed. According to the *Wireless World*, after a long period of hesitation, Rumania has finally decided to adopt broadcasting, and it is hoped that a 12-kW station under construction at Otopeni, between Bucharest and Ploesci, will be working before the end of March. A provisional 400-watt transmitter is already in operation on 401.6 metres. According to the *Plan de Bruxelles* the station should be working on 223.9 metres.

Sweden.—LICENCES.—The number of receiving licences is steadily growing, the increase during the last three months of 1928 having been nearly 10,000, so that the total rose to 381,000, or 62.6 per thousand inhabitants.—*Reuter's Trade Service* (Stockholm).

United States.—BRITISH RELAYS.—British programmes are to be heard all over the United States in March by transmitting them by short waves across the ocean. The British Broadcasting Corporation's programmes are to be received at New York, says *The Times*, by the Radio Corporation of America at Riverhead, Long Island, which will amplify and pass them on to the National Broadcasting Company's distributing centre in Fifth Avenue, New York, whence they will be fed to the network of broadcasting stations extending from the Atlantic to the Pacific coasts. Arrangements are also being made for European listeners to hear American programmes.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—February 26th. Posts and Telegraphs Department. Induction coils and registers for telephone work. (B.X. 5031.)*

February 19th. Dry cells and wet battery parts.

April 2nd. Jumper rings and terminal strips. (B.X 5066.)

March 18th. State Electricity Commission of Victoria. Insulators and accessories. (B.X. 4997.)*

April 8th. Galvanised steel transmission line towers. (A.X. 7401.)*

April 29th. Two or three steam turbo-generator sets with condensers for Yallourn Power Station extension. (B.X. 5062.)*

Ampthill.—February 4th. Board of Guardians. Electric wiring and fittings for heating of Board room.

Batley.—February 4th. Electricity Department. L.p. cable. (January 25th.)

Bedford.—February 22nd. Electricity Department. E.h.p., h.p. and l.p. cables, incandescent electric lamps. (See this issue.)

Belfast.—February 18th. Electricity Department. Materials for 12 months, including electrical accessories, lamps, carbon brushes, cables, joint boxes, meters, &c. (See this issue.)

Blackburn.—February 7th. Town Council. Electrical installation at Roe Lee School. Form of tender (deposit £1) from Mr. H. M. Webb, borough and water engineer.

Carlisle.—Electricity Department. One 15,000-kW turbo-alternator and condensing plant. (January 25th.)

Croydon.—February 7th. Electricity Department. 14,000 tons of coal suitable for use on chain-grate mechanical stokers. (January 25th.)

Dumfries.—February 21st. Electricity Department. One 1,500-kW turbo-alternator and condensing plant. (See this issue.)

Erith.—March 4th. Electricity Department. H.p. and l.p. cables, joint boxes, &c. (See this issue.)

Egypt.—CAIRO.—March 27th. Ministry of Interior. Supply and installation of an electric lighting system for the town of Fashu. (B.X. 5037.)*

Glasgow.—February 7th. Corporation. Electric lighting installation for the Shettleston Baths. Specifications, &c., from Public Works Office, 64, Cochrane Street (deposit three guineas).

Grimsby.—February 6th. Electricity Department. H.p. steam pipes and valves, circulating-water pipes and valves, water service pipes and valves. (January 25th.)

Halifax.—February 4th. Town Council. Electrician's work required in erection of 64 houses, Moor Road. Specifications, &c. (deposit £2 2s. each) from Mr. A. C. Tipple, borough engineer, Crossley Street.

Hendon.—February 11th. U.D.C. 29 closed circuit code signalling street alarms. (See this issue.)

India.—February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

Lancaster.—February 18th. Electricity Department. 400/600-Ah station battery with reversible booster, automatic switchgear, &c. (See this issue.)

Leeds.—February 4th. University. Electric wiring, &c., of the mining section of the University. (January 25th.)

February 15th. Electricity Department. Annual contracts for stores. (January 25th.)

February 8th. Board of Guardians. Electric light installation at Children's Block, Rothwell Institution. Form of tender from Mr. J. H. Ford, clerk to the Board of Guardians, Poor Law Offices, 11, South Parade, Leeds.

London.—CENTRAL ELECTRICITY BOARD.—February 15th. 66,000-V cables (London Area) in connection with the South-East England Electricity Scheme. (January 11th.)

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February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

March 2nd. 66,000-V and other transformers (London Area) in connection with the South-East England Electricity Scheme. (See this issue.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (January 11th.)

March 4th. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area), and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (January 18th.)

LONDON COUNTY COUNCIL.—February 4th. Wiring and fittings for electric lighting, heating and cooking in 86 tenements on Ossulston Estate. H.p. and l.p. cables, core re-actors, control battery, &c., for Greenwich power station. (January 18th.)

February 7th. Wiring and fittings for electric lighting at the Coroner's Court, Bethnal Green, and the Weights and Measures Office and Coroner's Court, Clapham (about 80 wiring points). (January 25th.)

METROPOLITAN ASYLUMS BOARD.—February 20th. Installation of electric lighting at Southwark Casual Ward. (See this issue.)

Lough Derg, Pettigo (Co. Donegal).—February 14th. Supply, delivery, and erection of two 10-kW heavy oil engine generating sets, storage battery, and switchboard. (January 18th.)

Lourenco Marques.—March 19th. Port and Railways Board. 50-kVA Diesel-driven generating set and an electrically-driven water pumping set. (B.X. 5050).*

Manchester.—February 5th. Board of Guardians. Supply of portable X-ray plant complete, for the Crumpsall Institution, Crescent Road, Crumpsall. Mr. F. W. Greenhalgh, clerk to Board of Guardians, Union Offices, All Saints, Manchester.

February 12th. Tramways Committee. General stores, including cable, bell wire, conduit tubing, switches, bells, cells, insulating material, &c. Schedules from the general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Newton Abbot.—February 28th. Board of Guardians. Installation of electric lighting at the Institution, Newton Abbot. (See this issue.)

Newmilns (Ayrshire).—February 9th. Town Council. Electrical wiring in connection with the Council's housing scheme. Specifications from the burgh surveyor.

New Zealand.—WELLINGTON.—March 12th. Posts and Telegraph Department. Switchboard cords. (B.X. 5017.)*
April 9th. Public Works Department. Induction voltage regulators for Lake Coleridge scheme. (B.X. 5018.)*
DUNEDIN.—March 20th. Tramways Department. Tramway equipment. (A.X. 7441.)*

Northern Ireland.—BELFAST.—February 9th. L.M. & S. Railway. Northern Counties Committee (Ireland). Stores required during year ended February 28th, 1930, including telegraph ironwork, wire, electric lamps, porous pots, &c. Form of tender (6d. each) from Mr. F. J. Martin, stores superintendent, York Road Station, Belfast.

Portsmouth.—February 6th. Tramways Committee. Insulating materials, lamps, motor windings, overhead line materials, &c. (January 18th.)

Sheffield.—February 14th. Electricity Supply Department. Turbo-alternator, condensing plant, evaporating and steam preheating plant, water-tube boilers, chimneys, superheaters, stokers, or pulverised fuel firing equipment, economisers, &c., wagon tippers, conveyors and elevators, cooling towers, electrically and hand-operated travelling cranes. (January 11th.)

South Africa.—JOHANNESBURG.—February 14th. Town Council. Two 1,030-kVA transformers. (B.X. 5005.)*
CAPE TOWN.—March 15th. City Council. Metal-clad switchgear. (B.X. 5004.)*
PRETORIA.—March 28th. Posts and Telegraphs Department. Telephone switchboard cords. (B.X. 5048.)*

Staines.—February 9th. Board of Guardians. An additional 168 lighting points, including cables, at the Institution, London Road, Ashford, Middlesex. Specifications from Mr. J. H. Tyars, architect, 28, Victoria Street, Westminster, London, S.W.1.

Wandsworth.—February 2nd. Board of Guardians. Reorganisation of the engineering plant at the Tooting Hospital. (January 25th.)

West Ham.—February 18th. Education Committee. Installation of electric lighting at South Hallsville new school, Agate Street, Tidal Basin. (January 25th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—Education Committee. Accepted:—
Electric lighting installations.—(£317), Reynolds & Bradwell; (£143), Baxter & Impey.

Brighton.—The Corporation General Purposes Committee has considered designs and prices for the electrical fittings for the interior and exterior of the Aquarium building, and recommends that the tender of the General Electric Co., Ltd., be accepted, at £1,340, for the internal fittings and £1,270 for the external fittings, and that Messrs. Pinching & Walton (who are the wiring contractors) carry out the work of the general fittings at an estimated cost of £400, making a total of £3,010.

Cowdenbeath, Fife.—Accepted:—
Electrical work in connection with the additions at the R.C. School.—Scott & Co. (Dunfermline).

Glasgow.—Tramways Committee. Recommended:—
Special track work.—Edgar Allen & Co., Ltd., Titan Trackwork Co., Ltd., and Hadfields, Ltd.
Electricity Committee. Recommended:—
12-kVA portable a.c. testing equipment (£168); seven 50-kVA transformers (£409).—Ferranti, Ltd.
50-h.p. motor (£143).—Alex. Stephen & Sons, Ltd.
50 large size electric cookers (£775).—Falkirk Iron Co.
Bases (76s. each), McCallum & Hope, Ltd.; steel poles (95s. each), Bromford Tube Co., Ltd.
Housing Committee. Recommended:—
Electrical installation at 510 houses on the Scotstoun Estate (£2,361).—A. Robertson.
Electrical installation at 366 houses on the Gairbraid Estate (£1,619).—D. Henderson.

Ilford.—Electricity Committee. Accepted:—
Cable (£1,060).—Union Cable Co., Ltd.

London. — POPLAR. — Electricity Committee. Recommended:—
Supply of economiser plant (£1,086).—Green Economiser Co.

LONDON COUNTY COUNCIL.—Main Drainage Committee. Electrically driven sewage plant at Abbey Mills pumping station. Installation of four pumping sets, with an option exercisable by the Council at any time prior to the taking over of the first four sets to purchase four additional pumping sets at the prices specified.

	First four sets. (1) £	Second four sets. (2) £	Total for eight sets. (3) £
W. H. ALLEN, SONS & CO., LTD. (Accepted)	36,677	23,985	60,662
Lilleshall Co., Ltd.	36,780	24,110	60,890
Gwynne's Pumps, Ltd. ...	38,305	24,914	63,219
Metropolitan-Vickers Electrical Co., Ltd.	38,640	25,850	64,490
English Electric Co., Ltd. ...	39.800	25.800	65.600
Worthington-Simpson, Ltd. ...	39.800	25.800	65.600
Vickers-Armstrong, Ltd. ...	36,500	35,300	71,800

The chief engineer's estimates comparable with the tenders were (1) £49,000, (2) £26,000, and (3) £75,000.

The committee has agreed to the sub-letting of the manufacture of articles required in connection with the contract as follows:—

(1) Motors, Crompton-Parkinson, Ltd.; (2) switchgear, Metropolitan-Vickers Electrical Co., Ltd.; (3) liquid starters, Erskine, Heap & Co., Ltd.; (4) automatic starters, Allen, West and Co., Ltd.; (5) sluice valves, Glenfield & Kennedy; (6) Venturi meter and recorder, British Pitometer Co., Ltd., or George Kent, Ltd., as may be required by the Council; (7) recording gauges and level indicator, Bristol & Co., Ltd.; (8) hydraulic pump, Joseph Evans, Ltd.; (9) pipework, Stanton Ironworks, Ltd., or other firm to be approved by the Council; and (10) electric cables, W. T. Henley's Telegraph Works Co., Ltd., or other firm to be approved by the Council.

Thornaby-on-Tees.—Town Council. Accepted:—
Wiring the library for electric light.—T. B. Watson and Son, Ltd.

Forthcoming Events.

Royal Society of Arts.—Monday, February 4th. John Street, Adelphi, W.C. 8 p.m. "The Treatment of Coal." Mr. C. H. Lander.

Association of Supervising Electricians.—Tuesday, February 5th. Junior Institution of Engineers, 39, Victoria Street, S.W. 6.30 p.m. "Beam Wireless." Lt.-Col. A. G. Lee.

Electrical Society of Glasgow.—Tuesday, February 5th. Reid's Smoke Room, Glasgow. 7.30 p.m. "Consumer, Contractor, and Supply Engineer." Mr. W. D. Brassington.

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Royal Institution of Great Britain.—Tuesday, February 5th. Albemarle Street, W.1. Meeting to consider proposal to celebrate the electric discoveries of Faraday.

Thursday, February 7th. 21, Albemarle Street, W. 5.15 p.m. "The Early History of X-Rays." Sir Wm. Bragg.

Institution of Electrical Engineers.—Thursday, February 7th. Hotel Cecil, Strand, W.C. 7 for 7.30 p.m. Annual dinner.

(Meter and Instrument Section).—Friday, February 1st. Institution, London, W.C. 7 p.m. "Recent Developments in Electricity Meters, with particular reference to those for special purposes." Mr. J. L. Carr.

(Wireless Section).—Wednesday, February 6th. Institution, London, W.C. 6 p.m. "The Development of the Oxide-Coated Filament." Messrs. B. Hodgson, L. S. Harley, and O. S. Pratt.

(Informal Meeting).—Monday, February 4th. Institution, London, W.C. 7 p.m. "Earthing and the Safety of the Public." Mr. W. R. Rawlings.

(North-Western Centre).—Tuesday, February 5th. Engineers' Club, Manchester. 7 p.m. "The Construction of the Grid Transmission System in Gt. Britain." Mr. Johnstone Wright and Mr. C. W. Marshall.

(Dundee Sub-Centre). — Tuesday, February 5th. Lamb's Restaurant, Reform Street, Dundee. 7.30 p.m. Discussion. "Earthed *versus* Insulated Systems."

(East Midland Sub-Centre).—Tuesday, February 5th. University College, Nottingham. 6.45 p.m. "Overhead Electric Lines." Mr. W. B. Woodhouse.

(London Students' Section).—Friday, February 8th. Institution, London, W.C. 6.15 p.m "Electric Welding." Mr. H. H. Taylour.

(North-Western Students' Section).—Saturday, February 9th. University Women's Union, Manchester. 7-11 p.m. Dance.

(North-Eastern Centre, Students' Section).—Friday, February 8th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Address by the Senior Chairman.

Physical Society.—Friday, February 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Engineering and Scientific Club, Wolverhampton.—Friday, February 8th. "Sound Waves and Musical Tones." Mr. L. Southerns.

British Electrical and Allied Industries Research Association.—Friday, February 8th. Savoy Hotel. Luncheon and annual general meeting.

Electrical Engineers' Ball, 1929.—Friday, February 8th. Hotel Cecil.

Institute of Wireless Technology.—Monday, February 11th. Engineers' Club, W. 7 p.m. "The Principles of Television." Mr. A. W. Thynne.

Notes.

Water-power in British Columbia.

Detailed plans for one of Western Canada's largest power plants were revealed at Victoria, B.C., recently, when the Hon. F. P. Burden, Minister of Lands, approved of an undertaking by the West Kootenay Power & Light Co. on the Pend Oreille River. This brought the programme of electrical development immediately before this Province up to a total of over 300,000 h.p. The announcement of details of the scheme shows that it will proceed immediately on a large scale. Between four and six million dollars will be spent to produce 80,000 h.p., all of which will be needed even before it is available, for the enormous business of the Kootenay Co. at the Trail smelter and for its other industrial customers. In an official order, Mr. Burden gives the company until November 25th to commence the actual construction of the plan. Before that time it must submit further plans and secure a water licence, which will allow it to divert 6,000 cubic feet of water per second from the river. The chief engineering feature of the project will be the construction of a dam 175 feet high to control the waters of the Pend Oreille. Legal complications in the way of the scheme, which were expected to delay it, have been removed. Under the programme as finally submitted to the Minister, it will not be necessary to secure the approval of the International Joint Commission on Boundary Waters, as had been anticipated, although the Pend Oreille crosses the boundary. The topography of the river, and the West Kootenay Company's plan for taking advantage of it, are unique. The river rises in American territory, crosses the boundary, and then immediately flows into the Kootenay River, and practically all the fall in the stream occurs during its short journey through British Columbia.

The Rôle of Surface Energy in Chemical Engineering.

Under this title Prof. W. E. Gibbs, D.Sc., M.I.Chem.E., will deliver a public address at the Royal Society of Arts, John Street, Adelphi, London, on Friday next, at 8 p.m. The paper will deal with surface tension; the properties of fine powders; dust explosions; lubrication; and other kindred subjects. The Chemical Engineering Group of the Society of Chemical Industry will welcome visitors at the meeting, and, if desired, confidential advance proofs will be sent to non-members on application.

The Largest Alternator.

The first piece of what will be the most powerful single-shaft single-unit electric generating machine in the world, which is being built at the Schenectady plant of the General Electric Co., U.S.A., for the East River generating station of the New York Edison Co., was to be delivered at the station on January 15th. The shipment consists of the two halves of the stator shell of a 160,000-kW turbo-generator, which will be the third of nine sets to be ultimately installed at the East River station. The shipment was to make eight carloads, and on reaching New York it was to be loaded on a barge and towed to East River. The armature when fully wound will weigh 375 tons. The building up of the armature and the winding will take about six months.

33,000-kVA Frequency Changer on Fire.

An unfortunate accident took place on January 19th in the Metropolitan-Vickers Co.'s Trafford Park works, to a large frequency changer. Whilst running at full speed on test, a short circuit in the pit under the machine set fire to a temporary wood air discharge duct; flames indrawn from the duct by fans at both ends of the machine then set fire to the stator windings, which were seriously damaged in the period of 5 minutes that elapsed before the rotor, weighing over 70 tons, could be brought to rest. On inspecting the damage, it was decided to completely rebuild the stator, using new laminations, new copper, and new insulation throughout; but, although the work is being pushed forward strenuously by everyone concerned, it is estimated that a delay of 7 weeks may occur. The set is notable as being easily the largest frequency changer yet built in this country. It is a reversible machine designed on the one side for 3 phase, 25 periods, 11,000 volts, and on the other side for 3 phase, 50 periods, 6,600 volts. The normal rating is 33,000 kVA at 500 r.p.m., with a momentary overload capacity of 100 per cent. The set is being built to the order of the London Power Company for the Deptford West generating station.

Educational.

The Polytechnic.—The School of Electrical Engineering announces a special course of lectures on "Picture Telegraphy" by Mr. E. S. Ritter, D.F.H., M.I.E.E. (of the Post Office Engineering Research Section), between 5 and 6 p.m. on the following Wednesdays:—January 30th, February 6th, 13th, 20th, and 27th, March 13th, 20th, and 27th. The fee for the course is 7s. 6d.

The Use of Coal.

In the course of a paper on "The Rational Utilisation of Coal," read recently before the North-East Coast Institution of Engineers and Shipbuilders, Mr. W. J. Drummond said that one distinct advantage with plant designed to burn pulverised coal had over stoker-fired plant was the wide range of coal it was able to utilise, and the consequent advantages in price which buying coal from different sources might offer. There were many points which required further attention; among them probably the more important were:—

(*a*) The high cost of grinding, both from the point of view of power and replacements. The wear on a coal-pulverising plant was almost unbelievable to those who had no experience of it.

(*b*) Drying equipment. Most, if not all, plant was severely limited by the moisture content of the coal they would handle, particularly if it were fine coal.

(*c*) Dust emission, from the stacks.

It was frequently urged that the use of pulverised coal enabled all sorts of material with a high ash content to be burnt efficiently; while, from the technical point of view, that was correct, it was seldom economical to do so unless the material existed on the site, *e.g.*, at the collieries themselves. Fuel of high ash and consequently low calorific value could not bear any handling or transport charges. For pulverised fuel-fired plant in towns remote from the coal fields, coal cleaned by the pure gravity separation method should be ideal. Such a fuel would be all below, say, 3/16 in.; its ash content would be two to three per cent., free moisture five per cent., and calorific value equal to large coal. The grinding costs of such fuel would be the least possible because of the complete absence of anything except coal, and the dust discharge from the chimney would to all intents and purposes be eliminated.

There already existed in coal as mined quite a considerable amount, varying probably from 2 per cent. to 8 per cent. of the gross, which was ready for dust firing without further treatment. It was not an easy problem to separate it, and to make full use of it when separated would necessitate the general adoption of special wagons for its transport. The advantage of being able to buy pulverised coal would be very great to small consumers, and the natural dust was a valuable product because it had no preparation costs to bear.

Turning to the question of competition between coal and oil as alternative fuels for power production purposes, the author said that the cost of a therm in terms of oil was not

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less than 2½ times that in terms of coal in England. Coal was in general more readily obtainable than oil, and the risk of accidental fire or explosion was much greater with oil than with coal. Moreover, coal could be more easily and cheaply stored than oil.

Appointments Vacant.

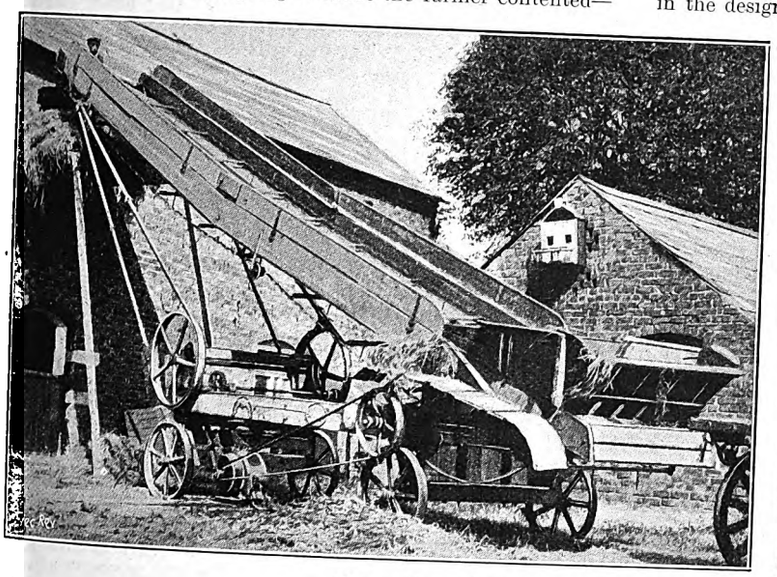
Electrical engineer at the City Road Institution for the Holborn Union. Professorship of Electrical Engineering at the College of Engineering, Guindy, Madras (Rs.1,000 a month). Assistant engineer (Rs.650 to Rs.750 per month) for the Government of Irak Posts and Telegraph Department. Sub-station attendant for the Colchester Corporation Electricity Department. Clerk (£180) for the Borough of Colne Electricity Department. (See our advertisement pages to-day.)

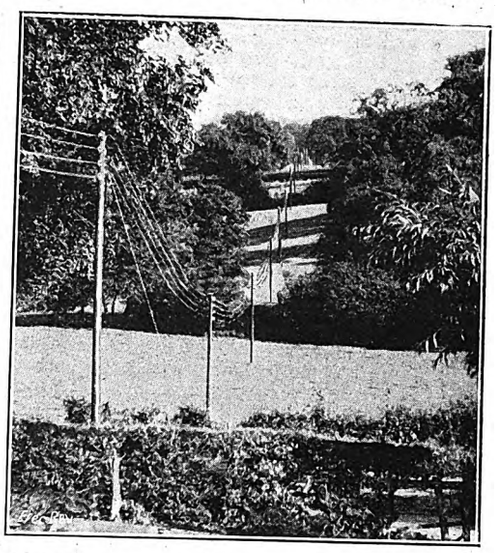
Lecture.

On Tuesday, January 22nd, Mr. Donald Smeaton Munro, chairman of the Scottish Centre of the I.E.E., read a paper on "Fire Hazards of Wiring" to the "Insurance Students' Circle," at Edinburgh. The meeting was largely attended, and the lecture was illustrated with practical experimental demonstrations particularly designed to show how the lack of continuity and defective earthing arrangements may cause outbreak of fire.

Rural Electrification Kinema Film.

Speaking after the exhibition of a kinema film designed to illustrate the benefits to be derived from the use of electricity in rural life and industries, Sir John Gatti said: "We do not pretend that we are going to make the farmer contented—that would be beyond the limits even of the most ingenious—but we hope we can show that electricity is a new factor in the life of the nation which the agricultural population might well hope to share, and that we are bringing to their doors the means of lessening labour which will help them towards a more prosperous era." The film was produced by the British Electrical Development Association, of which Sir John is president, and it was shown at the Plaza Theatre, London. Amongst those present were the Minister of Agriculture (Mr. W. Guinness) and the Minister of Transport (Col. W. Ashley). The accompanying illustrations are views from the film.





Examples of the Rural Application of Electricity.

The Swan Jubilee.

On January 17th Mr. E. S. Evans, district engineer of the North-East Coast Lighting Service Bureau, delivered a lecture at Sunderland on the Swan Jubilee, in the Subscription Library—the same building where Sir Joseph Swan gave his first Sunderland lecture on his lamp on January 17th, 1879. A member of the audience, Mr. Herbert Corder, was present also at the lecture given by Swan. It was pointed out by Mr. Charlton Deas, curator of the Museum, that Sunderland possessed no historical exhibits to commemorate the memory of Sir Joseph Swan, and an appeal has been made to possessors of his early lamps, either to give or lend on long loan an exhibit to the Sunderland Museum.

B.E.S.A. Publication.

The British Engineering Standards Association has just issued a revision of the B.S.S. for Tungsten-Filament Electric Lamps (No. 161-1928). The chief features of the revision are the reduction in the tolerances allowed on the light centre lengths, and, for lamps up to 100 watts, the light centre lengths themselves have been reduced. The overall length of the lamp and the maximum neck diameter, together with the distance from the contact plate of the cap at which the measurement of the neck diameter is to be made, are also given. The light output of lamps and efficiency are now given in terms of lumens only, except that in addition to the lumens output the nominal mean spherical candle power output is given. In former editions only maximum diameters of gasfilled lamps were given; in the revision the actual diameters (with tolerances) are specified for all sizes up to 100 watts. A change has been made with regard to the rating of vacuum traction lamps (series burning), the amperes at rated voltage being now adopted as a standard in place of volts at rated current. Copies of the specification, No. 161-1928, may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 3d., post free.

The Radio Valve Equivalent Network.

In a paper recently published in the I.E.E. *Journal*, Mr. F. M. Colebrook, B.Sc., of the National Physical Laboratory, analyses the variation with the resultant anode-circuit load of the input impedance and voltage magnification factor of a triode valve. A new mode of presentation is adopted which enables the total range of variation of these quantities to be represented as finite functions of a variable with a limited range of variation. The most important conclusion is that at very high radio frequencies the voltage magnification factor may appreciably exceed the voltage factor of the valve, this condition being reached for a finite pure inductive load. Under the same conditions, however, the shunt input impedance is very low. The most efficient means of associating a tuned circuit with a receiver of relatively low input impedance is considered in an appendix, but it is not suggested that the best value of coupling capacity should be calculated and used in the design of receiving systems, which would be impracticable owing to the difficulty of obtaining the necessary data for the calculation; however, in certain cases it will be advantageous to substitute a variable coupling condenser for a fixed one, and determine the suitable adjustment by ear; it could then, if desired, be replaced again by a fixed condenser of about the right capacity. A further application is to experimental work on input impedance of amplifiers and valves; it might be of particular use in the determination of negative input resistances by determination of the critical capacity coupling. Further, by the deliberate production of a negative input shunt resistance by means of a suitable inductive load in the anode circuit, a variable input coupling capacity can be used as a means of reaction control. This work was carried out as part of the programme of the Apparatus Committee of the Radio Research Board.

Fatality.

An inquest was held at Cambois (Northumberland) on January 22nd on the body of George Hornsby (43), who received a fatal electric shock in Cambois coal mine on January 12th. William Goodall, a shifter, stated that as he approached the haulage chain he received electric shocks in his feet with the result that he stumbled over the coal conveyor pans, receiving another shock. Robert Elliott, in evidence, said that just before the accident happened Hornsby and he were changing the picks of the coal-cutting machine. Hornsby, who was pulling the haulage chain, shouted, and witness ran to his aid. "As soon as I put my hand on the machine I got a shock. I got hold of a piece of timber, which took away part of the shock, but I was knocked down and my feet got on the machine and stuck there." The cause of the accident was described by John William Dawson, the chief electrician, as arcing inside an adaptor box used for joining up lengths of cable. An examination had shown that a locking pin was missing from the machine and from another adaptor box. Replying to Mr. Horsley, H.M. Electrical Inspector of Mines, witness said that if all the locking pins had been securely screwed in there would have been a better earth and it would

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have been more likely for the man to have escaped. The jury, in returning a verdict of "Accidental death," added a rider suggesting the more frequent inspection of colliery electrical equipment.

Nothing but the Truth.

At the Electrical Contractors' Association dinner last week, Mr. T. P. Wilmshurst told the following story, which is worthy of reproduction:—

An American lady whose father had been electrocuted at Sing-Sing was desirous of entering London Society. Of course inquiries were made as to her antecedents, and, in reply to a direct inquiry regarding her people, she averred that her father had occupied the chair of applied electricity at a large public institution in America.

Institution Notes.

Institution of Electrical Engineers.

The annual dinner of the North-Western Centre of the I.E.E. was held at the Midland Hotel, Manchester, on Wednesday, January 23rd, Mr. J. Harcourt Williams, chairman of the Centre, presiding. About 280 were present. Among the guests were the President of the Institution, Lt.-Col. K. Edgcumbe, R.E. (T.), Dr. S. L. Pearce, C.B.E., Dr. S. Z. de Ferranti, F.R.S., Mr. A. Page, Sir Benjamin Longbottom, Mr. P. F. Rowell (secretary, I.E.E.), and the speakers named below.

In proposing the toast of "The Cities and Trade of Manchester and Salford," Major-General Sir PHILIP A. M. NASH, K.C.M.G., C.B., said the Manchester district had always been the scene of great enterprise in the electrical industry, and Manchester had also been a pioneer in education, but it was the fate of many pioneers to be passed by others who profited by their example. Erected 25 years ago, the Manchester College of Technology achieved distinction, but had been surpassed by other institutions of a like nature, and he heard that it was to be extended; in making the extension, the authories should think far ahead and make adequate provision, so that Manchester might again lead in training young men who would keep the city in the forefront of the industrial world. Transportation facilities were not up to the standard which so important a city should maintain. There were five terminal stations in Manchester not connected with one another, the suburban railway service was not very good, and congestion of traffic in the streets caused delays. But he was sure local enterprise would overcome all difficulties and provide facilities which would enable the two cities to prosper and increase.

The Lord Mayor of Manchester, Lt.-Col. G. WESTCOTT, O.B.E., J.P., replying to the toast, said that when the electrical industry began, incompetent people rushed in, and there were still some people of that kind trying their hand at it. The function of a society such as the I.E.E. was to raise the standard and ensure efficient service for the supply of electricity in bulk or in detail. The industry offered great advantages and enormous opportunities; he hoped the members of the Institution would seize those opportunities on every occasion. In electrical development in this country, Manchester was second to none.

The toast of "The Institution of Electrical Engineers" was proposed by Mr. DOUGLAS MILLER, M.A., High Master of the Manchester Grammar School. He remarked that he hoped the work of electrical engineers would always be directed to the benefit of mankind and not to its destruction. The PRESIDENT, responding to the toast, said he regarded the Centres as the backbone of the Institution, and it was a privilege to visit them and make the acquaintance of members who could not come to London. It was very interesting to see that other institutions had followed the example and established Local Centres. In his presidential address he tried to show that the prosperity of any country was directly proportional to the amount of goods turned out per head of the population. In the curve which he plotted it was curious how exactly proportional the standard of living was to the productivity. But there was still a great tendency on all sides, chiefly among labour, to ignore the fact that in order to maintain a high standard of living, a high productivity was essential. There had been seven years of desperately bad trade, the only parallel to which was the period which followed the Napoleonic wars; then the depression was followed by tremendous developments in the use of steam and machinery, leading to the prosperity which marked the Victorian era. He was afraid they could not hope for such developments now. But still, in spite of the seven years' bad trade, the standard of living was much higher now than it was 50 years ago, and that was entirely due to the fact that a great deal more material was produced per individual. In order to get out of the present troubles, production should be increased. When a man knew there was a good deal of unemployment in the country it was very difficult to convince him that the remedy was to turn out more stuff; to find suitable arguments the matter had to be gone into very deeply, and then the man would not understand the arguments. But it was the fact, and everybody ought to get it into his mind: the only way to maintain the standard of living in this country was to increase the production.

The CHAIRMAN proposed the toast of "Our Guests," which was replied to by Mr. H. W. ARCHER; and Mr. A. B. MALLINSON proposed "The Chairman," Mr. WILLIAMS briefly responding. Afterwards a reunion followed, the opportunity of meeting old friends being very much appreciated.

FARADAY MEDAL.—At the January 24th ordinary meeting of the Institution, Capt. J. M. Donaldson, M.C., vice-president, who occupied the chair, in the absence of the president, Lieut.-Col. K. Edgcumbe, R.E. (T.A.), on a duty visit to Dublin, announced that the Council had that day made the eighth award of the Faraday Medal to Signor Guido Semenza (local hon. secretary for Italy). Signor Semenza delivered the fifteenth I.E.E. Kelvin Lecture (see ELEC. REV., October 31st, 1924).

Junior Institution of Engineers.

A paper on Michell bearings was read by Mr. J. F. Petree, A.M.I.Mech.E., before the Junior Institution on January 18th. The author remarked that this type of bearing now found application in machines of diverse types in some of which the special needs essential to its satisfactory working were not understood, some of these being in thrust assemblies without proper provision for oil circulation, and with insufficient oil capacity. Probably more than 90 per cent. of such troubles as were met with in the running of Michell bearings could be attributed to an insufficiency of oil, or dirty oil. The author said there was no truth in the assertion sometimes made that a forced lubrication pump was a necessary adjunct to a Michell bearing.

Iron and Steel Institute.

The annual meeting of the Institute will be held on Thursday and Friday, May 2nd and 3rd, at the Institution of Civil Engineers, London, when Professor Henry Louis, M.A., will assume office as the President. The autumn meeting will be held at Newcastle in the week commencing Monday, September 9th.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We regret to learn that Mr. V. W. DALE, the businsss manager of the British Electrical Development Association, was taken ill at Christmas with influenza, but we are glad to know that he is improving in health. The influenza was followed by pneumonia and empyema, and an operation was necessary, but good progress is now being made. We wish Mr. Dale a speedy return to his normal health and activity.

Mr. FRANK BUCKLEY, general manager of the Bury Corporation Tramways, has been appointed general manager and engineer of the Norwich Tramways. He takes up his new duties at the end of February.

The chairmanship of the Bradford Corporation Electricity Committee, vacant through the resignation of Alderman Wilfred Turner owing to ill-health, has been filled by Alderman J. W. LONGLEY, deputy chairman since 1910 (the period of Mr. Turner's chairmanship), except for one year when Ald. Longley took the chair owing to Mr. Turner being Deputy Lord Mayor. Ald. Longley is a consulting electrical and mechanical engineer, and he has taken a very important part, in conjunction with Ald. Turner and the city electrical engineer (Mr. Thos. Roles), in the development of the Bradford undertaking and in the preparations for the big extensions now in progress at the Valley Road generating station. Ald. Longley is succeeded in the Deputy-chairmanship by Councillor CHRIS. WATKIN.

Mr. E. W. UNWIN has arrived in London to act as export manager for Messrs. J. H. Connor & Son, Ltd., washing machine manufacturers, Ottawa. His address is, c/o The Canadian Chamber of Commerce in Great Britain, British Columbia House, 3, Regent Street, S.W.1.

At a recent meeting of the Chester Council it was decided to appoint an assistant to Mr. S. E. BRITTON, the city electrical engineer. It was stated at the Town Council meeting

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last week that many replies were received to an advertisement, but none of the candidates was quite suitable. The Council, therefore, accepted a recommendation of the Electricity Committee to rescind the previous motion of the Council, and in lieu thereof decided to appoint a mains superintendent.

The Derby Tramways Committee on January 21st appointed Mr. P. W. BANCROFT as deputy tramway manager for a period of six months. At the end of that time the question of the managership will be finally decided.

The Ilford Corporation Electricity Committee recommends that the salary of Mr. H. KING, assistant commercial manager, be increased from £500 to £550 per annum.

The General Purposes Committee of the Bridlington Town Council on January 21st considered a recommendation by the Electricity Committee that the salary of the borough electrical engineer (Mr. BECKETT) should be increased from £640 to £705 per annum. It was decided to defer the matter until the end of the financial year.

A large number of readers will learn with interest, and regret, that Miss LANFEAR will no longer take part in the arrangements for the I.M.E.A. conventions, at which she has so long been a most popular figure. As will have been inferred from the advertisement which appeared in our last issue, Miss Lanfear has resigned the post of secretary to the Association, which she has occupied for nearly 10 years. We can only express our sincere regret, and our hope that she will in some other *rôle* continue to serve the industry as efficiently as hitherto.

The *Industrial Australian and Mining Standard* states that after returning from a visit of inquiry abroad, Mr. R. LIDDELOW, secretary of the State Electricity Commission of Victoria since its inception, was given the additional title of commercial manager. It has now been decided to appoint him as commercial manager, in order that he may devote himself to the commercial development of the Commission's affairs. The assistant secretary, Mr. W. J. PRICE, has been appointed as secretary. Mr. D. E. WILLIAMS, fuel sales manager, has been appointed electrical sales manager. The same contemporary also states that Mr. G. L. JUST, manager in Australia for the Edison Swan Electric Co., Ltd., has been elected president of the Electrical Federation (Victoria). The *Industrial Australian* further announces that Mr. W. J. MOUNTAIN has resigned the secretaryship of the Melbourne Electric Supply Co., Ltd., a position which he has held since the inception of the company more than 28 years ago. Mr. J. A. KENNEDY, the assistant secretary and chief accountant, has been appointed to the position.

On December 11th a goodly gathering of representatives of electrical interests in Sydney gave a dinner in honour of Sir HUGO HIRST, BART. Mr. A. Maughan, the chairman, proposed Sir Hugo's health, and Mr. H. Forbes-Mackay and Sir Arthur Cocks supported. In responding, Sir Hugo is credited by the *Industrial Australian* with the remark that "a perfect atmosphere of friendly goodwill subsists between competing manufacturers in England to-day," and he was delighted to gather that the same spirit was sedulously cultivated in Australia.

It is recommended that the Nelson Electricity and Tramways Department should be reorganised. Under the scheme, Mr. G. N. NAYLOR, manager of the tramways and 'buses and electrical engineer, would confine his attention to the electricity department, while Mr. WHALLEY, chief clerk to the tramways, would take charge of the transport section.

According to a Sydney paper, Mr. W. R. CAITHNESS, a director of the British General Electric Co., Ltd., left Sydney on December 18th on a business trip to England.

The Times states that the Swiss Federal Council has appointed M. H. J. BOULANGER, of Grenoble, director of the Telegraphic and Wireless Service of the French Telegraph Administration, vice-director of the International Bureau of Telegraphs, in the place of M. Poulaine, recently deceased.

Mr. WILLIAM FORBES has resigned the post of manager of the Aberdeen Corporation Tramways on his appointment to a similar post under the Cardiff Corporation. A sub-committee of the Tramways Committee is considering the duties of the post and the question of a successor.

Mr. JAMES W. MCKAY, general secretary of the Electrical Wholesalers' Federation, Ltd., is prospective Liberal candidate for the city of Coventry.

Mr. D. A. S. PORTEOUS, A.C.G.I., A.M.I.E.E., formerly and for the past twelve years with Messrs. Johnson & Phillips, Ltd., has been appointed works manager to the Enfield Cable Works, Ltd., as from the beginning of 1929.

Obituary.—MR. SYDNEY MORSE.—We regret to record the death, which occurred on Sunday last at his residence in Airlie Gardens, Campden Hill, London, W., of Mr. Sydney Morse, J.P., Associate I.E.E. He had been playing golf the day before his death. Mr. Morse, who was 74 years of age, was a solicitor by profession. He began his interest in electrical affairs in connection with the late Mr. W. T. Henley and W. T. Henley's Telegraph Works Co., Ltd. From the year 1884 onwards for many years he played a prominent part in connection with electric lighting matters. He acted in the securing of many Provisional Orders, and for many electric lighting, tramway, and other companies. He was most prominent in association with such interests on their legal side, but he was also to the fore in opposition to municipal trading, was a member of the Electrical Trades Section of the London Chamber of Commerce for several years, and served on the Council of the Institution of Electrical Engineers.

Will.—Mr. FRANK SCHOFIELD, commercial manager of the Stalybridge, Hyde, Dukinfield, and Mossley Joint Tramways and Electricity Board, left £1,867.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Sterno Manufacturing Co., Ltd.—Private company. Registered January 19th. Capital, £10,000 in £1 shares. Objects: To acquire the leasehold property at 19, City Road, E.C., and the business of gramophone and wireless manufacturers and dealers carried on by the British Homophone Co., Ltd., together with the trade mark "Sterno." The subscribers (each with one share) are:—M. M. Innes, Oakleigh, 107, Park Road, Chiswick, W.4, clerk; W. C. Mitchell, 14, York Road, Walthamstow, E.17, clerk. Solicitors: Cohn, Seligman & Bax, 52, New Broad Street, E.C.2.

George Ellison, Ltd.—Registered as a private company, January 20th. Capital: £125,000 in £1 shares (30,000 preference and 95,000 ordinary). The preference shares confer the right to a fixed cumulative preferential dividend of 7 per cent., and the right to an extra 1 per cent. for every 1 per cent. dividend on the ordinary shares in excess of 10 per cent., but not exceeding for any year an extra 3 per cent. on the preference shares. Objects: To acquire the business of an engineer and maker of electric control switchgear carried on by G. Ellison at Perry Barr, Birmingham, together with the branches and subsidiary businesses belonging thereto. The subscribers (each with one share) are: T. G. Ellison, Flint Green Works, Acocks Green, Birmingham, engineer; G. Ellison, 14, Brueton Avenue, Solihull, engineer. G. Ellison is governing director at a salary of £3,000 per annum until he resigns or dies or ceases to hold half the ordinary shares allotted to him under the purchase agreement. Registered office: Wellhead Lane, Perry Barr, Birmingham.

South Essex Supply Co., Ltd.—Private company. Registered January 24th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, mechanical, and general engineers, tinplate workers, sign makers, &c. The directors are: E. J. Wreford, J. S. Wreford, and L. Summers, all of "Southcott," Squirrels Heath Road, Harold Wood, Essex. Registered office: 30, London Road, Romford, Essex.

Midland Radio Service, Ltd.—Private company. Registered January 19th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in apparatus for receiving, transmitting, reproducing or recording sounds, pictures, &c., and electrical, magnetic, chemical, optical, and scientific apparatus, &c. The subscribers (each with one share) are: H. C. Duffell, 7, Farquhar Road, Edgbaston, Birmingham, insurance official; H. F. Duffell, 7, Farquhar Road, Edgbaston, Birmingham, electrical engineer. Registered office: 7, Farquhar Road, Edgbaston, Birmingham.

Nye & Menzies, Ltd.—Private company. Registered January 21st. Capital, £1,000 in £1 shares. Objects: To carry on the business of railway and general engineers, agents for, brokers and factors of, dealers in and manufacturers of railway and general engineering equipment, tramways, motors, signalling apparatus, electrical and wireless apparatus, &c. The subscribers (each with one share) are:—Joan Peachey, 9,

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Hetley House, Hetley Road, W.12, private secretary; A. D. Poulter, 59, Rectory Road, Chelmsford, solicitor's clerk. The permanent directors are: C. E. K. Menzies and O. B. Marks. The other first directors are to be appointed by the subscribers. Registered office: 62, New Broad Street, E.C.2.

Meteor Electric Lamp Co., Ltd.—Private company. Registered January 21st. Capital, £500 in £1 shares. Objects: To carry on the business of commission agents, agents for the sale or purchase of machinery, manufacturers of and dealers in electric lamps, irons and kettles, machines, batteries, and all other electrical appliances, &c. The directors are:—L. J. Restall, 19, Fairmount Road, S.W.2; A. R. Ingersoll, 10, Lewisham Park, S.E.13. Registered office: 33-34, Sicilian House, Sicilian Avenue, W.C.1.

Harmony, Ltd.—Private company. Registered January 21st. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and wholesale or retail dealers in wireless receivers and instruments, drawn wire electric cables, electric lamps and parts, articles, and things used in connection with electrical, telegraphic, telephonic, and radio appliances, &c. The subscribers (each with one share) are:—Eva Ayres, 44, Beecroft Road, S.E.4, cashier; H. J. Ellery, 20, Maude Terrace, E.17, clerk. Registered office: 66, Newman Street, W.1.

Cryptocode Machine Syndicate, Ltd.—Private company. Registered January 25th. Capital, £10,000 in 5,000 preference shares of £1 each and 25,000 ordinary shares of 4s. each. Objects:—To carry on the business of manufacturers of and dealers in automatic, electrical, mechanical or other apparatus, machines, or other means used in connection with codes, codification, other secret forms of communication or similar processes, &c. The directors are:—E. W. Rollings, "Roseneath," Burges Road, Thorpe Bay, Essex; E. Shore, "Breakspears," Studland Road, Hanwell, W.7. Secretary: H. W. Bowen. Solicitors: S. Sebba, 7-8, Great Winchester Street, E.C.

Official Returns of Electrical Companies.

Sun Electrical Co., Ltd.—Capital, £100,000 in 50,000 ordinary, 20,000 preference, and 30,000 preferred ordinary shares of £1 each. Return dated November 26th, 1928. 27,112 ordinary, 17,391 preference, and 27,677 preferred ordinary shares taken up. £72,180 paid. Mortgages and charges, £22,760. Return of allotments, made up to December 14th, 1928, shows a further 90 preferred ordinary and 600 ordinary shares allotted, payable in cash and fully called up.

Lustrolux, Ltd.—Capital, £25,000 in £1 shares. Return dated June 12th (filed December 13th), 1928. 9,002 shares taken up. £9,002 paid. Mortgages and charges: £6,000.

Hailwood & Ackroyd, Ltd.—Capital, £25,000 in 3,200 preference and 1,800 deferred shares of £5 each. Return dated December 1st, 1928. All shares taken up. £15,500 paid on 3,100 preference shares, £9,500 considered as paid on 100 preference and 1,800 deferred shares. Mortgages and charges: £50,000 sealed debentures.

B.H.M., Ltd.—Capital, £5,250 in 5,000 preference shares of £1 each and 5,000 ordinary shares of 1s. each. Return dated October 2nd, 1928. 3,751 preference and 2,850 ordinary shares taken up. £3,086 paid on 3,001 preference and 1,700 ordinary shares, £807 10s. considered as paid on 750 preference and 1,150 ordinary shares. Mortgages and charges, nil.

E. A. Langrish & Co., Ltd.—Capital, £15,000 in 7,500 preference and 7,500 ordinary shares of £1 each. Return dated November 8th, 1928. 5,800 ordinary and 5,965 preference shares taken up. £11,234 19s. 11d. paid, leaving £530 0s. 1d. in arrears. Mortgages and charges, nil.

Commercial Telephone & Electrical Co., Ltd.—C. J. Hocking, builder, 35, Great Queen Street, Holborn, W.C., was appointed receiver on January 10th, 1929, under powers contained in debentures dated April 30th, 1924. J. H. Rook, solicitor, ceased to act as receiver and manager for the debenture holder on the above date.

Hackbridge Cable Co., Ltd.—Satisfaction in full on January 17th, 1929, of debentures dated January 12th, 1921, securing £40,000.

Particulars filed of £50,000 debentures authorised on January 17th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Corwen Electric Light Co., Ltd.—Capital, £2,000 in £1 shares. Return dated November 6th, 1928. 1,610 shares taken up. £1,610 paid. Mortgages and charges nil.

Metalite Co., Ltd.—Capital, £100 in £1 shares. Return dated December 10th, 1928. All shares taken up. £100 paid. Mortgages and charges nil.

E. & W. Shepherdson, Ltd.—Debenture dated January 9th, 1929, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Shepherdson, "Sunninghill," Longlands Lane, Morecambe.

Abbey Cables, Ltd.—Debenture dated January 9th, 1929, to secure £1,000, charged on the company's property, including uncalled capital. Holder: S. G. W. Norton, Norton House, Peaks Hill, Purley.

Colston Electrical Co., Ltd.—Debenture dated January 17th, 1929, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. J. F. Dutson, Grove Lodge, Parry's Lane, Stoke Bishop, Bristol.

J. C. White & Co., Ltd.—Debenture charged on the company's undertaking and property, including uncalled capital, dated December 31st, 1928, to secure all moneys due or to become due from the company to the Union Bank of Manchester, Ltd.

W. Mackie & Co., Ltd.—Capital, £12,000 in £1 shares. Return dated November 15th, 1928. 7,500 shares taken up. £3,155 paid. £4,345 considered as paid. Mortgages and charges nil.

Electric Supply Co. of Victoria, Ltd.—Capital, £325,000 in 175,000 preference and 150,000 ordinary shares of £1 each. Return dated November 29th, 1928. 175,000 preference and 125,000 ordinary shares taken up. £50,007 paid. £249,993 considered as paid. Mortgages and charges nil.

City Notes.

Prospectuses.

Vorarlberger Illwerke A.G. (V.I.W.).—Last week this company offered for public subscription £2,000,000 of 6 per cent. 30-year sterling bearer bonds at £92 per cent. The prospectus stated that the company was incorporated in Austria for the production of electricity, principally by water power. A third of the power produced is taken by agreement by each of the following concerns: Bezirksverband Oberschwäbische Elektrizitätswerke (O.E.W.") and the Grosskraftwerk Württemberg A.G. ("Growag"). The remaining third is at the option of the State of Vorarlberg. The Rheinisch-Westfälisches Elektrizitätswerk A.G. ("R.W.E.") has undertaken the rights and liabilities of the "Growag," and the three companies mentioned have agreed that until the whole of the bonds have been repaid, the amount paid by them shall be sufficient to cover the working expenses of the V.I.W. and the service of the bonds. The present capital of the V.I.W. is 20 million schilling, and an increase to 35 million sch. has been authorised. The proceeds of the loan are to be applied in the completion of the Vermuntwerk and Obervermuntwerk stations and other works; the annual output of these stations will be 150 million kWh and 35 million kWh, respectively. Further schemes which have been prepared will raise the company's annual output to 500 million kWh.

Glare-Visor (Parent) Co., Ltd.—Last week this company made an issue of 1,250,000 shares of 2s. each, representing half of its authorised capital. The company was recently formed to acquire sole and exclusive rights in an anti-dazzle screen, the "Correcta" dipping and swivelling headlight system and "Balkite" power units for charging purposes, &c. The chairman of the company is Sir Robert D. Moncreiffe, Bart. (chairman, Correcta Light, Ltd.), and the registered office is at 16, St. Helen's Place, E.C.3.

Central Public Service Corporation.

This American company last week published, for information only, in compliance with Stock Exchange Regulations, particulars of its constitution and objects. Its authorised share capital is $2,000,000, of which $538,605 has been issued, and it has a funded debt of $10,077,000. The primary objects of the company are those of a holding company, but it also has power to carry on electricity, gas and other public service undertakings. Its subsidiaries, operating in the United States and Eastern Canada, own 96,866 h.p. of electrical plant (27,536 h.p. hydro-electric), 1,266 miles of transmission lines, and 224 miles of electric railway. The consolidated net earnings of the company and its subsidiaries in the year ended October 31st last were $5,674,004, and a balance of $2,182,989 remained after meeting bond interest, &c., which was sufficient to cover more than three times the dividends on the outstanding preferred stock.

Dublin United Tramways Co., Ltd.

From the profits of the past year the directors propose to place £50,000 to track renewals, £15,000 to the mortgage debenture redemption fund, and £7,000 to overhead lines and cables. A final dividend at the rate of 5 per cent. per annum is recommended, making 4 per cent. for the year (against 4½ per cent.), leaving £13,785 to be carried forward.

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Vulcanite, Ltd.

The net profit for the year ended October 31st, 1928, was £6,024 (against £1,157 in 1926-27). A dividend of 6 per cent. (against *nil*) is recommended; £2,000 is to be placed to depreciation and a similar amount to the preference share dividend reserve, leaving £333 to be carried forward. The Wigan property has been enlarged and is now producing a new product for which there has been a considerable demand. The liquidation of the French subsidiary is nearing completion.

Aldershot Gas, Water and District Lighting Co., Ltd.

The annual meeting of the company was held on January 30th. The chairman, after reviewing the progress of the gas and water departments, said that the electricity department showed an increase of sales in the "B" area of 18.1 per cent. over 1927. He gave a list showing the advance in the use of various electrical appliances. The Hindhead undertaking was absorbed by the company in December last; that concern's accounts were not yet complete, but a full statement of the assets and liabilities would appear in the 1929 accounts. Three additional Special Orders had been applied for, and a public inquiry had been held by the Electricity Commissioners; the result of this was not yet available. Since Michaelmas, 1927, the price of electricity for lighting had been reduced by 0.8d. per kWh, and it was hoped to make a further reduction from Midsummer. The bulk of the capital expended during the year (£7,818) was in connection with the electricity undertaking. It was hoped to commence the erection of new showrooms at Fleet and Hindhead during the current year. The report and accounts were adopted.

International Light and Power Co.

There was a balance of £302,350 to the credit of profit and loss account for the period July 1st, 1927, to March 3rd, 1928, but after providing for debenture interest, &c., administrative expenses, and loss on sale of investments, there was a deficit of $3,769,306. A credit balance is brought forward, and other amounts totalling $965,233 are credited, reducing the deficit to be carried forward to $2,804,072.

Official Notices re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Barford Electric Supply Co., Ltd.
Direct Electrical Co., Ltd.
Electric Light & Power Contracts Finance Corporation, Ltd.
South Midlands and Berkshire Electric Light & Power Co., Ltd.
Warwickshire and South Midland Electricity Supply Corporation, Ltd.

Norwich Electric Tramways Co.

In compliance with Stock Exchange requirements, the company published this week, for information only, particulars of its constitution, &c. It was incorporated by Special Act in 1897, and under this and two later Acts operates 16½ miles of tramways, which are purchasable by the local authorities in 1932 or any seventh year thereafter; it also has motor-omnibus services. The authorised capital is £300,000 in £10 shares, of which £264,000 has been issued, fully paid. The company has issued £66,000 of 4 per cent. mortgage bonds, redeemable at par upon the purchase of the undertaking. When the remainder of the unissued capital is raised, the company is empowered to borrow a further £12,000 on mortgage.

Brazilian Traction, Light and Power Co., Ltd.

This week the company announced the completion of the purchase of nearly all the ordinary shares of the City of Santos Improvements Co., Ltd. The business of this company includes the supply of electric light and power in the city and the running of tramways. The acquisition calls for an expenditure of about $14,000,000, and the rapid expansion of the company's other undertakings necessitates further capital. The projected developments include the installation of a 40,000-h.p. set at the Parahyba (Rio) plant and one of probably 60,000 h.p. at the Serra (Sao Paulo) plant. The board has accordingly decided to offer to the holders of the company's ordinary shares additional ordinary shares of no par value on the basis of one share for each seven shares held, at the price of $40 per share. At a recent meeting of the board a quarterly dividend of 50 cents per share was declared on the ordinary shares.

German Company.

At its meeting on January 21st the board of the *Allgemeine Elektricitäts Gesellschaft* decided to recommend a dividend of 8 per cent. out of the net profits, amounting to 16½ million marks. It was stated that the turnover of all the companies affiliated to the A.E.G. totalled over half a milliard marks, while the orders at present in the hands of the company were estimated to be worth 385 million marks.—*Reuter.*

Stock Exchange Notice.

Dealings in the following have been allowed by the Committee of the Stock Exchange under Rule 159:—

Baird International Television.—25,000 "A" shares of 5s. each, fully paid, Nos. 1,025,001 to 1,050,000.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets again show strength in most departments. Investment takes the good stock which comes on offer: speculation is actively employed in the search for further fields which have not yet been discovered by the American gambler, and, not finding these, has to rest content with the stocks and shares at present available. One of the features of the past few business days has been a spurt in the prices of the Eastern cable stocks. Movements amongst cable equipment and electrical manufacturing shares are a little irregular. There is plenty of money for investment in the stock markets, there is a general willingness to use it, there is—in the third place—a steadily decreasing amount of stock or shares for purchase at anything that looks like a reasonable level. Some talk arose, early this week, of money becoming tighter within the near future, and this served to cast a slight shadow over the gilt-edged market.

"Dollar" Stocks.

Mention has been made on many occasions of the way in which the capital stock and shares in the American-Canadian utility companies have been rising. Prices have now reached such a level that they would seem to offer little further scope for appreciation. To take one example, Shawinigan Water common stock is up to 94; the company last paid 2 per cent. on the shares, so that the yield on the money at the present time is hardly more than 2¼ per cent. Nevertheless, the company is one of the best of its kind in the list, and its profits show annual expansion. Every now and then a new issue is made at a price which provides a handsome bonus to the proprietors. Anticipation of this policy being continued lends attraction to these shares at the present time. Otherwise, investors would hardly think of accepting so meagre a rate of interest on their money.

Brazilian Tractions, pursuing an erratic course, touched 79 and rallied to 81½. The participating preference have moved up to 260. A rise of 9 points lifted Pennsylvania Water and Power to 95½. Consolidated Gas and Electric Light of Baltimore shares are almost equally higher on the week at 111½. Mexico Tramways bonds rose a point to 60: the common shares advanced to 57½. Mexican Light and Power issues are unchanged. Pachuca Light and Power fives are better at 73. British Columbia "A" and "B" hardened to 59½ and 40½, respectively. Hydro Electrics are 40. Winnipeg Electric 5 per cent. bonds firmed up to 91½.

Artificial Values?

The statement is sometimes heard that present-day values in the Stock Exchange are largely artificial, the contention being based on the idea that dividend payments do not justify the existing quotations of shares not in dozens, but in hundreds, of different companies. How long the present state of affairs is going to last, or whether it will turn out to be the entry of a new régime in the world of finance, it will require a shrewd prophet to estimate. The demand for stock, especially of the more speculative order, comes largely from across the Atlantic, where the idea of values is certainly more blurred than it is over here. So long, however, as New York and Montreal set the pace by their insistent demand for industrials, irrespective of what dividends are paid, so long must prices continue to mount under the pressure of the buying orders which the Stock Exchanges receive in increasing quantities every week.

Home Railways.

The Metropolitan Railway Company declares its dividend on Thursday of this week, and anticipation looks for a possible 3½ to 4 per cent. for the year ended December 31st last. In the previous twelve months the company paid 3 per cent., but the traffics of last year were good enough to justify the expectation of an improvement. The results will be out before these notes appear. Meanwhile the price of the stock has remained at 67, while Districts are unchanged at 80. The feature amongst Home Rails is the strength of Underground Electrics, where the 6 per cent. incomes have spurted to 131, and the shares have had a jump of 28s. Optimists look for 8 per cent. on the latter. They will have to wait until February 7th before the company satisfies the doubts, which are at present bounded between 6 per cent., and the 8 per cent. just mentioned. London and Suburban Traction preference retain their strength at 13s., and London United Tramways debenture keeps about 61.

London Electricity Supply.

County of London Electric Supply ordinary have been in active demand, the provinces joining with London in purchases

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which raised the price to 49s. 6d. This is a florin gain since a week ago, when the price had already put on nearly as much by comparison with the previous week.

Bournemouth and Poole also proved a lively market, the quotation remaining unchanged, on balance, at 68s. 6d. London shares, apart from Counties, have not moved. The report of the London and Home Counties Joint Electricity Authority, dealing with its members' conclusions upon the London Electricity Acts of 1925, was published last week. The report maintains that it is clearly the intention of the scheduled agreements to limit divisible and surplus profits in such a way as to encourage reduced prices to, and increased consumption by, all classes of electricity users, and to exhaust the revenue of a company by reducing charges for current, the provision of limited interest, dividend charges and reserve funds, &c. The report is applicable to the London electricity supply companies. Shareholders may think that the phrasing—"to exhaust the revenue of a company"—sounds drastic, if not callous, but the clause serves to emphasise the unlikelihood of more than 7 per cent. dividend, the statutory rate, being paid by the London companies which do not occupy any exceptional position. Kent Electric 4½ per cent. debenture is 5 points better at 85. In the list of provincial shares Midland Counties ordinary are a little better at 30s. 6d.

General Electrics Jump.

The manufacturing group show irregular movements. British Aluminium ordinary shares, after their very sharp spurt, have reacted a trifle, to 47s. 6d. The market seems to be puzzled by the previous rise, for no particular increase in the dividend is expected, and the return on the money at the present price of 47s. 6d. is no more than four guineas per cent. It is thought, therefore, that some other cause, yet to be explained, is responsible for the improvement. British Insulated have been a good market, putting on ⅛ at 4 9/16. At this the yield on the money comes to £3 6s. per cent., on the basis of the 15 per cent. dividend at present being paid. General Electrics put on 6s. 3d. within the last half-hour of Monday afternoon, jumping to 3¼. The demand emanated from America. The 6½ per cent. preference are 1s. up at 24s. 6d. Prices of shares in the other members of this group are quiet. People who hold interests in such shares are looking for the companies to increase their earnings through the coming developments in the electricity supply, and in the cable-radio industries.

Seventy-five Points Up.

British Electric Traction deferred ordinary stock is 75 points higher on the week. The nominal price of 775 is probably well under the figure that a seller would obtain if he had a reasonable amount to offer. It is declared that the stock is worth at least 1,000 on its merits. There are buyers at 800 at the present time. This week the 8 per cent. preferred stock is up a point, which makes it 125. Another dramatic rise, though far less than B.E. Traction deferred, is in American Telephone and Telegraph, which has gained 17½ points at 225.

Breaking New Ground.

Those holders of United River Plate Telephones who accepted International Telephone and Telegraph stock in exchange for their shares have received a letter from the president of the latter company, giving them details of their new undertaking, with an evident desire to make the proprietors feel at home, as it were, with their acquisition. The idea is not entirely new to British companies, but it is sufficiently rare to make the practice worthy of remark. The too-general attitude of British boards of directors is to treat their fellow shareholders as being of no account unless proxies are required. Some directors would consider the International Telephone chairman's effort as being either superfluous or undignified, if not both. But the common-or-garden shareholder will probably appreciate such departure from the moss-grown paths of financial convention.

Cable Stocks.

The Eastern cable group is decidedly better, Eastern Telegraph ordinary being 5 points higher; Globes, Eastern Extensions and Westerns are 10s. to 15s. up. Attention is earnestly fixed upon what the companies—the Globe Telegraph and Trust excepted—will receive under the merger arrangements. It is said that everything is cut-and-dried in regard to the exchange of securities, the market anticipations in respect of which were repeated in last week's Electrical Review, on page 164. A still more considerable gain is one of £3 in Indo-Europeans, where the price is up to 54½. The wireless section is also better. Marconis at 78s. 9d. and Marconi Marines at 72s. 6d. show improvements. The Marine Company is expected to publish excellent figures within the course of the next week or so. The dividend for last year, 12½ per cent., will certainly be exceeded by 2½ per cent., if not by more. Hopefulness looks for a bonus of some kind, either in the dividend or in the shape of new shares. Burndepts are keeping their rise.

The rubber share market is quietly firm. Iron and steel shares are a trifle uncertain. The excitement in Ever Ready and Everlite shares has subsided, at any rate for the time being.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Jan. 28, 1929.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14†	15	68/6	—	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 8 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	49/6	+2/-.	3 3 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—	3 18 3
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	47/6	—	3 15 8
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/6	+6d.	4 5 3
Mid. Elec. Power	1	—	15	2 3/16	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	27/-	—	4 9 0
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	—	4 17 0
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	40/9	—	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/3	—	6 3 8
Yorkshire Elec.	1	8	8	36/6	—	4 7 8

†4% of which was tax free.

Home Rails.

Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	"	8	8	67	—	4 9 7
do. District	"	3½	4	80	—	5 0 0
Underground Electric	£1	1½	5	28/-	+1/-	3 11 5
do. do. Income ...	Bonds	6	6	131	+4	4 11 7

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½xd.	—	5 17 1
do. Def.	"	1½	1½	25½xd.	—	5 17 8
Automatic Telephone	1	10	10	2½	+1/16	4 14 1
Eastern Extension	10	10	10	27½	+¾	*3 13 6
Eastern Tel. Ord.	Stock	10	10	272½	+5	*3 13 6
Globe Tel. and T. Ord.	10	10	10	26	+½	*3 17 6
do. do. Pref.	10	6	6	11½	—	5 9 1
Great Northern Tel.	10	20	20	34½	—	... ...
Indo-European	25	10	10	54½	+3	*4 11 9
Marconi	10/-	5	*10	3 15/16	+1/16	... ...
Marconi-Marine	1	8¾	12½	3⅝	+⅛	3 9 1
Oriental Telephone Ord.	1	12	12	3	+1/16	... ...
United R. Plate Tel.	5	8	8	12½	—	3 4 0
Western Telegraph	10	10	10	27½	+¾	3 13 6

*Interim.

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	3 5/16	+⅛	3 3 6
do. do. 5% Deb. ...	Stock	5	5	77	—½	6 9 10
British Electric Traction Def. Ord.	"	—	—	775	+75	... ...
do. do. Pref. Ord.	"	8	8	125	+1	6 8 0
Brazil Traction	100	6	7	81½	—1	2 9 1
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 4 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	80	+1	6 5 0
Mexican Light Common	100	Nil	Nil	84½	—	... ...
do. 7% Pref.	100	Nil	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	13	15	3 5/16	+1/16	*4 4 9
British Aluminium Ord.	1	10	10	47/6	—9d.	*4 4 2
British Elec. Transformer Pref. ...	1	7	7	15	—	9 6 8
British Insulated Ord.	1	15	15	4 9/16	+⅛	3 6 0
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4¼	—	3 9 10
do 6½% Pref.	1	6½	6½	1¾	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	19/6	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	5 16 6
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	1	20	20	5 5/16	—	3 15 6
English Electric	1	Nil	Nil	8/9	—	... ...
do. do. Pref	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	+1/-	5 6 1
do. Ord.	1	7½	10	8½	+1/16	3 3 0
Henley	1	25	25	5¼	—	4 5 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 3
Met.-Vickers Ord.	1	8	6	36/-	—	... ...
do. Pref.	2	8	8	22	—	5 16 5
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	25	—	*4 14 6

*Dividends paid free of Income Tax.

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Electrical Exports of the United States.

Figures for 1926 and 1927 Compared.

THE following figures, showing the exports of electrical machinery and apparatus from the United States and the principal countries of destination in 1927, are taken from the recently-issued annual statistics of American trade. The comparative figures for 1926 have been added and notes of any increases or decreases given.

According to the official statistics the total values in thousands of dollars of the exports of electrical machinery and apparatus since 1922 have been as follows:—1922, 53,147; 1923, 59,927; 1924, 69,828; 1925, 73,790; 1926, 84,226; 1927, 84,610.

Insulated wires and cables, although shown below, are not classed in the United States statistics as electrical goods.

	1926. Thous. $	1927. Thous. $	Inc. or dec. Thous. $
Generators, d.c., under 500 kW—			
Total	960	871	− 89
To France	21	8	− 13
,, Canada	298	296	− 2
,, Mexico	89	60	− 29
,, Colombia	36	55	+ 19
,, Venezuela	43	31	− 12
,, China	12	11	− 1
,, Japan	19	31	+ 12
,, Australia	76	32	− 44
,, Cuba	34	55	+ 21
,, Brazil	64	28	− 36
,, Russia	6	17	+ 11
,, S. Africa	13	15	+ 2
Generators, d.c., 500 kW and over—			
Total	455	649	+ 194
To Canada	82	14	− 68
,, Cuba	10	19	+ 9
,, Brazil	12	225	+ 213
,, Chile	126	134	+ 8
,, Japan	123	75	− 48
,, Mexico	11	88	+ 77
,, Argentina	14	26	+ 12
,, New Zealand	—	21	+ 21
Generators, a.c., under 2,000 kVA—			
Total	188	170	− 18
To Canada	30	32	+ 2
,, Mexico	33	17	− 16
,, British South Africa ...	8	—	− 8
,, Colombia	12	33	+ 21
,, Cuba	2	7	+ 5
,, Philippine Islands ...	9	5	− 4
Generators, a.c., 2,000 kVA and over—			
Total	1,273	1,098	− 175
To Spain	80	—	− 80
,, Mexico	39	46	+ 7
,, Brazil	141	21	− 120
,, China	—	22	+ 22
,, Japan	604	899	+ 295
,, India	41	—	− 41
,, Chile	352	—	− 352
,, Canada	—	29	+ 29
Steam turbine generator sets—			
Total	920	1,822	+ 902
To Mexico	125	97	− 28
,, Cuba	108	105	− 3
,, Japan	355	45	− 310
,, Brazil	13	28	+ 15
,, Canada	111	106	− 5
,, Chile	224	20	− 204
,, Java	94	13	− 81
,, Argentina	11	943	+ 932
,, Australia	10	28	+ 18
Self-contained lighting outfits—			
Total	1,151	1,340	+ 189
To Spain	13	31	+ 18
,, Great Britain	128	122	− 6
,, Mexico	25	56	+ 31
,, Argentina	158	218	+ 60
,, Colombia	21	44	+ 23
,, Cuba	5	16	+ 11
,, Uruguay	30	32	+ 2
,, India	25	19	− 6
,, Australia	159	211	+ 52
,, British South Africa ...	106	70	− 36
Power transformers—			
Total	2,231	1,556	− 675
To Cuba	40	28	− 12
,, Canada	11	46	+ 35
,, Mexico	176	211	+ 35
,, Brazil	191	183	− 8
,, Chile	400	56	− 344
,, India	128	7	− 121
,, China	5	20	+ 15
,, Japan	888	364	− 524
,, Australia	48	45	− 3
,, Spain	5	110	+ 105
,, Russia	10	104	+ 94
Other transformers—			
Total	1,266	1,051	− 215
Accessories and parts for generators—			
Total	920	1,137	+ 217
Rectifiers, double current, and motor generators, dynamotors, synchronous and other convertors—			
Total	1,557	1,729	+ 172
To France	50	12	− 38
,, Great Britain	37	44	+ 7
,, Canada	220	375	+ 155
,, Mexico	41	35	− 6
,, Chile	318	144	− 174
,, India	36	35	− 1
,, Japan	313	299	− 14
,, Australia	144	184	+ 40
,, Spain	21	58	+ 37
,, Brazil	75	106	+ 31
Switchboard panels, except telephone—			
Total	2,193	1,628	− 565
Switches and circuit breakers over 10 amp.—			
Total	2,618	1,987	− 631
Fuses and fuse blocks—			
Total	352	370	+ 18
Watt-hour and other measuring instruments—			
Total	493	419	− 74
To Canada	61	46	− 15
,, Mexico	57	25	− 32
,, Cuba	22	38	+ 16
,, Brazil	162	133	− 29
,, China	33	29	− 4
,, Japan	21	27	+ 6
,, Australia	15	13	− 2
Volt-, watt-, and ampere-meters, and other recording, &c., apparatus—			
Total	2,152	2,139	− 13
Lightning arrestors, choke coils, &c.—			
Total	709	726	+ 17
Motors, under 1 h.p.—			
Total	2,000	2,614	+ 614
To Holland	20	13	− 7
,, Spain	52	58	+ 6
,, Great Britain	361	544	+ 183
,, New Zealand	72	42	− 30
,, Canada	634	753	+ 119
,, Mexico	44	39	− 5
,, Argentina	88	101	+ 13
,, Japan	107	98	− 9
,, Australia	162	179	+ 17
Stationary motors, 1 to 200 h.p.—			
Total	3,207	3,068	− 139
To Spain	69	17	− 52
,, Great Britain	132	157	+ 25
,, Canada	611	783	+ 172
,, Mexico	220	246	+ 26
,, Cuba	137	148	+ 11
,, Brazil	84	98	+ 14
,, Chile	295	175	− 120
,, China	28	42	+ 14
,, Japan	113	83	− 30
,, Australia	186	137	− 49
,, British South Africa ...	97	76	− 21
,, Argentina	513	281	− 232

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	1926. Thous. $	1927. Thous. $	Inc. or dec. Thous. $
Motors, over 200 h.p.—			
Total	884	402	− 482
To Canada	60	48	− 12
,, Mexico	47	29	− 18
,, Chile	244	13	− 231
,, Japan	128	22	− 106
,, British South Africa ...	10	7	− 3
,, France	10	10	—
,, Spain	40	2	− 38
,, Panama	82	32	− 50
,, Cuba	36	38	+ 2
,, Colombia	60	49	− 11
Railway motors—			
Total	1,126	915	− 211
To Canada	13	49	+ 36
,, Cuba	95	—	+ 95
,, Spain	49	90	+ 41
,, Mexico	4	1	− 3
,, Brazil	76	181	+ 105
,, Chile	66	3	− 63
,, Japan	175	264	+ 89
,, Australia	246	52	− 194
,, British South Africa ...	66	14	− 52
,, Colombia	52	36	− 16
,, Portugal	61	61	—
Starting and controlling equipment—			
Totals—			
For industrial motors ...	1,395	1,152	− 243
For electric railway and vehicle motors	203	247	+ 44
Accessories and parts for motors—			
Total	2,181	2,410	+ 229
Railway signals, switches, and attachments—			
Total	505	775	+ 270
To Canada	191	330	+ 139
,, Japan	42	160	+ 118
,, India	41	25	− 16
,, Chile	5	21	+ 16
,, Australia	86	44	− 42
,, Spain	10	81	+ 71
Insulating material—			
Total	1,380	1,361	− 19
To France	67	51	− 16
,, Great Britain	371	385	+ 14
,, Canada	273	366	+ 93
,, Japan	286	115	− 171
,, Australia	57	44	− 13
,, Italy	16	52	+ 36
Fans—			
Total	948	1,005	+ 57
To Canada	76	122	+ 46
,, Argentina	203	252	+ 49
,, China	119	72	− 47
,, British India	74	68	− 6
,, Australia	56	66	+ 10
,, Cuba	50	31	− 19
,, Mexico	45	50	+ 5
,, Great Britain	31	13	− 18
,, Japan	52	36	− 16
,, Hong-Kong	45	43	− 2
Heating and cooking apparatus—			
Total	1,722	1,558	− 164
To Great Britain	271	196	− 75
,, Canada	289	326	+ 37
,, Japan	62	62	—
,, Argentina	138	117	− 21
,, Australia	327	271	− 56
,, Mexico	85	77	− 8
,, Brazil	58	39	− 19
,, New Zealand	150	92	− 58
Motor-driven household devices—			
Total	1,744	2,312	+ 568
To Holland	86	88	+ 2
,, Great Britain	580	758	+ 178
,, Canada	255	427	+ 172
,, Japan	18	23	+ 5
,, Australia	336	395	+ 59
,, New Zealand	80	50	− 30
,, Belgium	39	62	+ 23
Industrial electric furnaces and ovens—			
Total	253	532	+ 279
Metal filament lamps—			
Total	1,603	1,538	− 65
To Canada	16	28	+ 12
,, Peru	25	24	− 1
,, Mexico	267	301	+ 34
,, Cuba	185	196	+ 11
,, Argentina	205	124	− 81
,, Brazil	44	50	+ 6
,, Australia	188	115	− 73
,, British South Africa ...	44	37	− 7
,, Chile	116	102	− 14

	1926. Thous. $	1927. Thous. $	Inc. or dec. Thous. $
Magnetos, sparking plugs, &c.—			
Total	1,904	2,006	+ 102
To Italy	102	121	+ 19
,, Great Britain	117	35	− 82
,, Canada	588	459	− 129
,, Argentina	81	82	+ 1
,, India	32	15	− 17
,, Japan	122	121	− 1
,, Australia	61	40	− 21
,, New Zealand	16	7	− 9
,, British South Africa ...	15	14	− 1
,, Mexico	29	29	—
Insulated wire and cable, iron or steel—			
Total	276	191	− 85
Insulated wire and cable, copper—			
Total	4,816	5,166	+ 350
To Great Britain	358	463	+ 105
,, Canada	565	573	+ 8
,, Mexico	479	506	+ 27
,, Cuba	602	776	+ 174
,, Brazil	314	566	+ 252
,, Chile	678	278	− 400
,, Japan	31	50	+ 19
Batteries, flashlight—			
Total	1,674	2,250	+ 576
To Mexico	148	122	− 26
,, Argentina	169	324	+ 155
,, India	307	292	− 15
,, Philippine Islands ...	202	217	+ 15
,, Australia	58	91	+ 33
,, New Zealand	66	74	+ 8
Batteries, other primary—			
Total	2,020	2,429	+ 409
To Norway	18	15	− 3
,, Great Britain	93	80	− 13
,, Canada	90	152	+ 62
,, Argentina	512	520	+ 8
,, Chile	35	43	+ 8
,, China	54	74	+ 20
,, Australia	411	702	+ 291
,, New Zealand	95	120	+ 25
,, British India	34	19	− 15
,, Brazil	85	79	− 6
,, Mexico	121	125	+ 4
,, Spain	13	25	+ 12
Batteries, storage—			
Total	3,443	3,673	+ 230
To Denmark	36	30	− 6
,, Great Britain	159	166	+ 7
,, Canada	293	299	+ 6
,, Mexico	149	120	− 29
,, Argentina	406	427	+ 21
,, Brazil	182	141	− 41
,, India	177	177	—
,, Australia	453	444	− 9
,, New Zealand	192	220	+ 28
,, South Africa	310	419	+ 109
,, Chile	111	142	+ 31
Metal conduit, outlet and switch boxes—			
Total	1,164	1,038	− 126
Telegraph apparatus—			
Total	1,018	1,037	+ 19
To Great Britain	218	60	− 158
,, Cuba	38	20	− 18
,, Canada	223	365	+ 142
,, Japan	43	99	+ 56
,, Argentina	6	10	+ 4
,, Newfoundland	91	8	− 83
,, Germany	88	62	− 26
,, Mexico	17	226	+ 209
Radio apparatus—			
Total	8,795	9,182	+ 387
Telephones, magneto— Total	105	356	− 81
Telephone, other— Total	332		
Telephone switchboards—			
Total	2,218	727	−1,491
Locomotives, electric railway—			
Total	1,841	690	−1,151
To Chile	301	260	− 41
,, Cuba	29	35	+ 6
,, Japan	928	—	− 928
,, Brazil	563	354	− 209
,, Canada	—	21	+ 21
Locomotives, electric, mining and industrial—			
Total	759	631	− 128
To Chile	285	244	− 41
,, Japan	45	37	− 8
,, Mexico	85	70	− 15
,, Australia	76	6	− 70
,, British South Africa ...	27	30	+ 3
,, Canada	26	74	+ 48
,, Soviet Russia in Europe...	133	—	− 133

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The E.C.A. Allied Associations.

Annual Dinner.

As we mentioned in our last issue, the annual dinner of the Electrical Contractors' Association, Inc., N.E.C.T.A., Ltd., and the National Federated Electrical Association was held at the Savoy Hotel, London, on January 22nd.

The chairman was Mr. W. H. WALTON (president), and about 300 members and guests attended. The guests included notable men representing all branches of the electrical industry. After the loyal toasts, Col. WILFRID ASHLEY, M.P., Minister of Transport, proposed the toast of "The Allied Associations and Honorary Officials." In his speech Col. Ashley said that the contractors were members of one of the most prosperous major industries of the country. No other industry—not even the motor-car industry—had shown such rapid progress. In 1927 he believed that for the first time our exports of electrical goods and machinery exceeded those of either the United States or Germany. The existence of an industry run on such sound and progressive lines proved that Great Britain was still able to lead the world. The recent legislation had placed the electricity supply industry on a still firmer basis. The Central Electricity Board was to be congratulated upon the progress which it had made during its short term of life. Credit was also due to the Electricity Commissioners, and the Government might be given just a little credit for its foresight in making a survey prior to the 1926 Act, which had given the Commissioners and the Board something to work on. By 1940 the value of the electricity sold annually would be £44½ millions more than if the Act had not been passed. By the schemes already approved, 64 per cent. of the population of the country had been covered, and contracts valued at over £3¼ millions had been placed. In six months' time, in the Glasgow area at least, distinct benefits to the consumer would be apparent. The E.C.A. was doing a great deal to aid the progress of the industry; he particularly congratulated it upon its harmonious relationships with its employés. The Association was out to see that the consumer got good work for his money, and also that the contractor was properly remunerated for that good work. Reverting to the supply industry, Col. Ashley said that the towns could look after themselves, but special attention had to be given to electrical development in rural areas. Although it might be a long time before money invested in rural electrical development would receive a return, the country as a whole would be benefited by that development. He hoped that fruitful results would issue from the Electricity Commissioners' Conference on the subject. He also hoped that in the near future a body with which he was acquainted would be able to select one or two sample rural areas for development in an endeavour to discover whether the inhabitants of such areas really desired to have electricity. For the purposes of the test, houses would be wired for an annual payment, and appliances would be supplied on a hire or hire-purchase system. He believed that the rural areas wanted electricity. What had been done at Evesham and around Chester could not be beaten anywhere on the Continent. Only by intensive propaganda could success be brought to rural electrification, and in this direction contractors could assist.

In replying to the toast, Mr. WALTON said that the greatest work of the E.C.A. was the engendering of harmonious relations between the various sections of the industry. The apprenticeship scheme which it had introduced was not only necessary to the Association's progress, it was vital to the public welfare. It was the Association's aim to raise the standard of the labour and material used in installation work. He regretted that all sections of the industry did not realise the benefits of organisation which led to a lack of cohesion. Much of the domestic electrical work which was being carried out to-day was most unsatisfactory. It had to be borne in mind that lighting was not the question now; more and more apparatus was being placed in the hands of the public, and the quality of the work and the safety of appliances were most important subjects. Electricity was perfectly safe if properly installed, but positively dangerous installations and appliances were being given to the public. Some definite qualification or experience should be possessed by electrical contractors. The next best thing was a reasonable electrical code with penalties for non-compliance. The Government having interested itself in electricity supply, should take steps to ensure sound development from the user's point of view. The relations between supply engineers and contractors continued to develop on the most friendly lines, and more and more authorities had entered into assisted wiring contracts with E.C.A. members, to their mutual advantage.

Mr. T. E. ALGER (past president) proposed the toast of "The Guests." After referring to the presence of Col. Ashley, he said that Lt.-Col. Edgcumbe was not only an eminent engineer, he had also rendered distinguished service to the country. Mr. Wilmshurst was a member of a body whose aim was to bring electricity to everybody at a reasonable price; the speaker asked him to bear in mind the necessity for ensuring that installations were properly carried out. The smallest factory with lighting only was subject to severe regulations, but in the home there was no protection whatever of that kind. He concluded with a reference to Mr. Frank Hodges and other distinguished guests.

Lt.-Col. K. EDGCUMBE (president, I.E.E.), responding, said that his Institution had a high regard for the E.C.A. Electrical contractors were in direct contact with the public, upon whom the whole industry depended, and much was due to their energy and diplomacy. They had a great responsibility, and he was glad to see them insisting that installation work should be of a high quality. The public had to be persuaded that bad installations were dangerous without causing a panic. He said that although the Institution had drawn up wiring rules, it could not enforce them, but the contractors could adhere to them.

Mr. T. P. WILMSHURST (Electricity Commissioner) said that the Commissioners approved the work of the E.C.A. in endeavouring to raise the standard of installation work. His 30 years' experience as a supply engineer had taught him how much shoddy work was carried out. The rural field was a most untouched, but last year 70 Special Orders for country areas were made, and there were at present another 85 in hand. Overhead lines were essential if a cheap supply was to be given; farmers and landowners were now more willing to grant wayleaves.

Mr. FRANK HODGES (Central Electricity Board), who also responded, said that the Government was entitled to a small meed of praise for having lived while electricity had progressed so far. Historically, the Electricity Act of 1926 had its birth in a party which he would not name. All the same, electricity was far too big for politics. The Board had a definite objective, and it knew that it could only get there by all the technical and commercial interests in the industry working together. The fact remained that when electricity was being generated cheaply and abundantly it had to be brought into actual use through the instrumentality of the contractors.

Mr. WALTER RIGGS proposed the health of the chairman, and Mr. WALTON briefly responded.

During the evening songs, &c., were rendered by Miss Alice Lilley and Messrs. Robert Easton, Frederick Gregory, and Leonard Henry, with Mr. David Richards at the piano.

A Contractors' Dinner at Kidderminster.

There was a large attendance of electrical contractors at the Lion Hotel, Kidderminster, on January 24th, the occasion of the second annual dinner of the Circle of electrical contractors associated with the Shropshire, Worcestershire and Staffordshire Electric Power Co.

The Circle was inaugurated about 18 months ago in connection with the E.D.A. Campaign, and has been continued, having now a large membership of contractors from the area of over 1,800 square miles which is now supplied by the S.W.S. Co. The primary objects of the Circle are the promotion of closer relationships between the contractors and the supply undertaking, and the standardising of systems of supply and prices.

The company was presided over by Mr. J. T. H. Legge, chief engineer and manager of the company and chairman of the Circle, and the guests included the Mayor of Kidderminster, Mr. E. G. Eddy, and Lieut-Col. W. A. Vignoles, Director and Secretary of the British Electrical Development Association.

During the dinner music was provided by the company's loud-speaking equipment. Mr. Legge proposed the loyal toast, and Lieut.-Col. Vignoles the toast of "The Circle," which was responded to by Mr. W. Donovan, of Donovan and Co., Birmingham. Mr. B. French, Kidderminster, proposed "The Visitors," and this was responded to by the Mayor of Kidderminster.

During the evening a presentation of a case of pipes was made to Mr. E. E. Hamar, commercial engineer of the company and hon. secretary of the Circle; and to Mr. C. C. McLeod, Circle Officer, a two-bottle tantalus was presented. An enjoyable concert programme followed, by the "Merry Optimists" party.

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The Physical Society's Exhibition.—III.

Annual Display of Electrical Instruments and Scientific Apparatus.

Everett, Edgcumbe & Co., Ltd.

"Universal" moving-iron instruments introduced two years ago constituted a novelty in a.c. ammeters and voltmeters, not only as regards accuracy (being capable of sub-standard accuracy on a.c. and d.c.) but also in their immunity from the effects of changes of frequency, wave-form, and temperature; moreover, their power consumption was about one-fifth of that of the usual a.c. instruments. For certain purposes a demand has now arisen for instruments with an even smaller power consumption and suitable for still smaller current and voltage measurements; for this purpose a line of rectifier-operated moving-coil instruments consist of a specially adjusted moving-coil system, operated in conjunction with a series of four copper-oxide dry rectifiers (fig. 2) arranged in the form of a Wheatstone bridge. They are particularly suitable for a.c. measurements of small currents and low voltages, such as have hitherto necessitated the use of reflecting laboratory instruments. Almost any desired range can be provided: for example, ammeters which give a full-scale deflection with any current down to 1 mA and up to 500 mA, or, if used in conjunction with a small current transformer (which is self-contained in the case of portable instruments) up to hundreds of amperes. Voltmeters can be supplied to give full-scale deflection with 1 volt, and there is no upper limit.

Voltmeters and ammeters (other than those operated through current transformers) are equally available for use on direct current, being of the moving-coil pattern, dead-beat, high working forces (superior in this respect to the thermo-couple pattern) constancy of zero (as compared with the erratic zero of the hot-wire type) and an almost evenly divided scale throughout the useful range. The rectifier principle is also applicable to low consumption switchboard ammeters for use with bushing transformers, but in view of the low consumption and extreme dead-beatness of the latest pattern of Everett-Edgcumbe moving-iron ammeter, the extra expense and complication of a rectifier instrument is not often justified.

Bar type single-turn current transformer reliability, by the use of cores of nickel-iron alloy, has attained to very great precision, but the ever-increasing voltages in use in this country (for example, the 132 kV adopted for the "grid") make the currents to be dealt with extraordinarily small, so that the available ampere-turns of such transformers are so much reduced that it is essential to minimise the power consumption of the instruments connected to the transformer secondaries. To this end the company has introduced ammeters which consume only 0.5 VA at full-scale deflection and relays of all kinds consuming even less; by the use of such instruments, fitted with a ½-ampere current transformer secondary (in place of the usual 5-ampere one) it is possible to reduce the total burden on the current transformers to less than 2 VA, even with the very long connecting leads which are so often necessary in modern power stations. In this way, accurate single-turn current transformers are now available for full-load currents of 20 amperes, or less. The scale of these ammeters is so extremely open at the lower end (see fig. 3) that accurate reading of the high-voltage current is possible down to as little as 2 amperes. For the measurement of time intervals ranging from 1/20 second upwards, a meter (fig. 1) embodies a Warren synchronous motor, driving a pointer which is released and stopped by means of two solenoids, so that the rotation of the pointer shows the time interval between the closing (or opening) of the one circuit and of the other. The standard meter's pointer makes one revolution per second and an auxiliary pointer one revolution in 10 seconds; the dial is divided into 100 parts, so that 1/100 second can be read off. The construction is such that the time constants of the two solenoids are identical, so as to eliminate any error.

Another innovation is the metal-cased portable "Inkwell" grapher: whilst weighing exactly the same as the more usual wooden-cased instruments, it is eminently suitable for use in tropical climates, or wherever subjected to rough treatment, and the arrangement of carrying handle makes it easy to transport.

An interesting exhibit was a set of springs in various stages of manufacture: Messrs. Everett, Edgcumbe, are, we believe, the only instrument makers in this country who manufacture their own springs, a circumstance which enables them to keep exact control over this most vital part, for any departure from the predetermined sequence of heat treatment at once shows itself in a wandering zero, loss of constancy, and other defects. When it is mentioned that the thickness of many of the springs used is well under 0.0005 in. and that a spring 0.0005 in. thick exerts more than twice the torque of one 0.0004 in. thick, it will be realised to what a degree of accuracy it is necessary to work.

Fig. 1.—Time-interval Meter.

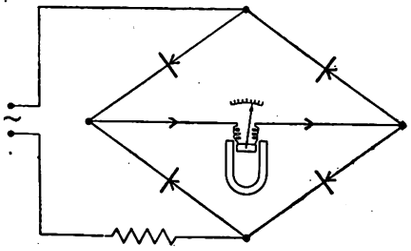

Fig. 2.—Rectifier-operated Meter Diagram.

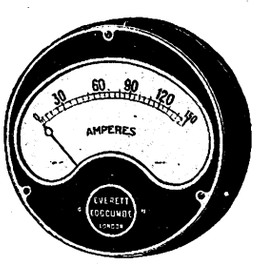

Fig. 3.—Low Power-consumption Ammeter.

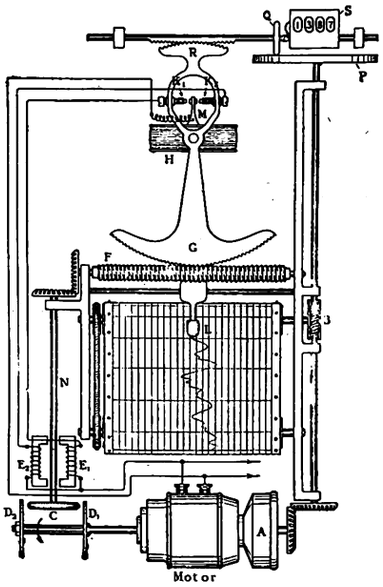

Fig. 4.—Integrating Equipment Diagram.

A recent addition to the train-testing relay recorders of current, voltage, speed, &c., for electric trains, consists in an integrating device suggested by Dr. G. V. Drysdale by means of which, not only are the quantities recorded graphically, but each is at the same time integrated throughout the journey, so that its average value can be at once determined. Fig. 4 shows the equipment diagrammatically, the lower portion representing the grapher and the upper part the integrating attachment. The counting train S is driven by a small friction wheel Q resting upon the driving disk P which is run at constant speed from the motor A and is so arranged that as the quantity to be measured increases in value the toothed sector R causes the wheel Q to traverse to the left; that is to say, further and further away from the centre of the driving disk P so that its speed is increased. In this way, the number of revolutions made by the integrating train S is exactly proportional to the product of the quantity to be measured into the distance moved by the chart (*i.e.*, the time); hence, the average value of the quantity measured can be obtained by simple division.

Electroflo Meters Co., Ltd.

For the control of high-temperature industrial heating a panel was arranged in four parts: associated with the double-pivoted pyrometer, essentially a high-resistance thermo-electric indicator with automatic cold junction temperature compensation, was control mechanism consisting of a depressor bar,

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periodically raised and lowered by means of a Warren synchronous motor, causing contact to be made in one of two electric circuits, depending upon the position of the pointer, *i.e.*, the operating temperature. Assuming that the furnace is cold, the depressor arm bottom contact is made; then a mercury vacuum switch inside the indicator is tilted by the motor and a circuit is established through the relay coil, causing the mercury relay switch to establish circuit to the contactor coil, so that the furnace current is switched on. The mercury switch is then broken by the motor, which, an instant later, raises the depressor arm; the circuit through the relay coil is broken, but the current is maintained in the contactor circuit by means of a holding switch, also operated by the relay coil. The furnace temperature continues to rise until the indicator pointer is above the control index, when, on the depressor arm falling, the alternative top contact is made; the mercury switch is then tilted as before, and a circuit is established which shorts the relay coil, breaking the contactor coil circuit. When the furnace temperature drops, the indicator falls below the control index and the cycle of operation is repeated, the furnace being maintained at the determined temperature by the position of the control index. The mercury vacuum switch eliminates the possibility of arcing at the contact; the coil box, also mounted on the panel, causes the indicating pointer to deflect to the right of the control index in the event of the thermo-couple burning out, or becoming disconnected, which ensures that the electricity supply to the furnace is cut off, so that no damage occurs to the charge, or furnace. The time switch enables the current to be switched on at a predetermined time, so that the furnace will be at the required temperature when it is desired to commence processing; it can also shut down the furnace automatically.

An absorption-type CO_2 indicator and recorder, with complete independence of water, glassware, and rubber connections, is operated by a 1/20-h.p. motor, driving a spur gear pump which exerts a suction equivalent to 12 in. mercury: a continuous supply of gas is drawn to the instrument, a definite sample being sealed off and forced to flow 8 in. under a baffle plate in the solution chamber, so that all of the CO_2 is absorbed; the residual gas then passes into a final measuring chamber and causes a bell to rise and a recording pen to move across a chart. An alternative model was also shown whereby electrical transmitting mechanism is operated as the bell rises; instead of a pen and pointer moving across a chart and scale, an arm is caused to add or deduct resistance in an electrical circuit.

Record Electrical Co., Ltd.

A change-coil ammeter, similar to the volt-ammeter set exhibited last year, but with the voltmeter portion omitted, is useful for testing over a range of from 6 to 600 A in six consecutive steps, d.c. and a.c., at commercial frequencies. It weighs 9 lb., and is 10.5 by 8.5 by 5 in. in size, fitted with a carrying strap.

A water-level indicator consists of a variable inductance (preferable in some respects to variable resistance) operated by a float, the a.c. being rectified and measured by a d.c. moving-coil "Cirscale" instrument; one of the latter also forms part of a tester for detecting the acidity of liquids by electrical means.

Radio Communication Co., Ltd.

The type RA.76 radio direction finder exhibited is applicable to spark, i.c.w., c.w., and telephony transmission over a range of from 550 to 1,100 metres. The frame aerial winding is enclosed in a rectangular chromium-plated copper tube mounted on a substantial deck pedestal (overall height of 6 ft. 9 in.) which does not cause visual obstruction. An indicating scale of large diameter and the control wheel rotating the frame (mounted on an extension below the pedestal) can be fitted over the chart table if required. The whole is non-magnetic, enabling the set to be fitted in the neighbourhood of the standard compass when necessary. Correction of quadrantal error up to 20 degrees is applied automatically, the setting being adjusted on calibration of the set, while the simplified method of sense indication becomes part of the normal process of taking a bearing. The amplifier controls have been reduced to four only, consisting of a single knob for tuning over the whole wave-range, reaction adjustment for increasing sensitivity and c.w. reception, sense switch to give direction on the line of bearing, and an on-and-off switch. The amplifier is of the superheterodyne type with a high intermediate frequency of the order of 75 kc/s. and the circuit arrangement successfully overcomes any tendency towards interaction between the oscillatory circuits and the frame aerial. Five low-consumption valves are employed, comprising a detector-oscillator, two screened-grid intermediate-frequency amplifiers, one detector with reaction, and one note magnifier. Under normal conditions the width of the silence arc is a few degrees only, and bearings are obtained with an accuracy of one degree after a little practice in about five seconds.

Baird & Tatlock (London), Ltd.

Amongst physical, chemical, and biological apparatus improved photometric bench devices were noticed; also a valve oscillator designed by Mr. D. C. Henry for obtaining a.c. for electrolytic conductivity work; and a new pattern of muscle thermopile: wound on a silver frame which is insulated with bakelite, the thinness of this insulator increases the heat capacity of the "cold" junctions, and they do not readily become warmed up; the "hot" junctions have a very small heat capacity, however, as they are stretched across the frame and no insulator is in contact with them except the thin bakelite insulation. The thermo-element is mounted on an *all-metal* base, coated with bakelite, which facilitates both a uniform temperature, resulting in a stable zero, and quickness in settling down, *i.e.*, 15 *minutes*, compared with *two hours* in the case of the old type.

Bellingham & Stanley, Ltd.

A hand fluorescence lamp fitted with a simple arc lamp in an asbestos chimney, which carries a filter glass passing the nearer ultra-violet light, has been designed for examining substances and medical diagnosing.

Isenthal & Co., Ltd.

A large selection of various types of mercury switches capable of handling currents up to 30 amps., some being suitable for use on circuits up to 1,000 volts, was on view and inexpensive mercury switch relays. A new direct-reading voltmeter which can be made for voltages up to 500,000 volts, consists essentially of two condenser plates between which an electrostatic field is created, the effect of the field upon a light rotating vane being directly shown as a luminous line on a scale according to the distance apart of the condenser plates. The instrument can be calibrated for comparatively low voltages (say, 1 to 10,000 volts) and the calibration curve extended up to any desired voltage. The movement of the vane is practically aperiodic and without friction. The instrument is very suitable for research, being independent of frequency; it is also used in connection with therapeutic and diagnostic X-ray work.

H. Tinsley & Co.

This large exhibit included a new alternating-current potentiometer, of the pattern of Prof. Pederson, of Copenhagen, for the investigation of audio-frequency voltages, which has been made in the test disk form for the International Standard Corporation's development research laboratory at Hendon.

Mr. O. E. Malinverno.

Representing Messrs. S. A. Brevetti Arturo Perego, of Milan, Italy, he exhibited portable safety telephone apparatus for straight connection to lines running along 33,000-volt overhead power lines. Its characteristics are such as to overcome inductive and electrostatic disturbances reaching the telephone and, in the event of accidental contact with the power lines, to prevent dangerous potentials reaching the telephone, or the operator. Besides the usual components of an ordinary telephone apparatus, the wooden box contains also two aluminium arms with h.p. fuses and hooks for connection to the line, and a telephone transformer. An earthed aluminium shield separates the primary coils from the secondary coil and also encloses both primary and secondary; the insulation between primary and earth, and between secondary and earth, stands a test of 30,000 volts.

Venner Time Switches, Ltd.

This exhibit consisted largely of time switches for widely different applications: for street and shop-window lighting, two-rate meter and maximum demand control, both electrically and hand-wound, with a neat solar device on some of the electrically-wound switches. An impressive instrument was a large current oil-break switch, which can be supplied to handle currents of 1,000 amperes at 600 volts, or up to 6,600 volts. The automatic time switch and coder adopted by Trinity House for Marconi direction-finding wireless beam lighthouses was arranged to repeat a given code station call in Morse by flashing lamps. Thermostats for the control of electric water heaters, stop watches reading to two decimal places of a second, the Venner-Dyke buoy lamp for 18 nights' operation consecutively without attention, for use on ocean cable repairs and maintenance, and the Venner C. & S. electrically-operated remote boiler water level indicator formed the remainder of the exhibit.

Research Section.

In the research and experimental section of the exhibition the British Research Association for the Woollen and Worsted Industries showed a photo-electric yarn-levelness tester. The British Thomson-Houston Co., Ltd., displayed apparatus for tracing visually the characteristics of radio loud-speakers and amplifiers. The Cambridge Instrument Co., Ltd., indicated a method of controlling a high-voltage supply by thermionic valves; also electrically-welded vacuo-junction joints. The General Electric Co., Ltd., demonstrated practical applications of photo-electric cells, amongst many other exhibits, and the Gramophone Co., Ltd., electrical reproduction, &c., while Mr. H. F. T. Jarvis had a new thermostat control device on view. The Air Ministry displayed an electrical wind direction recorder, Mr. E. B. Moullin exhibited a high-frequency ammeter which can be calibrated with a steady current, Dr. J. H. Vincent explained experiments with magnetostrictive oscillations at audio and radio-frequencies, while the National Physical Laboratory had a large exhibit of radio and other apparatus.

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Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

A New Cooking Outfit.

In the new No. 46 model cooking cabinet, fig. 1, of the Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1, a particularly interesting feature is that the hob and oven top are on one level, thus giving greater hob space than is usual with electric table cookers. The cooker is strongly constructed in cast-iron and steel, and the oven is made in one piece, vitreous enamelled inside, with all its corners rounded.

Fig. 1.—A " Jackson " Cooking Cabinet.

The cabinet can be supplied with mottled-enamel, nickel-plating, and other finishes. The oven cooking space is 15½ in. high by 13¼ in. wide by 15½ in. deep. The hot cupboard measures approximately 22½ in. wide by 17 in. deep by 8 in. high. The hob is fitted with two No. 86 hotplates and a grill, 10½ in. by 8 in. The hotplates are loaded at 1.5 kW each, and the grill at 1.8 kW. The loading of the hot cupboard is 500 W. The various units are controlled by 3-heat switches mounted in the front of the range, and each circuit is fused. The overall dimensions of the cooker are: Width, 48 in.; depth, 23½ in.; and height, 37 in., without splashplate.

New Polishing Irons.

The accompanying illustration, fig. 4, shows one of a range of " Elect " polishing irons which have recently been introduced by the ELECTRIC HEATING Co., George Street, Croydon. Six sizes are available, varying in weight from 3 to 8 lb., and with loadings ranging from 250 W to 600 W. The face of the sole plate is rounded and highly polished, while the cover is finished in nickel plate and also highly polished. Good-quality ruby mica is used for the elements. At a small extra cost a special earthing connector is supplied.

The " Met.-Vick " Electric Wash Boiler.

This strongly-made appliance is illustrated in fig. 3. The outer casing and lid are of blue enamelled steel and it has a container of stout-gauge copper tinned inside, the whole being mounted on three legs. The boiler is equipped with a standard 3-kW immersion heater which is accommodated in a sump at the bottom of the pan, being protected from the clothes by a removable perforated cover. The tank has a capacity of 10 gallons. If required, a tinned-copper spraying device can be provided. This forces a continuous supply of boiling soapy water through the clothes. The company considers that the boiler is particularly adapted to the requirements of hiring schemes.

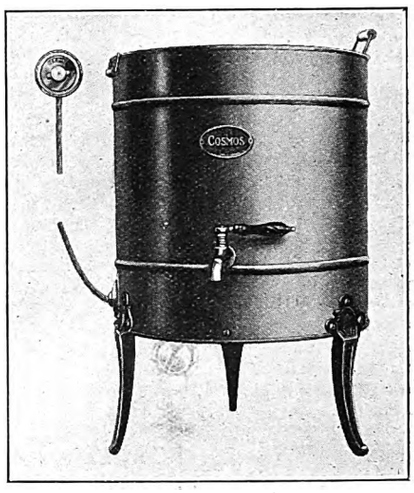

Fig. 3.—The " Met.-Vick " Wash Boiler.

A New Electric Heater.

The " Seymour " safety electric heater, fig. 2, an American production for which PROVINCIAL INCANDESCENT FITTINGS Co., LTD., Pifco House, 71, High Street, Manchester, have been appointed the sole sale concessionaires for Europe, probably represents a unique design for its class of apparatus. It is of simple construction, with a central enclosed element, and there is, it is claimed, a perfect diffusion of heat uniformly from all round the exterior. Other claims for the apparatus are that it is safe where there are children, and that it is suitable for warming children's food, shaving water, and so on; further, it is portable and can be used in any part of the

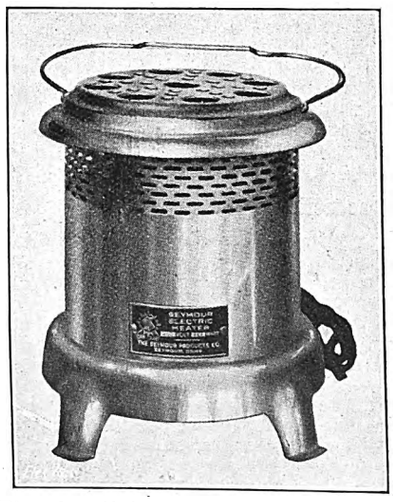

Fig. 2.—" Seymour " Safety Heater.

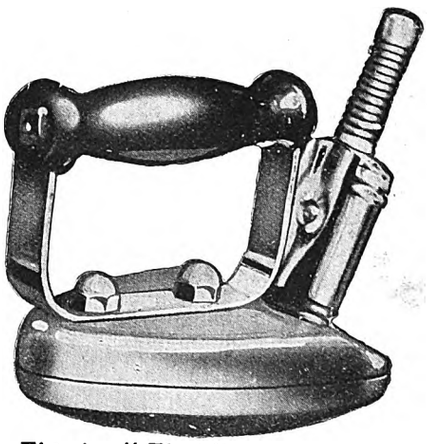

Fig. 4.—" Elect " Polishing Iron.

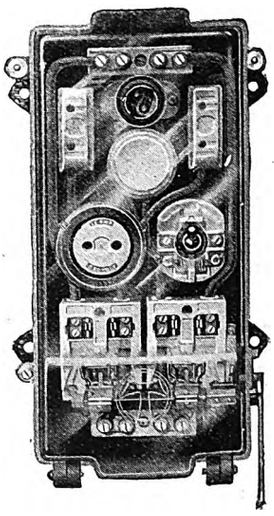

Fig. 5.—" Telac " Cooker Control Outfit, Ghost View.

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house. The dimensions are 10 in. high and 9 in. in diameter. The loading is 660 W, and the element is suitable for pressures of from 200 V to 250 V. The heater can be supplied in either cream-, pink- or blue-enamelled finish.

Cooker Control Units.

Simple and efficient control equipment for domestic electrical cookers is, of course, necessary, and where provision is made for plugging-in such subsidiary apparatus as irons, kettles, cleaners, and so on, the appreciation of the consumers has led to increased business. In this connection the cooker control units recently introduced by Messrs. J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham, are of interest. These are available in two types, the enclosed ironclad pattern and the open type on a wood base board. The latter is very simply constructed, and is intended chiefly to provide a cheap control unit for small "baby" cookers in housing schemes, and so forth. The ironclad units each incorporate a 30-A main switch and provision for a pilot light. Normally the pilot lamp is inserted through a slot in the cover, and it may serve as an extra point for small appliances, where, of course, such a procedure is sanctioned by the supply authority. For cases in which the supply authorities object to a b.c. lampholder, on the ground that it may be used for lighting purposes off the power circuit, an Edison-screw lampholder can be substituted. In the unit S.9,000, fig. 5, a subsidiary circuit consisting of a 2- or 3-pin socket (5 A or 15 A capacity), protected by d.p. fuses and controlled by an earthed-pattern tumbler switch, is provided. In this unit the pilot circuit is also protected by a fuse, in case the lampholder is used to take off current by means of a b.c. adaptor for some portable appliance. In another unit, S.9,010, a sub-circuit is again provided by means of a socket, but the controlling tumbler switch is eliminated, as is also one of the protecting fuses and the fuse in the pilot circuit. Other control equipments introduced by the company may be taken as standard, but adaptions are regularly being made to meet supply companies' requirements. Provision can be made for the incorporation of a lamp inside the case, with a bull's-eye glass in the lid, if preferred.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A Lightning Arrestor.

Marketed by E. R. Morton, Ltd., the "Wirt" lightning arrestor illustrated in fig. 1, seems to be a practical device. Through aerial and earth connections can be made with the

Fig. 1.—The "Wirt" Lightning Arrestor.

receiver without joints, which are liable to corrode; an air gap is sealed within a Bakelite moulding, which is provided with a large petticoat, so that it will retain its efficiency under adverse climatic conditions and provide a short, straight, path to earth for atmospheric discharges.

A Portable Receiver.

The new screen-grid portable receiver introduced by the General Electric Co., Ltd., follows convention in being

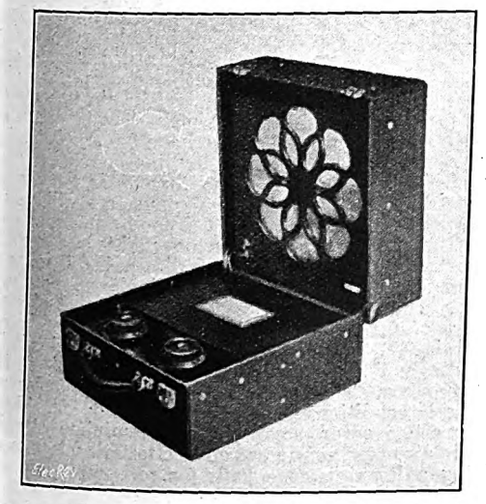

Fig. 2.—The "Gecophone" Portable Receiver.

divided into two sections, the main part housing the receiver and batteries, and the hinged lid the loud-speaker and frame aerial. Two tuning controls are provided, as well as a thumb-control reaction knob, while both long and short wavelength bands are covered, the change-over being effected by two switches, one on the left-hand side of the control panel and the other in the left-hand corner of the loud-speaker grille. Following the "Osram" screen-grid h.f. 2-volt valve, three successive valves comprise a detector and two stages of transformer-coupled low-frequency amplification, the last being a DEP.240 "super." The set is contained in a leatherette case (fig. 2), and its development has resulted in the production of a dependable non-spillable accumulator. Known as the 2-volt "Geeko" U-type, it has an actual capacity of 20 A, and, instead of the usual liquid electrolyte, a solid acid jelly surrounds the plates.

Improved "Exide DTG" Cell.

The "Exide DTG" cell is too widely known to need more than a very brief explanation of its design. Manufactured

Fig. 3.—Improved "Exide" Cell.

by the Chloride Electrical Storage Co., Ltd., it was developed to take the place of dry cells and primary batteries for prolonged small intermittent discharges, *e.g.*, bell work. The plates differ from ordinary comparatively thin plates, as they are massive slabs of active material enclosed in quite a slender antimonial lead frame, which construction permits of the plates standing idle for a protracted period (as much as two or three years it is claimed) between charges without undue sulphation. The advantages that the "DTG" cell has over dry and primary cells are its higher voltage per cell, stability

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of voltage when current is taken from it, and particularly the fact that when eventually fully discharged a recharge will restore the cell to a condition practically equal to new. Although the earlier designs gave satisfaction, they are now made more attractive in appearance and stronger than before, to withstand vibration in transit. As indicated in fig. 3, the two terminals are quite dissimilar in colour and shape and in size of screw thread, which distinctions, with the addition of polarity signs on the lid and box, ought to provide effectively for the observant, the blind, and the heedless. The ebonite lid is moulded on to the terminal posts and the plate group bars, which project below the lid, enabling the individual positive and negative plates to be securely burned to convenient lug projections on the bars. The plates therefore hang from the lid, which is supported on ledges in the moulded-glass box, and receive the desired lateral support from ribs cast in the wall of the box, but they have freedom to expand in all directions. The moulded ebonite lid is so shaped that when in position on the box ledges it forms a convenient trough with the inner face of the wall of the box, and the trough is filled with a sealing compound. A combined filling aperture and ventilation exit is sealed with a mushroom headed soft india-rubber plug.

A Potential Divider.

The potential divider illustrated in fig. 4, the height of which is 4⅛ in. and overall diameter 3 in., has been designed by the Mullard Wireless Service Co., Ltd., to enable many different values of anode and grid-bias voltage to be obtained from the domestic mains following the smoothing circuit. Very low voltages are obtainable by adjustment of the five wander plugs round the base, the total resistance between tappings 1 to 10 being 9,000 ohms.

It should be noted that a condenser of at least 2 mF capacity must be connected between each positive anode terminal of the receiver and the negative anode terminal; not more than 250 volts (input) should be applied to the divider, and in no case should the sum of the currents (output) exceed 60 mA.

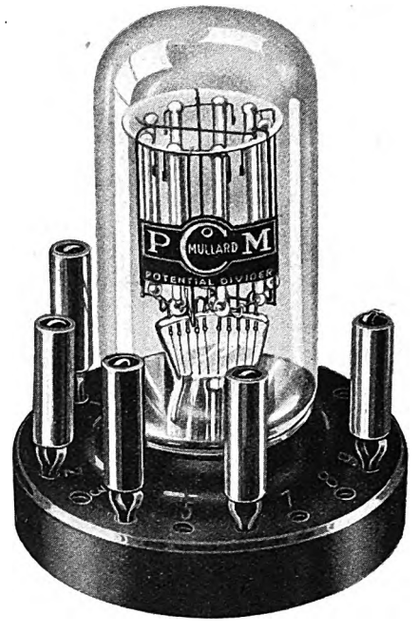

Fig. 4.—The P.M. Potential Divider.

Care must be exercised to prevent short circuits and avoid the possibility of receiving electric shocks.

The "Grid" Transmission System.

An outline of the chief constructional features of the 3-phase, 50-cycle, 132-kV (between phases) overhead lines being erected by the Central Electricity Board, the definite engineering costs included being reduced to a kVA basis to serve as a guide to the present economic position of e.h.p. systems in Great Britain.

By J. WRIGHT, M.I.E.E., and C. W. MARSHALL, B.Sc., M.I.E.E.

(*Extracts from paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE Electricity (Supply) Act, 1926, authorised the creation of the Central Electricity Board, to which was entrusted the construction of transmission lines and transforming stations required for interconnecting the power stations selected for supplying the national requirements of electrical energy and for providing supplies to undertakings which have no power stations. In almost all cases existing systems transmit large bulks of power from sources of energy to remote consuming points. In Great Britain the sources of energy are comparatively close to the users and to each other, and the function of the lines is to enable the most efficient power plant to operate at the highest load factor and to raise the plant utilisation factor by reducing the amount of spare plant required in individual stations. The interconnection of existing stations for this purpose has already been done on a comparatively large scale by many companies, so that the novelty of the grid scheme lies in its magnitude and the comparatively high voltage employed, rather than the introduction of any new principle.

The extent to which high-voltage transmission has been developed in other countries is illustrated by maps (in the original paper) of the main lines already constructed in France and Germany and a proposal for a national grid system in Spain. The comparative smallness of the British system,* as viewed from the standpoint of area of supply, is illustrated by a map of Great Britain superimposed on the area of a single large interconnected system in the United States. The systems in Europe, with the exception of Italy, are uniform in frequency and phase. France utilises 110-150 kV. The majority of German lines work at 110 kV, but the latest will operate at either 220 kV with an insulated neutral point, or 380 kV with the neutral point earthed. The Spanish scheme provides for a 220-kV ring main with 110-kV feeders and distributors. Most American systems operate at 60 cycles per second, although there is still a considerable amount of transmission at 25 and 50 cycles per second. The voltages used in America are very variable, the highest being 220 V. Lines operating at 132 kV are very extensively used in America; 30 companies operated lines of a total length of 3,824 miles in 1927, which represents an increase of 1,262 miles over that of 1926, and is a very definite indication that this voltage has proved satisfactory and successful in America. The complete British system will comprise 2,600 circuit miles of 132-kV overhead lines.

Overhead Lines.—The variation from normal voltage will not usually exceed ± 5 per cent. The voltage to earth will be maintained at a fixed maximum by directly earthing the neutral point of all transformers on the high-voltage side.

The choice of conductor material rested largely on the mechanical properties of the available metals. The difficulties in obtaining wayleaves and tower sites in towns made it essential to use spans of the maximum length. Steel-cored aluminium conductors are decidedly the best available in this respect, a further advantage being the protection afforded by the steel core against burning through in the event of a flash-over. The useful life of the conductors will very considerably exceed the 25 years called for by financial requirements. The standard line conductor consists of a central core of seven strands of galvanised-steel wire each 0.11 in. in diameter, surrounded by 30 strands of aluminium wire of the same diameter. The conductivity is equivalent to that of a copper conductor of 0.175 sq. in. cross-sectional area. The overall diameter is 0.77 in. The capacity of a single-circuit line is 50,000 kVA and the current corresponding to this at 132 kV is 219 amperes. The critical corona voltage under normal atmospheric conditions is approximately 184 kV. The earth conductor has seven steel and 12 aluminium strands, all 0.11 in. in diameter, serving as an electrostatic screen as well as providing a low-resistance path for returning fault current. Its characteristics are very different from those of the comparatively high-resistance steel wires usually employed on power lines, and, in view of the widely divergent opinions on the relative importance of the functions to be performed by earth wires, it will not be possible to demonstrate whether the extra expense is justified until actual experience has been obtained.

* ELEC. REV., January 25th, 1929, p. 168.

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Towers.—The single- and double-circuit mild-steel towers† are designed for a normal span length of 900 ft., but angle towers are so designed that when used with corresponding maximum angles of deviation the sum of two adjacent spans may total 2,000 ft. under favourable ground-contour conditions. The clearance of the lowest conductor to earth at a temperature of 50 deg. C. is 22 ft., while over buildings the minimum clearance is 8 ft. The vertical distance between conductors is 12 ft., and the projected horizontal distance is 3 ft. The minimum normal clearance between live metal and tower is 3 ft. 6 in. under the worst conditions of line displacement.

Three types of foundations, *viz.*, excavated earth, concrete ball, and ordinary concrete, are used, depending on the nature of the subsoil and also relative costs. The concrete ball foundation is new to Great Britain, but it is widely used in America; it is made by drilling a cylindrical hole for each tower leg and expanding the lower end of the hole to a spherical form by exploding a charge of dynamite in it. The tower leg stubs are fitted into position by means of a template, and the cavities are filled in with concrete; the operation is simple, accurate and economical.

Loading.—The vertical load is made up of the weights of the conductors, together with a coating of ice of ½ in. radial thickness, and the weights of all insulators and fittings. The transverse load is that due to (1) a wind pressure of 8 lb. per sq. ft. on the whole projected area of all conductors when coated with ice, (2) the horizontal resultant of the conductor tensions, and (3) a wind pressure of 25 lb. per sq. ft. on 1½ times the projected area of the members of one face of the towers. The longitudinal loadings are those impressed by the conductor tensions. These conditions are more severe than those called for in the recently revised Regulations of the Electricity Commissioners; under maximum loadings and broken-conductor conditions the factor of safety is 1.5.

Where concrete-ball or concrete-block foundations are used, the towers are earthed by means of galvanised-iron pipes 6 ft. long, 6 in. in diameter, and ½ in. thick. As a final precaution, sample towers are tested to destruction.

Insulation and Fittings.—The decision to use the cap-and-pin type with ball-and-socket fittings does not preclude the use of such types as the Spring-ring, Jeffery-Dewitt, Hewlett, and Motor if, in the future, their technical and economical disabilities, relative to the type chosen, are removed. The maximum working load on a suspension insulator string is 4,000 lb. The relative position of the arcing rings and horns, together with the number of units forming an insulator string, is such as to give a minimum wet flash-over voltage of 340 kV. The normal voltage to earth is 76,000 and the factor of safety is therefore 4.5. Light horns, designed principally to improve the potential distribution on the insulator chains, are quite inadequate for dealing with power arcs; hence the decision to use horns and rings of very robust construction. Except that one additional unit per chain is used at tension points, the electrical insulation is uniform.

Mechanical Vibration.—There is considerable danger of trouble from mechanical vibration: breakage of conductors at tension clamps or suspension points has always shown that the metal has become crystalline. The usual cause of vibration is the action of wind at right angles to the conductor, and although the amplitude of such vibration is much smaller than that caused by release from ice loading, it is in reality much more dangerous. The conductor tension is the predominant factor in determining the frequency and amplitude of the vibration. That vibration may occur in a particular span and not in others which are seemingly identical is probably attributable to differences in towers or foundations; it is even possible that the sources of vibration are in the towers. If vibration which so arises is free to travel continuously over the conductors without being absorbed at tension points, or towers, that is probably the most general solution of the problem, but it appears to be exceptionally costly. So far as has been practicable, the grid lines have been arranged to be outside the danger zone, but arrangements have been made to measure and record the magnitude of vibration; it will therefore be possible to fit at danger points special anti-vibration devices should such prove necessary.

"Grid" Protective System.—Well-built high-voltage transmission lines are very free from operation troubles, in comparison with lower-voltage lines, because of their stronger mechanical construction and the very large spacing of the lines, which eliminates trouble due to birds, branches and (in some cases) lightning. Modern conditions, however, demand absolute continuity of supply, and it would appear that existing types of protective gear could safely be adopted for the grid; pilot-wire systems offered the best probability of obtaining rapid and sensitive discriminative protection, but their cost is not justifiable on long lines where other forms of gear can give almost as good results. Impedance or reactance relays are the only alternative at present available and are being used on the long sections of the Scottish lines to operate in case of excessive or incorrect flow of current. To guard against abnormal increases of potential due to lightning and abrupt load changes, it was finally decided to rely on a high-conductivity earth wire, provision of arcing rings and horns, reinforcement of transformer end-turn insulation and earthing the neutral point. No lightning arrestors will be used in the first instance, but klydonographs will be installed at specially exposed points in order to measure the voltages which are actually induced.

Inductive Interference.—From an electrical standpoint the most important subject on which complete information is not yet available is that of the effects produced on communication lines by the currents in power lines. The International Consultative Committee on Long-distance Telephone Communication calls for a coefficient of deformation of wave-form of not more than 5 per cent., and the alternators supplying power to the grid will fully meet this requirement; transformers operate at low flux density, so that they do not introduce appreciable wave-form distortion. The large line conductor diameter effectively prevents the generation of voltage harmonics by corona formation, and further measures which have been taken are triangular spacing and frequent transposition of the power lines. The distance between the grid lines and existing communication lines has been kept as great as possible and care is taken to avoid long parallel sections. Danger exists from electrostatic effects for a distance of approximately 400 yards on each side of the 132-kV lines. Where it is impossible to arrange for the desired amount of separation, it is necessary to ensure that the energy acting in the communication circuit will not exceed 0.02 joule.

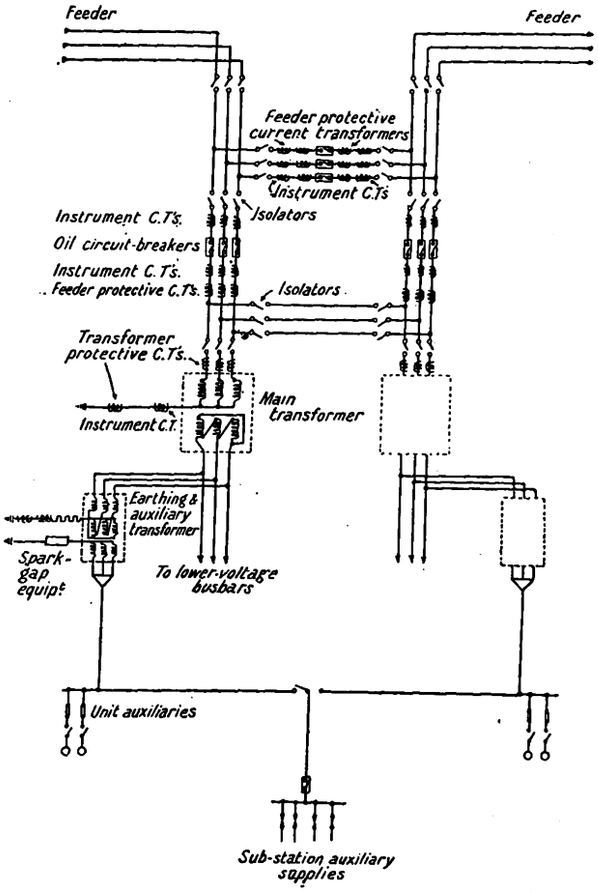

Fig. 1.—Diagram of Connections for 3 Circuit-breaker Sub-station.

The specific resistance of the earth is a predominant feature in determining the induced voltage, and it is also certain that the value chosen by Rüdenberg (5×10^{-14} C.G.S. units) gives too high voltages in most cases. Each country must determine the appropriate resistance for its own conditions, and it has been definitely decided that the earthed-neutral system is better than the insulated-neutral system as regards non-interference with communication circuits: the number of faults which occur on the power lines is reduced, selective protective apparatus is much more rapid and certain in action, so that a fault can be eliminated in a small fraction of a second, with the result that the duration of large earth currents, which are most to be feared, is very small. With fully-insulated neutral points there is also a tendency for faults to occur simultaneously on different phases at widely distant points on a system.

Sub-stations and Switchgear.—Six basic types of outdoor sub-stations were designed, fig. 1, as follows:—

L.N.E.	3 circuit breaker, non-extensible ...	low type.
H.N.E.	3 circuit breaker, non-extensible ...	high type.
L.E.	3 circuit breaker, extensible ...	low type.
H.E.	3 circuit breaker, extensible ...	high type.
L.D.B.	double busbar	low type.
H.D.B.	double busbar	high type.
C.	connections only between transformers and feeders.	

† ELEC. REV., October 28th, 1927, p. 751.

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Type L.N.E. (fig. 2) provides switching arrangements for two 132-kV lines and two transformer banks, and it has a by-pass connection to enable each transformer bank to operate from either of the supply lines, normally kept open, and one transformer switch and the section switch must open automatically in the event of a fault occurring in either a line or a transformer. This arrangement utilises the minimum of apparatus consistent with rapid resumption of service after a fault. It has been chosen in preference to the more usual lay-out in which a circuit breaker is installed on each feeder, in addition to those included in the design under consideration, because of the saving in cost, the reduction of maintenance charges, and the decreased number of danger points brought about by the simplification. Choice of design in any particular case depends entirely on site conditions: the H.D.B. arrangement (fig. 3) reduces the floor area required to the minimum, but involves the use of more structural steel and increases the height, so that inspection and maintenance are somewhat more difficult; it is only used where sufficient space for the L.D.B. type cannot be obtained.

The factor of safety of the complete structure is 2.5; the material is the same as that of the transmission-line towers, and the busbars are hollow tubes 0.9 in. in. diameter, the copper cross-sectional area being 0.3 sq. in. The suspension insulators are identical with those on the overhead lines.

The main 132-kV circuit breakers, built up of single-phase sets, have a rated rupturing capacity of 1½ million kVA and their tanks are mild-steel cylinders with cast-steel covers of the same strength; the contacts are of the explosion-pot or multiple-break type. Each tank is fitted wih valves and screwed caps for coupling it to the oil-filtering and storage plant. The circuit breakers are normally operated from a 110-V storage battery, and they can be controlled locally, or from a remote point, but not from both points simultaneously; hand operation can be resorted to in the event of failure of the electrical gear.

The isolating switches are of the rotating centre-pillar type, the three forming a 3-phase set being interconnected mechanically so that they can be operated simultaneously manually, but provision has been made for subsequent electrical control should it prove necessary. The isolating switches are interlocked with the main circuit breakers, and on double-busbar equipments it is impossible to make a connection to both busbars at the same time. Further interlocks prevent a transmission line earthing-switch being opened, or closed, until the isolating switch on the line is open; or a by-pass switch being opened, or closed, unless the parallel circuit is complete.

The current transformers are of the single-turn bushing type, fitted over the insulators of the primary conductors, and the secondary windings can be left open-circuited on full primary load without being damaged. The standard full-load secondary current is 0.5 ampere. Potential transformers are connected to the lower-voltage side of the main transformers. The equivalent transformation ratio is 132,000/110 and the secondary winding is tapped in steps of 1.43 per cent. for a range of ± 10 per cent. to correspond to the tappings on the main transformers. In addition, the potential transformers are compensated to allow for the voltage-drop in the main transformers, so that their secondary voltage is a true measure of the line voltage.

The sub-station auxiliary services are supplied from tertiary windings on the earthing transformers. The standard voltage is 400/230 V, converted to 110 V direct current for battery charging (to operate the circuit breakers and to supply emergency lighting) by motor-generators.

A copper earth conductor of 0.25 sq. in. sectional area runs round each station and an earth plate is sunk at each corner of the earth-bar system; care is taken in all cases to ensure

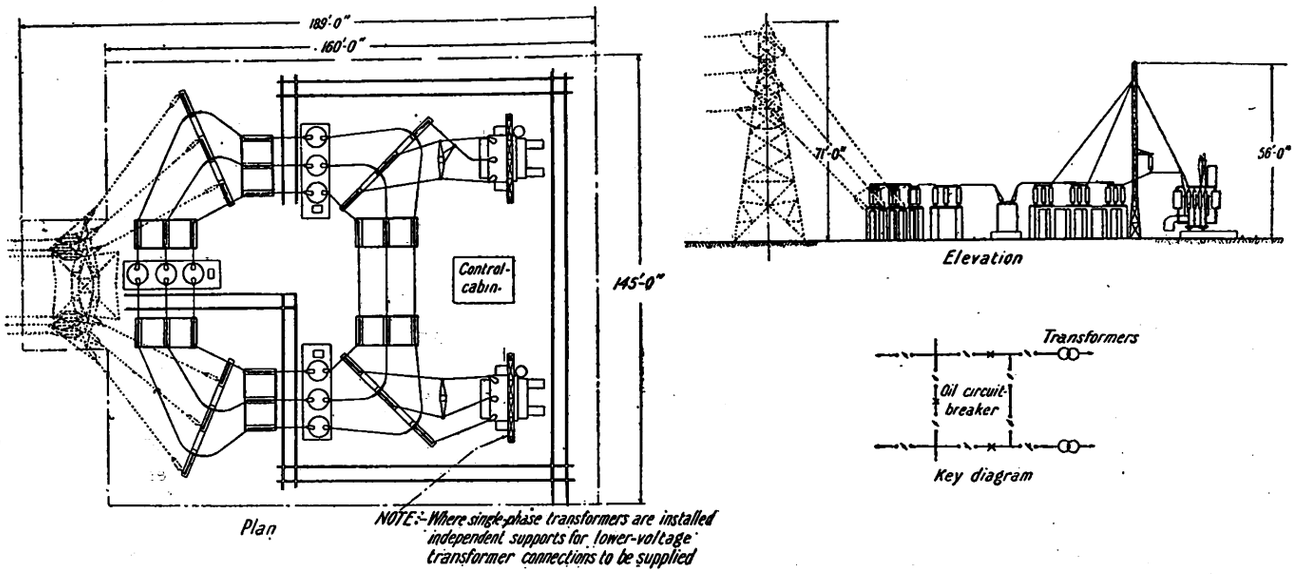

Fig. 2.—Typical Lay-out of Low Non-extensible Sub-station.

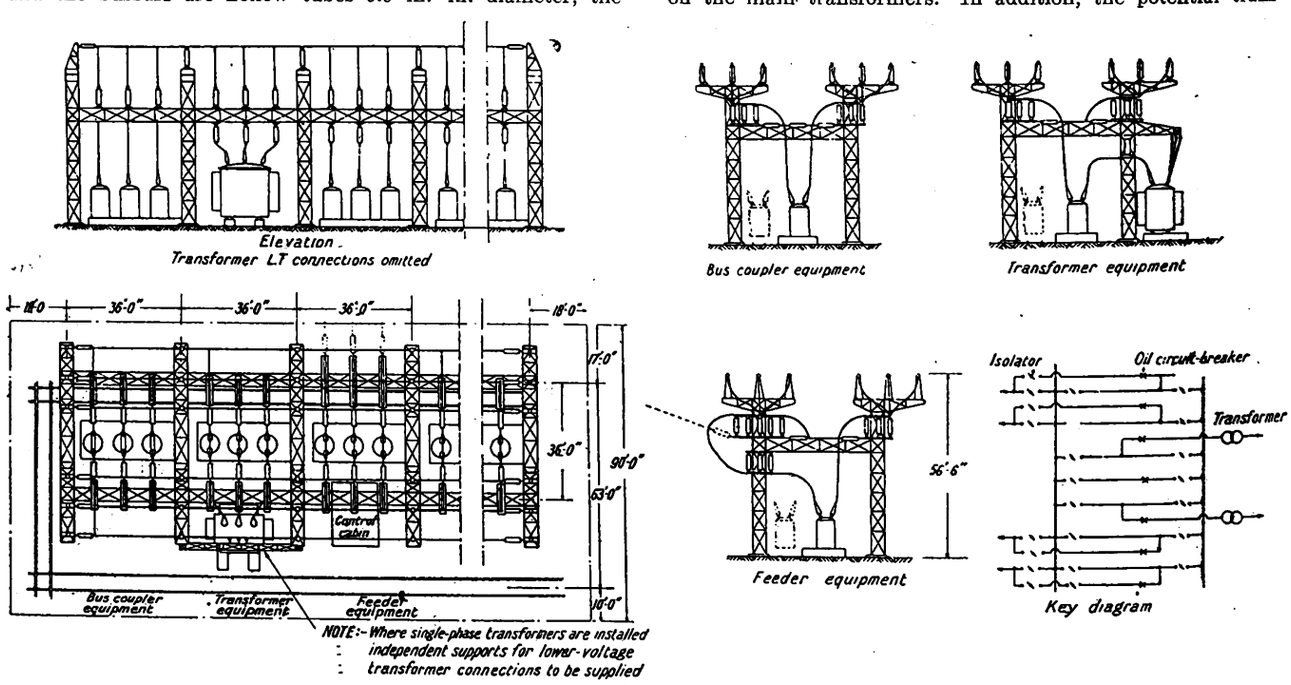

Fig. 3.—Typical Lay-out of High Double-busbar Sub-station.

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that the earth in the vicinity of the plates can be kept permanently damp.

Operation of the Grid System.—In the earlier stages each section, such as Central Scotland, South-East England, or Central England, will function as a separate unit; district engineers will be in general control and all operations will be done by local operating engineers in accordance with their decisions. There will be a central point in each district from which all operations for that district will be carried out, or supervised; each district control engineer will have telephone communication with all power and transformer stations in his area. A special control room will be provided in each area, in which all the apparatus necessary for guiding the engineers will be located. The indications which are considered to be essential to the control engineer in a particular district are summarised briefly by giving the readings which are provided for him by all stations, as follows:—

(1) The operating positions (whether open or closed) of all circuit breakers, isolating and earthing switches.

(2) The transformation ratio in use on each transformer bank.

(3) The load which is being imported by or exported from each station, together with the current and power factor.

(4) The current, voltage, and power factor in each feeder circuit.

(5) The plant in operation and available for operation.

The operating positions of the 132-kV line and sectioning circuit breakers will be transmitted automatically to the central control room, but no automatic indications of the isolating and earthing switches will be provided, as operation is purely a local matter, and any sudden abnormality is sufficiently indicated by the load variations accompanying it. The isolating switches will usually be operated only after communication with the control engineer, who will thereafter register their positions on his diagram. In the event of a local engineer being forced to operate such switches on his own initiative, due to emergency conditions, he will notify the control engineer of the alterations made. The load-indication instruments show the power and the wattless component of each circuit.

The transmission of automatic indications from remote points will be accomplished through telephone pilot wires in the sections of the grid which are at present being constructed; the possibilities of transmitting such indications by carrier-current systems are not being neglected. The function of the control engineers is to direct the operating engineers in the power stations and sub-stations, who will retain direct control of the plant, as at present. The operating records and statistics, as well as the meter readings required for accountancy purposes, will also be kept at the control rooms.

Transport.—It was decided for the time being to limit 3-phase transformers to 30,000 kVA capacity, to comply with the railway companies' requirements. Special wagons are being built to enable both the railway and road sections of the journeys to be made expeditiously.

Transformers.—All on the 132-kV system are for outdoor working: both core and shell types will be used, of 30,000 kVA or less of the 3-phase type, while those of higher capacity are made up from single-phase units. The standard capacities to be used are 7,500, 10,000, 15,000, 20,000, 30,000, 45,000, 60,000, and 75,000 kVA. Natural colling is used on the smallest, and larger ones have natural cooling up to half load or slightly more, while at higher loads forced air-blast cooling may be applied directly to the radiators on the transformer tanks, or to separate coolers with forced oil circulation. This is a definite departure from existing British practice and has marked advantages over water cooling. The auxiliary cooling plant operates only under emergency conditions and the risks due to corrosion or leakage are reduced.

The 132-kV windings are star-connected, the neutral point being connected permanently and directly to earth. The lower-voltage windings are delta-connected. In some cases the lower-voltage windings are in two parallel sections so as to provide two secondary pressures. The transformers have high impedance and their windings are very strongly constructed and supported. Adjustable clamps are provided to take up shrinkage of the insulating material. Voltage-regulating equipment can be operated under load for variations of ratio of ± 10 per cent. from normal in steps of not more than 1.43 per cent. One per cent. of the turns at each end of the phase windings is insulated to withstand full line voltage between turns for three seconds. The next 4 per cent. is graded so that at 5 per cent. of the number of turns from each end the insulation can withstand one-third of full line voltage for three seconds. The remainder of the winding is, except at tappings, insulated to withstand one-fifth of full line voltage for the same period. The insulation between turns of the tapped coils and 3 per cent. of the windings on each side can withstand one-third of the full line voltage between turns.

The terminal bushings are fitted with arc rings to allow of flashing-over without damage to the porcelain and conductors. Flexible connections are used between the bushings and the windings so as to avoid damage if there is any relative movement between them, and preference is not shown for either condenser-type or plain oil-filled bushings, but all types used in any particular schemes are mechanically interchangeable. An alarm device gives warning in the event of the winding temperature reaching 100 deg. C., and closes the tripping circuits of the breakers controlling the transformers if it rises more than 10 deg. C. above the temperature at which the alarm is given.

Except at three-shift power stations where permanent earthing facilities exist, a separate earthing transformer is provided for the secondary side of each 132-kV transformer; its main interconnected-star winding is directly connected to the lower-voltage side of the power transformer, and an auxiliary star-connected winding gives 400 volts, 3-phase, and 230 volts, single phase. The neutral point of the earthing transformer primary is earthed through a resistance. The earthing transformer can carry the full auxiliary load of the station auxiliary motors and lighting system continuously, and, in addition, any earth fault current for 15 seconds. The earth fault current is of the order of 400 to 900 amperes. The capacity of the auxiliary windings is 100 kVA, plus the kVA required for the station auxiliaries.

(*To be concluded.*)

Discussion in London.

Mr. W. B. WOODHOUSE thought the paper was a splendid account of the Central Electricity Board's work and it reflected great credit on British engineers; he hoped it would reflect equal credit on the manufacturers of the equipment when completed. It did not state how the "grid" had been designed, but the ruling principle seemed to be security, efficiency, and reasonable capital expenditure. It should be remembered that trivial causes might lead to serious disturbances: there were many reasons for adopting the 3-phase system, but they were not overwhelming and there might be cheaper methods. A 6-phase system would enable balanced protection to be employed, but six wires were too many and too costly, as stronger towers would be needed to resist the greater wind pressure. A 4-wire system might, however, be tried, and he had obtained the permission of the Electricity Commission to erect a section of such line experimentally. The use of 110 kV was commonplace in America; 200 kV was considered satisfactory there, and they regretted not having adopted 300 kV because the higher the pressure the less likely were the lines to be disturbed by lightning storms. The C.E. Board had been almost forced to use steel-cored aluminium lines for long spans; the weakest link in the chain was the switchgear, which appeared to be too costly and would not be really reliable.

Mr. R. O. KAPP pointed out the C.E. Board was doing more than merely follow the fashion; it had set the industry tasks which had been fulfilled well, and so set the fashion. The British "grid" had been designed as a whole, whereas those existing in other countries had grown bit by bit and were therefore uneconomical and difficult to operate with any degree of "loose coupling." The junctions of the ring mains would be "loose coupling" points and the rings themselves would always remain rings. The only thing that was certain about an urban system was that it would be inadequate a few years after its completion, but they need not be pessimistic about the "grid" in that respect, for only a small proportion of the total load would pass over it; it would work harder during the second and third years of its existence than during the fourth and fifth, and after that its growth would be due to the obsolescence of generating plant rather than increase of load.

Mr. A. PAGE remarked that the title of the paper might be extended to include the words "operation" and "maintenance." No time had been lost in presenting facts to the I.E.E. and through it (which was the right way) to the industry, and he hoped full advantage would be taken of the discussion so that the final "grid" would represent British engineering. Reliability received first consideration and involved reduction of corrosion, avoidance of insulator failure, selective protection, avoidance of interference with Post Office communication lines, and appearance acceptable to the public, all without extravagance in first cost. He paid tribute to the Post Office, railways, local authorities, and land owners for the public spirit they had shown. The electrical industry had been able to answer any call made upon it and all orders had been placed in Britain.

Mr. J. R. BEARD explained how the tops of the overhead-line towers had been modified to give them a tapering appearance, which improved them. The style and arrangement of the sub-stations, including the installation of few large, in preference to many small, transformers were the most preferable from the point of view of capital cost. He exhibited a lantern-slide map indicative of the progress made with the erection of the lines in South-East England, and said the fact that wayleaves for some 350 towers had already been obtained was a tribute to the energy of the C.E. Board's officers.

Mr. W. A. COATES considered it was not quite accurate to say that the manufacture of high-voltage equipment was breaking new ground. Soon after the 1914-18 war at least four makers commenced the development of such gear and it was available before the "grid" was decided upon; of course, it had since been improved. In the U.S.A. the low type of sub-station had not been quite satisfactory, as the forest of steel work around the high type of station protected it against atmospheric disturbance. The comparison of the cost of land with that of the steel structure of a double bus-bar station was not quite fair, for one insulator failure might cut across both bus-bars; such an accident could be avoided by erecting an addi-

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tional steel member across the centre of the sub-station, which would absorb any saving of cost that might have been made.

Mr. R. BORLASE MATTHEWS pointed out that so far they had only heard rumours of what was being done, but the paper abolished all doubt that they had a system in advance of anything elsewhere, and it was always well to set the fashion. He was pleased to learn that ferro-concrete poles had, at least, received attention; also that protective pilot wires had not been adopted, for they might necessitate catenary suspension, which would add to the unsightliness of the lines. The paper did not include data relative to the secondary transmission system.

Captain J. M. DONALDSON (chairman), on account of the lateness of the hour, asked for other contributions to the discussion to be submitted in writing for publication in the I.E.E. *Journal*.

Mr. C. W. MARSHALL replied to the discussion, Mr. Johnston Wright having read the paper in abstract. The assumption that the national system would be loosely coupled was correct, local lines being more rigidly coupled, and the design was such that the series impedance of the transformers could be taken advantage of if necessary. He doubted whether the claims made for other than the 3-phase system would be forthcoming in practice; electrostatic dissymmetry was not so pronounced in the 3-phase case. In this country they had to contend with atmospheric pollution, rather than lightning.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Size of Generating Sets.

With reference to the recent announcements made in connection with the manufacture of generating sets of such large capacity as 67,250 kW, we should value the opinions of some of your readers on the advisability of the principle of "placing so many eggs in one basket."

Without in any way wishing to take any specific example, but rather to treat the principle of the matter, we consider one of the basic facts of continuity of supply to be—that the capacity of the largest set running on any system be governed by the ability of the remaining machines to take up its load in the event of its failure.

Whilst realising the economies to be effected in such directions as:—

(1) cost per kW of plant installed;
(2) operating costs;
(3) overall efficiency (at full load),

it must be admitted that no generating set yet made has been guaranteed against failure, and also that the loss of a 60,000-kW machine, to the comparatively small systems in this country, would, to say the least, upset the load-distribution, if not endanger the supply.

We repeat that further opinions on this subject, which to us is interesting and topical, would be valued.

H.².

January 24th, 1929.

[It should be borne in mind that when the "grid" is in operation, "small systems in this country" which are not connected with it will be much too small to contemplate the use of large generating sets; and the failure of a 60,000-kW set will not upset the grid, one of the principal functions of which is to render stand-by plant superfluous.—EDS. ELEC. REV.]

Lamp Trading.

Mr. R. E. A. Mallet mentions another instance of the trader being badly let down, and his remarks tally with our own experience. But it is on the lamp question that the trader stands most in need of fair play from the manufacturers—in this case a "ring."

I use the word "ring" with no malice aforethought, but simply through a desire to call a spade a spade. If no "ring" was involved there would be no occasion for comment because, then, being free to buy in the open market, traders would have an obvious and simple remedy.

Lamp business should be one of the "plums" reserved for the traders who have expended energy in the cultivation of it. The fact that anyone without any electrical knowledge can *now* hand lamps over the counter is no reason why any 'cute tradesman who has had no hand in the spade work of created demand should be invited to edge in for the profits.

I am optimistic enough to believe that the E.L.M.A. must see the need of giving fairer backing to the trade. I would like to challenge the E.L.M.A. to deny the accuracy of the following: That, despite its official definition of a retailer, any individual having any kind of business premises can be proposed by the E.L.M.A. representatives and thereby secure full reseller's discount by signing the agreement.

Surely, the E.L.M.A. has not such a narrow outlook as to imagine that Tom, Dick, and Harry side-line "merchants" are necessary to sell its wares?

I shudder at the prospect of the barber, with his razor on the upstroke, asking me: "How are you off for electric bulbs?"

J. H. Noble,

Director, THE ELECTRO-MECHANICAL SUPPLIES, LTD.

Coventry, *January 22nd*, 1929.

Load-Levelling.

Mr. W. Holmes, at the outset of his interesting paper on "Load-Levelling Relays," as reported in your last issue, mentions the change-circuit system as "one of the most interesting schemes yet put forward in a practical way." In the next sentence, however, this favourable comment is spoiled by the statement that "it needs additional mains and special gear at the receiving end."

May I point out that these are not characteristics peculiar to the change-circuit system; they apply to load-levelling operations of any kind, the only difference being that the change-circuit system gives a far higher return on the comparatively small additional capital entailed than any other system can. Moreover, the change-circuit system will meet the situation entirely, continuously and accurately dove-tailing the two loads, *viz.*, the constant-pressure and the variable-pressure demands, under every variety of conditions.

While there is undoubtedly a field of application for the ingenious load-levelling relay of Messrs. Ferranti, neither it nor any other device of this character can automatically and continuously level up the load and increase the load factor in a degree comparable with that of the change-circuit system. Moreover, the latter system is the only one which is immune from the possibility of increasing the maximum demand on the generating plant, a most important point when purchasing in bulk, as many supply authorities will shortly be doing.

The problem can be looked at from the point of view of return on extra capital expended, or from that of public utility and service, with equally satisfactory results in favour of the change-circuit system of supplementary supply. As to cost of mains; in any event existing l.p. mains are too small to carry the extra loads which are inevitable on cultivation of the all-electric house scheme and kindred projects. Additional mains for these loads, if for constant-pressure supply, will cost substantially more than their equivalent for change-circuit supply, and they will not do the work so effectively, or cheaply, to either the consumer or the supply authority. Any station engineer who will take the trouble to go into the question of the alternative methods will verify these statements.

The variable-voltage meters mentioned by Mr. Holmes are not required on the change-circuit system, and the expensive item of meters for consumers' premises is saved. The heat-supply electric service is easily arranged by fixed payments per quarter, based on the size of the consumer's plant; thus, the consumer knows exactly what his liability is, and he gets his hot-water supply and cheap room heating automatically and without attention on his part, the simple apparatus being in the custody and under the control of the supply authority. The only meters required are the ordinary watt-hour meters on the primary side of the induction regulators in the sub-stations.

Geo. Wilkinson.

Harrogate, *January 28th*, 1929.

Gramophone Reproduction.

The contribution by Mr. E. W. Braendle in your last issue on the above subject is interesting, but may mislead readers in some respects. To save space in your "Correspondence" columns I propose to quote from the article and give my comments rather baldly: further explanation and proof could be given if space were available.

1. P. 140, first column: ". . . the audible quality of any tone depends entirely on the amplitude of the harmonics, not on relating phasing. . . ."

True for sustained notes of unchanging amplitude, but almost certainly untrue in other cases, which make up much of music.

2. End of p. 140 and beginning of p. 141, dealing with "pick-ups": "In any case, . . . the damage to the track is considerable; . . ."

The passage is not clear, but I read it as a statement that "damping" a pick-up is the cause of record wear. In actual fact, each of the three components of the mechanical impedance (elastic reactance, viscous resistance, and massive or inertia reactance) causes wear of a different part of the groove, and the question is much too complicated to be discussed in half a column. I hold that the suggested test by feeling a pick-up for "resilience" is quite useless. Your contributor does not mention electromagnetic damping, which is important. Working a pick-up into an unsuitable electrical load may upset it entirely.

3. P. 141, first column: ". . . the 'cutting-off' at this frequency (5,000 cycles) would not be noticed. . . ."

Obviously not, for in actual practice nothing is normally recorded above this frequency; the recorded range is only

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150-4,500 cycles at full value, and the falling off is sharp at the upper end.

4. Same, next paragraph: your contributor vastly exaggerates the difficulty in designing gramophone amplifiers. Owing to the restricted frequency range (say, 100-5,000 cycles) they are much easier to design than broadcast radio receivers, which call for 40-8,000 cycles. I should certainly reject for radio work either of the designs he shows, though they would be fairly satisfactory for a gramophone.

5. P. 141, second column: "Loud-speakers of the moving-iron, or 'reed,' type have not, so far, seriously competed with the moving-coil pattern . . . " (either for power or frequency range, he explains).

I imagined it was common knowledge that my own firm's "Lion" moving-iron speaker has a power capacity equal to that of the few really first-class coil-drive types, and that the biggest musical experts have spent the last few months trying to decide which is really the better. In the long run it seems to have come down to a matter of personal taste: both the "Lion" and the first-class coil-drive speaker are practically perfect to all but the highly trained specialist's ear.

6. Same, next paragraph, on output transformers "... . the transformer method is adopted as being the most satisfactory . . . ."

Your contributor does not mention the important advantage of a choke (or a *choke-fed* transformer) of allowing the large audio-frequency component of current in the last anode circuit to flow directly to the filament. This is essential with mains units of the normal rather high internal resistance, as otherwise there will be retroactive effects (positive or negative) which may completely ruin the frequency characteristics of the amplifier.

7. Generally, I am afraid that your contributor is not entirely up-to-date: much has been learned in the last year or two by those directly engaged in the electrical reproduction of music.

P. K. Turner, M.I.E.E.,
Chief Radio Engineer,
GRAHAM AMPLION, LTD.

Slough, *January 26th*, 1929.

Cost of Running a Private Motor Car.

I should like to communicate with some fellow reader on the subject of what is a fair allowance to an employé of a firm who owns his own car and runs it for business purposes. It is assumed that the cost of a new car is £275 and that he runs 10,000 business miles in an industrial area per annum, and that the car is in use on the firm's business for 5 days each week.

F. J.

January 28th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

20,692. "Electric arc lamps." Siemens-Schuckertwerke Akt. Ges., O. Krell, and H. Gerdien. August 5th, 1927. (303,534.)

24,938. "Electrical distribution boards and structures." G. Heptonstall and W. Shaw. September 22nd, 1927. (303,391.)

25,722. "Electric switchgear." British Thomson-Houston Co., Ltd., and E. D. Regis. September 29th, 1927. (303,427.)

25,849. "Electric switchgear." British Thomson-Houston Co., Ltd., and E. D. Regis. September 30th, 1927. (303,458.)

25,981. "Composite signalling conductors." Electrical Research Products, Inc. October 6th, 1926. (278,705.)

26,054. "Coil-winding machines." Hotpoint Electric Appliance Co., Ltd., E. R. Clarke, and W. J. Sims. October 3rd, 1927. (303,434.)

26,063. "Method of, and apparatus for, rendering an alternating-current differential wattmeter independent of frequency when employed as a resistance meter." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). October 3rd, 1927. (303,460.)

26,158. "Electric combined control switches for automobile lighting, signalling, and horn-sounding." J. Bathgate. October 4th, 1927. (303,462.)

26,193. "Electrical transformers or couplers." F. W. Twort. October 4th, 1927. (Cognate application, 31,983/27.) (303,541.)

26,194. "Electric signalling devices." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. October 4th, 1927. (303,465.)

26,297. "Sparking plugs." R G. L. Halford. October 5th, 1927. (303,549.)

26,301. "Electrical contact devices." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). October 5th, 1927. (303,550.)

26,302. "Composite sets for telephone and telegraph lines." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). October 5th, 1927. (303,551.)

26,303. "Automatic telephone systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. October 5th, 1927. (Addition to 268,862.) (303,552.)

26,315. "Variable-inductance devices." Igranic Electric Co., Ltd., and G. Holdway. October 5th, 1927. (303,553.)

26,369. "Electric inspection lamps for motor-vehicle use." L. T. Payne. October 5th, 1927. (303,555.)

26,421. "Load-discriminating systems for electric circuit breakers." A. Reyrolle & Co., Ltd., and R. Willoughby. October 6th, 1927. (303,558.)

26,487. "Composite electric conductors." W. E. Beatty (Bell Telephone Laboratories, Inc.). October 6th, 1927. (303,561.)

26,503. "Rectifiers for alternating currents." M. Singelmann. October 6th, 1926. (278,731.)

26,540. "Contacts for electric switches and circuit breakers." A. Reyrolle and Co., Ltd., and J. R. Smith. October 7th, 1927. (303,563.)

26,759. "Electric protective arrangements." A. Reyrolle & Co., Ltd., and H. Leben. October 10th, 1927. (303,571.)

26,793. "Semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. October 10th, 1927. (303,575.)

27,095. "Starting device for electromotors equipped with a clutch." K. Kaisser. October 12th, 1927. (303,578.)

27,186. "Thermionic valves." M-O. Valve Co., Ltd., and J. W. Wigan. October 13th, 1927. (303,580.)

27,308. "Head lamps for motor road vehicles." Barker & Co. (Coachbuilders), Ltd., J. Ridlington, and W. T. G. Fensom. October 14th, 1927. (303,584.)

27,432. "Wireless receiving sets." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 15th, 1927. (303,586.)

27,434. "Wireless receiving sets adapted for continuous or alternating-current feeding as desired." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 15th, 1927. (303,587.)

28,314. "Combined electric turn-switch and wall plug." Z. B. Begg. November 3rd, 1926. (280,187.)

28,648. "Electric induction furnaces." M. Surjaninoff. October 30th, 1926. (279,883.)

28,764. "Method of, and means for, eliminating disturbing noises in the optical reproduction of sound records." Siemens & Halske Akt. Ges. April 9th, 1927. (288,225.)

28,766. "Electric heating elements." H. H. Berry. October 28th, 1927. (303,597.)

29,546. "Remote-control apparatus." Igranic Electric Co., Ltd., and A. H Curtis. November 4th, 1927. (303,603.)

29,857. "Electrical heating units." R. A. F. Jackson and J. D. Place. November 8th, 1927. (303,606.)

30,077. "Wireless receiving circuits." Edison Swan Electric Co., Ltd., and L. H. Soundy. November 9th, 1927. (303,608.)

31,198. "Electric motor-control systems." General Electric Co., Ltd., and H. G. McClean. November 21st, 1927. (303,617.)

31,490. "Supporting means for electric lamp shades." E. L. Dunand. November 23rd, 1927. (303,620.)

32,569. "Electric arc lamps." Sun-Vi-Lite, Ltd., and R. J. Rawlings. December 2nd, 1927. (303,628.)

34,816. "Stereoscopic Röntgen ray fluoroscopy." F. Bornhardt. December 27th, 1926. (282,765.)

35,005. "Electric cooking vessels and coffee-making apparatus." E. R. Del Riccio. December 28th, 1926. (282,781.)

35,404. "Stereoscopic Röntgen ray fluoroscopy." F. Bornhardt. May 18th, 1927. (Addition to 282,765.) (290,619.)

1928.

3,095. "Electric conductor of solid cross-section and smooth surface." Metallbank und Metallurgische Ges. Akt. Ges., and J. Zagorski. January 31st 1928. (303,666.)

5,375. "Thermionic valve amplifying circuits." L. F. Douglass. February 20th, 1928. (303,681.)

5,557. "Automatic switches for battery-ignition engines." F. J. Stuart. February 22nd, 1928. (303,682.)

6,798. "Arrangement for detecting the direction of propagation of a current, particularly applicable to switching in telephone installations." C. J. A. Lange and L. J. E. Forest. March 5th, 1927. (286,607.)

7,355. "Insulator of the pintle type for live wires." F. Berg. March 9th, 1928. (303,689.)

7,725. "Boxes or containers for electrical accumulators." W. R. Edwards and R. Edwards & Co., Ltd. March 13th, 1928. (303,690.)

9,551. "Disconnecting switches for overhead electric lines." Aktiebolaget Bergslagens Gemensamma Kraftforvaltning. March 29th, 1927. (287,916.)

11,380. "Electric conductors of high negative temperature coefficient." H. Andre. June 17th, 1927. (Addition to 280,862.) (292,152.)

11,573. "Incandescent electric lamps having means for giving different degrees of luminous intensity." G. De Gasenko. May 31st, 1927. (291,372.)

14,628. "Remote control of electric power sub-stations." Associated Telephone & Telegraph Co. October 11th, 1926. (Divided application on 278,746.) (290,643.)

15,323. "Transformer for polyphase rectifiers." Maschinenfabrik Oerlikon. June 11th, 1927. (292,064.)

18,286. "Electric switching apparatus." International General Electric Co., Inc. June 23rd, 1927. (292,625.)

18,609. "Electric incandescent lamps." General Electric Co., Ltd. July 13th, 1927. (293,827.)

19,620. "Insulating blocks for the heating elements of electric heaters and the like." G. Pate and J. R. Laird. July 6th, 1928. (303,727.)

20,232. "High-frequency signalling systems." Marconi's Wireless Telegraph Co., Ltd. July 12th, 1927. (293,803.)

23,020. "Spark plug." G. A. Moller. July 30th, 1928. (303,729.)

22,446. "Coupling devices, suitable for use with rotatable frame aerials and the like." Telefunken Ges. für Drahtlose Telegraphie. August 3rd, 1927. (294,989.)

22,540. "Current-collectors for electric vehicles." G. Fischer. August 8th, 1927. (295,280.)

30,749. "Acoustic signalling devices." R. Bosch Akt. Ges. November 28th, 1927. (301,378.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 23rd:—

Dunco. No. 494,730. Class 6. Electric vacuum cleaning machines.—Sir Duncan Watson, trading as Duncan, Watson & Co., 61-62, Berners Street, W.1.

Gilectra. No. 497,438. Class 6. Electric turntable motors for gramophones.—Matthew Gill, Brunswick House, City Road, Manchester.

Radiographophone. No. 494,759. All goods in Class 8.—Columbia Graphophone Co., Ltd., 102-108, Clerkenwell Road, E.C.1.

Orchestrope. No. 497,243. Class 8. Combination kinematographic and sound reproducing apparatus.—"M.P.A." Wireless, Ltd., 62, Conduit Street, W.1.

Exide. No. 497,299. Class 8. Instruments and apparatus for use in radiotelegraphy and telephony, and instruments consisting of a radio receiving set and a gramophone.—Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.

Power from Mud.

After prolonged experiments, a German company has purchased pumping plant and drying fields, at a cost of £250,000, with which to recover from the bed of the River Emscher, and to prepare for use as fuel, mud which is rich in combustible matter, washed down from the Westphalian coalfields. The *Morning Post* reports that the Rheinisch-Westfalisches Elektrizitätswerke has contracted for a supply of 100,000 tons of such fuel per annum, for use at an electric power station which is to be erected near the pumping station. As the removal of the mud from the bed of the river is necessary for the purpose of navigation, the scheme is doubly economical.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALFRETON.—Housing scheme (46), for the U.D.C.; surveyor (returnable deposit of £5 5s.).

BARNSLEY.—52 houses, Burton Grange; borough engineer.

BEACONSFIELD.—Houses (22), for the U.D.C.; Blackwell and Meyer, builders, Bexley Heath.

BENSTEAD.—Nurses' home, Mental Hospital (£22,500); L.C.C. architect.

BIRMINGHAM.—Alterations to stores, infectious diseases hospital, Yardley Road, Little Bromwich (deposit £1. 1s.); Dallas & Lloyd, architects, Cornwall Buildings, 45, Newhall Street.

BLANDFORD.—Houses (30), Milbourne St. Andrew, for E. R. Debenham.

BRIGHTON.—Elementary school, Hodsgrove Meadow (£30,000); Education Committee. Extensions, Phœnix brewery, Phœnix Place; Tamplin's Brewery, Ltd. 96 houses, Turners Allotments; borough engineer.

BURY (LANCS.).—Extensions, Anglo-Continental Grape Products, Ltd.; C. R. Cooper, architect, Market Street.

CHINGFORD.—Senior school for Essex Education Committee; director of education, Chelmsford.

CLAYBURY.—Nurses' home, Mental Hospital (£18,319); A. E. Symes, Ltd., Stratford.

COATBRIDGE.—Re-erection of business premises, Main Street, for A. M. Robb (£4,000).

COVENTRY.—Wesleyan halls; trustees, Warwick Lane Wesleyan Church.

DUKINFIELD.—Housing scheme, St. Luke's, for the T.C.; Halliday & Agate, architects, 14, John Dalton Street, Manchester (returnable deposit of £2 2s.).

DUMBARTONSHIRE.—Silk factory for British Silk Dyeing Co., London; the secretary.

DUNDEE.—Additions to slaughter houses; G. Baxter, city engineer, 91, Commercial Street.

FARNHAM (SURREY).—Additional 60 houses, for the R.D.C.; surveyor.

GLASGOW. — Extension at garage, Parkhead Tramway Depot, for Corporation (£15,000); city architect. Extension of warehouses for Messrs. Ewing & McIntosh, Sauchiehall Street; Mr. James Wright, jun., architect. Factory extensions; Templeton & Co., Craignestock Place. Alterations and improvements, Regent Flour Mills; Scottish Co-operative Wholesale Society, Ltd. Extensions, 41, Oswald Street; Stewarts & Lloyds, Ltd.

GUILSBOROUGH.—Reconstruction of Baptist Church and school; trustees.

HIGH WYCOMBE.—Chair factory, Copyground Lane, for White Bros.

HULL.—Extensions to Repertory Theatre, for the Little Theatre Co. (£12,000); E. C. Davies, architect, London.

HUYTON (ST. HELENS).—Additional 21 houses, for the U.D.C.; surveyor.

ILFRACOMBE.—Orchestral hall and public offices (£9,245), for the U.D.C.; surveyor.

IRLAM AND CADISHEAD.—Additional 75 houses, for the U.D.C.; surveyor.

IRTHLINGBOROUGH (NORTHANTS).—Factory for Maddocks & Co., leather manufacturers.

KEYNSHAM (BRISTOL).—School (280 places), for Gloucestershire E.C.; director of education, Gloucester.

KIDDERMINSTER.—Housing scheme (40), for the T.C.; J. Hawcroft, borough engineer (returnable deposit of £2 2s.). Showrooms, stores, and shed extensions, Exchange Street, for Brintons, Ltd., carpet manufacturers.

KIMBERWORTH.—Parochial Hall (£3,000), Col. J. E. Knight, architect, Rotherham.

KING'S LYNN.—Cinema at Hunstanton; Allflat & Courtney, Hill House, architects.

LEITH.—Re-erection (after fire), of mills, West Bowling Green Street, for R. F. Bell & Son (£5,000 to £7,000).

LIVERPOOL.—Extensive developments with ornamental gardens, &c., Otterspool; land steward, Municipal Buildings, Dale Street.

LONDON (POPLAR, E.).—Additions, premises of Green & Weir, Ltd., Brunswick Street; T. Edge. School for 360 boys, South Poplar; St. Mary and St. Joseph's Catholic trustees.

LONDON (*continued*).

(SHOREDITCH, E.).—Reconstruction, Teale Street area; L.C.C. architect.

(STEPNEY, E.).—Hostel for women, Chicksand Street; Salvation Army.

(HENDON, N.W.).—Church, Eversfield Gardens; London Congregational Union.

(ST. JOHN'S WOOD, N.W.).—Buildings, Hanover Lodge, Park Road; Bostels, Ltd.

(ST. MARYLEBONE, N.W.).—Houses, Maida Vale; D. W. Beck.

(ST. PANCRAS, N.W.).—Extensions, Royal Free Hospital, £100,000; governors.

(FULHAM, S.W.).—44 tenements, Harwood Road, £34,000; L.C.C. architect.

MAIDSTONE.—Isolation hospital extensions, for the R.D.C.; surveyor.

MANCHESTER.—Hall, hotel and garage; Chas. Swain & Partners, architects, Manchester. Housing scheme (28), for Manchester Housing, 1926, Ltd.

NEWBURY.—Extensions, Money Memorial Museum; Captain Borgnis. Extensions, District Hospital, Andover Road; trustees.

NEWTON-IN-MAKERFIELD.—Secondary school (deposit (£2); Mr. Sarckinson, county architect, 16, Ribblesdale Place, Preston.

NORTHAMPTON.—Technical college and school, Kettering Road housing site, for the borough E.C.; A. C. Boyde, director of education.

NORTHFLEET.—Extensions, Crete Hall Road; W. T. Henley's Telegraph Works Co., Ltd.

ORMSKIRK.—Housing scheme (32), for the U.D.C.; H. W. Chadwick, surveyor (returnable deposit of £2 2s.).

OXFORD.—School (£65,112), for the City E.C.; Hinkins & Frewin, builders. Additional 238 houses, for the T.C.; borough surveyor.

PEMBURY (TUNBRIDGE WELLS).—Telephone exchange, for H.M. Office of Works; G. F. Penn, Ltd., builders.

PENN (BUCKS.).—Smallpox hospital (£7,800), for the C.C.; county architect, Aylesbury.

ROTHWELL.—34 houses at Rothwell Haigh (17), Carlton (8), and Lofthouse (9); J. Southwart, surveyor to Council (deposit £1 1s.); tenders by February 11th to Mr. E. F. Moorhouse, clerk to Council.

ST. ASAPH (N. WALES).—Isolation hospital (£11,000), for Joint Hospital Board.

SHOREHAM (SUSSEX).—Additional 44 houses, for the U.D.C.; surveyor.

SHORT HEATH (WOLVERHAMPTON).—Houses (36), for the U.D.C.); J. Hicken & Son, builders, Willenhall.

SOUTHAMPTON.—Mental institution, Corporation Committee.

SOUTHEND-ON-SEA.—Cinema, Leigh Road and Maple Avenue, for the South Essex Cinema Syndicate.

STIRLING.—Adaptation of Royal Infirmary as education offices (£3,500); executive officer, Stirlingshire L.E.A.

STROUD (GLOS.).—Housing scheme (40), for the U.D.C.; F. S. Cutler, surveyor (returnable deposit of £5).

TAUNTON.—Additional 100 houses, for the T.C.; borough surveyor. Extensions, High Street, for Hatchers, Ltd., drapers.

THORNE.—School, Goole Road (£34,000), for West Riding E.C.; Education architect, Wakefield.

TORQUAY.—Two blocks of flats, Westhill estate, for the T.C.; borough engineer (returnable deposit of £2 2s.).

WAKEFIELD.—Church, Byepass Road; Sir Chas. Nicholson and Messrs. Wrigley & Son. Seven shops and 14 garages, Dewsbury Road; city architect. Registry of Deeds (£57,658), for West Riding C.C.; county architect, Shire Hall.

WALTHAM CROSS.—Houses (50), Waltham House estate, for Biss Bros.

WOLVERHAMPTON.—Mission Hall, Low Hill, for Bushbury Church Council; vicar. X-Ray department, for the B.G.; clerk. Bank extensions, Kings Square; Lloyds Bank, Ltd. Warehouse, &c., Oxley Bank, for the Goodyear Tyre & Rubber Co., Ltd. Three-storey business store, Market Street, for Marks & Spencer, Ltd., London; W. J. Rawlins, architect.

WYKEN (COVENTRY).—School (300 places), for Warwickshire E.C.; director of education, Warwick.

YORK.—31 houses, adjoining Fifth Avenue (deposit £2 2s., completion by September 30th); F. W. Spurr, city engineer, Guildhall, York (February 4th).

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The

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Engineers and the Future.

THOSE who have followed the correspondence that has lately been published in this journal on the question whether it pays to acquire knowledge may find some encouragement in a timely speech which was recently delivered before the North-East Coast Institution of Engineers and Shipbuilders by Lord Londonderry, who tried to draw the veil aside from the future, revealing greater engineering prosperity all over the world with better prospects, plenty of regular employment, and certainty of a career. While we fear that there are some who are driven by circumstances to clamour immediately for something more tangible than hope and forecast, however well based these may be, it is desirable that all should occasionally look well ahead, because there are abundant reasons for encouragement, whether we limit our observation to electrical engineering industry or extend it to all branches of engineering work.

Lord Londonderry prefaced his speech with the belief that we were only on the threshold of scientific development, and that soon new scientific processes would be introduced which would facilitate the harnessing and development of the earth's resources for the use of mankind. The industrial change that is progressing amongst us at home—the policy of rationalisation and amalgamation—he described as a necessary step in the process of the evolution of commerce. The blight of commercial stagnation, the direct result of the reduced purchasing power of the world, had fallen upon engineering as well as upon other industries, and one of the most ominous signs thereof he found in the lack of recruits that had been entering it. After later alluding to the signs that there was now an increasing demand for British products and to the benefits that should ensue as employers and employés succeeded in readjusting their mutual relations for themselves, the speaker proceeded to urge members of the Institution to use every endeavour to attract young entrants and apprentices to the twin professions of engineering and shipbuilding.

He agreed that at the moment there were few inducements to parents to put their boys into such trades, but in looking to the comparatively near future he ventured the opinion that in all probability lads who entered

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now would find the old conditions of plentiful employment and good prospects returning by the years when they were out of their time. Nothing could be more fitting than the closing part of Lord Londonderry's speech wherein he referred to the magnificent openings for engineers that must result from the development which is proceeding, and must proceed more and more, in the Dominions and Colonies. Whatever present-day impression is inevitably made upon so many men by the slow rate of progress at which engineering and other industries are dragging themselves out of the deep trough of depression that has handicapped them for so long, there is a brighter day to dawn, preparedness for which was urged by the speaker in the interests of engineers' own children who should be taught their fathers' profession, the assumption being sound that if it is ultimately good for the children it will also be so for the fathers themselves.

We sympathise with those who are tempted to feel that all this is very much like offering them a stone when they ask for bread, but we have in other issues stated reasons why we believe that in the electrical engineering world at any rate the situation is favourable notwithstanding that here and there, rationalisation measures, like the Electricity Scheme, are involving displacements temporarily. The period is one through which we have to pass in order to reach the better days to which we have referred. But the handicap period may be shortened if our travellers abroad can bring in more orders from markets concerning which we are endeavouring to give data from week to week. This week we concentrate in that particular on parts of South America, and we wish to emphasise the important office filled by the British traveller to, or agent in, this vast market. If to make two blades of grass spring up where one grew before was considered a creditable performance in less strenuous and more prosperous days, what shall be said of those who bring business to-day to our factories from parts of the world whence comparatively little has yet come?

South American Electrical Markets.

With Russia still a very doubtful quantity and the rest of the European countries generally capable of attending to their own requirements, British electrical manufacturers are being compelled more and more to cultivate the distant markets. We have recently drawn attention to possibilities in the Middle and Far East, and Australia has been closely studied. There remains the South American continent with those vast potentialities and resources which we have emphasised from time to time, and concerning which various electrical articles have been published. Stimulated in the first place by foreign capital, the people of Argentina, Brazil, Chile, and the other republics are becoming increasingly favourable to modern methods, and in many cases are themselves projecting large development schemes.

In this issue we review a report upon Argentina by Mr. H. O. Chalkley, Commercial Counsellor at the Buenos Aires Embassy. This is of greater electrical interest than the majority of the D.O.T. reports, and it seems to indicate that electricity is increasingly a predominant factor in Argentine economic life. No one doubts that the Republic is a rapidly growing one worthy of the attention of all who have goods to sell. British recognition of Argentina's place as a leading nation was quite recently signified by the promotion of our representative there to the dignity of Ambassador. British trade with Argentina expanded last year, but Mr. Chalkley warns us that this is no excuse for any slackening of effort. In the electrical market we by no means have our own way. We have to meet German, Italian, and other activity (usually coupled with lower prices), and growing United States influence which Mr. Hoover has recently tried to re-inforce. United States influence seems to have impressed a good deal of American practice upon Argentine electrical methods. Vast sums of money were invested by British interests in earlier South American developments, and British trade interests in the market were strong. In Argentina trade is following the course of finance, and it must be noted that American capital which is extending throughout the continent is generally loyal to its home industry—a loyalty no doubt often due to associations of interests.

What must British electrical manufacturers do to retain what business they have and to increase their share? Lower prices would seem to be the first necessity as in other markets, but that is a matter of organisation at home. In the market itself incessant effort and constant study are essential. Customers nowadays have their own ideas of what they want, and while British standards may be excellent, manufacturers will find it worth their while to relax a little from their rigid specifications if they cannot educate their customers up to them.

Following Mr. Chalkley's report, we publish statistics of the electrical import trade of Chile and Peru, from which the relative position of the United Kingdom to other suppliers can be gauged. These indicate that there is considerable scope for the enlargement of our share of this trade.

The North-East Coast Exhibition.

At the moment the exhibition which occupies the minds of all who have a stake in British economic life is the British Industries Fair which opens in London and Birmingham on the 18th inst. We would, however, draw attention to another exhibition which cannot fail to be of the first importance. This is the North-East Coast Exhibition of Industry, Science and Art, which is being held from May to October this year. A few details of this display appear in our "Business Notes" to-day; these are sufficient to indicate that it will give a very good representation to the engineering, and particularly the electrical engineering, industries. The illustrations in a brochure which we have received, indicate that the exhibition will be on a good scale—spacious buildings laid out in beautiful grounds—and it should prove a great attraction to the population of the North and visitors from the Continent.

It is earnestly to be hoped that the exhibition will provide a considerable stimulus to the trade of the North-East Coast, which for a long time has languished under the depression of the coal, iron and shipbuilding industries.

Facsimile Photo-radiograms.

That photo-telegraphy has long outgrown the experimental stage is clearly indicated by the extensive and varied use that is made of the regular commercial services that are available to the public in this country, on the European Continent, and in America; indeed, last Sunday's demonstration of Marconi's Wireless Telegraph Co., Ltd., suggested that in time facsimile services may largely replace Morse telegraphy on busy circuits, and that the receipt of photo-radiograms, *i.e.*, exact replicas of the senders' hand-written originals, will be the normal procedure.

Elsewhere in this issue a brief outline of the methods employed will vindicate the claim that they differ from others in use at present: the apparatus is certainly ingeniously contrived and reproduces beautifully clean facsimiles of the originals. Moreover, not only has it been specially adapted to operate on short-wave beam radio circuits, thus making it possible to reduce considerably the period of transmission, as compared with long-wave services, but it is also learned with interest that the possibility is contemplated of devising a system of superimposing on one and the same beam radio circuit several telegraph channels, one for facsimile transmission, and one for telephony; in fact, a triplex circuit. Thus is the value of research clearly demonstrated, and the Company is to be congratulated on having obtained results of so high an order of merit.

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A Modern Dairy Installation.

In the recently-built milk depôt of United Dairies (London), Ltd., at Streatham, 30,000 gallons of milk is pasteurised and bottled per day, and electric driving is employed throughout.

By way of illustrating the importance that is attached to the use of electricity nowadays in the handling and treatment of milk, we have obtained, by the courtesy of United Dairies (London), Ltd., some interesting particulars and photographs concerning the application of electric driving in their milk depôt at Valley Road, Streatham.

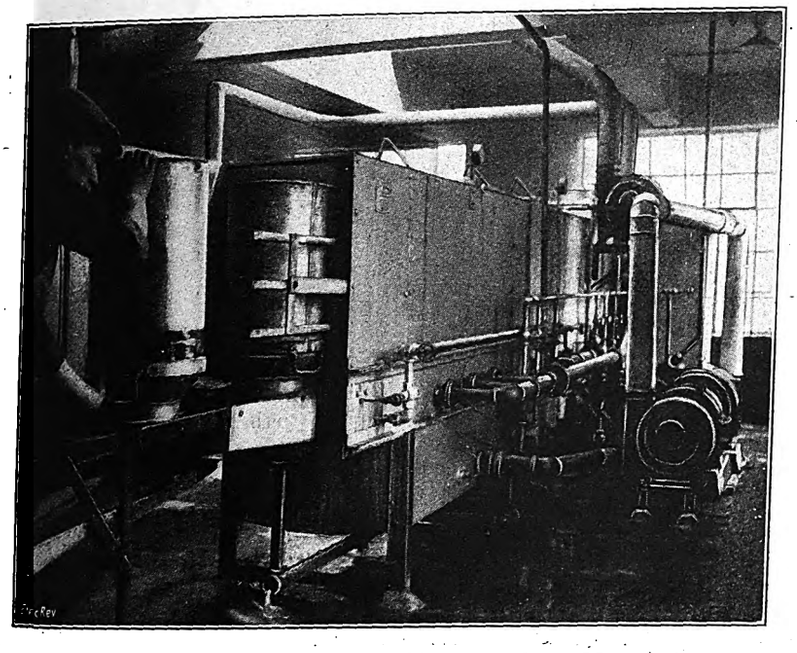

Fig. 1.—Can-washing Machine; 10-h.p. Motor.

This large dairy can safely be said to represent up-to-date practice; it was built on modern lines only three years ago, and it has since—indeed, it is now being brought up to scratch. Further, it is one of the country's largest milk-handling establishments, dealing with something like 30,000 gallons of milk per day. The purpose of the "factory" is to receive daily from farms "raw" milk, to treat it by pasteurisation and allied processes, bottle the milk and dispatch it for distribution throughout a large South-London area.

It is true that electricity does not provide the considerable amount of energy used for heating in the various processes, but the power supply is wholly electric and by no means meagre, representing a total loading of about 200 kW.

Briefly, the process embraces the initial cooling of the milk in storage tanks by means of brine, centrifugal clarification, pasteurisation on the regenerative principle, and bottling and capping. These operations involve pumping, ammonia compressing, conveying by lifts and runways, agitating the milk in various storage and holding tanks, and so on, all embodying electric driving. There are other auxiliary, but important, operations where electric driving is also employed, including washing and drying the milk cans.

From a milk-arrival bank (ground floor) the liquid is taken in churns to the tipping and weighing floor by means of a 30-cwt. goods lift and a chain elevator, according to the size of the churns. The lift is driven by a 17-h.p. motor and the chain elevator by one of 3 h.p. There is also a "lowerator," a similar apparatus to the elevator, but for the reverse operation; this is driven by a 1½-h.p. motor. The two chain machines are fitted with suitable trip gear, the "lowerator" having an electro-magnetic shoe-type brake which operates in conjunction with the no-volt trip coil on the starter.

A can-washing machine, fig. 1, on the tipping floor is capable of dealing with eight cans per min., and is driven by a 10-h.p. motor. A conveyor on this machine carries inverted cans over steam and water sprays. A feature is that the same motor drives both the water and air pumps for cleaning and drying the cans, in addition to the conveyor.

Six 1,000-gallon glass-lined storage tanks, fig. 4, on the floor below are equipped with hollow jackets through which brine is circulated for cooling; the brine-circulation pumps are positioned in the building basement. Three additional 3,000-gal. storage tanks are now being installed. At the base of each tank is bracketed a 3-h.p. "Westinghouse" motor, connected through high-ratio reducing gear to the agitating blades inside. These motors are controlled by "change-over" starter switches, for direct switching, the two "ways" carrying heavy and light fuses, respectively. An inspection window in the top of each tank is served by a special reflector fitting. A 4-h.p. motor-driven pump forces the cooled milk from the storage tanks to the cleaning and pasteurising apparatus on the floor below. After flowing through pre-heating apparatus, which brings

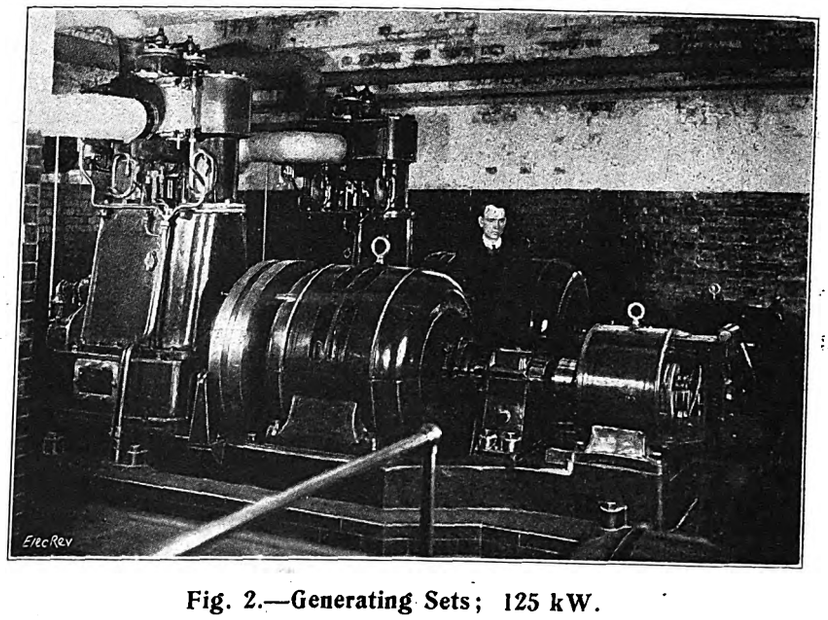

Fig. 2.—Generating Sets; 125 kW.

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its temperature up to 70-80 deg. F., the milk is dealt with by centrifuges by Alpha-Laval Co., Ltd. The machines are similar to cream separators of the same make, except that they do not run so fast, about 5,000 r.p.m. They embody the "built-in-motor" principle, but employ belt driving through friction clutches. Each machine is driven by a 1.8-h.p. A.S.E.A. motor, and will deal with 1,200 gal. of milk per hour. The cleansed milk is taken through the pasteuriser, where it is raised to pasteurising temperature, 145 deg. F., and then into holding tanks, in which it is allowed to "rest" for half an hour. From the holders the milk is forced down, through cooling equipment, to "pasteurised" storage tanks, and then to the bottling and capping machines.

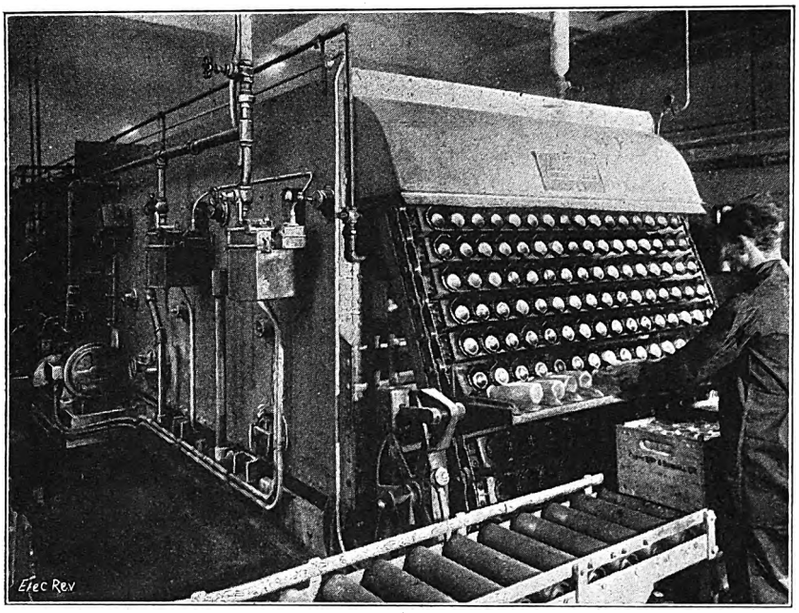

Fig. 3.—Bottle-washing Machine; 12- and 7½-h.p. Motors.

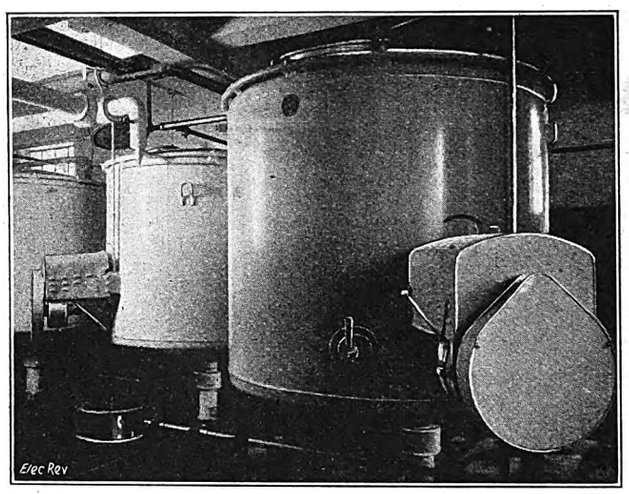

Fig. 4.—Milk-storage Tanks, showing Agitating Equipment.

The circulation of the milk through the pasteurising equipment, *i.e.*, from the holding tanks, is effected by a compressed-air and vacuum system. Compressed air is let into the holding tanks at the end of predetermined times automatically by means of an electrically-controlled system of valves. The control equipment consists of a ½-h.p. motor driving through an extremely-high-reduction gearing (54,000-1) a central valve-operating drum, so that the period between the opening and closing of the valves depends on the "run" of the motor. The pasteurising plant is capable of dealing with 2,200 gallons of milk per hour.

In the basement are installed the vacuum and air-compressor pumps for the pasteurising plant, both with 7-h.p. motors, chain drives and oil-immersed starters. A 7-h.p. motor-driven hot-water pump is also installed in connection with this plant. Fig. 6 is a general view of the bottle-filling room, showing the holding tanks above.

There are six "Enoch" bottle-filling machines, each driven by a 1-h.p. motor. Each is capable of filling and capping 72 pint and half-pint, or 66 quart bottles per hour. Bottle-washing is another important process. There are two "Super-Kleen" machines for this purpose, each of which is fed with empties at the rate of 140 per minute. Each bottle is in the machine for from 20 to 25 min., and is soaked and subjected to jets of steam and hot and cold water. Fig. 3 depicts one of the washers. It works on the crate-conveyor principle, and is served by a 12-h.p. motor for the conveyor drive and a 7½-h.p. motor for the water jets and sprays. By means of a small 6-V relay device on each of these machines a record is given of the stops of the machine during any period. This apparatus plays an important part in an efficiency scheme adopted by the company; the amount of a bonus paid to the operatives varies with the working efficiency of the concern.

For the milk-cooling apparatus there are installed in the basement three 10-ton "Lightfoot" ammonia compressors, each driven by a 45-h.p. slip-ring motor, 575 r.p.m., fig. 7, with the necessary cooling plant. Duplicate 5-h.p. motor-driven circulating pumps serve the condenser equipment.

Two 9-h.p. directly-motor-driven pumps serve for circulating brine through the cooling tanks and after-pasteurising cooling equipment. An air-circulating fan provides the means of cooling the bottle store chamber. The necessary water is obtained from a deep well equipped with a 4,000-gallons-per-hour pump driven by a 20-h.p. motor controlled by a "Watford" automatic float-control starter. The tepid water from the processes is delivered to a tank on the roof by means of a 5-h.p. motor-

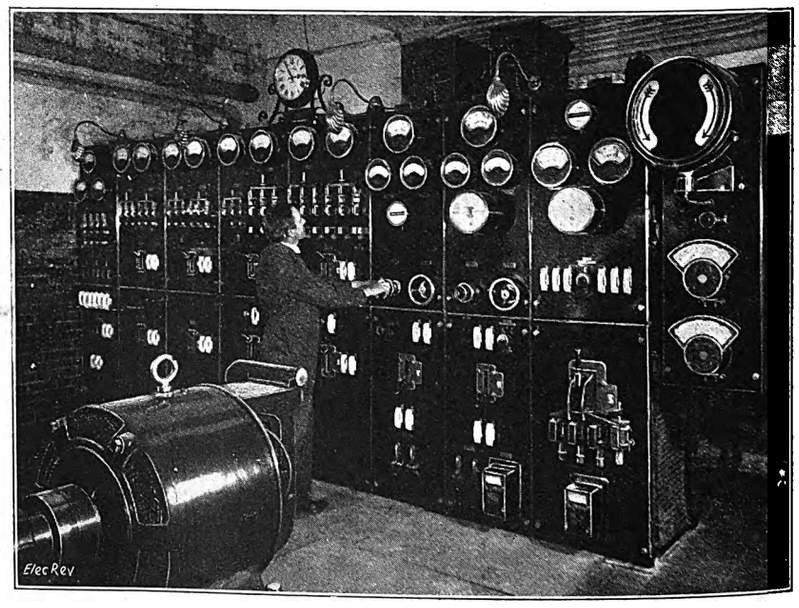

Fig. 5.—Switchboard; Distribution Panels with Throw-over Switches.

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A Ropeway Installation.

Means of Transport to and from the Anamalai Hills Tea Plantations.

FROM the south of Mysore, South India, nearly to Cape Comorin, there extend several groups of hills, on the higher slopes of which are extensive tea plantations. The chief centres of the industry are the Nilgiri Hills, the Anamalai Hills, and a parallel range known as the High Range. Access to the Anamalai Hills is a matter of some difficulty, since they rise abruptly from the Coimbatore Plain to a height of about 3,000 feet, and the Ghat road which leads into them has 43 "hair-pin" bends in the first 17 miles; until recently the sole means of transport was the two-wheeled bullock cart. As the industry developed, the need for a convenient and economic transport system became more and more pressing, and many alternative projects were discussed for the improvement of the road, the use of motor lorries, and the building of a railway from Cochin. Finally, after many delays, a ropeway was decided upon, and the contracts for it and for a hydro-electric power station and electric transmission line were placed late in 1926. The installation of the ropeway was entrusted to the British Ropeway Engineering Co., Ltd.; of the electrical machinery and transmission line to the English Electric Co., Ltd.; and of the water turbine to Messrs. Boving & Co., Ltd.

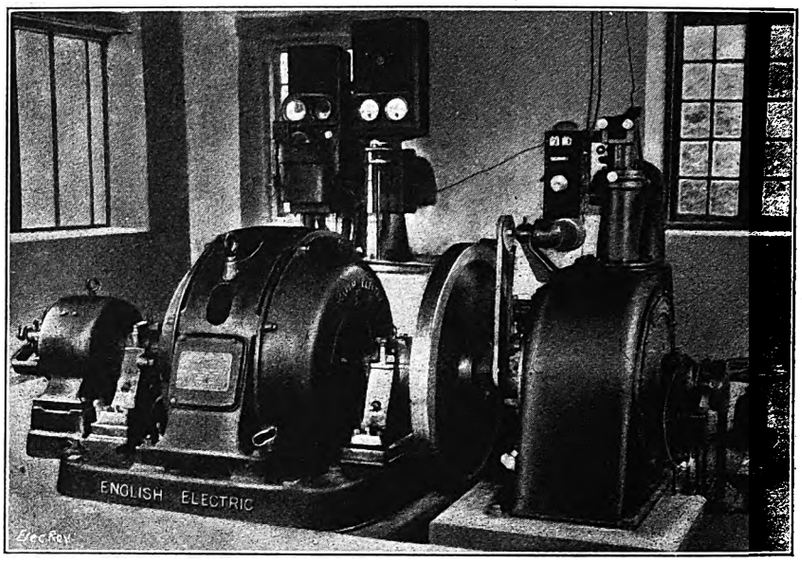

Fig. 1.—Water-turbine Generating Set; 150 kVA.

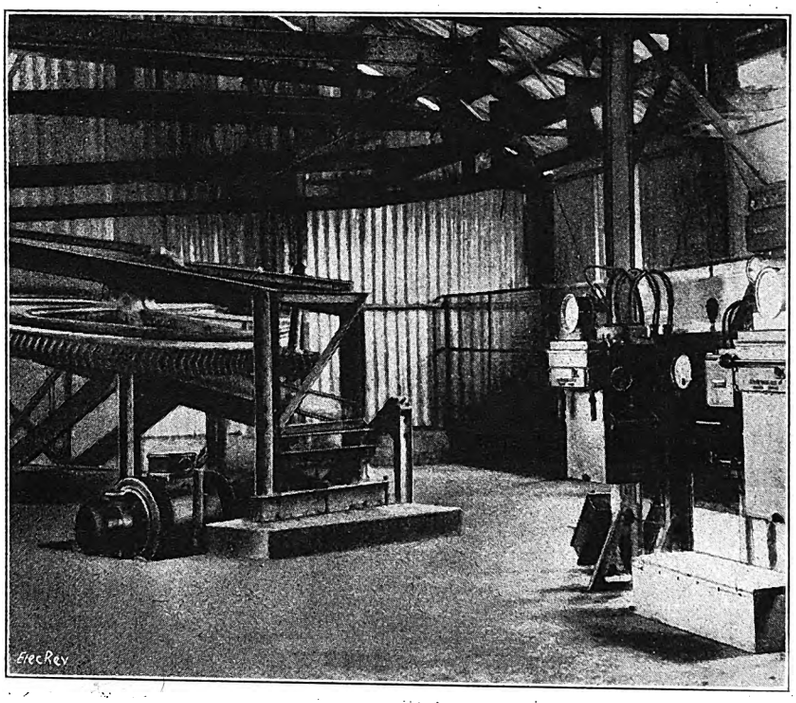

Fig. 2.—Driving Motor and Equipment for Ropeway Section.

The ropeway is operated by electric power derived from the hydro-electric station, which makes use of a 700-ft. fall. Fig. 1 is a view of the generating plant, consisting of a double-nozzle "Boving" impulse turbine, coupled to a 150-kVA, 3,300-V, 3-phase "English Electric" alternator. Power is transmitted by an overhead transmission line to the two ropeway driving stations at Waterfall and Valoni, which divide the ropeway into three sections. At each station there is a three-phase bank of "English Electric" transformers, which give a low-pressure supply to the motors at 220 V.

Fig. 2 shows the 38-h.p. "English Electric" slip-ring motor and drive installed in the Waterfall station for operating the second section of the ropeway. The first section from Iyarpadi to Waterfall is driven by a 50-h.p. motor in the same station. Each motor drives the rope sheaf through a worm gear and double-helical spur gear. At Valoni a 50-h.p. motor drives the third section of the ropeway, which extends to the terminal station at Vannanthorai, whence the tea and other produce are conveyed to the railway at Pollachi. Fig. 3 is of special interest in that it shows the ropeway and the transmission line crossing the road, the latter having interposed at this point a length of three-core cable, which is supported by the bridge seen in the picture.

The ropeway has effected a revolution in the transport of the district.

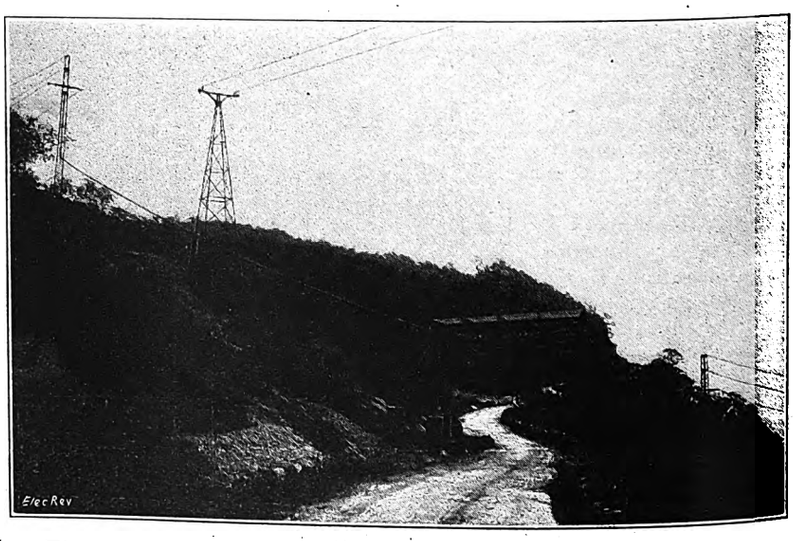

Fig. 3.—Road Crossing for Ropeway and Transmission Line.

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Heating Metals by Electricity.

A Special Process Adapted for Welding, Hardening, and Other Industrial Operations.

By PAUL HOHO.

(*Concluded from page* 187.)

IN order to maintain the e.m.f., even with a reduced amount of current, a compound or shunt-wound dynamo with low armature resistance is recommended for use with the process, or a low-resistance battery of accumulators; otherwise the liberation of heat per sq. cm. of surface contact with the liquid falls away with the current density, that is to say, as the heated surface is increased. It is also necessary to have at hand an e.m.f. controller. This must not, however, act on a resistance in the principal circuit, but either on a resistance for the shunt excitation of the dynamo, or on a cell-switch for the series-connected battery. It will be gathered that the main circuit should have a low resistance, similar to that of lighting circuits, and that under certain conditions the use of an over-compounded dynamo is to be preferred.

Bath Temperature.

The process can be worked with liquids at all temperatures ranging from 0 deg. C. up to boiling point.

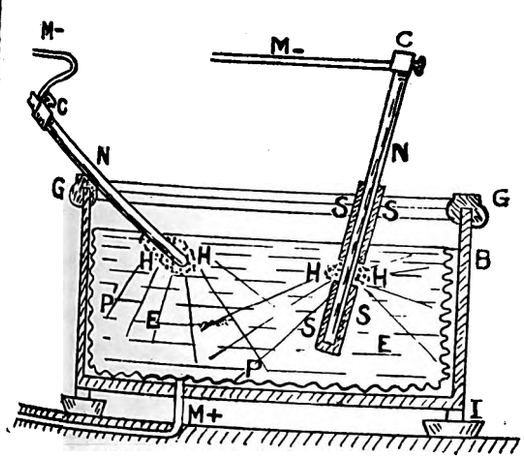

Fig. 1.—Ordinary Metal-heating Bath.

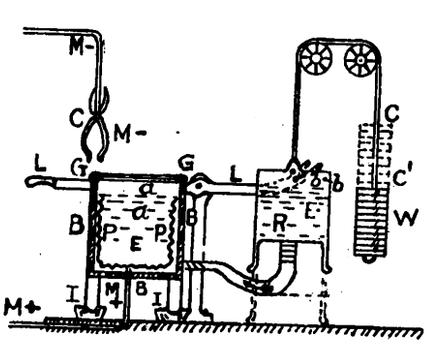

Fig. 2.—Special Purposes Apparatus.

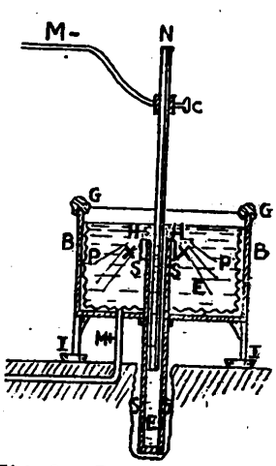

Fig. 3.—Bath Adapted for Forging.

It should be remembered that the conductivity of the bath increases with the temperature; it is therefore an advantage to work at a high temperature, although if it is too near the boiling point, the liquid passes too easily, and in too large quantities, into steam, which interferes with the operation.

Bath Homogeneity.

It is necessary that the solution should be of equal density throughout, otherwise certain parts of the metal may be heated more or less than the remainder, and even for a certain part of the metal the calorific action may vary from one moment to another according to the degree of agitation of the liquid. To secure a correct solution, the salts should be dissolved in hot water and the liquid allowed to stand for a day or two until there is no solid matter in suspension.

The working of the apparatus must be started progressively. If the current is suddenly switched on to a piece of metal having a large surface in contact with the liquid, a sort of short-circuit will be set up which, however, will only last for an instant, as it will be broken by the formation of gas between the metal and the liquid, so creating supplementary resistance. There is, however, a waste of current; moreover, the current flow will be greater through those parts of the surface of the metal which are clean than through those which are rusty or contain impurities, the scaling action of the process at the latter points being consequently reduced. The result is that for a certain period there will be sudden and irregular jumps in the intensity of the current, accompanied by violent agitation of the liquid and troublesome momentary sparking. For the foregoing reason, it is advisable to apply the current to the metal before the latter is inserted in the bath, or before any insulator is fitted to it. It is also recommended that the metal be inserted into the bath slowly and steadily.

When large surfaces amounting to many sq. metres have to be heated before being hardened, it must be remembered that each square centimetre will easily take 300 watts, equal to 3,000 kilowatts per sq. metre. It is not possible to heat the whole of such a surface at one operation, and still less suddenly to pass current through the whole piece. Therefore the gradual process above mentioned is followed, this being also equally applicable to small parts.

The three foregoing points—constancy of e.m.f. at the terminals, homogeneity of the bath, and progressive heating from zero—are all of prime importance. Attention may also again be drawn to the need for maintaining the uniform quality of the liquid and for the protection of the edges of any projections on the metal by the judicious use of insulators.

Metallurgical Applications.

In principle, the liquid bath forms the "furnace" in which the metal is heated, and all the methods usually adopted in the case of furnaces may be applied either

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unchanged or with such modifications as the special characteristics render necessary.

The design of the apparatus can be varied as necessary according to the nature of the work and character and size of the parts to be dealt with. Some examples are shown in figs. 1 to 8. In figs. 1-4, inclusive, similar lettering is used for corresponding parts, as follows:—

- B represents the tank containing the electrolyte E.
- C represents the contacts which connect the part N to be treated with the negative pole of the electric circuit.
- G represents an insulated protector.
- H represents the gaseous sheath.
- I represents the insulators.
- M represents the current leads.
- P represents the "passive" electrode.
- N represents the active electrode—the part to be treated.
- R represents the supplementary tank.
- S represents the tubes, disks, or other insulators.

Fig. 1 shows an ordinary form of tank, in which a bar surrounded by an insulating tube, to secure local heating, is being dealt with as already described.

Fig. 2 represents a modification for special purposes. In many cases some difficulty may be experienced in moving the treated piece in the bath. By means of the lever L, the tank R may be raised or lowered, so altering the level of the electrolyte; in this way the treated part may be given a greater or less degree of immersion without having to move the part itself. It will be obvious that the lever can be replaced by a pedal to obtain the same effect. The supplementary bath may also be arranged as part of the main tank.

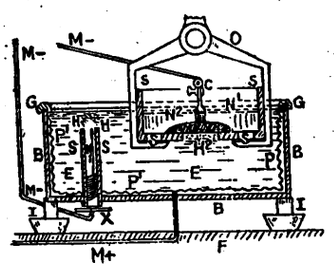

Fig. 4.—Plug-making Equipment.

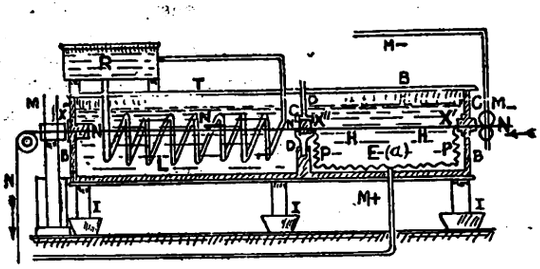

Fig. 5.—Cable-annealing Bath.

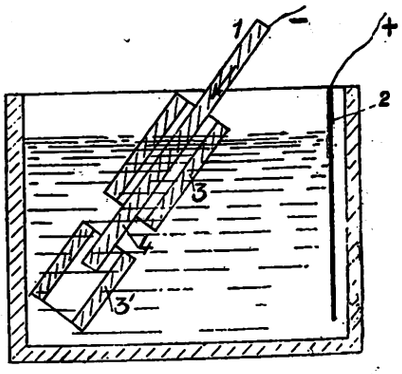

Fig. 6.—Axle-hardening Apparatus.

Local Heating for Forging, Welding, &c.

Fig. 3 shows a method of utilising the bath for the forging or bending of iron, so that any particular part of the metal can be heated. As the drawing indicates, the surface exposed to the calorific action may be adjusted by means of a movable sleeve X on the insulating tube S.

Fig. 4 shows an arrangement for the manufacture of plugs. The two pieces N^1 and N^2 to be welded together are submitted to the bath action at the same time, the end H of the rod and the central part H^2 of the plate being also simultaneously submitted to the action of the bath.

Insulators which render the whole an insulated bath, localise the action of the heat exactly to the desired points. The exposed portion of N^1 can be adjusted by means of a regulating screw X.

Another form of apparatus can be utilised for the welding of iron and steel parts, such as are used for the production of hatchets, the respective parts being heated in separate baths of different suitable liquids. Still other applications include that of heating small parts, such as needles, from one end to the other without contact with the negative electrode; that of hardening to any desired depth the surface of turned steel parts by allowing the electrical action to take place only on certain portions at a time, and that of hardening large numbers of small parts by mounting them on a rotating wheel which permits the parts to be brought into the bath one after the other. In the latter case, after each part has been in the bath for the predetermined time, the current is cut off, allowing the part to cool, before the next one is moved round and the current circuit again completed.

An important application is that of annealing cables after being built up of strands of wire. This can be done in various ways, one of which is shown in fig. 5. The cable is drawn through a box X^1 and an appropriate opening in one side of the bath, it being heated up to the requisite temperature as it passes through the latter. The temperature attained depends on the e.m.f. of the circuit, the area of surface of the length of cable exposed to the action of the current, and the speed at which the cable is passed through the bath. When the desired temperature is reached, the length of cable is advanced through an opening in the opposite bath side into a second and final tempering bath, the liquid of which is maintained at a constant temperature.

Fig. 6 shows one form of bath for the progressive hardening of the surface of such parts as the ends of axles.

Fig. 7 depicts an arrangement for the hardening of steel armour plates. The plate rests on the bottom of the tank between two fixed insulators 3 and 4, and its entire upper surface is covered with an insulating plate 5, connected to a wall 6, extending the full width of the bath, thus leaving a free space 7. The insulating unit 6 and 7, which contains the positive electrode 2, is first placed on the armour plate towards the right. In order to regulate the current, the armour plate is thus at the commencement completely insulated, but in proportion to the movement of the unit 5 and 6 it is progressively exposed until there is an open surface equal to that between the plate 5 and the wall 6, exposed to the action of the current, and so it is heated—this continuing to the end of the movement, so that all parts of the surface are successively heated for an equal period of time, and afterwards, as soon as the wall 6 has passed above it, the respective heated parts enter a zone protected against the action of the current, where they, in turn, undergo the hardening operation whilst still in contact with the liquid.

The essential point is to protect all parts of the armour plate, except that below the space 7, and also the tank, if this is also a conductor, against any current which may pass to the positive electrode.

To secure this, the armour plate can be also protected laterally by insulators and the wall 6 arranged to descend on the sides of the plate to the bottom of the tank, the space between 5 and 6 being also, if necessary, closed by insulators. The horizontal plate 5 may be replaced by a vertical or inclined insulating plate 5^1.

Fig. 8 shows the arrangement for the hardening of the heads of steel rails. The rails are held in the bath in an inverted position in such a way that only the part to be hardened is submerged in the liquid, the ends of the rails being prolonged by two insulators 3 and 4 having a similar profile to the rails. Two insulating walls 5 and 6 contain the positive electrode 2.

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the part of the rail within the free space 1 being heated and then moved to the right, where the hardening operation takes place in the way already described. In order to protect the sides of the rail against current action due to any disturbance of the level of the liquid, supplementary insulators 8 and 8¹ are mounted near the rail sides. As an alternative arrangement, one of the insulating walls may be inclined partially or altogether, as indicated at 5¹.

The tanks or baths can be varied to suit any particular class, shape, or size of material to be treated. Thus, taking, for example, the cylinder of a steel rolling mill, this may be rotated in the liquid, and by means of appropriate insulation only a part of its surface heated at a time, the rotation continuing until the whole cylinder is brought up to the requisite heat.

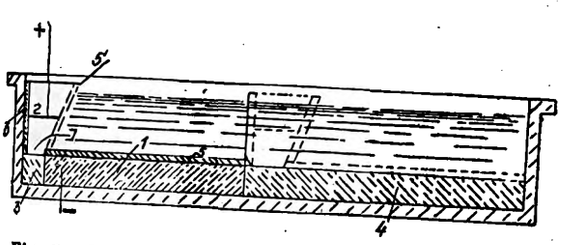

Fig. 7.—Bath for Hardening Steel Armour Plate.

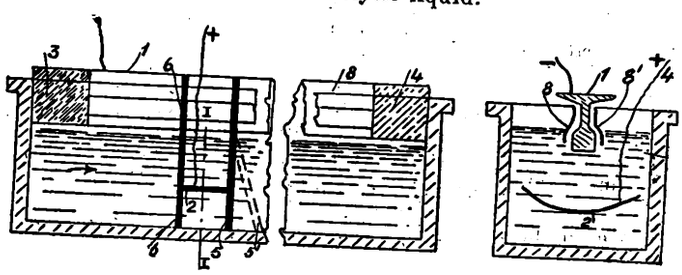

Fig. 8.—Bath for Hardening Steel Rail Heads.

It may be here pointed out that the illustrations only indicate different forms of baths or tanks diagrammatically; they only show the parts connected with the process, the auxiliary devices and accessories necessary for carrying out the actual operation, such as the current conductor connections, means for renewing the liquid, the cooling of the latter, and the gear for handling the parts under treatment not being indicated.

Future Developments.

In considering future developments of the process, let us imagine a soft insulating material capable of absorbing, like a sponge, a certain quantity of liquid from, and in close contact with, a metallic dish or small cylinder a few centimetres in height and diameter. If the metallic container be connected to the positive of a source of current, it will act as a positive electrode; the sponge by simple contact can heat up a metal connected to the negative pole; the latter could therefore be heated by passing the sponge over it.

To reduce the size of the apparatus, the liquid could be conveyed to the sponge in a continuous stream, adjustable by hand, and at any desired pressure, by means of a flexible pipe. A better solution of the problem would be secured by means of a pliable material, such as asbestos. An asbestos cloth might be applied in place of the sponge, or a casing having strands of asbestos or other heat-resisting material might be used. To reduce any danger of the sponge or other body becoming consumed, recourse might be had to the use of silicates in the electrolytic liquid.

To ensure a sufficient surface contact between the positive electrode and the liquid contained in the type of sponge used, the interior surface of the electrode might be provided with a large number of metallic points penetrating into the sponge, also the edges of the electrode, in order to protect it against direct contact with the metal to be heated.

Arrangements of this kind are at present being experimented with, as a result of which it is hoped to arrive at some original and interesting solutions. To conclude, it may be said that such a method would enable heat to be applied to a metallic surface in the same way as one applies paint thereto by means of a sponge, a wad, or a brush, the intensity and temperature of the heat being controllable by simple hand pressure.

Switchboard Instruments.

A Review of Modern Practice in the Design and Use of Indicating Electrical Equipment.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

THE various types of indicating instruments in general use are detailed, together with the properties of each, including those of withstanding overload and freedom or otherwise from temperature and frequency errors, &c. Considerations on changing the range of instruments due to altered conditions of use are given, and in the case of a.c. instruments, the applicability to different frequencies. Other considerations as to type of scale obtainable with different instruments, and the improved (first-grade) moving-iron and induction instruments, are included. Ammeters and voltmeters are mainly dealt with, but all indicating instruments, wattmeters, power-factor indicators, synchroscopes and frequency indicators are within the scope of the article, whilst integrating meters are beyond it. Graphic instruments and relays are dealt with as far as they require instrument transformers, which are dealt with at some length. The B.E.S.A. standard ratings for instrument transformers are given, and the consumptions for different types of relay. For use in deciding on the required size of instrument transformers, an indication of the consumption of the various types of instrument is given, but the limits are very wide.

General.

The types, patterns, and sizes of electrical instruments for switchboards are many, and although the types in general use are now few, by elimination of the unfit, there is at present no uniformity in either pattern or size. Some central-station engineers like to have large instruments with long scales that can be easily read from a distance. To cater for this the 9-in. and 12-in. circular instruments, and large sector and edgewise patterns, have long been available, and in more recent years the circular case with nearly circular scale, first commenced with induction-type instruments and now also produced in the moving-iron type, and the 360-deg. scale power-factor indicator.

Other central-station engineers require compactness as the first essential, so that as many instruments as possible can be grouped on a small control board, often of the desk pattern. Both of these classes have to be catered for, at least as far as ammeters, voltmeters, and wattmeters are concerned.

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Power-factor indicators, synchroscopes, and frequency indicators are not usual in small sizes, but as only a few of these are required, the lack of small sizes is not so objectionable. Power-factor indicators are perhaps an exception, and as their use is increasing on all sorts of generator and feeder panels, it may be that there is scope for a small instrument comparable in size with the 3- or 4-in. dial ammeters and voltmeters.

D.C. Instruments.

The moving-coil instrument in general is supreme, but the recent advent of moving-iron instruments which have first-grade accuracy on d.c. gives a considerable scope to this type of instrument on d.c. as well as a.c., as the cost is in all cases in favour of the moving-iron, for equal size and range of instrument. Switchboard instruments rarely need to be better than of first-grade accuracy, but possible exceptions may be where bus-bar voltage is regulated by automatic voltage regulators, and so first-grade moving-iron instruments (on d.c.) have a considerable scope.

As first-grade accuracy is easily attained by moving-coil instruments, others of lower grade should not be tolerated, and substandard accuracy is rarely required for a switchboard instrument. A first-grade instrument is generally more robust and therefore adapted to the fluctuations and heavy overloads met on switchboard instruments. All ranges are permissible, and up to a few hundred volts or amperes the instrument is generally self-contained. In the case of ammeters, however, it is often a convenience to have external shunts for all but very low ranges, so that the shunts may be fitted in the run of the bus-bars, rather than bringing bus-bars to the instrument. In the rare case of e.h.p. d.c. boards it is not possible to isolate the instruments as can be done for a.c. by means of transformers, and so the cases of the instruments should not be earthed, but isolated from earth and contact with attendants by some such method as using a flush instrument with a complete glass cover over the whole front of the apparatus. In the case of e.h.p. d.c. voltmeters on a system with one pole earthed, it is, of course, permissible and desirable to connect the voltmeter on the earthed side, with the series resistance mounted at the back of the board away from other connections. As a general rule it is advisable to earth the cases of all instruments, and to insert fuses in voltmeter leads, though this practice is not universal.

If subsequent extensions require the range of instruments to be altered, it will generally be found that little has to be scrapped. At the outset the whole of the instruments should be inspected, and their new ranges calculated. By a rearrangement it will then be possible to change instruments so that the highest ranges only are wanting and the low range instruments are spare; a new shunt or series resistance for the highest-range instrument is obtained, and the instrument is sent for recalibration. This course is preferable to fitting a new shunt on site and altering the scale by hand, as a hand-figured scale usually upsets the appearance of any instrument. Alterations in range are most usual with ammeters, voltmeters only being required to be altered with change of station pressure as a rule.

The consumption of moving-coil instruments varies approximately proportionally to the range. At low ranges the consumption is much less than that of other types, but for high-range ammeters the case is different, the usual power loss in a 5,000-ampere shunt being nearly 400 watts, and if it belongs to a graphic or recording ammeter, it will be twice as much, or more.

The overload capacity of these instruments is generally good, but good mechanical construction is necessary, as damage may be more severe on the mechanical system than on the electrical, caused by the force with which the pointer hits its end-stop. A bent pointer requires careful handling if it is to be straightened on site.

Temperature errors are negligible with switchboard instruments of this type, with all except some cheap ammeters having insufficient swamping resistance. The standard shunt drop of 0.075 volt at full load tends to immunity from this error, unless the moving-coil itself is of high resistance and requires too great a proportion of the millivolts available.

Multi-range ammeter switches are a source of error unless the switch contacts are massive and well fitted. An erorr of a high order can be introduced if the change-over switch makes faulty contact. Such switches should be checked periodically with a low-range millivoltmeter or portable galvanometer when about full-load current is passing through the shunts. Any flicking or variation shown when the switch is moved slightly points to the switch requiring overhaul. Two-way tumbler switches are rarely suitable, as the contacts are too uncertain and changeable with time.

Graphic instruments on d.c. are almost invariably moving-coil, and as the volt drop across a graphic ammeter is 0.15 to 0.2 volt, their shunts need careful disposition in order to maintain them cool, and so unable to affect other instruments in their neighbourhood.

The case for the use of moving-iron instruments on d.c. is best for relatively high ranges, and in any case these instruments are not generally good on d.c.—nor on a.c. for that matter, below about 50 volts and 1 ampere.

D.c. instruments are usually limited to voltmeters and ammeters, wattmeters being unusual; a dynamometer wattmeter may be employed if required, if it is fitted with series resistance on the pressure side, and a shunt on the current side, as transformers are, of course, useless. (The induction wattmeter, like other induction instruments, will not read on d.c., except that a sudden change of load may cause a transient indication.) The ease with which a central zero can be obtained is very useful for some d.c. circuits, both for voltmeters and ammeters. A set-up zero is easily obtained to the extent of 50 per cent., and is often useful for voltmeters.

A.C. Instruments.

Of the various types available, the majority of a.c. ammeters and voltmeters are of the moving-iron type. Induction instruments were popular at one time on account of their long scales (about 300 deg.), but as they were not of better accuracy than second grade their use declined until recently; it was rare to see an induction instrument—this article does not deal with integrating meters. As there are now at least two makes of first-grade induction instruments on the market the type is definitely reviving, mainly by that school which favours long-scale instruments for reading at a distance. However, there is also at least one moving-iron instrument marketed having an equal length of scale, and so, even if an engineer must have long-scale instruments, the induction is not the only type which may be used. If attention is confined for the present to ammeters and voltmeters the above two types, together with the dynamometer, practically cover the field. The thermal type is nearly extinct for power frequencies, and electrostatic voltmeters are nearly so, except for very high voltages, and then chiefly for laboratories, and not industrial switchboard work. Dynamometer instruments are less used now, as the accuracy of moving-iron instruments has increased considerably in the last few years, and the moving-iron instrument is the cheapest on the market, for a given size and range. Of the various errors in alternating-current ammeters and voltmeters, temperature error is nearly absent with moving-iron instruments, except for voltmeters of less than about 50 volts range. For the usual range of 110 volts for voltmeters operated from voltage transformers, the error is well within first-grade accuracy, for a good make. The old shaded-pole induction instruments were by no means free from this trouble, and that was their main source of error, resulting in no better than second-grade accuracy. The two new patterns are vastly improved and temperature error is now negligible as far as switchboard instruments are concerned, so that on this point there is little to choose between them and the moving-iron type. The frequency error of induction instruments will be discussed later.

(To be concluded.)

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London Trunk Power Cables.

A criticism of the proposal to lay unarmoured extra-high-pressure cables directly in the ground from the point of view of reliability.

By K. BELL.

IN view of the dangers brought to light during the inquiry into the Holborn explosion, it is interesting to examine the proposals contained in the specification covering the lay-out of the trunk cables to be laid in the London area in connection with the South-East England Electricity Scheme.

For the lower voltages up to 33,000 volts, standard types of 3-core armoured cable will be employed, and these types will not be further discussed, as they only form a small portion of the scheme and their manufacture and laying have now become routine practice.

On the other hand, the 66,000-volt cables are novel and, ranging in size from .15 to .35 sq. in., are all to be of the single-conductor, lead-sheathed, unarmoured type, waterproofed by two linen or paper tapes with one hessian tape overall, all well compounded.

It might be thought that these unarmoured cables would be drawn into ducts, or otherwise protected; but, in spite of the importance of these mains, the specification calls for the cables to be laid direct in the ground in triangular formation, and protected by either a flat reinforced-concrete or wooden cover. The usual bedding and covering of fine earth riddled through half-inch square mesh is specified.

When it is borne in mind that these cables are to be laid, although not as yet in the Central London area, in some of the busiest parts of London where there is heavy traffic and the ground is already congested with existing services, it will be realised that with plain lead-sheathed, unarmoured cables laid direct in the ground as specified, there will be great difficulty in laying and maintaining a satisfactory system of trunk feeders.

There are the following obvious objections to the proposal:—

(1) The damage to the lead sheath and distortion of the insulation which are bound to occur during the laying of unarmoured cables in the congested London area where the cables must inevitably be laid in a tortuous path to avoid existing mains and other obstructions.

Although any trouble which is likely to arise under this heading will be the responsibility of the cable-laying company, some of the troubles might not develop during the guarantee period, and as reliability of operation must be the primary consideration of any grid system, the cables should be made mechanically stronger by some form of armouring, or else be laid at a sufficient depth to permit of their being laid out on a practically straight run below existing obstructions.

(2) Even in soil passed through half-inch square mesh sieves, stones can be found in the "fine soil" of sufficient size to penetrate the lead sheath of an unarmoured cable. Stones or sharp material which may fall or be thrown into the trench must not be overlooked. This danger, which will be increased in the London area by the heavy traffic and vibration, will be further greatly increased whenever any future excavations are made by other undertakers who cannot be expected to replace the soil with the same care.

(3) One cannot contemplate with equanimity the carrying out of future excavations in the London streets with unarmoured cables working at 66,000 volts lying hidden in the ground with only a wooden marker board as protection.

The greatest care has always been needed to prevent damage to existing armoured mains when carrying out excavations in their vicinity and also in supporting mains across the excavations should they be exposed.

It is obvious that these risks will be very materially increased if unarmoured cables are used, as the slightest touch with a pick or shovel will penetrate the lead sheath.

It would appear that the danger from damage from outside sources has to some extent been considered, as the specification requires the three single-conductor cables forming each feeder to be laid in triangular formation with the base of the triangle at the top next to the protecting cover. It will be readily seen that this gives some slight extra margin of protection, but at the same time this will hardly be commensurate with increased cost of laying entailed by requiring the two top cables to be supported in some manner over the bottom cable before filling in.

It may possibly be that the proposals are of a preliminary nature with a view to obtaining, besides prices for the work, the opinions and recommendations of the various cable companies, otherwise it is hard to understand how a system with such obvious dangers to the safety of the public, as well as to the safety of supply, has come to be considered at all.

Single-conductor armoured cables for use on alternating-current systems have been manufactured and laid for some years past. The only objection is the high cost of the non-magnetic armour. There is every possibility of this cost being reduced in the event of a considerable quantity of non-magnetic armoured cable being required.

The other alternative is to lay the lead-sheathed cables in specially-shaped concrete troughing similar to that employed for the cables round Paris or, alternatively, to employ the American practice of drawing the cables into ducts which would also have the additional advantage of allowing provision for future extensions to be made.

There is a growing realisation that it is necessary to allow for the longitudinal expansion of cables produced by their heating on load, and this can be suitably allowed for if either the trough or duct system is employed.

If the use of cables of the high voltage of 66 kV can be justified and permitted in the London area, the laying and operation of the approved method of construction will be watched with great interest by all in the electrical industry, but before any decision is taken, the dangers of unenclosed unarmoured cables should be given very careful thought.

Melting River Ice Electrically.

The Canadian Federal Government has concluded a contract with Prof. Howard T. Barnes, of Montreal, inventor of a thermo-electrical process of melting great bodies of ice, to keep the St. Lawrence River channel clear this winter between Montreal and Sorel, and thus advance the commencement of navigation in spring. The experiment, which is the largest of its kind yet undertaken, will involve an expenditure of 60,000 dollars.—*Reuter's Trade Service* (Ottawa).

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Facsimile Radio-Telegraphy.

A brief outline of the latest photo-telegraph apparatus of Marconi's Wireless Telegraph Co., Ltd., employed on a transatlantic short-wave beam radio-telegraph circuit. Since the photo-telegraph service was inaugurated for public use in 1926* between London and New York, picture transmission has undergone considerable development.

THE success of short-wave beam radio-telegraph services pointed the way to new achievements, and the Marconi Co.'s research department has, during the last two years, been developing a photogram system adapted to short-wave wireless and to land-line circuits with the object of attaining higher speeds and clearer reproduction; in fact, it is preparing a true facsimile service that may in time replace Morse telegraphy on busy circuits so that the normal procedure may be the delivery of telegrams in the actual handwriting of the sender.

Fig. 1.—Transmitter Photoelectric Cell.

How far the research engineers have succeeded was demonstrated last week-end at the Company's beam receiving station at Somerton (Somerset); the management of the Company was represented by Major-General Sir Graham Bowman-Manifold, K.B.E., C.B., C.M.G., D.S.O., while the demonstration was in charge of Mr. G. M. Wright, of the Marconi Research Department, who has been responsible for the development of the facsimile apparatus. At the American end, Mr. Davies, an English engineer, is in charge of the experiments.

The system differs both mechanically and electrically from any other; while there are certain difficulties still to be overcome before practical "perfection" is attained, it is now possible to transmit two images over two radio channels simultaneouly, each 8 in. × 10 in., in less than 20 minutes. The "messages" have the advantage of unimpeachable accuracy, and the possibility of including not only handwriting, but also a reproduction of anything that can be written, or drawn, on paper is a particularly valuable feature when complicated figures and diagrams are required to be sent.

From the operating point of view, the most important novelty about the gear is that it runs continuously; it is not necessary to stop the machinery every time a new picture is put on the transmitter, or taken off the receiver. As soon as one "message" is finished, another can be placed on the cylinder and transmission begins at once, which fact alone effects an economy by obviating the running-up of the machinery and synchronising the two ends of the circuit separately for every picture; in addition, preparation of the message to be transmitted is not required, reception is perfectly direct, and can be checked as it is taking place, enabling faults to be instantly detected and corrected. The apparatus being also ingeniously arranged to transmit two pictures at once, one radio channel could be kept busy with "ordinary" telegrams and the other reserved for the "urgent" messages.

The process is as follows: the "message" to be transmitted is placed face downwards upon a metal cylinder, being held in position by a flexible band. Around the cylinder is a narrow slit, across which the "message" is slowly drawn by traversing mechanism. A point of light, focused through the slit, revolves and so illuminates, successively, every part of the image as it travels along the cylinder. The light is focused into a small spot on the surface of a steel "chopper" disk, 14 in. in diameter with 144 equally-spaced holes near its periphery, which is run at speeds up to 5,000 r.p.m., its purpose being to provide a convenient carrier frequency which is modulated by the varying intensities of the image. The maximum carrier frequency produced by this arrangement is 12,000 cycles per second, the normal rate used being 6,000 cycles per second.

The interrupted light emerging from the "chopper" disk is collected by a condensing lens and focused down to intensely illuminate a pin hole, from which the light is collected and converted in a parallel beam through the hollow spindle of the motor driving the optical rotor (which is the means of revolving the point of light) to the inside of the transmitting cylinder, and is there thrown by means of the prism and lens of the

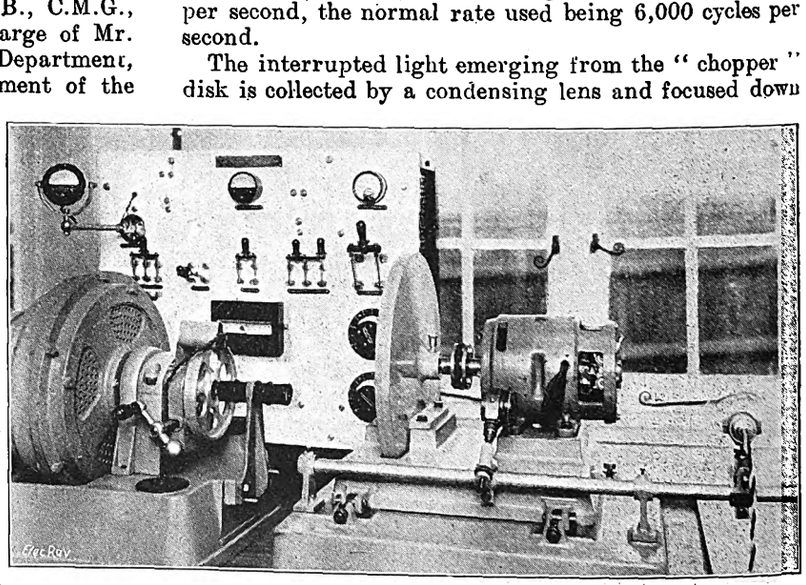

Fig. 2.—Light "Chopper" Disk.

* Elec. Rev., June 4th, 1926, p. 820.

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rotor through the slit in the cylinder on to the image to be transmitted. The reflected light from the image, varying according to the tone shades, is collected by

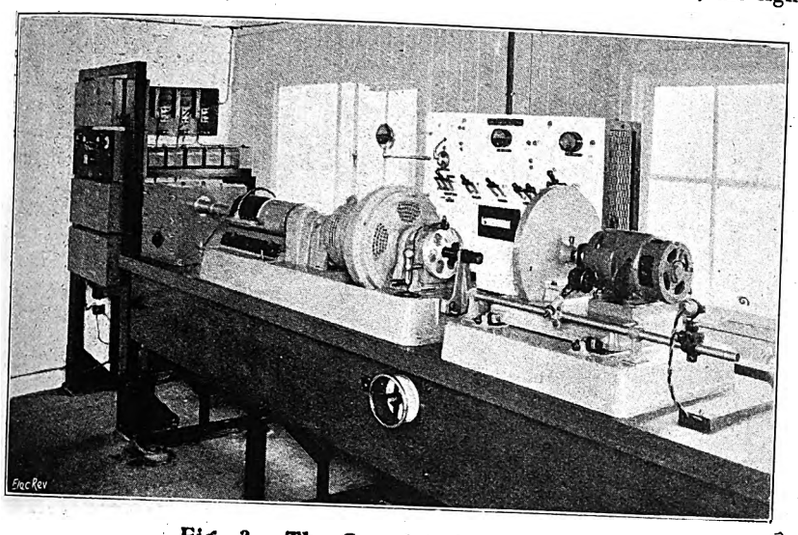

Fig. 3.—The Complete Transmitter.

a lens and again converted into a parallel beam which impinges on a photo-electric cell. The voltage of the current flowing through the latter is varied by the intensity of the light thrown upon it and applied to the grid of the first of a number of magnifying valves, the output of which is utilised to modulate the beam radio transmitter.

The receiver is similar in its main features to the transmitter, being the means of reversing the process carried out by the transmitter, for it translates electrical impulses into terms of light, which is achieved by the application of a phenomenon discovered by Kerr in 1875. A Kerr cell, acting as a light shutter, allows a spot of light to fall on a sheet of sensitised paper only when an electrical current is passed through the cell.

The arrangement of the receiver is as follows: light is passed through two Nicol polarising prisms, between which is placed the Kerr cell, which is actuated by the incoming wireless signals. The light traversing the first Nicol prism is polarised and passes between the two small electrodes of the cell, which is filled with nitrobenzine; it then passes to the second Nicol prism.

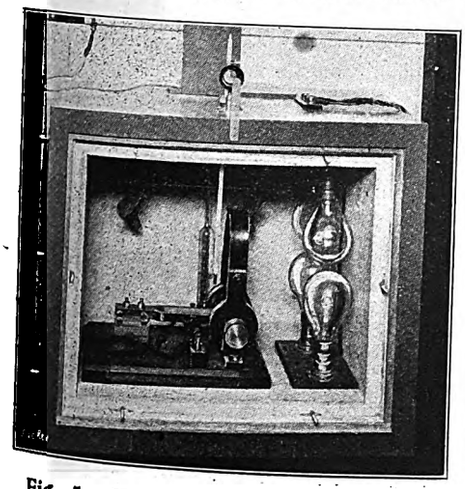

Fig. 5.—Heat-insulated Tuning-fork Box.

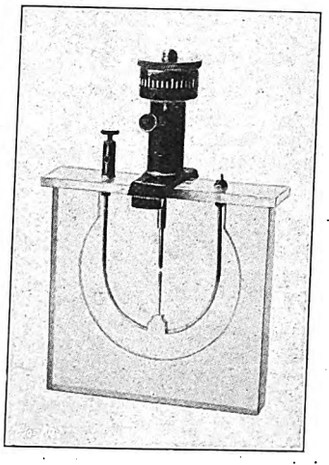

Fig. 6.—A Kerr Cell.

which is so arranged that the light is completely cut off from the receiving cylinder when no voltage due to an incoming wireless signal is applied to the electrodes of the cell. When a wireless signal arrives and causes a voltage to be applied to the electrodes of the cell, the light is able to pass to the receiving cylinder; it is then collected in a parallel beam by an optical rotor which shrows a small spot through the slight in the receiving cylinder on to a piece of bromide photographic paper which is placed round it and laterally pushed over the slit. In this manner the light and dark portions of the image on the transmitting apparatus are faithfully recorded at the receiving end.

The photographic paper on the receiving cylinder is held down by a thin flap of celluloid through which the position of the received image may be observed during reception from the revolving streak of light which scans the paper through the slit in the cylinder.

In order to reproduce at the receiving end the exact image of the picture placed on the transmitter, the transmitting and receiving optical rotors must synchronise in their revolutions, which is achieved by motors whose speed is controlled by valve-maintained tuning forks at the transmitting and receiving stations. To obtain constancy of the rate of vibration, the forks are enclosed in a heat-insulating

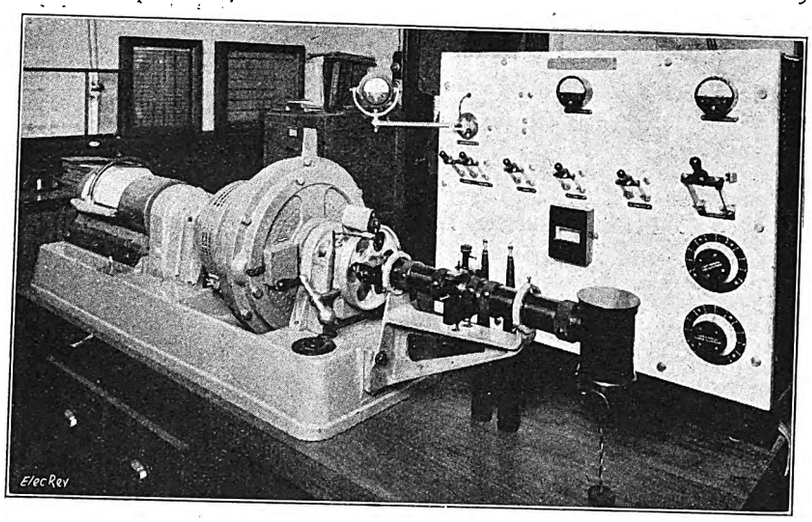

Fig. 4.—The Receiver at Somerton.

box,† the air in which is kept at a steady temperature by heating lamps, automatically switched on and off by means of a toluol regulator, two fans in the box stirring the air in order to keep an even temperature. By this arrangement the temperature in the box is maintained constant to within 0.05 deg. F., as can be observed for checking purposes by means of a thermometer which projects through the top of the box.

When starting the machines the tuning fork is made to vibrate, and either the natural frequency, which is 300 cycles, or the second, or fourth, harmonic of the fork frequency, can be selected, amplified, and passed through the armature winding of the a.c. synchronous motor of the driving machine. The frequency selected is also made to illuminate a neon tube mounted over a stroboscope wheel on the spindle of the d.c. motor driving the optical rotor, which may then be adjusted so that a clear stationary image of the stroboscope is obtained; the d.c. motor is then "locked" and the driving mechanism is automatically kept in step

† ELEC. REV., Jan. 25th, 1929, p. 174.

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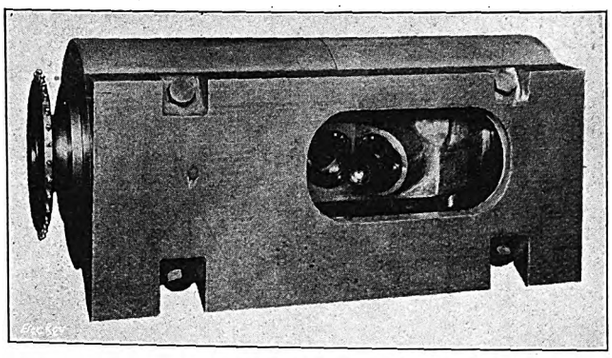

Fig. 7.—The Light Rotor.

with the fork frequency, or its selected harmonic. The new Marconi facsimile system is in every way suitable for the transmission of pictures over landlines also, the speed with which pictures can be transmitted depending on the quality of the landlines; quality which will enable landlines to carry the highest musical notes without serious diminution in volume allows the transmission of pictures at maximum speed. From what has been written it will be understood that the messages to be transmitted do not need to be prepared in any way, but reception takes place in a photographically "dark" room. Nothing can be seen on the bromide paper on the receiving cylinder, except the revolving spot of light, until the paper is developed, when the picture makes its appearance; the developing process is by no means lengthy and quite straight forward.

The test transmissions took place from the beam station at Rocky Point, Long Island, U.S.A., reception taking place at the Marconi beam receiving station at Somerton, Somerset, which carries on commercial wireless services at the present time with the U.S.A., Argentine, Brazil, and Egypt

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

British Industries Fair Notes.

The 1929 British Industries Fair opens simultaneously at Castle Bromwich, Birmingham, and the White City, London, on Monday, February 18th, and there is every indication that it will be even more productive of results than its predecessors.

The Government is again giving a banquet at the Mansion House on the evening of the opening day, and invitations have been sent to many distiguished foreigners whose interest and assistance are invaluable to British industry and trade.

We have already published full lists of the electrical and allied exhibitors in both sections of the Fair. In succeeding issues we propose to deal with the exhibits in some detail.

Practically all of the associations and institutions connected with the electrical industry and profession are to pay official visits to the Birmingham Section. We gave a list of these bodies and the functions which they are attending in our issue of January 11th (p. 63). It has been arranged to hold a conference of electrical engineers and others connected with the industry at 11.15 a.m. at Castle Bromwich on Friday, February 22nd. The chair will be taken by Sir John Gatti, J.P., M.A., President of the British Electrical Development Association, and an address upon how to increase the sales of electricity and electrical apparatus will be delivered by Lieut.-Col. W. A. Vignoles, D.S.O., M.I.E.E., Director of the Association. After the address the meeting will be open for discusssion, and it is hoped that all members of the electrical industry attending the fair will do their utmost to be present. It is only by enlisting the earnest support of all sections of the industry to efforts of this kind that electricity can take its place in the forefront of our national life.

The Chairman of the Local Committee, Mr. R. A. Chattock, M.I.E.E., city electrical engineer, 14, Dale End, Birmingham, will, on application, be pleased to send an admission ticket to anyone who proposes to attend the conference.

An invitation has been extended by the Committee of the Electrical Section to the South Midland Students' Section of the I.E.E. to visit the Birmingham Section on February 23rd. The invitation was limited to the first 100 members making application for tickets. Tea is to be served in the Royal Room, Building C, Electrical Section.

Visitors to the Fair will find their trade and technical papers displayed at the joint exhibit of the Periodical, Trade Press, and Weekly Newspaper Proprietors' Association. At Birmingham the stand number is 10D/6, whilst at the White City it adjoins the Overseas Buyers' Club. Every publication offers its services to visitors to the Fair, and all are cordially invited to make the fullest use of the Service Departments of the trade and technical Press. A special Information Bureau will be available at the White City stand, where subscribers' advertisers' and overseas buyers' inquiries will be expeditiously dealt with.

For those desirous of taking advantage of the opportunity, representatives of the publications exhibited will be pleased to make appointments for interviews at the Bureau, and generally to assist in every way possible to meet the requirements of clients. Specimen copies may be obtained from the stand.

A joint exhibit will also be arranged under the auspices of the Association at the Ring Messhaus, Leipzig International Spring Fair, when similar facilities will be placed at the disposal of visitors.

The North-East Coast Exhibition.

As we mentioned some time ago, an exhibition representing the industry, science and art of the North-East Coast is to be held in Newcastle from May to October this year. The arrangements for the exhibition, which is on a large scale, are now well in hand, and the electrical industry will be well represented. The British Electrical Development Association is to have a large stand, and the Electric Lamp Manufacturers' Association is arranging a very fine lighting exhibit. In addition, the important electrical concerns of the area, including Messrs. C. A. Parsons & Co., Ltd., A. Reyrolle & Co., Ltd., J. H. Holmes & Co., Ltd., and the Newcastle-upon-Tyne Electric Supply Co., Ltd., are all arranging effective displays. The list of vice-presidents and the general council contains the names of practically everybody of importance in North-East Coast affairs, and His Majesty the King has consented to act as patron. Sir Charles A. Parsons, O.M., is president.

We hope to give fuller particulars of the exhibition at an early date, but we may say now that the Palaces of Engineering and Industry will have a total floor space of 260,000 sq. ft.; thus the various branches of the industry should be well represented. The general manager of the exhibition is Mr. C. P. Hainsworth, Pearl Buildings, Newcastle-upon-Tyne.

The F.B.I. "Business Barometer."

The review of trade prospects by the Federation of British Industries for the first quarter of 1929 states that the past year was disappointing not because there was no progress, but because the rate of progress was slow. Reference is made to the restriction of credit by the banks, and competent authorities are quoted as stating that the more rapid adaptation of foreign competitors to post-war conditions has been due in a large measure to the favourable monetary conditions provided by their financial authorities. Conditions appear favourable to a continuance of the slow rate of progress, but so long as the present credit stringency persists it is not easy to foreshadow any marked change for the better in the conditions of the distressed trades, though schemes of reorganisation and rationalisation will doubtless be undertaken. Assistance is expected from orders which may be placed by the Central Electricity Board and similar public schemes.

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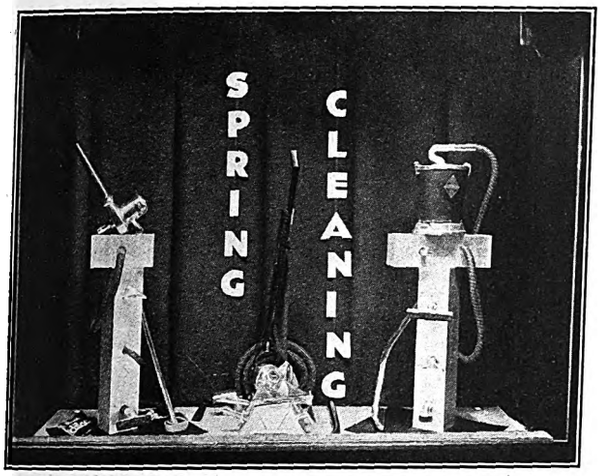
The American monetary situation, it is said, continues to be full of difficulties and dangers for Europe. The fall in the German Bank Rate is regarded as a propitious event, removing the possibility of further gold exports from this country to Germany. Conditions are promising in Chile and Argentina, while in the Far East the re-establishment of treaty relations with China should have beneficial results.

E.D.A. Activities.

February (and, of course, subsequent months) means spring cleaning, and it is in this direction that the efforts of the British Electrical Development Association are now being directed. Throughout the National Press appropriate advertisements are appearing, emphasising the ease and troubleless nature of electrical spring cleaning. For local advertising by individuals or groups of contractors and dealers three



An E.D.A. Spring-cleaning Window Display.

special illustrated announcements have been prepared, and they are available at very reasonable prices. The supplementary programme which has been issued also contains illustrations of two window displays which can be arranged with the assistance of E.D.A. We reproduce one of these; although it is simpler and cheaper, it seems to be the more effective.

The German Electrical Industry.

The report of the directors of the Allgemeine Elektricitäts Gesellschaft states that the improvement in the economic situation mentioned in the last report continued during the past year, and the turnover, including that of the undertakings whose share capital is entirely held by the company, increased by 500,000,000 marks, being an advance of about 25 per cent. The gross profits, 25.15 million marks, represented an increase of over 45 per cent., and additional provision for depreciation was made. The net profits were 16.50 million marks, as compared with 12.35 millions, and after placing 2,000,000 marks to the pension fund, a dividend at the rate of 8 per cent. is declared, as in the preceding year. The improved turnover is ascribed in the first place to the extension of the workshops, the technical perfection of the manufactures, the far-reaching reorganisation of plant, standardisation and constructive improvements. The full effect of these measures will be felt in the future. The expansion in the turnover has been effected without a material increase in the number of persons employed.

The report proceeds to say that the development of electricity supply by public works and the consequent extensions render the company independent to a certain degree of the general situation; the use of electricity has not yet reached "saturation" point. The quantity of orders on hand is greater than a year ago. Satisfactory activity was experienced in the construction of main-line electric locomotives, as well as for rail motor coach equipment. An active demand was manifested for the electrification of cross-country railway lines and the construction of new sections, while new equipments were developed to meet the requirements of the tramways. The orders from ironworks for electrical plant were small owing to the amalgamation of undertakings, but the orders from the mining industry increased. The report also refers to increased deliveries to the home and foreign chemical industry, paper and textile mills, as well as crane construction works. Although the foreign organisations increased their turnover, the prices obtained were not very satisfactory. Foreign sales were greatly handicapped by the constantly growing home manufacture in individual countries and Customs protective measures. Moreover, free competition abroad is becoming still more restricted through the increasing influence of foreign financial concerns.

Czecho-Slovakian Electrical Imports.

According to the *Board of Trade Journal*, during November last Czecho-Slovakia imported electrical machinery and appliances valued at 34 million crowns (about £207,000), bringing the total for the first eleven months of last year up to 229 million cr. (about £1,400,000).

Wages in the Contracting Industry.

The National Federated Electrical Association announces that as from the second pay-day in February the following rates of wages for electricians employed in the electrical contracting industry will take effect: Grade A—1s. 9¾d. per hour (¼d. increase); Grade B—1s. 7½d. (½d. increase); Grade C—1s. 6d. (no change); Grade D—1s. 4¾d. (¼d. increase). These rates will remain in force up to and including the period covered by the first pay-day in June.

Plumber-Jointers' Wages.

The above alteration in wages in the electrical contracting industry affects the wages of plumber-jointers and their mates in the No. 10 (Greater London) Area. The new rates, applicable over the same period, will be:—Plumber-jointers, 1s. 9¾d. per hour; mates, 1s. 5.4d. per hour.

The Banks and Industry.

Speaking at the annual meeting of the Westminster Bank, Ltd., last week, the Chairman (Mr. R. H. Tennant) said that the banks had been accused of restricting credit and hampering industry and trade. If this could be proved, he would be the first to work for the immediate expansion of credit; but while production could be stimulated by credit, trade expansion was dependent on effective demand for the goods produced. The expansion of credit in the absence of an effective demand would produce all the evils of inflation. After referring to the need for efficient large-scale production and the attainment of cheapness combined with quality, Mr. Tennant said that amid all the world changes, Britain had two assets which had not changed in value. They were the skill and vigour of our workers by hand and brain; and our advantageous geographical position—a coast line studded with ports looking out upon the great European Continent.

In his address to the shareholders of Martin's Bank, Ltd., the Chairman (Mr. R. M. Holland-Martin) said that the outlook in the iron and steel industries was more hopeful; British prices were now on a more competitive level, and British makers would soon benefit by new railway rates and rate relief. The past year had been a bad one for trade, but the future was not without hope. We had learnt the lesson that trade would not come to us without effort on our part, even if we produced the best goods. The marketing of goods had been developed enormously by our rivals, and to sell abroad to-day the manufacturer needed to send out his travellers equipped with a knowledge not only of the life of the country they were visiting, but also with the power to talk to the trader in his own language. It was most advisable, too, that those with authority in their firms should constantly visit those countries in which they marketed their goods. Personal touch was as necessary with markets as with men.

Recent Contracts.

The Relay Automatic Telephone Co., Ltd., has been awarded, in open competition, a contract for the supply of a 350-line private automatic telephone system to be installed in the Imperial Japanese Navy Department at Tokyo. The installation is to be equipped forthwith with 300 lines. In addition the Department has placed an order with the Relay Company for the equipping of the H.I.M.S. *Mamiya* with an automatic system.

The "Xcel" tube heating system (Siemens Electric Lamps and Supplies, Ltd.) has been installed at the Ealing centre of the National Sunray and Health Centres, Ltd. The contractors for the work were Messrs. R. A. Poole (London), Ltd., of Goldhawk Road, W.12.

Registered Electrical Contractors.

The following applications for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its meeting on February 1st:—

Skinner & Burtonshaw, Southborough.
Jones & Gifford, Conway, North Wales.
Barratt & Co., Rusholme, Manchester.
Richardson, Thomas K., & Co., Liverpool.
Passmoor, J., Sunderland.
Meiklejohn, J. B., Ltd., Glasgow.
Sparkes Electrical Co., Aldershot.
Stone & Co. (Bristol), Ltd., Bristol.

At the same meeting six applications were declined.

Factory Canteens.

Canteens have become a permanent feature of factory administration, and already there is developing a technique in the management of them. In order that those responsible may have an opportunity of exchanging ideas on the practical points involved, a Canteen Conference is being held at the Hotel Victoria on February 14th and 15th, by the Industrial Welfare Society. On the second day, the Rt. Hon. J. R. Clynes, M.P., will be the guest at luncheon. Various experts will give papers on such aspects of the subject as service and staff, equipment and overhead charges, buying, and cooking and catering. The general aim of the conference will be to discover the best means to economy under all these heads. On each of the two days conducted visits will be made to exemplary canteens in the Metropolitan area.

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Bankruptcy Proceedings.

H. D. DOUGLAS, trading as H. D. Douglas & Co., engineer and wireless factor, 32, Queen Victoria Street, E.C.—An application for an order of discharge was made on January 30th to Mr. Registrar Warmington, at the London Bankruptcy Court, on behalf of this bankrupt, who failed in June, 1926. The Official Receiver reported that the admitted claims amounted to £3,233; the assets valued by the bankrupt at £531 had realised £164; a further sum of £125 had been received, and a dividend of 8½d. in the £ had been declared. The applicant began business in June, 1918, with a capital of £400, and traded with success until 1924; the business afterwards gradually declined owing to trade depression and bad debts, and in March, 1926, on account of pressure by creditors, it was discontinued. The failure was further attributed to law costs. The discharge was suspended for six months on statutory grounds.

A. ANGERS, trading as A. Angers & Co., 19, Bristol Road, Wavertree, Liverpool, electrical engineer.—Liabilities of £3,190 and assets of £112 were disclosed in the statement of affairs presented at the adjourned public examination of this debtor held recently at Liverpool. In reply to questions, the debtor stated that he had suffered from neurasthenia since the war, which had interfered with his business. He admitted that he had been aware of his position for some years, and had been in the hands of moneylenders since 1924. The strike in 1926 and losses on contracts also contributed to his failure. He stated that for overdraft purposes he submitted balance sheets to his bank which did not reveal loans and private debts, but the overdraft was guaranteed by his brother. The debtor added that he had had very heavy expenses in connection with the sale of a patent, his share of which he sold for £650, the money going into the business. The examination was closed.

H. BUCKLEY, electrician, 23, Asylum Road, Old Kent Road, S.E.—The first meeting of creditors was held on January 28th at the London Bankruptcy Court before Mr. Walter Boyle, Senior Official Receiver. The only proof of debt tendered was by Mr. C. F. Ebert, Peckham, who claimed £1,932 as a judgment creditor in respect of moneys alleged to have been advanced to the debtor. The latter disputed liability except as to a small balance. He stated in reply to the chairman that he did not attend before the Registrar when the receiving order was made because he had no notice of the appointment to hear the petition. The chairman announced that he would apply for an order for summary administration of the estate in bankruptcy.

B. H. WISHAW, Bakewell Road, Matlock, electrical and wireless engineer.—The adjourned public examination of this debtor was held recently at Derby. The debtor stated that an agent to whom he had given money for the payment of certain trade accounts had not used it for that purpose. In this way he had been deprived of between £90 and £100. The examination was further adjourned in order that the debtor should furnish a cash account.

C. K. GOVETT, trading as "Kenneth, Govett & Co.," 179, Albany Road, Cardiff, electrical contractor.—The first meeting of creditors was held recently at Cardiff, when the debtor attributed his failure to illness and bad trade. A statement of affairs was presented to the meeting, which showed liabilities of £412 and assets of £12, leaving a deficiency of £400. The case remains in the hands of the Official Receiver as trustee of the estate.

J. ROYSENTUL, electrical engineer, 45, Woodbury Grove, Finsbury Park, N.—The first meeting of creditors was held last week at the London Bankruptcy Court. No statement of affairs was lodged, and it appeared that only one proof of debt for £1,059 had been sent in. The case was left in the hands of the Official Receiver.

E. TEMPLE and J. E. BURKETT (Westoe Electrical Co.), wireless dealers and electrical contractors, 105, Canterbury Street, South Shields.—Last day for proofs for dividend, February 13th. Trustee, Mr. A. J. Gray, 48, Pilgrim Street, Newcastle-upon-Tyne.

E. C. JENKINS, wireless dealer, 124, Cheltenham Road, Bristol.—Receiving order made January 26th on debtor's petition.

F. J. HUDSON, electrical engineer, late of 44, Heath Road, Bradford.—First meeting, February 8th, at the Official Receiver's office, 12, Duke Street, Bradford; public examination, March 8th, at the County Court, Bradford.

W. T. JACOB, wireless engineer, 14, Meyrick Street, Pembroke Dock.—Receiving order made January 26th on debtor's own petition.

N. H. WOOD, electrical engineer, 32, Highbury Avenue, Thornton Heath, late of 38, St. Charles Square, W.10.—Application for discharge to be heard February 21st at the County Court, Croydon.

Company Liquidation.

BRITISH ELECTRIC VEHICLES, LTD.—Mr. E. T. A. Phillips, Official Receiver and Liquidator, 33, Carey Street, W.C.2, announces his intention of applying for his release as liquidator of the company. He reports that the assets of the company are being realised by a receiver for the debenture holders, and there is no prospect of any surplus becoming available for the unsecured creditors.

Private Arrangements.

R. A. EAVES and H. D. CAMERON, trading as the Empress Radio and Electrical Company, Manor Works, Stonehouse, Plymouth, and as the Westminster Radio, at Plymouth, Bridgwater, Taunton, and Newquay.—In consequence of pressure from creditors and with a view to protecting the assets, an assignment of effects has been executed in favour of Mr. Percival White (Messrs. White & Pawley), 6, Sussex Terrace, Plymouth. A meeting of creditors was to be held at the Great Western Hotel, Paddington, on February 5th. It is hoped that as a result of certain negotiations which are proceeding with some of the relatives of Messrs. Eaves and Cameron, a proposal will be made at the meeting for the liquidation of the trade liabilities for an immediate cash payment.

Dissolutions of Partnership.

H. E. WILD & SON, wireless dealers, &c., 63, Market Street, Shaw, Lancs.—Messrs. H. E. & V. Wild have dissolved partnership. Mr. V. Wild will attend to debts.

CURRIE & HANCHETT, electrical contractors, 5 & 7, Altrincham Street, London Road, Manchester.—Mr. G. Hanchett and Mr. G. Currie have dissolved partnership. Mr. Currie will attend to debts and continue the business in his own name.

Central Electricity Board Contracts.

The Central Electricity Board has placed with the STREAM-LINE FILTER CO., LTD., 45, Horseferry Road, S.W.1, the contract for filter plant to deal with the transformer and switch oils at each of the thirteen stations included in the Central Scotland Scheme. The value of the order approaches £20,000, and the scheme for the handling and storage of the dirty and clean oil, which has been prepared by Messrs. Kennedy and Donkin in conjunction wit the Central Electricity Board, is a very complete and effective one. The company's purification plant is based upon the well-known "stream-line" principle of edge-filtration; the plant is a simple static one, quite independent of centrifugal principles.

In our advertisement pages to-day the Central Electricity Board invites tenders for the following:—South-East England Electricity Scheme:—33,000-V overhead line—Luton to Aylesbury.

New Catalogues and Lists.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Catalogue S.L. 150/12. This is a well-produced, fully-illustrated list of the company's domestic appliances of all kinds—cookers, fires, cleaners, small devices, ultra-violet ray apparatus, &c. A number of new lines are included.

MESSRS. JOHN SHAW & SONS, WOLVERHAMPTON, LTD., Wolverhampton.—A price list of "Trojan" electric lamps.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Book 5, Section 36, dealing with the "Pul-syn-etic" system of electric impulse clocks for ships. Illustrated.

NEW SYSTEM PRIVATE TELEPHONES, LTD., Effingham House, Arundel Street, W.C.2.—An illustrated leaflet advertising the company's rented telephone system.

MESSRS. HEYES & CO., LTD., Water-Heyes Electrical Works, Wigan.—An illustrated pamphlet dealing with the company's prismatic bulkhead lighting fittings and their applications.

MESSRS. CHARLES CLIFFORD & SON, LTD., Fazely Street Mills, Birmingham.—A booklet dealing with "Al-dur-bra" (aluminium-brass) tubes for condensers, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Catalogue Section F (4), containing illustrated details and prices of the company's industrial and street-lighting equipment. Also Leaflets F.4.857-8-9, containing illustrations and prices of "Gecofix" lighting fittings designed for small suburban houses and the like.

MESSRS. A. H. HUNT, LTD., Tunstall Road, Croydon.—Catalogue No. 60 and Leaflet No. 138B, dealing respectively with commercial types of ammeters and voltmeters, and small electrical measuring instruments. Illustrated and priced.

THE BRITISH ELECTRIC RESISTANCE CO., LTD., Ohmic Works, Queensway, Ponders End.—A price list of vitreous-enamelled resistance units of various types and sizes.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Pamphlet 155A, containing an illustrated treatise upon the construction and characteristics of the company's "super tension" cables.

MESSRS. JOHN MOORES & CO., Ravald Street Works, Salford.—February price list of compound, ebonite, micanite, tapes and other insulating materials.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—Folder 4,746, containing illustrations and prices of "Elasta" lamps. Also a February calendar-blotter.

VAC-TRIC, LTD., Broadway Works, Cricklewood, N.W.2.—A coloured showcard (about 12 in. by 17 in.) depicting a little girl operating a "Vac-Tric" vacuum cleaner. Priced.

Jugo-Slav Tariff Modifications.

The *Board of Trade Journal*, dated January 31st, gives some particulars of modifications (mainly increases) in the Jugo-Slav Customs tariff under a commercial treaty with Austria. It is seen that the duty on "water turbines, with external driving wheel over 1.8 m. in diameter" is increased from 25 to 30 gold dinars per 100 kg. Telegraph and telephone apparatus, signalling apparatus, and electric measuring and counting

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apparatus is subject to a duty of 200 dinars per 100 kg. (instead of 150 dinars). On electric cookers, irons, &c., the duty is raised from 200 to 300 dinars per 100 kg. The duty on "copper cables and cords" is increased from 70 to 100 dinars per 100 kg.

Electrical Trade of the Philippines.

Mr. T. Harrington, British Consul-General at Manila, has forwarded to the Department of Overseas Trade a report on commercial conditions in the Philippine Islands (Stationery Office, 1s. net). The trade of these islands is, of course, dominated by the United States, about 60 per cent. of the imports coming from this source. The share of the United Kingdom is less than 5 per cent. The report shows that in 1927 the imports of electrical machinery, apparatus and appliances were valued at £501,410, as compared with £347,920 in 1926. In the latter year the following were the principal suppliers:—United States (£290,760); Germany (£23,520); and the Netherlands (£6,920). During the first six months of 1927 the electrical imports were valued at £217,020.

Book Notices.

"Science Abstracts" (A. & B.), Vol. XXXII. Part 1. January 25th, 1929. London: E. & F. N. Spon, Ltd. Price 3s. each.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. January, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Matthew Murray, Pioneer Engineer. Records from 1765 to 1826." Edited by E. Kilburn Scott. Pp. 132; illustrated. Leeds: Edwin Jowett, Ltd. Price 2s. 6d.

"Faraday House *Journal*," Vol. XIII, No. 2, Lent Term, containing articles on the "Theory of the Transformer," two sources of "Power for To-morrow," and the "Lighting of Aeroplane Landing Fields."

"The Radio Manual," by G. E. Sterling. Pp. vii+666; figs. 273. London: The Library Press. Price 30s. net.

The Marking of Imported Copper.

As a result of the recent inquiry under the Merchandise Marks Act, 1926, a draft Order-in-Council has been laid before Parliament requiring the marking of imported copper plates, sheets, strips, rods, wire, and tubes upon exposure for sale with an indication of their origin. The methods of marking each class are set out in the Order.

"Hidden Risks."

It will be remembered by our contractor readers that the above is the title of a pamphlet recently produced by the National Register of Electrical Installation Contractors for use of those who are on the Register. It is for public distribution, and draws attention to the dangers of shoddy wiring materials and careless installation, and recommends the public to go to registered contractors for their electrical work. Mr. T. Trimnell, the secretary of the Register, says that the pamphlet has met with a good demand; over 70,000 copies have been ordered. He points out, however, that the potentialities are far greater than this. If every registered contractor ordered 500 copies, over 600,000 would be disposed of. The price of the pamphlet is 12s. 6d. for 500 copies, or £1 3s. per thousand.

Prestatyn and the Sale of Fittings.

At last week's meeting of the Prestatyn Council a protest was made against the proposal of the Council to open premises for the sale of electrical fittings and appliances. A petition was presented by local tradespeople against the Council's entering into competition with private traders. After a long discussion it was decided to refer the matter to a committee.

Social Events.

On January 26th members of the Welfare Club of the Relay Automatic Telephone Co. gathered at Anderton's Hotel, Fleet Street, for their annual dinner. Major White, the sales manager of the company, occupied the chair, and Mr. W. T. Finlay, the chairman of the Welfare Club, responded to the toast of the evening. The Richard Fox Trio provided a musical entertainment.

The West Wilts district staff of the Western Electricity Supply Co., Ltd., held a whist drive and dance at the Town Hall, Trowbridge, recently. The company numbered over 300. Prizes were given by the directors and chief officers of the company, and they were presented by Mrs. H. Ledbury.

The annual whist drive and dance organised by the officials and staff of the Stockton Corporation Electricity Department was held recently. The Mayoress of Stockton (Mrs. Goldston) presented the prizes to the whist-drive winners; and others who took a prominent part in the proceedings were the Mayor (Ald. J. Goldston), Councillor G. P. Fairless (chairman of the Electricity Committee), and other members of the Town Council, and Mr. S. G. Marston, electrical engineer.

Trade Announcements.

Mr. H. HOLT, 43, Hall Gate, Doncaster, is now representing Messrs. Wm. Sanders & Co., Wednesbury, in the Doncaster area.

"Magnet House," a new branch of the GENERAL ELECTRIC CO., LTD., in Birley Street, Blackpool, was formally opened on February 1st by Councillor T. G. Lumb, J.P., chairman of the Corporation Electricity Committee.

MESSRS. F. W. MORGAN and L. J. WOLF have acquired the whole of the business of WAGNER ELECTRIC SUPPLIES, LTD., 66, Victoria Street, S.W.1, and the name of the company has been altered to Wolf & Morgan, Ltd.

MESSRS. ALLEN & SON, electrical and radio engineers, of Gravesend, have this week removed their business to larger premises at 11, Windmill Street, where there are new showrooms.

Correction.

We are asked to publish the following notice:—The BRITISH THOMSON-HOUSTON CO., LTD., regret that by a clerical error in the advertisement in our issue of January 25th of the judgments obtained by them against various defendants granting injunctions restraining the infringement of Patent No. 10,918 of 1913, the name of the Direct Electric Lamp Co., Ltd., appeared as one of such defendants instead of the Direct Electric Lamp Co., the word "limited" having been inadvertently inserted after such defendants' name.

Unemployment.

The number of registered unemployed on January 21st was 1,425,600. This represented a decrease of 9,400 since January 14th, when the total was 1,435,000. On January 23rd, 1928, the figure was 1,178,750.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price Feb. 5	Fortnight's inc or dec
a Acid, Oxalic ...	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	"	£52	...
a Bisulphide of Carbon	"	...	...
a Borax ...	"	£25	...
a Copper Sulphate	"	£25 10s.	...
a Potash, Chlorate	per lb.	3½d. to 4d.	...
a " Perchlorate	"	5½d.	...
a Shellac	per cwt.	£18 10s.	...
a Sulphur, Commercial	"	£11	...
a " Roll	"	£11	...
a Soda, Chlorate	per lb.	3d.	...
a " Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	3¾d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£95 to £100	...
b " Wire	per lb.	1/1 to 1/9	...
b " Sheet	"	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metal—			
Grade I ...	per ton net.	£203	£3 inc.
Grade II ...	" "	£141	£1 inc.
Grade III	" "	£76	£1 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	10⅝d.	...
c " Tubes (solid drawn)	"	1/0½ to 1/0¾d.	¼d. inc.
c " Wire, basis	"	10⅞d.	...
c Copper Tubes (solid drawn)	"	1/2¼	...
c " Bars (best selected)	per ton.	£104	£2 inc.
c " Sheet	"	£104	£2 inc.
c " Rod	"	£104	£2 inc.
d " (Electrolytic) Bars	"	£78 15s.	...
d " " Sheets	"	£148 10s.	...
d " " Wire Rods	"	£88 15s.	...
d " " H.C. Wire	per lb.	11s.	...
f Ebonite Rod ...	"	2/3 to 2/6	...
f " Sheet	"	2/3 to 2/6	...
n German Silver Wire	"	2/2	...
h Gutta-percha, fine ...	"	nom.	...
h India-rubber, Para fine	"	1/0½	1d. inc.
l Iron Pig (Cleveland No. 3.)	per ton.	65/-	...
l " Wire, galv. No. 8. P.O. qual.	"	£21	...
g Lead, English pig ...	"	£23 15s.	5/- inc.
g Mercury	per bot.	£22 5s.	...
e Mica (in original cases) small	per lb.	3d. to 8/-	...
e " " medium	"	4/- to 8/-	...
e " " large	"	10/- to 20/- & up	...
p Phosphor Bronze, plane castings	"	1/8½	...
p " " drawn bars & rods	"	1/8½	...
p " " rolled strip & sheet	"	1/8¼	...
p " " wire...	"	1/4¾	...
o Platinum	per oz.	£13 17s. 6d.	7/6 dec.
d Silicium Bronze Wire	per lb.	1/-	...
r Steel, Magnet, in bars	"	7½d.	...
n Tin, Block (English)	per ton.	£227 15s. to £228 5s.	£5 15s. inc.
n " Wire, Nos. 1 to 16	per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their report dated February 2nd Messrs. James Forster and Co. stated that the demand for lead from consumers has been decidedly better, but all purchases have been freely met by sales by importers. Consumption is well maintained; although arrivals during January were considerable, there is actually a shortage of early arrival lead, prompt lead standing at a premium of 2s. 6d. per ton over late February arrival. On the Continent conditions remain quiet, with no shortage of supplies. If present conditions continue, there seems every likelihood of an appreciation in prices.

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Lighting and Power Notes.

Aberdeen.—ELECTRICITY EXTENSIONS.—Extensions to the generating station, at an estimated cost of £7,300, have been authorised by the Corporation Electricity Committee. These include a new switch chamber and switchgear.

Birmingham.—LOANS SANCTIONED.—The Corporation Electricity Supply Committee has received sanction to the following loans.—Buildings (sub-station), £51,700; sub-station equipment, £198,100; frequency changer, £11,500; and purchase of Imperial Arcade, Dale End, £30,000.

Blackpool.—ILLUMINATIONS.—Owing to the General Election the Corporation has decided not to proceed with any special early season attractions in 1929. The usual illuminations are to be installed in the autumn, however, from September 21st to October 21st.

Bognor.—"CRAIGWELL HOUSE."—The Bognor Gas and Electricity Co., Ltd., has already completed the laying of a special main, about half a mile in length, to supply the needs of the Royal Household during its visit. The a.c. supply will be used principally for heating and cooking, the lighting supply being taken from Sir Arthur du Cros's private plant.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Ontario Hydro-Electric Power Commission during the fiscal year ended October 1st last constructed 993 miles of additional rural lines distributing power to 5,918 new customers in 22 townships and four villages. The expenditure involved was approximately $2,300,000, half of which was paid as a bonus by the Ontario Government. The construction programme for the present fiscal year provides for the erection of 930 miles of rural lines, of which 120 miles has already been completed.

The organisation of the North-Western Power Co., a subsidiary of the Winnipeg Electric Co., was completed at Winnipeg on January 11th. The company has voted $15,000,000 for the first work in the development of its power site at Seven Sisters Falls, on the Winnipeg River. The initial development, when operating under full head, will produce 112,000 h.p., the first delivery being expected late in 1930. The ultimate installed capacity of the plant will be 225,000 h.p.

Chelmsford.—STREET LIGHTING.—The Corporation Electricity Committee has considered the question of lighting the streets by electricity, and has reported that the Electric Supply Corporation, Ltd., states that it is not in a position to supply electricity for the lighting of the whole town, but that it would be prepared to furnish particulars and terms for the lighting of the principal streets. The Committee has recommended that the town clerk be instructed to write to the Electric Supply Corporation, Ltd., and inquire on what terms it would be prepared to illuminate by electricity the principal streets in the borough.

Continental.—GERMANY.—Two new 35,000-h.p. turbo-generator sets have recently been ordered for the Bohlen power station of the Sachsische Elektrisches Kraftwerke Gesellschaft, of Dresden. The company, which during the financial year 1927-28 supplied 226 million kWh, has two power stations, the capacity of which, when the above-mentioned plant is installed, will amount to 300,000 kW.

Coventry.—LOAN.—The Corporation Electricity Committee is applying for sanction to the borrowing of £17,805 for mains, &c.

Cuckfield.—PRICE INQUIRY.—The Ministry of Transport has informed the Rural District Council that, after considering the evidence given at the recent inquiry, it has decided not to make an Order that the Crawley and District Electricity Supply Co. should reduce its prices for electricity.

Cumberland.—ELECTRICITY SCHEME.—Representatives of the Central Electricity Board met officials and members of the County Council at Carlisle on January 28th with regard to the Government's electricity scheme so far as it affects Cumberland. Consideration was given to the proposed cable routes through the Lake District and other areas. It is understood that the Wigton Rural District Council raised no objection to the proposed route through its area, that the Cockermouth Rural District Council decided to ask the authorities to carry the cables underground, and that Keswick Urban District Council had passed a similar resolution.

Dover.—CHANGE OF VOLTAGE.—At a recent meeting of the Corporation Electricity Committee the town clerk submitted the consent of the Electricity Commissioners to an alteration from 100 to 200 V in the pressure of supply.

Dunbar.—ELECTRICITY SCHEME.—Negotiations have now been completed for an electricity supply in Dunbar, and the Lothians Electric Power Co. is preparing to lay the necessary cables from Luggate to the town.

Eastbourne.—LOAN.—The Corporation is applying for sanction to borrow £11,350 for mains extensions, &c.

Egypt.—THE ASSOUAN DAM.—The Egyptian Government has appointed a committee to study a scheme for utilising the Assouan Dam for the generation of hydro electricity.

Glasgow.—PROGRESS DURING DECEMBER.—Under the Corporation Electricity Department scheme 537 houses were wired in December, bringing the total to date to 11,191, while 389 hired appliances were installed, making the total 17,851.

Grange-over-Sands.—INQUIRY RESULT.—As the result of an inquiry held at Ulverston on November 20th, the Ministry of Transport has approved the scheme of the Barrow-in-Furness Town Council for the erection of an overhead transmission line from Ulverston Viaduct to Meathop, in order to provide a supply of electricity to Cartmel, Lindale, and Meathop Sanatorium.

Heckmondwike.—YEAR'S WORKING.—The statement of the past year's working of the Urban District Council's electricity undertaking, recently submitted to the Council, showed a profit of £5,824, as compared with a surplus of £2,438 for the previous year. The electricity sold totalled 1,477,025 kWh. an increase of 177,280 kWh. The chairman of the Electricity Committee said recent reductions in charges to consumers would probably be followed by further reductions shortly.

Hexham (Northumberland).—INQUIRY.—A Ministry of Transport inquiry was held on January 28th into the application by the Hexham and District Electric Supply Co., for permission to erect overhead cables and poles on the county road at Acomb, near Hexham, for the purpose of giving a supply of electricity to Acomb. Objection was offered by the County Council, which stated that a sub-committee of the Bridges and Roads Committee which has visited the site has recommended that no poles should be erected. Mr. Aylott contended that the objection of the County Council was unreasonable. If any road widening was carried out it would mean that the underground cable would be below the metalled portion of the highway, which was objectionable because the road would have to be broken open for every service needed. Hexham Rural District Council did not offer any objection to the erection of an overhead line at Acomb. After the inquiry the Inspector visited the area.

India.—MANDI SCHEME.—According to *Indian Engineering*. work on the Mandi hydro-electric scheme is proceeding rapidly, and a large quantity of machinery has already been assembled at Shanan. The operations are so advanced that the second stage of construction, namely, the building of a dam across the Uhl river to increase the power to over 70,000 kW, is now approaching completion. The erection of a transmission system is expected to start about six months hence.

Irish Free State.—DUBLIN.—The Electricity and Public Lighting Committee has recommended that application be made to the Electricity Supply Board for sanction to a loan of £148,636 to cover the ordinary capital requirements of the electricity undertaking from July 1st, 1928, to December 31st, 1929.

London.—BATTERSEA.—The Borough Council Electricity Committee has decided to extend mains and services and convert gas lamps at a cost of £4,845.

ELECTRICAL DEVELOPMENT.—According to the *Financial Times*, the London Power Co., Ltd., which supplies ten London electricity distributing companies with energy, reports that the output of the stations increased from 506,387,796 to 593,915,537 kWh, equivalent to 17.3 per cent. increase, and the maximum demand from 226,811 to 242,700 kW, equivalent to 7 per cent. increase. Notwithstanding the increased output, the total amount charged by the company for electricity has decreased from £1,681,942 in 1927 to £1,641,162 in 1928. This is due to economies effected in the costs of production. The whole of the generating stations and the 22,000-volt transmission mains of the constituent companies have now been transferred to, and are directly operated by, the Power Company.

Moray.—OPPOSITION TO SCHEME.—The County Council has decided to oppose the Grampian electricity scheme, chiefly on the grounds that there is no guarantee that a supply will be available to ordinary consumers, that the terms are prohibitive, and that the Order would debar Moray from obtaining electricity from any other source on reasonable terms.

Nelson.—ADMINISTRATION REORGANISATION.—At the next monthly meeting of the Town Council a proposal will be submitted for the reorganisation of the Electricity and Tramways Department, which is under the management of Mr. G. N. Naylor The proposal is that Mr. Naylor should for the next six months at least confine himself to the electricity department. One reason for this is the increasing demand for electricity and the need for a thorough overhaul of the mains system.

Newcastle-on-Tyne.—ELECTRICITY CHARGES.—The *Yorkshire Post* reports that as a result of representations made recently by a joint conference of Tyneside local authorities on the question of the charges made by the two supply companies for electricity for domestic consumption, some reduction is promised. Mr. R. P. Sloan, managing director of the Newcastle-upon-Tyne Electric Supply Co., Ltd., has written to the town clerk of Newcastle, stating that the directors have decided to introduce two new tariffs—one relating to shop lighting, which will operate from the commencement of the current quarter, and the other relating to domestic lighting, which will operate from the commencement of the June quarter. The Newcastle and District Electric Lighting Co.,

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Ltd., has intimated that it has decided to make a substantial reduction in the charge for electricity in most cases from January 1st, but the form it will take has not yet been settled.

Plymouth.—CABLE EXTENSIONS.—The Corporation Electricity Committee has authorised cable extensions involving an expenditure of £4,000.

South-East Lancashire Electricity Advisory Board.—FRINGE ORDERS.—The Engineering Advisory Committee has recommended the Board to approve applications for Fringe Orders authorising the Cheadle and Gatley Urban District Council to supply electricity to certain premises in Northen Etchells, the Mid-Cheshire Electricity Supply Co., Ltd., to supply certain premises in Bucklow and Macclesfield rural districts, and Wigan Corporation to supply premises in the rural district of Wigan and the urban district of Upholland.

SPECIAL ORDERS.—The Board is recommended to support applications for Special Orders by the Lancashire Electric Power Co., authorising it to supply electricity in Blackrod, Croston, Withnell and district, and the Trent Valley and High Peak Electricity Co., Ltd., in the rural district of Hayfield and part of the rural district of Glossop Dale.

OPERATING STATISTICS.—For the quarter ended September last the total energy delivered to the feeders was 212,658,076 kWh, as compared with 214,555,686 kWh for the corresponding quarter of the preceding year, and the cost per kWh was 0.2608d., as against 0.2758d.

TRANSMISSION LINES.—The Electricity Commissioners have sanctioned the construction of the main transmission lines between Barton and Trafford (Stretford) power stations. The Board has been recommended to approve the proposals of the Lancashire Electric Power Co. to extend certain existing 33,000-V feeders, and to provide new 33,000-V cables between Radcliffe and Kearsley, and Kearsley and Hill Top sub-station, in connection with the company's Kearsley station, which is due to be brought into commission in about nine months' time.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising St. Helens Corporation to supply electricity in the urban district of Rainford, and the Electrical Distribution of Yorkshire, Ltd., to supply electricity within part of the rural district of Worksop.

Stalybridge.—BREAKDOWN.—The electricity supply in Stalybridge, Hyde, Mossley and Dukinfield was cut off at about 7.30 p.m. on February 1st owing to a failure at the Hartshead power station. A supply was temporarily restored in the centre of Stalybridge by the use of batteries at the Waterloo Road sub-station, and by transferring the load to the Tame Valley power station it was possible to restore a number of street and shop lights in about half an hour, but much of the lighting was suspended for the night. We are informed by the Metropolitan-Vickers Electrical Co., Ltd., that the trouble was in no way due to the turbine, but arose through a fault in some of the auxiliary wiring, which affected the protective device installed in connection with the turbo-generator.

Stoke-on-Trent.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has decided that an e.h.p. feeder be laid from Hanley to Greenbank Road, Tunstall, and l.p. mains from the sub-stations at Greenbank Road and Sneyd Hill, at an estimated cost of £13,000, and that two sub-stations be provided, at an estimated cost of £4,000.

The electrical engineer has reported upon the size and condition of mains laid in Church Street, between Clarence Road and Market Square, Longton, and the Committee has decided that an a.c. 4-core distributing main be laid and that the sub-station in Longton works be equipped with the necessary switchgear and transformers, at a cost of £3,750 for mains and £2,250 for transformer sub-station equipment.

Stourport.—NEW PLANT.—In consequence of the rapidly increasing demands upon the Shropshire, Worcestershire and Staffordshire Electric Power Co., the Stourport station, which was opened about eighteen months ago, is now being equipped with additional plant of 25,000 h.p., which will bring the total capacity of the station up to 75,000 h.p. Since the station was opened, the company's area of supply has been greatly increased, and now covers over 18,000 sq. miles.

Stratford-on-Avon.—INQUIRY.—The Ministry of Transport has informed the Rural District Council that Mr. A. D. Erskine will hold an inquiry on March 31st respecting the Council's objections to the use of overhead cables at Kineton.

Twickenham.—PURCHASE OF UNDERTAKING.—The Town Council, on January 24th, decided to serve notice upon the Twickenham and Teddington Electric Supply Co., Ltd., of the intention of the Council to purchase the undertaking authorised by the Twickenham Electric Lighting Order, 1900, and to enter into an agreement with the London and Home Counties Joint Electricity Authority providing for the transfer of the undertaking to that body.

Wimbledon.—NEW SUB-STATION.—The Corporation Electricity Committee has recommended the approval of a scheme to provide six new sub-stations and two transformer kiosks, and the enlargement of 14 existing sub-stations, and equipment of several sub-stations on consumers' premises at an estimated total cost of £23,000, and that application be made for sanction to a loan for these purposes.

York.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has considered a report from the city electrical engineer as to the maximum demand on the power station during the year 1928, which shows that the d.c. demand was 4,765 kW. The present d.c. feeder system is fully loaded, and it will be necessary, to deal with the anticipated supply of next winter, to erect and equip sub-stations in various parts of the city. The following are the estimated costs of the necessary works: E.h.p. cable extensions, £16,390; sub-station buildings, £2,600; switchgear equipment, £6,780; and transformers, £2,000.

Tramway and Railway Notes.

Cheltenham.—PARLIAMENTARY BILL.—The Cheltenham and District Light Railway Co. has deposited a Bill to introduce railless cars and omnibuses along the routes of all or any of the existing light railways and along other specified routes in Cheltenham, Charlton King's and Winchcombe.

Continental.—ITALY.—The Italian Ministry of Communications has not only ratified the existing contracts between Italy and Switzerland for carrying out railway work, but it has also decided to adopt the electrical system in vogue in the latter country on the section Iselle-Domodossola. The system on that line will be a.c., single-phase, 15,000 V, and it will no longer be necessary, as in the past, to change engines at Iselle and at Brigue. The Swiss Federal Railways will therefore ensure the running of the international trains as far as Domodossola.

SPAIN.—The Cabinet will give immediate authorisation to the Minister of Public Works to proceed with the work of electrifying the following lines: The Madrid-Avila, the Madrid-Segovia-Medina, the Valencia-Cuenca, the Madrid-Villa Nueva de la Reina, the Catalonian system, the Valencia-Encina, the Miranda-Bilbao, and the line over the Cantabrian Mountains to Santander—a total mileage of about one thousand three hundred. The Government intends that all the necessary material shall be manufactured in Spain.—*Reuter* (Madrid).

HOLLAND.—The directors of the Dutch Railways intend to operate the line between Amsterdam and Rotterdam entirely by electricity. At present only the Dutch passenger trains between the two cities are worked by electricity, while the international through trains which use this route, such as French and Belgian, are still operated by steam locomotives. It is, however, expected that the latter will offer no objection. It is also intended to employ electric traction for the goods trains on this route.

Glasgow.—INQUIRY.—An inquiry was held last week in connection with a proposal to install an 18,750-kW turbo-alternator at Pinkston power station belonging to the Tramways Department. Col. T. C. Ekin, chief engineering inspector of the Electricity Commission, presided. Mr. T. M. Cooper, for the Corporation, said there were five electricity concerns in the area, and if the application was refused the Corporation would be obliged to take supplies from each of these. The power station at Pinkston cost £564,000, and distribution was made to ten sub-stations. The cost of the power supply to the tramways was approximately ½d. per car mile lower than the next lowest tramway undertaking. Much of the plant required replacing. There were two alternatives, one of which was scrapping the Pinkston station and taking the supply from Dalmarnock station. It would also be necessary to convert the sub-stations at a capital expenditure of £385,000. The tramway manager estimated that if he had to take a supply from the Glasgow Electricity Department he would have to find £283,000 more in the period 1930-34. Mr. Graham Robertson, K.C., for the Central Electricity Board, proposed that the Tramways Department should continue using Pinkston station, and should take any excess demand required from Dalmarnock station, and that as and when the efficient Pinkston plant worked out its life the station should be shut down, and further supplies taken from Dalmarnock. Mr. J. L. Mackenzie, deputy town clerk, said that the Tramways Department could generate energy at a cheaper rate than the Electricity Department because the Dalmarnock station was built at a time when costs were at the peak. Mr. L. Mackinnon, general manager of the Tramways Department, said of that of the plant at present installed at Pinkston station he only regarded the two large sets as efficient. Mr. J. McDonald, chief electrical engineer of the Tramways Department, said that in 1927 Pinkston station had a maximum load of 21,000 kW. It was his opinion that provision must be made for the suggested alterations at Pinkston station if it was to cope with additional work efficiently. The department proposed to put in six new boilers capable of working at a pressure of 300 lb. per sq. in., and 720 deg. super-heat. In connection with the improvements it was estimated that there would be a saving of £8,000 a year on fuel and £3,500 in wages. Professor Howe also said that the cost of power would be less under the proposed scheme than if

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energy was taken from Dalmarnock station. Mr. H. Hobson, supply engineer of the Central Electricity Board, said that if the Tramways Department took a partial supply from Dalmarnock power station, there would be an annual saving in the total cost of electricity of £11,698, and it would result in the gradual lowering of the cost of supplies to the tramways. Mr. J. M. Kennedy, consulting engineer, of Messrs. Kennedy and Donkin, said that if the two departments had been inter-connected, they would have saved, in his opinion, something like £13,000 per annum during the past few years. Mr. Arthur Collins, adviser to public bodies, in dealing with the financial aspect of the case, said he thought it would be to the advantage of the Tramways Department to adopt the Electricity Department's scheme. It was unsound policy for a tramways department to spend so large a sum as proposed on an electricity undertaking, constructed to supply electricity to the tramways alone. Mr. Graham Robertson, K.C., addressing the chairman on behalf of the objectors, said that the position of the tramway industry at present was somewhat precarious in view of motor-'bus competition. The department, by taking power from Dalmarnock, would be receiving an insurance against the possibility at a future date of having to scrap plant. Mr. Cooper, K.C., addressed the Inspector in connection with the case for the Corporation, and the inquiry was closed after lasting four days. The decision will be announced later.

Preston.—Track Renewal.—It is recommended that the single tramway track in Ribbleton Lane be relaid, at an estimated cost of £5,000.

United States.—Regenerating Locomotives.—A 75-mile stretch of the Great Northern Railway in the United States through the Cascade range of mountains east of Seattle is being electrified. The locomotives for hauling the passenger trains over this electrified section are claimed to be the largest and most powerful of their type. They are also, according to the engineers, unique in that they will utilise the economical advantages of both d.c. and a.c. On the down-grade they regenerate from 30 to 35 per cent. of the power required to move them when on the up-grade. The regeneration of power also serves to control the down-grade speed of the trains, making it possible to reduce the speed of a train on the heaviest grade from normal to two miles per hour without the use of brakes.

Telegraph and Telephone Notes.

Abyssinia.—Radio-telegraphy.—It is understood that the Government has advertised for tenders for the erection of a large international radio-telegraph station at Adisabada.—*Reuter's.*

International Telephony.—Holland and Argentina.—Wireless telephone communication between Amsterdam, Rotterdam, and The Hague on the one part and Buenos Aires on the other, was to be opened to the public on February 4th, *via* the Trans-Radio companies of Berlin and Buenos Aires.—*Reuter* (Amsterdam).

Paris and Buenos Aires.—Direct wireless telephone communication between Paris and Buenos Aires was inaugurated on January 30th.—*Reuter's* (Paris).

Germany and Finland.—Telephone service between Germany and Finland was officially inaugurated, says *The Times*, on January 30th.

Consultative Committee.—Meetings of the International Consulting Committees of Telegraph and of Long-distance Telephone Communication are to be held in Berlin from June 10th to 17th next.

Isle of Man.—Submarine Cables.—Sir William Mitchell-Thomson (Postmaster-General), replying in the House of Commons to a question, said that if no unforeseen difficulties arose the work of laying the submarine telephone cable between the Isle of Man and the mainland would be completed in July next.

Jamaica.—Telephone Service.—The British Cable and Telephone Company has applied to the Government for a concession to operate an island telephone service in parts of the island outside the area covered by the licence of the Jamaica Telephone Company. It is proposed that the Government should guarantee the interest and capital expenditure involved for a certain number of years.—*Reuter's* (Kingston).

Post Office Accounts.—1928 Results.—The P.O. commercial accounts for the year ended March 31st, 1928, indicate a surplus of £107,391 on the telephone service (£283,375 in 1926-27). There was a deficit of £1,380,829 on the telegraph system (£1,349,112 in 1926-27).

The accounts of the Imperial cable service between Penzance and Halifax, Nova Scotia, show a loss of £32,696 on operating, compared with a profit of £3,883 in the preceding year, due partly to the decline in traffic receipts, attributable to the completion of the radio "beam" services, especially that to Australia, and partly also to interruptions of the cables, which were considerably greater than in the previous year.

The accounts of the wireless telegraph services show a considerable increase in turnover by comparison with last year's accounts, as they now include the working of the wireless services recently established with the Dominions by means of the "beam" system of transmission. Although the accounts do not cover a full year's working for all of the four "beam" services, it appears that their operation as a whole showed a net surplus of £89,473 in the year under review, and this has reduced the deficiency on the other wireless activities comprised in the accounts.

The Telephone Service.—Automatic Exchanges at Newcastle.—An order for a provincial telephone system was placed by the Post Office with Standard Telephones & Cables, Ltd., on January 22nd. There will be a main exchange (Newcastle Central) and eleven satellite exchanges, providing in all nearly 20,000 lines, with an ultimate capacity of 42,000. The exchanges will be equipped with step-by-step apparatus, and it is expected that they will be completed by the end of 1930.

Manchester.—The annual report for 1928 prepared for the Manchester District Advisory Committee (Mr. W. J. Medlyn, M.I.E.E., superintending engineer, South Lancashire District) indicates that during the year the number of new telephones fitted was 8,999; allowing for cessations, the net increase was 5,091, or 6.2 per cent. Effective trunk calls and telegrams totalled 6,482,134, an increase of 264,028, and local calls continued to climb to 66,000,000. New exchange buildings have been completed, and the transfer to automatic working will take place before the end of 1929; meanwhile, the greater part of the duct and cabling work involved in the Manchester automatic conversion scheme has been satisfactorily completed. A new automatic exchange was opened at Shaw and extensions of existing equipment were carried out at 19 exchanges. The new repeater equipment at the Manchester head Post Office was completed, and five new private automatic branch exchanges were installed.

Liverpool.—In the Liverpool district new exchanges opened included one at Port Soderick (Isle of Man), and extensions of the existing equipment were carried out at fourteen exchanges. The number of new telephones fitted was 7,403; allowing for cessations, the net increase was 3,791, or 5.75 per cent., which is not quite so satisfactory as in the previous year, when it was approximately 6½ per cent. Traffic between Liverpool and the Continent continued to show a marked increase, the average monthly figure rose to about 590, and in November a total of 772 originated Continental calls was reached. Special facilities were arranged experimentally for dealing with telephone calls between the Liverpool Cotton Association and Bremen (Germany) with a view to encouraging and facilitating the cotton trade between the two cities. The number of calls dealt with in the district approximated to 67¾ millions, an increase of about 4½ per cent

Automatic Exchange.—According to *The Times*, a village automatic telephone exchange has been installed at Haynes, Bedfordshire.

Radio Notes.

Austria.—Licences.—At the end of 1928 the total number of receiving licences in force was 325,200. According to *World-Radio* there were 17,283 cessations, but by January 14th, 1929, the total was 317,382.

B.B.C. Revenue.—Post Office Share.—Post Office commercial accounts for the year ended March 31st, 1928, published by the Stationery Office (No. 6, price 9d. net) show that the cash receipts from wireless licences amounted to £1,234,898, from which was deducted £154,362 for expenses of management and £1,427 contributed towards the cost of converting certain spark marine telegraph stations. From the sum of £1,079,109 which remained, £824,237 was paid to the British Broadcasting Corporation and the balance to the Exchequer. The expenditure incurred in respect of the change of coast stations to the interrupted-continuous-wave system was the first instalment of a total expenditure estimated at £20,000, necessitated by an agreement reached at the Washington International Radio-Telegraph Convention in 1927.

Belgian Congo.—New Station.—Arrangements are under way to set up a wireless station in the Belgian Congo for broadcasting talks and musical programmes. The Belgian Colonial Minister has given his assent to the scheme, and it is now being submitted to the Governor-General of the Congo for his consideration. The initiator of the scheme is Mr. Goebel.—*Reuter's* (Brussels).

Canada.—Short-Wave Conference.—A conference on short-waves is taking place at Ottawa this week. The United States is being represented by three members of the Federal Radio Commission, two of the Navy, and an assistant solicitor of the Department of State. Canada is represented by the Deputy Minister of Marine and Fisheries, the director of the Radio Branch of that Department, and others connected with radio work in the Federal Government. Newfoundland, Mexico and Cuba were also invited to send representatives.

Common Wave-length.—Hull.—The B.B.C. announces that the Hull station has been included among those stations

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transmitting on the national common wave-length of 288.5 metres (1,040 kilohertz), which is ultimately to be adopted by practically all British relay stations; the change took place on February 1st. As the Hull station formally transmitted on a frequency of 1,020 kilohertz (294.1 metres), the change is so slight that very little, if any, readjustment of listeners' receiving apparatus should be necessary.

United States.—British Relay.—Music broadcast by the B.B.C. was heard on February 1st by American listeners from New York to San Francisco. The programme was carried on a wave-length of 25.53 metres by the National Broadcasting Company, being picked up from Chelmsford at Riverhead, Long Island. The experiment was not altogether successful owing to severe atmospherics.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—February 26th. Posts and Telegraphs Department. Induction coils and registers for telephone work. (B.X. 5031.)*

March 12th. Telephone relays. (B.X. 5078.)*

April 2nd. Jumper rings and terminal strips. (B.X. 5066.)

March 18th. State Electricity Commission of Victoria. Insulators and accessories. (B.X. 4997.)*

April 8th. Galvanised steel transmission line towers. (A.X. 7401.)*

April 29th. Two or three steam turbo-generator sets with condensers for Yallourn Power Station extension. (B.X. 5062.)*

Aylesbury.—Electricity Department. Materials for 12 months, including cables, insulators, meters, joint boxes, &c. (See this issue.)

Ayrshire.—Education Authority. Electric lighting installation at Stewarton higher-grade school extension. Schedules from Mr. W. Reid, master of works, Education Offices, Ayr.

Bedford.—February 22nd. Electricity Department. E.h.p., h.p. and l.p. cables, incandescent electric lamps. (February 1st.)

Belgium.—February 19th. Municipal authorities of Ixelles, Brussels. Armoured l. and h.p. cables. Particulars can be obtained from the Service de l'Electricité, Hotel Communale, Ixelles.

Bromley.—March 4th. Education Committee. Installation of electric lighting at the Raglan Road Council school. Specifications, &c., from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

Carlisle.—Electricity Department. One 15,000-kW turbo-alternator and condensing plant. (January 25th.)

Dumfries.—February 21st. Electricity Department. One 1,500-kW turbo-alternator and condensing plant. (February 1st.)

Egypt.—Cairo.—March 27th. Ministry of Interior. Supply and installation of an electric lighting system for the town of Fashu. (B.X. 5037.)*

March 6th. Underground and overhead transmission line from the Mit Chamr Electric Power Station to the town of Kom el Nour. (B.X. 5074.)*

Erith.—March 4th. Electricity Department. H.p. and l.p. cables, joint boxes, &c. (February 1st.)

Hastings.—February 25th. Corporation. Electrically-driven pumping plant for the Kent Street pumping station. Specification (£5) from the engineer, Mr. G. M. C. Taylor, of Messrs. John Taylor & Sons, Caxton House, Westminster, S.W.1.

Hendon.—February 11th. U.D.C. 29 closed circuit code signalling street alarms. (February 1st.)

Hove.—February 20th. Corporation. Electric lamps for 12 months. Schedules from the borough surveyor's office.

Lancaster.—February 18th. Electricity Department. 400/600-Ah station battery with reversible booster, automatic switchgear, &c. (February 1st.)

Leeds.—Electricity Department. February 15th. Annual contracts for stores. (January 25th.)

March 9th. 2,000- and 6,600-V single-phase, and 3-phase (6,600-V) Scott-connected transformers for a period of two years; 11,000-V, 3-phase transformers. (See this issue.)

London.—Central Electricity Board.—February 15th. 66,000-V cables (London Area) in connection with the South-East England Electricity Scheme. (January 11th.)

February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

March 2nd. 66,000-V and other transformers (London Area) in connection with the South-East England Electricity Scheme. (February 1st.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (January 11th.)

March 4th. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area), and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (January 18th.)

South-East England Electricity Scheme. March 2nd. 33,000-V overhead line—Luton to Aylesbury. (See this issue.)

Metropolitan Asylums Board.—February 20th. Installation of electric lighting at Southwark Casual Ward. (February 1st.)

London County Council.—February 26th. One 10-cwt. electric goods lift for the Hammersmith Building Trade School. (See this issue.)

Lourenco Marques.—March 19th. Port and Railways Board. 50-kVA Diesel-driven generating set and an electrically-driven water pumping set. (B.X. 5050.)*

Manchester.—February 12th. Tramways Committee. General stores, including cable, bell wire, conduit tubing, switches, bells, cells, insulating material, &c. Schedules from the general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Newcastle-upon-Tyne.—February 18th. Tyne Improvement Commission. One 1½-ton portal electric travelling level luffing crane. Specification (21s.) from Mr. A. Blacklock, secretary, Tyne Improvement Commission Offices, Bewick Street, Newcastle-on-Tyne.

Newmilns (Ayrshire).—February 9th. Town Council. Electrical wiring in connection with the Council's housing scheme. Specifications from the burgh surveyor.

Newton Abbot.—February 28th. Board of Guardians. Installation of electric lighting at the Institution, Newton Abbot. (February 1st).

New Zealand.—Dunedin.—March 20th. Tramways Department. Tramway equipment. (A.X. 7441.)*

Northern Ireland.—Belfast.—February 9th. L.M. & S. Railway. Northern Counties Committee (Ireland). Stores required during year ended February 28th, 1930, including telegraph ironwork, wire, electric lamps, porous pots, &c. Form of tender (6d. each) from Mr. F. J. Martin, stores superintendent, York Road Station, Belfast.

February 18th. Electricity Department. Materials for 12 months, including electrical accessories, lamps, carbon brushes, cables, joint boxes, meters, &c. (February 1st.)

February 26th. Tramways Committee. Stores (including electrical accessories, carbon brushes, armature and field coils, &c.) for 12 months. (See this issue.)

Paisley.—February 13th. Corporation. Electric lighting installation for the housing scheme. Schedules from Master of Works, 16, Gilmour Street.

South Africa.—Cape Town.—March 15th. City Council. Metal-clad switchgear. (B.X. 5004.)*

Pretoria.—March 28th. Posts and Telegraphs Department. Telephone switchboard cords. (B.X. 5048.)*

Cape Town.—City Council. March 21st. 300 amp. fuses. (B.X. 5080.)*

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Staines.—February 9th. Board of Guardians. An additional 168 lighting points, including cables, at the Institution, London Road, Ashford, Middlesex. Specifications from Mr. J. H. Tyars, architect, 28, Victoria Street, Westminster, London, S.W.1.

West Ham.—February 18th. Education Committee. Installation of electric lighting at South Hallsville new school, Agate Street, Tidal Basin. (January 25th.)

Worsley.—February 23rd. Urban District Council. Electric lamps required during year ending March 31st, 1930. Form of tender from Mr. J. Howard, surveyor to the Council, Town Hall, Walkden, near Manchester.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Brisbane.—City Council.—The Vice-Mayor has recommended the acceptance of a tender by Messrs. Babcock and Wilcox, Ltd., for three boilers for the City Council's new power house, at a cost of £74,266, which, on a comparable basis, was the lowest tender.—*Reuter* (Brisbane).

Buntingford.—Herts. C.C. Accepted:—
Electric lighting installation at police station.—Messrs. Giffens.

Hull.—Telephone Committee. According to the *Yorkshire Post*, four sets of tenders for equipment were opened by the Telephone Committee last week, and in only one case was a British tender accepted, namely, that of David Willetts, Ltd., for insulator bolts. In all cases the lowest tenders were accepted, motions to accept the lowest British tenders being defeated. The three foreign tenders accepted were: Ericsson Telephones, Ltd., for a switchboard; W. F. Dennis & Co. for lead-in wires; and the Equipment & Engineering Co. for insulators.

Irish Free State.—Dublin.—Borough Commissioners.
Renewal of the contract for 1929 for the maintenance of electricity meters (approx. £700).—General Electric Co., Ltd.
Time switches.—Avonwerke E.G. and Drake & Gorham Wholesale, Ltd.
—*Irish Builder and Engineer.*

London.—London County Council.
Stores Committee. Accepted:—
Electric insulating materials for 12 months.—Attwater and Sons; British Central Electrical Co., Ltd.; Butterfield & Renton; Connollys (Blackley), Ltd.; Hammett and Andrew; Mica & Micanite Supplies, Ltd.; Micanite and Insulators Co., Ltd.; A. A. Sample; and Siemens Bros. & Co., Ltd.
Education Committee. Accepted:—
Electrical work at Trade School for Girls, Hammersmith (£180).—H. J. Cash & Co., Ltd.
Highways Committee. Accepted:—
Machined bronze bearings (£4,712).—Anti-Attrition Metal Co., Ltd.
24,500 porcelains.—Electric & Ordnance Accessories, Ltd.
290 ceiling lamp reflectors.—Revo Electric Co., Ltd.
Controller segments.—Edwin Showell & Sons, Ltd. (£560); Yorkshire Switchgear and Engineering Co., Ltd. (£393).

Salford.—Electricity Committee. Accepted:—
4,200 yd. e.h.p. cable (£1,436).—Connollys (Blackley), Ltd.
17,000 yd. l.p. cable (£2,633).—Greenwich Cable Works, Ltd. Cable (various) (£9,359).—N. V. Nederlandsche Kabelfabriek.
Health Committee. Accepted:—
Installation of X-ray apparatus at the Tuberculosis Dispensary (£348).—A. E. Dean & Co.
Education Committee. Accepted:—
Installation of electric lighting at Trafford Road girls' Council school (£196).—J. Price & Sons.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Renewal of interior stack of cooling tower (£612).—Davenport Engineering Co., Ltd.
Switchboard at Stoke sub-works (£713).—Crompton Parkinson, Ltd.
Wiring and fitting eight all-electric houses in Avenue Road, Hanley (£362).—Hawley, Ingram & Co.
E.h.p. switchgear (£8,354).—Metropolitan-Vickers Electrical Co., Ltd.
Electrically-driven air compressor (£552).—Hamworthy Engineering Co., Ltd.

Surrey.—County Council. Accepted:—
Electric lighting installation at new reception hospital, Brookwood (£1,225).—V. G. Middleton & Co., Ltd.

Wimbledon.—Baths Committee. Accepted:—
Electrical installation at new swimming baths (£265).—W. F. Iles.

Forthcoming Events.

British Electrical and Allied Research Association.—Friday, February 8th. Savoy Hotel, W.C. 12.45 for 1 p.m. Annual general meeting.

Physical Society.—Friday, February 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Institution of Mechanical Engineers.—Informal Meeting.—Friday, February 8th. Institution, Storey's Gate, S.W. 6 p.m. "The Profession of the Mechanical Engineer." Mr. L. A. Legros.

Institute of Wireless Technology.—Monday, February 11th. Engineers' Club, W. 7 p.m. "The Principles of Television." Mr. A. W. Thynne.

Nottingham Society of Engineers.—Monday, February 11th. Victoria Station Hotel. 7.30 p.m. "Electric Furnaces, Their Products and Uses." Mr. G. S. Haydon.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, February 12th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "The D.C. Pressure Testing of E.H.P. Cables, with Notes on Modern Systems of Fault Finding." Mr. H. Gough.

(Manchester Local Group).—Thursday, February 14th. Geographical Hall, Deansgate, Manchester. 7.45 p.m. "Domestic Electrification." Mr. J. L. Carr and Mr. J. D. Beattie.

Illuminating Engineering Society.—Wednesday, February 13th. Trocadero Restaurant. 7 for 7.30 p.m. Annual dinner.

Institute of Fuel.—Wednesday, February 13th. Burlington House, W. 6 p.m. "Fuel Economy and the Small Steam User." Mr. W. F. Goodrich.

Electroplaters' and Depositors' Technical Society.—Wednesday, February 13th. Northampton Institute, E.C.1. 8.15 p.m. "The Electrodeposition of Cadmium for Rust Prevention." Mr. S. Vernick.

Institution of Electrical Engineers.—Thursday, February 14th. Institution, London, W.C. 6 p.m. "Voice-Frequency Telegraphs." Mr. W. Cruickshank.

(London Students' Section).—Friday, February 8th. Institution, London, W.C. 6.15 p.m. "Electric Welding." Mr. H. H. Taylour.
Tuesday, February 12th. Victoria House, Southampton Row, W.C. 7.30 p.m. to 12. Dance.

(North-Eastern Students' Section).—Friday, February 8th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "The City of Winnipeg Hydro-Electric Installation." Mr. S. Gibson.

(South Midland Students' Section).—Friday, February 8th. University, Birmingham. 7.15 p.m. "Hydro-Electric Stations in Switzerland." Mr. P. E. Lyddon.

(North-Western Students' Section).—Saturday, February 9th. University Women's Union, Lime Grove. 7-11 p.m. Dance.
Tuesday, February 12th. Engineers' Club, Manchester. 7.15 p.m. "The Electric Propulsion of Ships." Mr. H. B. Collings.

(Western Centre).—Monday, February 11th. Bristol. Ordinary meeting.

(North-Eastern Centre).—Monday, February 11th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "The Construction of the Grid Transmission System." Mr. Johnstone Wright and Mr. C. W. Marshall.

(North-Midland Centre).—Tuesday, February 12th. Hotel Metropole, King Street, Leeds. "An Introduction to Researches on Circuit Breaking." Messrs. E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce.

(Scottish Centre).—Tuesday, February 12th. Royal Technical College, Glasgow. 7.30 p.m. "Overhead Electric Lines." Mr. W. B. Woodhouse.

(Dundee Sub-Centre).—Thursday, February 14th. University College, Dundee. 7.30 p.m. "Overhead Electric Lines." Mr. W. B. Woodhouse.

Electrical Wholesalers' Federation.—Thursday, February 14th. Savoy Hotel, Strand, W.C. 6.30 for 7 p.m. Annual dinner.

British Institute of Radiology, incorporated with the Röntgen Society.—Thursday, February 14th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

Royal Institution of Great Britain.—Thursday, February 14th. 31, Albemarle Street, W. 5.15 p.m. "The Early History of X-Rays." Sir Wm. Bragg.

British Electrical Development Association.—Friday, February 15th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Organising for Increasing Sales—Spring Cleaning Season, 1929."

Association of Mining Electrical Engineers (Western Sub-Branch.—Saturday February 16th. 60, Wind Street, Swansea. "Fault Localisation." Mr. S. T. Richards.

British Industries Fair.—Monday, February 18th to Friday, March 1st. At Castle Bromwich, Birmingham, and the White City, London.

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The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

SUNKIST juice extractors.
PERFECTION vacuum cleaner.

Notes.

An "All-Electric" Liner.

For the propulsion of the world's largest ship, a White Star liner now on the stocks at Belfast, the Diesel-electric drive has been chosen, says the *Daily Telegraph*. At present the largest craft to be equipped with Diesel-electric drive is a 12,500-ton oil-tanker built by Scotts' Shipbuilding Co., of Greenock, for American owners. The new ship, however, is of 60,000 tons, and is designed for high speeds. The Diesel machinery of the Italian liner *Augustus*, which is the biggest motor ship now in existence, has an output of 25,000 h.p. These figures indicate the magnitude and responsibility of the task which confronts the builders of the machinery, who are understood to be Messrs. Harland & Wolff, at whose yard the ship herself is under construction. The plant will consist of a multiple set of Diesel engines coupled to generators, which supply the electric motors turning the four propeller shafts. Practically all the auxiliary machinery from derricks, cargo winches, and boat davits, to the cooking and cleansing appliances, will be worked by electricity.

The M. S. *Courageous*, first of three cargo boats to be converted by the United States Shipping Board to electric drive, made her official trial trip on December 18th, 1928; together with the *Triumph* and the *Defiance*, she was originally equipped with geared-turbine single-screw drive. The work of converting her was done by the Federal Shipbuilding Company at Kearny, N.J., U.S.A., from specifications prepared by Gibbs Brothers, Inc. The new plant consists of four 1,280-h.p., 250-r.p.m., four-cycle, air-injection, Diesel engines furnished by the McIntosh & Seymour Company, each directly connected to two electricity generators, one supplying power for propulsion and the other for excitation, auxiliary power, and lighting. The complete electrical equipment for the vessel was furnished by the General Electric Company, of New York. The main generators are four 800-kilowatt, 250-r.p.m., 375-volt, direct-current machines, while the auxiliary generators are four 100-kilowatt, 250-r.p.m., 240-volt, direct-current machines. The propulsion gear is a double motor on one shaft, each rated at 2,000 horse-power, 60-r.p.m., 750-volts, shunt wound, and directly connected to the propeller shaft. Generators and motors are connected in series: the control is of the variable-voltage (Ward Leonard) type with operating stations in both the engine room and pilot house.

All deck and engine-room auxiliaries have been converted to electric drive, utilising motors aggregating approximately 700 h.p. The ships have a displacement of 10,500 dead-weight tons each, and each has 60,000 cubic feet of cargo space.

Faraday House Old Students' Association.

The Association has arranged to hold a dance on Tuesday, March 5th, at the Victoria Halls, Southampton Row. The price of a double ticket, including buffet, is 10s., and of a single ticket 7s. 6d.; early application should be made to the Hon. Secretary, Faraday House O.S.A., Southampton Row, London, W.C.1.

London Electricity Charges.

The London and Home Counties Joint Electricity Authority has published a "Statement of Charges made for Lighting, Power, Heating and Cooking Supplies by Electricity Supply Undertakings in the London and Home Counties Electricity District as at January 1st, 1929." This occupies 25 quarto pages, and demonstrates in a remarkable manner the lack of uniformity in methods of charging as well as accentuating the discrepancies between rates of charging in adjacent districts. It is also noticed that the majority of undertakings now offer some form of two-part tariff.

Institute of Metals.

The annual general meeting and "coming-of-age" celebrations of the Institute of Metals will be held on March 13th and 14th. The annual dinner will be held at the Trocadero Restaurant at 7 p.m. on the first day, and there will be a conversazione at the New Science Museum, South Kensington, on March 14th.

Rural Electricity in Glamorgan.

The South Wales Electrical Power Distribution Co. (Mr. J. W. Beauchamp, M.I.E.E., engineer and manager) provides electricity extensively in the Vale of Glamorgan, a new 5.5-mile, 11,000-volt line at present serving the villages of Aberthin, St. Hilary, Llanmaes, Llandough, St. Mary Church, Boverton, and the old world town of Llantwit Major. The Vale of Glamorgan is rich in agricultural value, and it is expected that the farmers and smallholders will avail themselves of the supply now available. To inaugurate the supply at Llantwit Major, a formal "switching on" ceremony of the street lighting was recently performed by Mr. T. R. Thomas, chairman of the Parish Council, and for the first time the narrow winding streets of the quaint old town were illuminated by electric light. After the ceremony, the councillors and their wives, and other guests, were entertained at dinner by the Company, after which an electrical exhibition, which continued throughout the week, was opened in the Town Hall, an ancient edifice dating from the 12th century, which was decorated with evergreens and electric fairy lamps for the occasion. The electrical display, which caused great interest amongst farmers and other inhabitants of the Vale, included a poultry house, electrically lighted and fitted with electric incubators and "foster mothers"; electric milk separators and bottle fillers; a butcher's shop with an electric cold-storage cabinet and meat choppers; a grocer's shop window showing correct and incorrect methods of electric lighting, and coloured lighting effects; and an electric kitchen with the usual cooking, washing, ironing, and other appliances, besides an interesting illuminated model of the Company's power station. A small reception room beneath the Town Hall was fitted up as an electric "Sunray" room, the light from the "Sunray" heaters producing a remarkably comfortable effect.

A Coal Distillation Company.

According to the *Financial Times*, an undertaking—the Leicestershire (L and N) Coal Distillation—has been formed to erect and operate commercial units for coal distillation by the "L and N" process. When in full operation, the company will treat nearly half a million tons of British coal per annum. The first commercial unit of plant, with a capacity of over 100 tons of coal daily, has been erected, and is said to be fulfilling expectations; the yield obtained per ton of coal treated is:—Oil, 19 gallons; residual fuel, 13 cwt.; gas, 10 therms. It is claimed that the lubricating oils obtained by this process were found on test by the National Physical Laboratory to be superior in many respects to the lubricating oil obtained from well oil.

Lecture Lantern Slides.

The Marconiphone Co., Ltd., has prepared two lectures on "The Screen-grid Valve" and on "A.c. Mains Valves," respectively, which it is prepared to loan to secretaries of Radio Clubs and other interested persons.

E.A.W. Activities.

Owing to the success of the ball held by the Electrical Association for Women last year, and to the number of requests for the function to be repeated this year, it has been decided to hold a ball at the Hotel Cecil on April 16th, the same day as the annual luncheon.

The Ashford and District Branch held its first annual dinner at Ashford recently; the president, Mrs. F. G. Hayward, was in the chair. Responding to the toast of "The Association," Alderman Mrs. Hammer, chairman of the E.A.W., said that, although started only four years ago, the Association already had 3,000 members, with 13 branches. The main object of the organisation was education. Mr. H. Wilson, electrical engineer to the U.D.C., said that his department meant to make Ashford a town of cheap electricity.

A large party of members of the Birmingham branch of the Association recently paid a visit to the headquarters of the Shropshire, Worcestershire and Staffordshire Electric Power Co. at Halesowen. They were received, in the unavoidable absence of Mr. J. T. H. Legge, the chief engineer and manager, by Mr. E. E. Hamar, the commercial engineer to the company.

At a meeting held at Gloucester, on January 25th, it was decided to form a Gloucester and District Branch of the Association, and hold the inaugural meeting early in February. Lady Berkeley is to be the president of the branch.

At the Stoke-on-Trent Corporation Electricity Committee meeting recently the chairman reported that it had been decided to form a local branch of the E.A.W.

On January 30th, Mr. A. P. M. Fleming gave an interesting address to the Manchester and Salford Branch on "Milestones in the Progress of Electricity."

At an inaugural meeting at Swansea on January 24th it was decided to form a Swansea and District Branch of the Association. The Branch president will be Lady Bryn Edwards.

On January 23rd members of the E.A.W. visited the Knightsbridge showrooms of Messrs. Troughton & Young, Ltd., when Mr. A. B. Read gave an interesting lecture on modern decorative lighting. On January 27th, Mr. F. W. Purse, West Ham, gave his first lecture before the Association —"From the Coal Heap to the Electric Cooker." On January 30th a very enjoyable social was held at 46, Kensington Court, in aid of the funds of the E.T.B.I.

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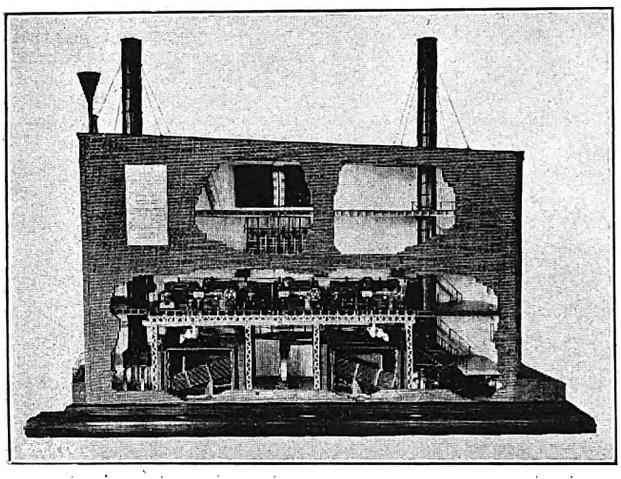
Generating Station Model.

The accompanying illustration depicts one of three working models of the old Pearl Street generating station of the Edison Electric Illuminating Company, made in the mechanical construction shops of the New York Edison Company. The work was personally supervised by John W. Lieb, senior vice-president of the New York Edison Company, who was the station's first electrician. The models were made for historic reference and to serve as concrete records of a station that ushered in the Electrical Age. They are reminders of the difficulties overcome by Thomas A. Edison's perseverance, energy, and will-power in establishing an entirely new art. They are built on a scale of one-half inch to one foot, and show all the equipment and apparatus with which Edison began the generation and distribution, for public sale, of electrical energy to the lower end of Manhattan in September, 1882. Operated by a small motor, the ventilating and forced-draught system, the reciprocating engines and the famous Jumbo dynamos, all run just as they did on that first day. Each model is 62 in. long, 34 in. high, and 13 in. wide, with two smoke stacks rising 14 in. over the room. They show the four floors which comprised the Pearl Street station, and each piece of equipment has been



Model of Old Pearl Street Generating Station of the Edison Electric Illuminating Co.

reproduced. They are made entirely of metal and are lighted by a dozen 15-watt lamps concealed in one of the side walls. Pins hold the four walls, roof and floors together, so that the models can be taken apart to be repainted or repaired. The side wall has been partly cut away to show the interior and its operations. On the first floor is shown the auxiliary equipment which provided power for coal handling, forced-draught, and ventilation. The boilers are also shown. On the second floor are the six reciprocating engines directly connected to six Jumbo dynamos. On the third floor is the control equipment for the bank of 1,000 lamps that are on the fourth floor, which were used for testing and handling variations in the load.

The name plates on the models read as follows:—"Model showing the interior of the historic Edison Central Station, 257, Pearl Street, New York City. Scale one half inch equals one foot. Commenced operation September 4th, 1882, destroyed by fire January 2nd, 1890. Original equipment consisted of 125 normal horse-power, 350 r.p.m., Porter-Allen engines, each directly connected to an Edison Jumbo dynamo having a capacity of twelve hundred 16-candle-power, 110-volt lamps. Steam at 120 pounds pressure was supplied by four Babcock & Wilcox boilers. Original engines were replaced by Armington & Sims engines shown in the model."

Association of Supervising Electrical Engineers.

In view of the recent illness of the general secretary of the above Association, Mr. A. Brammer, it has been decided to postpone the annual general meeting from February 12th to March 19th, 1929.

Telephotograph Development.

We learn that tests have now been completed with the Korn photo-telegraphy apparatus which will allow German police to transmit finger-prints and photographs of wanted criminals by wireless. Sets of apparatus are being installed at Berlin and Breslau, and they will shortly be in use, Professor Arthur Korn said. Great improvements are said to have been incorporated in the latest apparatus, the whole picture is transmitted and received in one minute, which means that 5,000 of the points building up the picture are dealt with every second. The police will send all their telegrams as well as finger-prints and photographs by photo-telegraphy. They will simply write out their messages and transmit them as though they were pictures. Then mistakes will be impossible.—*Brittain Scienservice.*

Birmingham University Developments.

In the report of the Standing Joint Committee for Research at the University of Birmingham, it is stated that during the past year the following published contributions were made from the Department of Electrical Engineering: By Professor Cramp on "The Possible Use of High-Frequency Power for Electric Traction"; and by Mr. Harvey on "The Present Position and Probable Future Development of the Mining Electrical Industry," on "Electricity from the Colliery Manager's Point of View," and on "Electric Motors and Control Gear."

The Governors of the University of Birmingham report the receipt of the following gifts to the University: The Premier Accumulator Co.: A six-volt 30-ampere-hour accumulator, for use in the Department of Electrical Engineering, and Mr. Walter F. Higgs, of Messrs. Higgs Motors, Witton: A 220-volt motor, for use in the Department of Electrical Engineering.

E.P.E.A. Dinners.

The annual dinner of the N.W. Midland Centre of the Electrical Power Engineers' Association was held at Wolverhampton on January 25th. Among those present was Mr. Frank Hodges, who said the Central Electricity Board could not play its part towards the objective of cheap electricity supplies throughout the country without the co-operation of every organisation within the industry.

The members of the Portsmouth area of the Electrical Power Engineers' Association held their annual dinner at Southsea on February 2nd, when Mr. B. Howatt presided over a representative gathering.

Mr. B. Handley, engineer and manager of the Portsmouth undertaking, was entrusted with the toast of the Association, and remarked that although the body was young in years, it was experienced. Following upon the formation of the Association, working conditions had been bettered to a wonderful degree, and those who had come into the industry since the formation of the Association could hardly appreciate the conditions under which their predecessors had had to work. The improvement had been brought about by peaceful persuasion, which was all to the credit of the Association.

Mr. A. V. Sendell, vice-president of the Association, responded. The Association's motto was, he said, "Symbol of Service," and he understood that to mean service to the industry in which they were engaged and service to the Association, which, in its turn, meant service to one another. He paid a tribute to those who served the Association, for the position in which they found themselves to-day was the result of their work. Mr. Sendell also drew attention to the fact that as the result of an amendment of the rules, engineers engaged in the manufacturing industry were now eligible to become members of the Association.

The toast of the Portsmouth Corporation and Electricity Committee was proposed by Mr. A. G. Hiscock, who referred to the Corporation's efforts to exploit the natural advantages of the city. In reply, Councillor W. J. Lewis, vice-chairman of the Electricity Committee, speaking of the progress made in connection with the undertaking, declared that whatever success had been achieved was due to their excellent chief and the splendid staff he had gathered round him at the works. He also referred to the happy relations existing between the Committee and the engineers at the works, and he hoped they would continue. It had been the policy of the Committee to adhere to any schedule, whatever it might be, and that made the work of the Committee much easier.

The president afterwards toasted the ladies, for whom Mr. P. Rycroft (Messrs. Babcock and Wilcox) made a fitting reply. Dancing wound up the proceedings.

The London J.E.A.

The London and Home Counties Joint Electricity Authority has had under review the London Electricity Acts of 1925, and on January 25th issued a report, which had been adopted, upon the following questions:—

(*a*) The limitation placed upon the London electricity companies with regard to divisible or retainable profits.

(*b*) The obligation imposed upon the London companies to reduce the charges for electricity.

(*c*) The reserve funds which the companies may keep as prescribed by the Acts referred to.

The effects of the various clauses and agreements are discussed in detail, says *The Times*, and the report concludes:—

"The questions raised in the report are not free from difficulties in the interpretation of the statutes. It is clearly the intention of the scheduled agreements to limit divisible and surplus profits in such a way as to encourage reduced prices to, and increased consumption by, all classes of electricity users and to exhaust the revenue of a company by (*a*) meeting proper expenses of generation and distribution; (*b*) providing limited interest and dividend charges and reserve and contingency funds; (*c*) reducing charges for electricity. It is reasonable to believe that the proper application of the statutes will lead to these results."

Industrial Standards of Length.

A memorandum, C.B. (ME) 6,965, on the proposed international temperature of adjustment for industrial standards of length has been circulated by the British Engineering Standards Association to interested organisations and individual

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firms throughout the engineering industry. Mr. J. E. Sears, the British delegate to the seventh International Conference on Weights and Measures, asked for the advice of the B.E.S.A., and the latter's committee which was appointed to deal with the subject is disposed to concur in the proposal to which the memorandum relates, namely, international agreement on the temperature of 68 deg. F. (20 deg. C.) as the future temperature of adjustment for industrial standards of length in both the British and the metric systems, provided the proposal receives the support of the nations interested. Before taking definite action, the B.E.S.A. Committee desires to ascertain as fully as possible the views of British industry thereon.

The Channel Tunnel.

On January 22nd, Mr. Thurtle asked the Prime Minister if he was prepared to find time for an early discussion of the motion relating to the Channel Tunnel.

Mr. Baldwin replied that, in view of the wide public interest in the Channel Tunnel project, the Government had come to the conclusion that the time was ripe for a comprehensive re-examination of the question. It was anxious that a very thorough examination should be made of the economic aspects of the matter, in order that those might be weighed with Imperial defence considerations, and a decision reached on broad grounds of national policy. In view of the time that would be required to carry the project through all its stages to the completion of the tunnel, they were convinced that it would be in the public interest, if possible, to deal with this important question outside of the party atmosphere and by agreement, so that the decision of one Government might not be upset by another. In view of the pressure of business he was not prepared to give time for a debate.

Electricity in the United States and Great Britain.

In the course of his presidential address to the Birmingham Electric Club on Friday last, Mr. F. Forrest, M.I.E.E., chief assistant electrical engineer to the city Electric Supply Department, dealt with electricity supply in the United States and Great Britain. Comparing the sales of electricity in large cities, he said it was evident that from three to four times more energy was sold per head of population in the United States than in this country. Various factors contributed towards the greater use of electricity there than in this country; among them were the almost universal use of electricity in the servantless homes for all sorts of purposes, the fact that more than twice the horse-power of motors was provided in the factories for each man employed than was usual in this country, and also to the relatively low prices charged for the current and current-consuming appliances. The average price obtained per unit sold for all classes of supply in the large cities in the United States was about 1.1d., as compared with 1.2d. in this country, in spite of the fact that salaries and wages were 2¼ times higher there than here. The 25 most efficient British stations were rather more efficient than the 25 most efficient American stations, in spite of our smaller units of plant and poorer load factors. The hours of effective use in America were 4,200, as compared with 2,600 in Great Britain. This had a great effect upon the price at which electricity could be sold. An analysis of the statistics presented by the Electricity Commission shows that about 65 per cent. of the electricity generated in this country by statutory undertakers was furnished by municipalities, and only 35 per cent. by private companies; in the United States the proportion was 3 per cent. by municipalities and 97 per cent. by companies. The efficiency of steam generating stations had now reached about the limit of what was possible, and further reductions in the price of electricity could only be obtained by increasing the volume of sales, by improving the load factor, by the adoption of attractive tariffs, and by reducing the cost of distribution.

The Holborn Explosion.

The Government inquiry into the cause of the Holborn explosion in December last was resumed on January 23rd, 30th, and 31st, and concluded on February 5th.

In his evidence, Prof. J. S. Haldane, one of the referees, said he had come to the conclusion that on the morning of the explosion the tunnel must have been filled with an explosive mixture of air and gas from anærobic fermentation in contaminated soil, and that it was that mixture which ignited at the manhole. Prof. W. A. Bone thought it likely that pieces of disused carbide accidentally fell or were blown into the manhole, and they had only to suppose that the carbide got wet for it to decompose. Mr. Robert Sinclair, district superintendent in the engineering department of the Post Office, said that he had found the ventilation blower in the P.O. tube satisfactory in every way.

Col. Thomas Purves, engineer-in-chief to the Post Office, said that if they were called upon to use street gratings to disperse big accumulations of gas, they would run the risk of causing fires in the streets through lighted matches being thrown, sparks from the feet of pedestrians, or from steam engines using the streets.

Mr. Harold Moore, consulting chemist, said that of the three theories advanced as to the cause of the explosions, he preferred that of coal gas.

Professor Richard Vernon Wheeler, D.Sc., director of Safety in Mines Research Board experimental stations, said that in his opinion it was impossible that the shattering effect so noticeable along the Post Office tube and in the roadway could have been produced by a methane-air explosion, and highly improbable that it could have been produced by a petrol-air explosion. The explosion of coal gas and air so soon as the detonation stage had been reached would produce such damage to the tube and to the roadway as had been observed.

Mr. A. T. Miller, K.C., for the Gas Light and Coke Company, read a memorandum from Prof. Bone in reply to that of Prof. Wheeler. Professor Bone stated that from his observations and information of the kind of damage done, the Holborn explosions did not appear to have been, so far as gaseous explosions went, particularly violet. He could not share Professor Wheeler's view that it was so impossible for the damage observed in the Post Office tube explosion to have been produced by a methane-air explosion and so highly improbable that it could have been produced by a petrol-air explosion that coal gas only must be held responsible for it.

Sir Thomas Inskip, addressing the Commission, said that it would appear to be desirable, from the point of view of public safety, if the gas company could in the future give intimation of any leakages of gas it had ascertained in the neighbourhood of any big subway or tube in which gas might collect. If such a course had been adopted in this case, the disaster might have been avoided.

Mr. Miller submitted that the Post Office tube was left unventilated as "a trap" for the accumulation of any gas of whatever kind which might be free to collect there until such time as it became actively dangerous. Even if the Commission found that there was coal gas in this tube he thought they would find that its presence was not due to any lack of care on the part of the gas company, but that the absence of ventilation was primarily the cause of explosion.

The inquiry was closed.

Furnace Temperature Control.

In the research laboratories of the General Electric Co., U.S.A., a "thyratron" has recently been adapted to furnace temperature control. The temperature of the furnace is measured by a thermo-couple or resistance thermometer connected to the grid circuit of the thyratron in such a way that, when the temperature is below the desired point, the thyratron carries current sufficient to operate a contactor requiring two or three amperes. In the past very delicate mechanical devices have been used as relays to enable the heavy furnace currents to be controlled by the extremely minute currents from thermometers; the thyratron, it is stated, supplies the most sensitive means yet found for amplifying these feeble impulses to control the large amounts of power used for furnace heating.

Electrolytic Cable Corrosion.

Mr. J. H. C. Brooking, managing director of the Greenwich Cable Works, Ltd., writes that, while the book recently published by Mr. G. W. Stubbings on "Underground Cable Systems" is excellently written and accurate on most matters, it is "not quite up to date with regard to the prevention of electrolytic corrosion"; as this trouble is "becoming of increasing seriousness," he refers to the remedy of sheathing lead-covered cables, likely to be affected, with "Pernax," a compound of rubber and certain waxes intimately mixed, without any sulphur, and therefore applied without vulcanising. "It has remarkable qualities with regard to being unaffected by time, weather, or corrosion. Apart from its use in increasing quantities since 1903, it has proved these qualities during the last four or five years by its use all over the country for overhead-line bird guards at the highest of tensions. Its use, therefore, as a cable sheathing against electrolytic corrosion is worth considering by anyone affected."

Appointments Vacant.

Mains jointer for the East Grinstead Urban District Council Electricity Department. Floor sales manager for Dublin Showrooms, for the Irish Free State Electricity Supply Board. Assistant meter tester and reader for the Ilkley U.D.C. Electricity Department. Mechanical engineer (£600) for the Government of Nigeria P.W. Department. Electrical engineer for the Holmfirth Urban District Council. Full-time teacher in electrical engineering for the Barnsley County Borough Education Committee. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

Informal Meeting.—At the informal meeting on January 28th (Mr. A. Morgan in the chair), Mr. F. C. Raphael opened a discussion on "Mains Testing," and exhibited a number of lantern slides showing means of indicating breakdown and formulæ of tests. The I.E.E. regulations for leakage tolerances were rather indulgent for many networks, and he showed how they permitted very appreciable current to pass under certain conditions. For three-wire d.c. networks he

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advocated a high-resistance voltmeter between each bus-bar and earth to indicate the remarkable rise in voltage when a main had a bad leakage. For a.c. systems he suggested the possibility of a condenser in lieu of removing the "earth" for test.

Mr. A. H. Bennett asked whether there was any value whatever in continuously-taken insulation tests. Tests at frequent intervals were sufficient, but on the d.c. part of a system he would change over the outers to earth lines periodically.

Mr. R. Grierson pointed out to those who advocated abolishing limiting resistances that without them the balancers of a three-wire system would have to take the earth wire potential, whatever it might rise to. He was sure the earthing of the mid-wire through limiting resistances was the lesser evil, but he asked if it was realised how serious it was to put limiting resistances in the star point of transformers.

Mr. A. G. Hilling thought the whole secret of success was to fuse a network properly and keep the limiting resistances as low as possible. He felt that the resistance should be 0.2 ohm instead of the 2.0 ohms allowed by the Regulations.

Messrs. P. F. Allan, J. R. Bedford, E. Brown, W. A. Erlebach, A. F. Harmer, A. G. Kemsley, F. C. Knowles, H. J. Neill, J. Spiley, and A. Watson also spoke.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Captain R. G. VERNON, secretary of the East African Power and Lighting Co., Ltd., Nairobi and Mombasa, will shortly be in London for the purpose of arranging agencies. From the middle of February his address will be c/o J. K. Gilliat & Co., Ltd., 7, Crosby Square, London, E.C.3.

Salford Corporation Electricity Committee has appointed Mr. R. MELLOR, of Streatham, assistant to the consumers' engineer at a salary of £288 per annum.

The American Institute of Electrical Engineers through its Edison Medal Committee has awarded the Edison medal to Dr. FRANK B. JEWETT for his contributions to the art of electrical communication. Dr. Jewett is vice-president of the American Telephone and Telegraph Co., and president of the Bell Telephone Laboratories. In 1904 Dr. Jewett joined the staff of the American Telephone and Telegraph Co. and began his engineering research work in telephony. Under the direction of Mr. John J. Carty, then chief engineer, Dr. Jewett worked out methods which led to phantom loading of large gauge and open-wire circuits, the practical use of telephone amplifiers and the development of phantom duplex cables. In 1912 he became assistant chief engineer of the Western Electric Company, and in 1916 chief engineer. During the war he served in the U.S. Signal Corps, and in 1925 was appointed to his present position.

Mr. LESLIE H. HAM, who has since 1926 been the senior charge engineer at the Bargoed high-pressure power station, has been appointed combustion engineer at the new Government power station at Kalyan, Bombay, in connection with the electrification of the Indian State Railways.

Dr. ANTONIO S. AMALLO has lately been appointed Director-General of the Argentine Posts and Telegraphs.

Mr. G. A. HALMSHAW, of Dewsbury, late inspector of telephones, who has retired after 40 years' service, has been presented by the staff of the engineering department with a divan easy chair and a mahogany clock. Mr. Halmshaw commenced his career with the National Telephone Co.

Mr. DESMOND PEARSON, formerly with the Silvertown Company, has joined the staff of Messrs. Veritys, Ltd. He is now associated with Mr. R. D. Fairclough, M.I.E.E., at the company's Leeds depôt.

Mr. W. N. RINGROSE was recently presented with a silver cigarette case by the staff of Messrs. Ferguson, Pailin, Ltd., upon the occasion of his leaving their service to take up the position of switchgear sales engineer with the Electric Construction Co., Ltd., Bushbury, Wolverhampton.

There was some discussion in the House of Commons on January 29th regarding the appointment of Sir BASIL BLACKETT as chairman, and Lord CLARENDON as a director, of the new Communications Company. Mr. Churchill, for the Government, replied to the effect that there was no reason why these two gentlemen should not hold other positions.

It is announced that Mr. S. R. MULLARD has resigned from the board of Everlite, Ltd.

The Times states that Major C. E. PRINCE, late of Marconi Wireless Telegraph Co., has joined the board of Radiovisor Parent, Ltd.

Major H. J. HOLMES, M.B.E., M.C., late of the Strand Electric and Engineering Co., Ltd., has joined Messrs. Mortimer & Gall in the capacity of contracts manager.

Obituary.—MR. R. M. HORNE-PAYNE.—We have to record the death, which occurred on January 30th at Merry Meade, Brentwood, of Mr. Robert Montgomery Horne-Payne. He passed away in his 60th year, the cause being pneumonia. The prominent part which Mr. Horne-Payne had taken for many years in the development of the British Columbia Electric Railway and Power Company and its various undertakings has been frequently placed on record in the financial and other pages of this REVIEW. His connection was also very close with the tramway, light and power companies and undertakings operating in Rio de Janeiro and Sao Paulo, of both of which he was a director and vice-president. The Monterey Railway, Light and Power Co. and the West Gloucestershire Power Company were among other concerns in which he was directly interested.

MR. J. A. HENDERSON.—We regret to record that news has been received by cable of the death of Mr. John Alfred Henderson, of Victoria Villas, Wooler, from pneumonia. His death occurred at Vera Cruz, Mexico, at the age of 35 years. He served his apprenticeship with the British Westinghouse Co., Manchester (now Metropolitan-Vickers), and studied at the Manchester Technical College. He subsequently secured an appointment with the Vera Cruz Electric Light, Power and Traction Co., rising to a responsible position. Mr. Henderson was a member of the I.E.E. He had arranged to be home in May, his wife and three children having preceded him by a few months.

MR. F. THORP.—We regret to learn of the death of Mr. Frank Thorp, London representative of Messrs. Ferguson, Pailin, Ltd., which occurred at his residence, 5, Bewlys Road, West Norwood, S.E.27, on January 27th. Mr. Thorp's health broke down in 1927 when, with the company's acquiescence, he relinquished his duties for several months, and at the end of last July he returned, apparently much improved. Unfortunately, he had another breakdown a few weeks ago, which resulted in his death. The interment took place at Manchester on January 31st. Mr. Thorp had been in control of the company's London office since January, 1923.

MR. C. W. PARKES.—The death took place on January 19th, at Port Erin, Isle of Man, after a long illness, of Mr. Charles Wesley Parkes, who was for over 25 years on the staff of the Westinghouse Electric Co., for whom he travelled extensively as construction superintendent. Mr. Parkes was born at Bloxwich, near Wolverhampton, and went out to Pittsburgh as a pupil to Mr. T. A. Edison. He came back to Port Erin on his retirement 17 years ago. He was 66 years of age.

MR. H. MARSHALL.—The death occurred on January 20th, at the age of 66 years, of Mr. Henry Marshall, who was associated with the firm of Messrs. John Tinsley, Ltd., electrical engineers, of Darlington.

PROF. S. LUSSANA.—The death recently occurred in Genoa, at the age of 66 years, of Prof. Silvio Lussana, director of the Experimental Physics Department of the Royal University of Genoa.

M. L. DETHIOUX and M. BOCQUET.—The death is announced from Brussels of M. L. Dethioux, director-general of the Belgian Telegraphs and Telephones. The deceased presided at the International Telegraph Conference held in the Belgian capital last autumn. The Belgian Department has sustained a further loss by the sudden death of M. A. Bocquet, who was appointed successor to M. Dethioux.

MR. R. TOOTALL.—Mr. Richard Tootall, of Crossens, formerly in business in partnership with his brother in an electrical engineering business at Darwen, died on Saturday, aged 69. We understand that he installed the electric light in several leading business establishments in the town many years ago before the municipal undertaking was started.

MR. E. APPLEBY.—The sudden death is announced of Mr. Ernest Appleby, who was the oldest member of the staff of Messrs. Alfred Graham & Co., Ltd. He was 52 years of age.

MR. C. CLARKE.—*The Times* states that Mr. Charles Clarke, joint managing director of Waygood-Otis, Ltd., died suddenly on Thursday last week from pneumonia following influenza.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Adey Radio, Ltd.—Private company. Registered January 28th. Capital, £25,000 in 5s. shares. Objects: To adopt an agreement with Adey Wireless, Ltd., and H. W. Adey, and to carry on the business of manufacturers and repairers of and dealers in portable wireless sets, loud speakers, wireless parts, &c. The subscribers (each with one share) are:—S. G. J. Hart, 58, Cleveland Road, South Woodford, clerk; Cecilia M. Storer, 26, Palmerston Road, Wimbledon, S.W.19, clerk. The first directors are:—J. M. Bush, H. W. Adey, and S. M. Segar, jun. Registered office: 99, Mortimer Street, W.1.

Edison Accumulators, Ltd.—Private company. Registered January 26th. Capital, £10,000 in £1 shares. Objects: To carry on the business of electricians, electrical and mechanical engineers and contractors, manufacturers of and dealers in electric storage batteries, motors, carriage, omnibus, and other public or private conveyance proprietors, &c. The directors are:—J. F. Monnot, 36, Grove Court, N.W.8.; Emile G. Lind, 20, Bryanston Mansions, York Street, W.1. Registered office: 15, Upper George Street, Edgware Road, W.1.

Basil Marsh, Ltd.—Private company. Registered January 26th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus, &c. The permanent directors are:—Basil Marsh, 17, Victoria Road, Brighton, electrical engineer; Arthur R. Spilsbury, 12, Temple Street, Brighton, electrical engineer. Qualification, £1. Secretary: A. W. Prodger. Solicitor: J. A. Bosley, 2, Palace Place, Brighton.

Premier Battery & Magneto Co., Ltd.—Private company. Registered January 28th. Capital, £1,600 in £1 shares. Objects: To acquire the business of battery and magneto manufacturers and engineers now carried on at 118, Hampstead Road, N.W.1, as the "Premier Battery & Magneto Co." The directors are:—A. J. Blake, 118, Hampstead Road, N.W.1; H. H. Powell, A.M.I.E.E., Palace Chambers, Bridge Street, S.W.1. The latter is permanent chairman and managing director so long as he holds one share. Registered office: 118, Hampstead Road, N.W.1.

Electrical Factors, Ltd.—Private company. Registered January 26th. Capital, £500 in £1 shares. Objects: To carry on the business of factors of and dealers in electrical, wireless and engineering goods and equipment, &c. The directors are:—W. H. Burton, 3, Appleton Road, Hale; A. W. Turner, Megohm, Carver Road, Hale. Secretary: R. Parker, 3, York Street, Manchester.

Border Electrical Factoring Co., Ltd.—Private company. Registered January 28th. Capital, £5,000 in £1 shares (3,450 7½ per cent. cumulative preference and 1,550 ordinary). Objects: To carry on the business of electrical factors, &c. The permanent directors are:—W. H. Gardiner, 99, Denton Street, Carlisle; J. Ridley, The Nook, 1, Hart Street, Carlisle; T. H. Little, 25, Sheffield Street, Carlisle. Secretary: T. H. Little. Registered office: Collier Lane, Carlisle.

David Rowan (Vidro), Ltd.—Private company. Registered January 26th. Capital, £5,000 in £1 shares (3,250 ordinary and 1,750 10 per cent. preference). Objects: To adopt an agreement with D. Rowan for the acquisition of the business carried on as "David Rowan & Company," at 142a, Islington, Liverpool, and to carry on the business of manufacturers of electrical, mechanical, and illuminated signs, motors, generators, switches, electrical, wireless and mechanical apparatus, designers of posters and advertising matter, signwriters, electrical and mechanical engineers, &c. The first directors are:—D. Rowan, A.M.I.E.E., 45, Hope Street, Liverpool (chairman and managing director); J. Millar, 217, Townsend Avenue, West Derby, Liverpool (manager). D. Rowan is permanent. Registered office: 32, Imperial Chambers, 62, Dale Street, Liverpool.

Centrolian Radio, Ltd.—Private company. Registered February 1st. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with F. H. P. Sumner and D. B. McQueen, for the acquisition of the trade mark, "Centrolian" No. 498,875, and to carry on the business of manufacturers of radio gramophones, gramophone records, radio receivers, telegraphic, telephonic and photographic apparatus, valves, &c. The first directors are G. Williamson, St. Medans, Primrose Road, Calderstones, Liverpool, cotton salesman; M. Tucker, Sinclair Drive, Mossley Hill, Liverpool, cotton merchants' manager; C. K. Wilson, 38, Canning Street, Liverpool, bookkeeper (all permanent). Secretary: C. K. Wilson. Registered office: 19, South John Street, Liverpool.

Sphinx Electric, Ltd.—Public company. Registered January 29th. Capital, £300 in 1,000 ordinary shares of 1s. each and 1,000 10 per cent. participating preference shares of 5s. each. Objects: To acquire the registered trade mark "Sphinx" from Auto-Bulbs, Ltd., and to carry on the business of manufacturers of and dealers in electric lamps, fuses and signs, &c. The directors are: C. P. Preston, 10, Riverdale Gardens, Twickenham Park, electrical engineer; A. H. Chovil, "Peterbrook," Warstock, lamp manufacturer; W. Plummer, "The Elms," Ashford, engineer. Registered office: Sphinx House, Hatton Garden, E.C.1.

Overhead, Ltd.—Private company. Registered January 30th. Capital, £10,000 in 9,500 7½ per cent. cumulative preference shares of £1 each and 10,000 deferred shares of 1s. each. Objects: To carry on the business of electrical engineers and contractors, manufacturers and suppliers of and dealers in electrical overhead line equipment, &c. The subscribers (each with one preference share) are: G. J. S. Scovell, C.B.E., Ashmansworth Manor, Newbery, Berks., company director; Sir B. C. Beauchamp, Bt., 4, Grosvenor Crescent, S.W., company director. Secretary: W. Rickinson. Solicitors: Blundell, Baker & Co., 16, Serjeant's Inn, E.C.4.

Official Returns of Electrical Companies.

Radio Maritime, Ltd.—Capital, £5,000 in £1 shares. Return dated November 3rd, 1928. 3,418 shares taken up. £3,418 paid. Mortgages and charges, nil. Return of allotments, made up to December 11th, 1928, shows a further 100 ordinary shares allotted, payable in cash and fully called up.

Frinton-on-Sea and District Electric Light & Power Co., Ltd.—Capital, £10,000 in 7,300 preference and 2,700 ordinary shares of £1 each. Return dated June 29th, 1928. All shares taken up. £10,000 paid. Mortgages and charges: £4,000.

D. Halett & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 20th, 1928. 4,420 shares taken up. £320 paid, £4,100 considered as paid. Mortgages and charges, nil.

British Brown-Boveri, Ltd.—Capital, £50,000 in £5 shares. Return dated December 21st, 1928. 50s. per share called upon 8,500 shares All shares taken up. £21,250 paid, £7,500 considered as paid on 1,500 shares. Mortgages and charges, nil.

Van Raden & Co., Ltd.—Capital, £10,000 in £1 shares. Return dated July 18th, 1928. 6,754 shares taken up. £4,654 paid, £2,100 considered as paid. Mortgages and charges: £1,800 mortgage and £1,200 debentures.

Baxendale Bros., Ltd.—Satisfaction (*a*) in full on August 25th, 1928, of debenture dated January 16th, 1918, securing £500, and (*b*) to the extent of £200 on July 20th, 1916, and £800 on August 25th, 1928, of debenture dated May 11th, 1916, securing £1,000. (Notices filed January 21st, 1929.)

Cecil Cooper & Co. (London), Ltd.—Capital, £12,000 in £1 shares. Return dated October 8th, 1928. 9,156 shares taken up. £9,156 paid. Mortgages and charges, nil.

Malay and Eastern Power Development Co., Ltd.—Capital, £40,000 in 10,000 "A" preference, 29,000 "B" preference, and 1,000 ordinary shares of £1 each. Return dated December 31st, 1928. 5,000 "A" preference, 29,000 "B" preference, and 1,000 ordinary shares taken up. £35,000 paid. Mortgages and charges, 122,275 dollars, Malay currency.

Hartley Engineering Co., Ltd.—H. H. C. Mitchener, 11, Portland Street, Southampton, and E. H. Hawkins, 4, Charterhouse Square, E.C.1, were appointed receivers and managers on January 15th, 1929, under powers contained in 1st mortgage debenture dated March 3rd to October 10th, 1928. B. H. C. Mitchener and E. H. Hawkins were also appointed receivers and managers on January 18th, 1929, under powers contained in second debentures dated April 5th, 1928.

Vidal Engineering Co., Ltd.—Charge on freehold hereditaments at Thornton Road, Thornton Heath, dated January 18th, 1929, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd. Also debenture of

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same date collateral to the above charge to secure £13,000 or any lesser sum due thereunder charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Westminster Bank, Ltd.

G. Yeldon, Ltd.—Prior lien debenture creating a first charge on the company's assets, present and future, including uncalled capital dated January 5th, 1929, to secure £500. Also first debenture of same date and on same property to secure £2,500 (subject to the above debenture). Holder: E. H. Hawkins, 4, Charterhouse Square, E.C.1.

Mersey Power Co., Ltd.—Satisfaction in full (1) on November 15th, 1928, of charge dated November 27th, 1918, securing £300,000, and (2) on December 31st, 1928, of second debentures dated May 27th, 1924, securing £296,475.

Reason Manufacturing Co., Ltd.—Satisfaction in full on January 24th, 1929, of trust deed dated December 18th, 1900, securing £25,000.

P. N. Forbes, Ltd.—W. G. Grosvenor-Launder, Northam, Henley-on-Thames, was appointed receiver on January 23rd, 1929, under powers contained in debenture dated June 15th, 1928.

C. J. Plucknett & Co., Ltd.—£20,000 in £1 shares. Return dated December 28th, 1928. 15,007 shares taken up. £7 paid. £15,000 considered as paid. Mortgages and charges, £2,200.

Precision Electric, Ltd.—Capital, £500 in £1 shares. Return dated January 12th, 1929. 100 shares taken up. £100 paid. Mortgages and charges, nil.

Brookhirst Switchgear, Ltd.—Capital, £550,000 in £1 shares. Return dated January 1st, 1929. 126,002 shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, £25,000.

Hightensite & Ebonite Manufacturing Co., Ltd.—Issue on January 24th, 1929, of £2,100 debentures, part of a series already registered.

City Notes.

Singapore Traction Co., Ltd.

The directors' report for the year ended September 30th last states that the accounts show a satisfactory recovery from the previous year's position, when the results were seriously affected by a boycott of the company's services. The profit was £37,260 (against £13,780); to this is added £2,367 brought forward, making £39,627. After making various appropriations, including £10,000 for renewals, there is a balance of £22,540. It is proposed to pay a dividend of 5 per cent. (against *nil*) on the 7 per cent. cumulative preference shares, absorbing £10,000, and a similar amount is to be paid to the managers (the Shanghai Electric Construction Co., Ltd.). This will leave a balance of £2,540 to be carried forward. The arrears of dividend on the preference shares will now amount to 11 per cent. At the date of the accounts the 19 miles of route authorised by the Traction Ordinance was being operated under railless traction, with the exception of Elgin Bridge, the reconstruction of which is expected to be completed in May. There are 90 trolley 'buses in service, and a further 15 are being constructed. In addition, the construction of seven motor-'buses is nearing completion; the company intends to develop this form of traffic. The company has ceased to generate electricity, and its requirements are now met by a supply from the Municipality. The meeting was to be held on Wednesday last

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee of the Stock Exchange under Rule 159:—

Norwich Electric Tramways.—26,400 shares of £10 each, fully paid, Nos. 1 to 26,400.

Callender's Cable and Construction Co., Ltd.—130,000 new ordinary shares of £1 each, fully paid, Nos. 800,001 to 930,000.

Aldershot Gas Water and District Lighting.—£110,000 new four per cent. preference stock, fully paid.

Burndept Wireless (1928).—20,000 shares of 5s. each, fully paid, Nos. 600,022 to 620,021.

Underground Electric Railways of London.—46,380 ordinary shares of £1 each, fully paid, Nos. 7,010,341 to 7,056,720.

British Participation in the "Sofina."

The Times reports that the British Shareholders' Trust, Ltd., acting on behalf of Mr. F. Dudley Docker's group, has secured a participation for London in the new issue of ordinary shares of the Société Financière de Transports et d'Entreprises Industrielles ("Sofina"), which has acquired the business of the old company of the same name. The company has cash resources of about £10,000,000 and its open reserves amount to over £8,000,000. With the large resources now at its disposal and its close association with many of the most important financial institutions in each of the principal money markets of Europe and America, it will be in a position to carry out electrical undertakings of magnitude in any part of the world. Among other companies the Sofina Company controls, or is interested in, the following:—Companhia Hispano-Americana de Electricidad, Société Internationale d'Energie Hydro-Electrique ("Sidro"), Compagnie Générale de Tramways de Buenos Ayres, Société d'Electricite de Rosario, and the Electric and Railway Finance Corporation, Ltd., London. The market value of the capital of the various undertakings managed by the Sofina Company is approximately £170,000,000. This week the company published, for information only, a statement of its constitution and objects.

Ever-Ready Co. (Great Britain), Ltd.

At an extraordinary meeting on January 31st the shareholders passed a resolution providing for the capitalisation of £74,000 of the general reserve and its issue in the form of 296,000 5s. ordinary shares to existing shareholders in the proportion of one new share for each five held. In his speech, the chairman (Mr. M. Goodfellow) referred to the acquisition of an interest in Lissen, Ltd., in which the company had been assisted financially by the Ever-Ready Trust & Finance Co., Ltd. They expected to derive far-reaching advantages from this transaction. The company had, in addition to this, invested a substantial sum in the Trust & Finance Co., and had made considerable expenditure in the enlargement of its factories and plant. The funds had been provided from accumulated profits and bankers' loans, and it was clear that an issue of ordinary shares would have to be made at an early date. Shareholders would be given the right to subscribe for these on bonus terms.

Hall Telephone Accessories (1928), Ltd.

The net profit for the year ended December 31st last was £30,094. Of this £2,393 has been placed to capital reserve, £5,000 to general reserve, and £5,800 to income tax reserve, and directors' additional remuneration takes £1,070. It is proposed to pay a final dividend of 6 per cent., making 10 per cent. for the year, and £4,631 is to be carried forward. The report states that the company has received satisfactory contracts from several Government Departments and telephone companies at home and abroad, including a further long-term contract from the General Post Office. In order to provide funds for the purchase of the business of Thomas Watson and Sons, suppliers of telephone and allied equipment, it is proposed to create 70,000 new 10s. shares, of which 56,000 will be issued. Shareholders will have the right to purchase one new share at 11s. for each five shares which they hold. Meeting: February 11th.

Traction and General Investment Trust, Ltd.

The annual meeting was held on January 31st, when the chairman (Mr. H. A. Vernet) said that since the last report the subscribed capital had been increased from £683,280 to £888,264 by the issue to shareholders of 25,623 £8 shares, at £11 5s. each. The premium on the issue had been transferred to reserve; the shareholders personally had also derived considerable benefit. The value of investments had risen from £1,639,618 to £2,116,530. Although shareholders might think that the 16 per cent. dividend was unduly liberal, the surplus was adequate to meet this. They anticipated a further increase of revenue during the current year. There had been a rise in the proportion of their investments in Europe.

Fife Tramway, Light and Power Co., Ltd.

The profits of the undertakings owned and operated by the company for the year ended December 31st last amounted to £127,004, and a balance of £91,459 was received. After meeting administrative expenses, &c., and adding £5,253 brought forward, the amount available is £85,451. Debenture interest and redemption is paid, and £8,000 is transferred to reserve. It is proposed to pay an ordinary dividend of 4 per cent. (as for 1927), leaving £5,848 to be carried forward. During the year £150,000 of 5½ per cent. 5-year registered notes was issued, the proceeds being used to repay temporary loans and to provide capital for development. Meeting: To-day, Friday.

Official Notice Re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Beaver Accumulator Co., Ltd.
Blackadda Radio Co., Ltd.
Gold Bow Enamel Wire Co., Ltd.
Pagets Radio Components, Ltd.
Radio and Electro Technical Industries, Ltd.
Radiophones (1925), Ltd.
Telephos (1925), Ltd.
Wireless League Gazette Publishing Co., Ltd.

Everlite, Ltd.

The statutory report of this recently-formed company states that 1,650,000 1s. shares have been allotted for cash, the remainder (350,000) having been allotted as fully paid in part consideration for the purchase of an invention, patents, &c. The cash received amounts to £112,875. The amount paid to the vendors, &c., is £34,635; preliminary expenses have amounted to £1,017; and the excess of payments over receipts on trading account is £71; leaving £77,151 in hand. The report was presented at a meeting on February 4th.

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Vera Cruz Electric Light, Power and Traction Co.

The control of this company has passed into the hands of the American and Foreign Power Co., New York, which has purchased about 224,000 of the 350,000 £1 shares forming the company's capital. The American concern offers 8s. per share for the outstanding shares, and the directors recommend the acceptance of the offer. The company has an accumulated debtor balance of £17,693 and has paid no dividends for six years.

Grampian Electricity Supply Co.

The company is seeking a Provisional Order to extend its area of supply to include the Counties of Aberdeen, Banff, Kincardine, Elgin, and a number of places in Inverness, Ross, and Cromarty. This will necessitate the provision of additional generating facilities and the raising of the authorised share capital from £1,750,000 to £2,500,000. The issued capital of the company is £800,000, and it is proposed to make an early issue of a further £1,000,000.

London Power Co., Ltd.

The accounts for the past year show a balance on revenue account of £683,490 (against £495,081). From this debenture interest, sinking fund instalments, contribution to companies' fund, &c., are met, and it is proposed to pay the fixed dividend of 6 per cent. A staff pensions scheme has been approved and £12,000 has been set aside for the purpose, in addition to £12,000 already reserved.

On Wednesday last the company published a prospectus offering £3,000,000 of 5 per cent. redeemable debenture stock at £99 10s. per cent., repayable at par on October 1st, 1972, or at any time after October 1st, 1952. Mention was made in the prospectus of the guarantee of the ten constituent companies to ensure that the company's obligations are fully met. The proceeds of the issue are required for extensions of the company's business, in particular for the first section of the new "selected" station at Battersea; to meet obligations of the company under contracts for the purchase of the undertakings of the constituent companies, &c., and for the general purposes of the company.

West London and Provincial Electric and General Trust, Ltd.

At an extraordinary meeting on January 30th resolutions were passed increasing the capital to £390,000 by the creation of 18,000 new shares of £5 each, and subdividing each of these shares into one £4 preference share and one £1 ordinary share and converting them into preference and ordinary stock.

Metropolitan Railway Co.

A final dividend of 2¼ per cent. has been declared on the ordinary stock, making 3½ per cent. for the year, as compared with 3 per cent. in each of the two preceding years. A similar final dividend is to be paid on the Surplus Lands stock, making 3¾ per cent., against 3⅝ per cent.

City of Buenos Ayres Tramways (1904), Ltd.

After again transferring £10,000 to amortisation and general fund, the directors propose to pay a final dividend of 1s. 3d. per share, making 5 per cent. for the year (as for 1927). A balance of £1,345 is carried forward, against £2,885 brought in.

Westminster Electric Supply Corporation, Ltd.

A final dividend of 13.12d. per share has been declared on the ordinary shares, making up the "standard" dividend of 8.8 per cent. for the year ended December 31st last.

Yorkshire Electric Power Co.

A final dividend of 1s. per share, making 8 per cent. for the year (as for the preceding year) is recommended on the ordinary shares.

Italian Issue in New York.

The Pirelli Co. (Italy) last week offered 50,000 shares of common stock at $60 per share in New York.

Herbert Morris, Ltd.

The half yearly dividends have been declared on the 6 per cent. and 5 per cent. cumulative preference shares.

St. James' and Pall Mall Electric Light Co., Ltd.

The directors recommend a final dividend of 9.949d. per share on the ordinary shares, making up the standard dividend for the past year.

Stocks and Shares.

MONDAY EVENING.

THE Metropolitan is the first company this year in the Home Railway group to announce its results for 1928, and it is perhaps a little unfortunate that the declaration should have been regarded as a disappointment, for it had the effect of spreading dulness, which proved to be temporary, amongst Home Railway stocks as a whole. Possibly expectation had been a little optimistic in looking for 4 per cent. in respect of 1928, whereas the actual figures make 3½ per cent. for the year, and are far from being unsatisfactory. The company published traffics showing an increase of £59,000 over those of 1927, and the 3½ per cent. calls for about £38,000 extra cash as against the money required to pay a 3 per cent. dividend for 1927. The price of the stock went back 1½ to 66½. The District and the Underground Electric Railways announcements come on the Thursday in this week. It may be mentioned that Underground Electric incomes stand 20 points higher to-day than they did a year ago, the £1 shares having risen during the twelve months about 6s. per share. Both have been a little higher than the current quotations, and, in spite of the Metropolitan figures, optimism runs strongly in regard to the anticipated results due to be published on the day before this paper is. Underground incomes are down 2 points, the Districts gained the fraction at 80½.

London Lighting and Power.

In the market for London electricity shares, Kensingtons are a little better at 27s., and Metropolitans lost 1/16 from their recent rise, going back to 47s. 6d. The London Power Company publishes a very interesting report showing an output of nearly 600 million units, a rise of 17 per cent. over the previous year's figures. At the same time, the company's charge for energy was lowered by about 2½ per cent., thanks to reductions in the cost of fuel, rent, and rates. The report states that six of the company's stations have been selected under the electricity scheme for South-East England. The Power Company's dividend on the ordinary shares is fixed at 6 per cent., any surplus going to the benefit of consumers. The price of the 5 per cent. debenture stock is 102 middle, with an interest payment due in March. The stock is, of course, a gilt-edged investment. These are very early days in which to look forward to what may happen in 1931, when most of the London companies' dividends drop to a fixed 7 per cent., but the experience of the London Power Company hints at the possibility that, in years to come, the companies may find it possible to reduce charges to their customers sufficiently to enable a further dividend to be distributed over and above the 7 per cent. which is the basis upon which our calculations of yield are worked out in the tables of prices.

Provincial Power.

Scottish Power have been a feature of strength at 34s., and Bournemouths rose to 69s. 6d., both issues showing improvements of 1s. There is a fair amount of activity in the provincial companies' shares, owing, of course, to the expectation that more money will be required in the near future, and that fresh capital will be raised through the offer to proprietors of shares at prices under those ruling in the market for the existing securities.

Participating Preference.

Of the participating preference shares on offer, mention may be made of Tilling & British Automobile Traction 8 per cents., which give £6 1s. 3d. per cent. at the present price of 33s. ex dividend. The shares rank equally with the ordinary for a further 2 per cent. above their 8 per cent., after the ordinary have received the latter rate. The participating dividend is being regularly paid. Lancashire Electric Light & Power 7 per cent. participating preference carry the right to a further 3 per cent. after the ordinary have had 7 per cent., and both classes have received 7½ per cent. for each of the last six years. The price of these Lancashire preferences is 30s., at which shares can be obtained, returning 5 per cent. on the money, the dividends being due in March and October. The Isle of Thanet 6 per cent. preference, which are quoted at 29s., and yield £4 2s. 9d. per cent., rank equally with the ordinary after the latter have received 6 per cent. For 1927, the ordinary dividend was 4 per cent., and the preference are therefore receiving the 6 per cent. to which they are entitled. Amongst the shares upon which dividends are paid free of tax, Adelaide Electric 5 per cent. at 22s. return 4½ per cent., which is equal to about 5⅝ per cent. gross, taking the tax at 4s. in the £.

Shares on Offer.

There are available at the present time a few hundred Edison Swan Electric 7½ first preference shares at 25s. 6d., ex the dividend due this month. The yield on the money is £5 17s. 6d. per cent., and the issue requires £7,500 for the service of its dividend, an amount which is covered nearly ten times by the sum available yast year. Crompton Parkinson 6 per cent. second preference can be bought at 19s. 3d., *cum* the dividend now pending, and yield practically 6¼ per cent. on the money. There are also several thousand Atlas Light & Power 7 per cent. first preference, which can be bought at 23s. 3d., or a little lower, to pay 6 per cent. on the money, with dividends due in June and December. Atlas ordinary have risen to 25s. 6d. on American support. A return of £6 1s. is available from Whitehall Electric Investment 7½ per cent. preference at 24s. 9d., with April and October dividends, the margin in this case being liberal.

Eastern Cable Stocks.

Globe Telegraph ordinary shares have gained £1, at 27; Eastern Extension and Western Telegraph shares are 5s. higher in each case. Eastern Telegraph ordinary retains its rise to 272½. No news was forthcoming up to the time of writing.

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on Monday night, to dispel the uncertainty surrounding the amount of new stocks that are to be given in exchange for existing stock and shares in the two Eastern and in the Western companies. Indo-Europeans at 54½ retain the full sum of their recent remarkable rise. United River Plate Telephone shares have been removed from the pages of the Stock Exchange Official Lists, by reason of the acceptance, by most of the shareholders, of one or other of the alternatives offered by the International Telephone and Telegraph Company, whose capital stock has risen to 230. The latter is paying quarterly dividends at the rate of 6 per cent. per annum.

B.E.T. Fireworks.

British Electric Traction deferred stock has had a further spectacular jump of 50 points, bringing the price to 825. This compares with 500 at the beginning of the year. Mention has been made here already of the estimate that the stock is worth 1,000, and the market anticipation of the four-figure quotation becoming reached. As there is but £147,888 stock in issue, held by people of the class who rarely sell, it is not unlikely that the anticipation may be realised. Stock changed hands at 800 and 805 on the last day of January. The 8 per cent. preferred ordinary is quoted in our weekly price-list and stands at 126. There is also a 6 per cent. cumulative participating preferred stock, at 127½, the last two half-yearly dividends on which were 60s. and 90s. The company's 5 per cent. debenture stock is 98½ middle, and its 4½ per cent. second debenture stock is 82 to 85.

Mexican Utilities.

Another dramatic rise is that of 15½ points in Mexican Light and Power stock, which has now reached 100. The stock is in shares of no par value, the American invention that grows rapidly in popularity across the water, but which still occasions perplexity—sometimes a mild acerbity—amongst British investors. This stock is in receipt of no dividend at present, but it is expected to re-enter the lists, before very long, with a 4 per cent. per annum distribution. Mexico Tramways 5 per cent. bonds are 4 points better at 84. Pachuca Light and Power 5 per cent. first mortgage gold bonds are guaranteed by the Mexican Light and Power Company, and have speculative attractions at 74. Interest is payable in April and October. A speculator might take a fancy to Vera Cruz Electric Light and Power and Traction 5 per cent. first mortgage debentures. The market price of 60 indicates the risk attaching to the bonds. Interest is duly met, but the company's £1 shares have received no dividend for nearly six years.

General Electrics and Others.

The main excitement of the week, so far as it relates to the prices with which we are concerned, is centred around General Electrics. New York took the shares in hand very vigorously, and at one time the price touched 87s. 6d., which is, on dividend performance, a fanciful figure, and, presumably, will offer a great temptation to British shareholders to part from shares upon which they—the holders—are receiving not more than 10 per cent. dividend at £1. As already mentioned here, when Americans want to buy shares, they do not stick at trifles, but buy with the same disregard of limits as Paris used to do in the old days when she thirsted for Kaffirs. From 4⅝ the price went back to 76s. 3d.

The other members of the manufacturing group are decidedly good. Henley's have risen to 6, British Insulated gained 1/16, Siemens are a better market at 30s. and over, buyers. Johnson and Phillips have risen to £2.

Wireless and Others.

Marconis have risen to £4 a share, and have been up to 81s. 6d. The rise is associated with the renewed expectation of what the company is likely to receive as its proportion of the Communication Company's assets. Canadian Marconis rallied to 35s. Marconi Marines remained firm at 3⅝. Lively speculation in Baird Television whirled the price to 14s. 9d., from which it has subsided to 12s. Ever-Ready shares, old and new, are 25s. 6d., the former being ex rights. The price of Everlites moved in dramatic fashion, reaching 11s. at one time, from which it dropped obliquely to 6s., and rallied to 7s 9d.

Such movements as these attracted more public attention even than an extraordinary advance in the price of Canadian General Electric common, which put on 56 points to-day—Monday—rising to 210. At the same time, Calgary Power shares rose 10 to 165. Montreal Light and Power at 120 are 7 up, and Shawinigan, which have been down to 91, recovered to 95. Rio Tramway 5 per cent. first mortgage bonds at 91½ are a point up.

Amongst the European issues, Prussian Electric bonds remained at ½ discount. The market in iron and steel shares is quiet, with Vickers rather easier at 12s. 6d., but considerable activity has characterised the shares of some of the compressed coal and steam-raising companies, more particularly those of recent introduction. Amongst rubber shares, nothing of importance has occurred to ruffle the placid surface of a market which waits upon the course of events which will follow the recent improvement in the price of the material to 11d. per lb.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Feb. 4, 1929.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14†	15	69/6	+1/-	... ...
Brompton Ordinary	1	8¾	8¾	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 8 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	49/6	—	3 3 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—	3 18 3
Kensington Ordinary	1	8	8	27/-	+6d.	5 3 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	46/3	—1/10	3 18 1
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/6	—	4 5 3
Mid. Elec. Power	1	—	15	2 7/16	—	... ..
Newcastle-on-Tyne Ordinary ...	1	5	6	27/-	—	4 9 0
do. 7% Pref. ...	1	7	7	26.6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	+1/-	4 14 2
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	40/9	—	... ..
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/3	—	6 3 8
Yorkshire Elec.	1	8	8	36/6	—	4 7 8

†4% of which was tax free.

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	,,	8	8	65½	—1½	5 6 10
do. District	,,	8½	4	80½	+½	4 19 5
Underground Electric	£1	1½	5	27/6	—6d.	3 12 9
do. do. Income ...	Bonds	6	6	129	—2	4 13 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	102xd.	+½	5 16 6
do. Def.	,,	1½	1½	25	—	5 17 8
Automatic Telephone	1	10	10	2⅛	—	4 14 1
Eastern Extension	10	10	10	27½	+¼	*3 12 9
Eastern Tel. Ord.	Stock	10	10	272½	—	*3 18 6
Globe Tel. and T. Ord.	10	10	10	27	+1	*3 14 1
do. do. Pref.	10	6	6	11½	—	5 9
Great Northern Tel.	10	20	20	34½	—	... ..
Indo-European	25	10	10	54½	—	*4 11 0
Marconi	10/-	5	*10	4	+1/16	... ..
Marconi-Marine	1	8¾	12½	3⅝	—	3 9 1
Oriental Telephone Ord.	1	12	12	3	—	... ...
Western Telegraph	10	10	10	27½	+¼	3 12 9

*Interim.

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	3⅝	+1/16	8 5 6
do. do. 5% Deb. ...	Stock	5	5	77	—½	6 9 10
British Electric Traction Def. Ord.	,,	—	—	825	+50	... ..
do. do. Pref. Ord.	,,	8	8	126	+1	6 7 0
Brazil Traction	100	6	7	79	—2½	2 4 3
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 4 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	—	... ..
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	84	+4	5 19 1
Mexican Light Common	100	Nil	Nil	100	+15½	... ..
do. 7% Pref.	100	Nil	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... -

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	13	15	3 3/16	+1/16	*4 4 9
British Aluminium Ord.	1	10	10	47/-	—6d.	*4 5 1
British Elec. Transformer Pref....	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅝	+1/16	8 5 0
Brush Ord.	1	10	10	28/9	—	6 19 9
Callenders	1	15	15	4¼	—	3 9 10
do 6½% Pref.	1	6½	6½	1¾	—	5 4 0
Crompton Parkinson Ord.... ...	5/-	—	—	1	+6d.	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	5 16 6
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	23/9	—	5 16 6
Enfield Cable Ord.	1	20	20	5 5/16	—	3 15 6
English Electric	1	Nil	Nil	8/9	—	... ..
do. do. Pref	1	8	Nil	10/-	—	... ..
Gen. Elec. Pref.	1	6½	6½	21/6	—	5 6 1
do. Ord.	1	7½	10	31 3/16	+3/16	2 12 4
Henley	1	25	25	6	+⅛	4 3 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/8	—	... .
Johnson & Phillips	1	12½	10	2	+3/16	5 0 0
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	25	—	*4 14 6

*Dividends paid free of Income Tax.

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Electrical Trade with South America.

The Situation in Argentina, Chile and Peru.

The Argentine Electrical Market.

THE annual report, dated October, 1928, by Mr. H. O. Chalkley, C.B.E. (Commercial Counsellor to the Buenos Aires Embassy) upon conditions in Argentina (Stationery Office, 3s. net) appears to contain more matter of interest to the electrical industry than usual.

In his introduction Mr. Chalkley makes a brief study of the commercial relations between this country and Argentina showing how trade has followed investment. British trade with the Republic showed a welcome improvement during 1928, but this does not justify any relaxation of efforts to maintain it, for competition remains very severe. "British export trade to this market can expand or contract, according to the will and capacity of the British manufacturers and merchants who are responsible for it." The development of the country calls for an ever-increasing volume of imports; other things being equal, British goods are preferred; and a superior local machinery for the importation of these goods exists. In spite of these favourable factors conditions must be studied on the spot; competition must be aggressively met; local agents must be generously and vigorously supported; and propaganda and advertisement must be maintained. Among the important works which are in prospect are the construction of underground railways in Buenos Aires, the electrification of the Buenos Aires suburban railways, and the placing of its lines underground by a British telephone company. These projects, which it is reasonably possible to expect will be undertaken, signify greatly increased opportunities for trade and investment.

The Electrical Market.

International competition and cross-currents in the important electrical plant and materials trade are interesting but obscure, and British manufacturers should give special consideration to the reports of their Argentine connections and endeavour to frame a leading policy. American interests are particularly active, sometimes in association with German interests and at others in competition. The German electrical manufacturers have suffered from increased cost of production and from the local prejudice that German plant and materials should be cheaper than others, so that their margin of profit has become small and they are endeavouring to fix prices and sales conditions. The Germans, Americans and Italians all have plans for further local manufacture. Stronger competition from Italy, Holland and even Denmark is expected, and representatives of Swedish and Swiss finance and electrical industries have visited the Republic to study conditions.

The sale of large generators, motors and transformers is mostly in the hands of the nationality that controls the capital; for instance, the Germans and Italians, who own the largest power plants in and around Buenos Aires, naturally buy machines of German and Italian manufacture, and, moreover, impose their own standards for the installation of equipment to their lines. The railways are users of large generating machinery of British make. Any further electrification of the large British railways (and the Central Argentine company proposes to convert from steam to electric traction its second suburban route) will make a big difference to British manufacturers of generators, transformers, cables, switchboards, &c. An American corporation has acquired a controlling interest over a large number of small country power plants. The Germans and Americans so far usually outbid the British manufacturer on generating machinery in most of the smaller plants that are constructed throughout the country, and a closer study of this situation is recommended to British manufacturers. Latterly there has been an increase in the sale of British motors, but the competition in this line is very great.

Several years ago the British sold most of the conduit on the market, but they were later replaced by the Germans with a lighter article. During the war the Americans brought out a heavy-gauge conduit which has found favour for installations in all important buildings. The switches and sockets in general use are mostly American standards, and it would be a very difficult matter to change this. The Germans produce a cheaper but inferior switch; they manufacture electrical devices of a quality which would not be acceptable in Germany, especially to meet the competition in foreign markets such as Argentina. It is always to be hoped that the Argentine regulations will be made more severe.

In selling electric heaters, stoves, fans, irons, toasters, percolators, and other household devices, the Germans seemed at one time to be the most prominent, but since the war the Americans hold the field. The Americans generally manufacture a superior article to the Germans, but recently the latter are imitating the American devices and underselling. The British manufacturer has little chance, unless there is a big change in the policy of manufacture. Although as a rule the British article is more robust, it is not manufactured in the quantity that enables a low price to be offered. There may not be such a very great difference in the manufacturing costs, but the Argentine market is one where prices are cut very fine. The presentation of the article also has a great deal to do with successful selling.

There is a large and growing demand in the Argentine for insulated wires and cables of all kinds. The British manufacturers stand very high in the manufacture of paper-insulated and armoured cables for underground transmission, but the Germans seem to work to British specifications and undersell. Rubber covered wires and cables are usually too costly for the market. The Germans and Italians, and to a smaller extent the Dutch and Belgians, manufacture wires, cables and flexible cords to meet the Argentine requirements, which are for an article of inferior quality to sell as cheaply as possible, as there are practically no regulations governing electrical installations, the installers using as cheap a quality of material as they can get. In underground distribution boxes the standards are mostly German, although during the war there was a slight deviation to American practice. In the large cities it is becoming the practice to use vitrified clay duct for nearly all underground work, both for power and telephony. The British were the principal suppliers of this duct until the war, when they were supplanted by the Americans. British firms have again booked orders against severe competition, and the quality has been highly satisfactory. Factories are now being installed for the manufacture of clay duct.

Electrical Import Trade.

It is shown in the report that the total value of electrical machinery and materials imported into Argentina in 1927 was approximately £4,273,000, as compared with about £4,673,000 in 1926. The United Kingdom supplied electrical goods and apparatus valued at £1.038,626 in 1926, and £655,073 in 1927. Some details of the imports are given in the appended table:—

	1926. kg.	1927. kg.	Inc. or dec. kg.
Electrical accessories (n.s.m.)	689,300	582,922	− 106,378
United Kingdom ...	443,372	174,750	− 268,622
Germany	145,866	.279,558	+ 133,692
United States	82,654	90,733	+ 8,079
Wire and cables	13,493,447	12,693 362	− 800.085
Germany	6,240.414	5,859,827	− 380,587
United Kingdom ...	4,351 541	3,105,751	−1,245,790
Italy	1,381,252	1,285,371	− 95,881
United States	735,683	1,003,173	+ 267,490
Dynamos and electric motors	3,969,747	4,215,905	+ 246,158
Germany	2,378,607	2,303.300	− 75,307
United States	372,302	441,179	+ 68,877
Sweden	304,057	240.615	− 63,442
Italy	206,029	256,536	+ 50,507
United Kingdom ...	358,579	411,214	+ 52,635
Batteries	1,676,423	2,445,277	+ 768,854
United States	1,319,131	1,994,700	+ 675,569
Germany	213,615	247.417	+ 33,802
United Kingdom ...	92.508	87.045	− 5,463
Insulating tubes	2,835,386	3,611,016	+ 775.630
Germany	1,361,070	2,103.963	+ 742,943
United States	699,056	729,986	+ 30,930
United Kingdom ...	665,780	729,857	+ 64,077
Radio apparatus ... £	132.214	313,186	+ 180,972
United States ... £	77,995	127,449	+ 49,454
Netherlands ... £	29,131	40,349	+ 11,218
United Kingdom £	14,625	16,297	+ 1,672

The report says with regard to the last item that Great Britain has not obtained a share of the radio apparatus trade commensurate with the developed state of its industry. This appears to be due more to a lack of investigation and selling arrangements than to price. American manufacturers monopolise the business in complete sets, and about half of the valves sold come from Holland.

Methods of Trading.

One section of the report gives advice and guidance to exporters to the Argentine market. Local representation is considered of the first importance. The local British merchant

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houses do not appear to have progressed as trade has expanded, but in lieu of this increased numbers of manufacturers have maintained direct representation, have opened branches, or even established local factories. The questions of credit and terms of payment are discussed, and it is said that the difficulties in this direction are all part of the problem of price. If prices can be brought down by British exporters the question of terms will not present so much difficulty as is commonly met with at present. There is a feeling, which has little justification, that the large concerns in Argentina which send buyers to Europe regard the appointment of agents unfavourably. This is not the case where the agent is expert and carries weight in the decisions of his principals. Satisfactory agents have to be sought actively, and their terms of remuneration must be attractive, *i.e.*, the turnover must be large or the commission ample. It has to be remembered that Buenos Aires is an expensive city. Full inquiries should be made regarding prospective agents, whether such an agent is to have financial responsibility or not. Fairly numerous losses and disappointments have occurred in recent years through the neglect of these elementary precautions. Advertising is particularly difficult for the foreign manufacturer owing to its cost and to the variety of media. It is, however, of great importance in sales campaigns for the marketing of branded goods through importers or agents. Public advertising is not so difficult as advertising to the trade, but in both cases the advice of a local expert is necessary.

Electricity Supply and Traction.

The consumption of electricity in Buenos Aires continues to expand. During 1927 the Cia. Hispano-Americana supplied 487 million kWh, and the Cia. Italo-Argentina 115 million kWh. Rapid progress is being made with the construction of the new power station of the former company in the new port which will have a capacity of 630,000 kW. The foundations of a 300,000-kW station are being prepared for the other company. Large and valuable orders were secured by British manufacturers for the Hispano-Americana installation, and the Italian company is consulting British firms regarding certain special items of its prospective requirements. The Cia. Anglo-Argentina de Electricidad, which owns a number of country power stations in the province of Buenos Aires and in Cordoba, has come under the control of American capital, and is preparing to extend its operations. British capital controls power stations in Parana, Santa Fé, Cordoba, and Tucuman.

The Ministry of Public Works has issued a report of investigations, extending over some years, into the possibilities of utilising as sources of hydro-electric power, the falls of Iguazu, the rapids of Apipe on the river Parana, or the falls of Salta Grande on the river Uruguay. The basis of economic utilisation must be the transmission of power for use in Buenos Aires. Iguazu, situated at 1,200 km. from Buenos Aires, could supply a maximum power of 250,000 kW, Apipe, 1,000 km. distant, 451,000 kW, and Salta Grande, 450 km. distant, 200,000 kW. The conclusion arrived at is that, under present conditions, it would be impossible for power transmitted from any one of these sources to compete economically with the power supplied by the two new "super" power stations now being erected in the port of Buenos Aires. The cost of the most advantageous scheme, that of Apipe, is put at between £20 and £25 millions.

After mentioning the operations of the four tramway companies of Buenos Aires, the report states that the question of the construction of a system of underground electric railways, the only fundamental solution of the Buenos Aires traffic problem, remains in suspense, the proposals of a British group having been found unacceptable and definitely refused by the Municipal Council. The Anglo-Argentine Company's proposals for reform of its concessions so as to enable the company to raise the necessary capital for tube construction are still before the Council.

A concession for the construction of an underground electric railway has been held by the Lacroze Tramways Co. since 1912. The system proposed will run through the city of Buenos Aires, connecting the terminus of the Buenos Aires Central Railway to the centre of the city and the port, ending in the neighbourhood of the Retiro Station of the Central Argentine Railway. Towards the end of 1927 the Lacroze Company transferred the concession to the Buenos Aires Central Railway. Recently the plans have been duly approved, and with the arrival of the technical engineers of the American contractors work was commenced in September, 1928. The system will consist of a double- electric line of 1.435-metre gauge, comprising an extension of about 10 km., and will be entirely completed in about two years.

Communications.

The United River Plate Telephone Co. is the most important concern of its class in Argentina. It has a capital of £10,000,000 and about 125,100 telephones in Buenos Aires and 61,500 in the provinces. A scheme for placing the lines between Buenos Aires and Rosario awaits Government sanction, and the company is proceeding rapidly with the conversion of its system to automatic working.

In 1928 international telephonic communication joining Argentina, Chile and Uruguay was inaugurated by the International Telephone & Telegraph Corporation (United States), which has acquired the Sociedad Co-operativa Telefonica of Buenos Aires and telephone enterprises in Uruguay and Chile.*

The development of radio-telegraphy by the Transradio Internacional is dealt with, and Mr. Chalkley says that, following upon successful short-wave telephony tests, a service is being inaugurated between Argentina and England, France, Germany and the United States. There are now 15 commercial broadcasting stations and 25 others which operate intermittently.

Electrical Imports of Chile.

Statistics for 1926 and 1927.

THE following figures, showing the values of the imports of electrical and allied goods into Chile in 1927 are taken from the recently published official trade returns. The figures for 1926 are also given, together with the increase or decrease in each case.

	1926. Thous. Pesos.	1927. Thous. Pesos.	Inc. or dec. Thous. Pesos.
Insulators for telegraphs and telephones, &c.—			
Total	752	427	− 325
From United States	580	243	− 337
,, Great Britain	52	50	− 2
,, Germany	107	117	+ 10
Wire, insulated or sheathed (covered)—			
Total	2,629	1,882	− 747
From Germany	617	896	+ 279
,, United States	1,057	658	− 399
,, Belgium	47	49	+ 2
,, Great Britain	548	135	− 413
Incandescent electric lamp bulbs—			
Total	2,216	2,558	+ 342
From Germany	900	1,162	+ 262
,, United States	576	760	+ 184
,, Holland	314	247	− 67
,, Great Britain	121	95	− 26
Apparatus (various) for electric lighting—			
Total	3,282	1,936	−1,346
From United States	2,333	1,219	−1,114
,, Great Britain	263	172	− 91
,, Germany	642	488	− 154
Telephone apparatus—			
Total	1,771	2,435	+ 664
From Great Britain	615	1,500	+ 885
,, Germany	133	352	+ 219
,, Belgium	306	168	− 138
,, United States	291	180	− 111
,, Sweden	345	186	− 159
Telegraph apparatus—			
Total	483	905	+ 422
From Germany	112	38	− 74
,, United States	256	405	+ 149
,, Great Britan	83	433	+ 350
Wireless apparatus—			
Total	803	659	− 144
From Great Britain	15	59	+ 44
,, Germany	145	86	− 59
,, United States	571	419	− 152
,, France	—	50	+ 50
Electric cables—			
Total	7,392	3,367	−4,025
From Germany	546	319	− 227
,, United States	5,389	1,905	−3,484
,, Great Britain	1,234	1,120	− 114
Electric bells and parts thereof—			
Total	27	31	+ 4
From Germany	21	16	− 5
,, United States	5	13	+ 8
Pipes and tubes, insulated for electrical purposes—			
Total	381	162	− 219
From Germany	118	112	− 6
,, United States	261	28	− 233
,, Great Britain	2	4	+ 2

* The International T. & T. Corporation has acquired the United River Plate Telephone Co. since the date of the report.

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	1926. Thous. Pesos.	1927. Thous. Pesos.	Inc. or dec. Thous. Pesos.
Carbons for electrical purposes—			
Total	133	60	− 73
,, United States	17	37	+ 20
,, Great Britain	59	9	− 50
,, Germany	55	14	− 41
Dynamos, motors and parts thereof—			
Total	14,496	6,873	−7,623
From Germany	3,143	1,702	−1,441
,, United States	9,982	4,456	−5,526
,, Great Britain	1,127	479	− 648
,, France	19	58	+ 39
Electric lamps (other than incandescent bulbs)—			
Total	575	654	+ 79
From Germany	334	264	− 70
,, United States	177	351	+ 174
,, France	22	17	− 5
,, Great Britain	11	18	+ 7
,, Holland	5	4	− 1
Meters—			
Total	795	659	− 136
From Germany	327	255	− 72
,, United States	96	49	− 47
,, Great Britain	364	271	− 93
Cells and accumulators—			
Total	1,155	2,021	+ 866
From Germany	134	164	+ 30
,, United States	900	1,660	+ 760
,, Great Britain	70	169	+ 99
Posts for supporting electric wires and cables—			
Total	796	126	− 670
From United States	781	113	− 668
,, Great Britain	15	2	− 13
Electric fans—			
Total	171	149	− 22
From Germany	36	11	− 25
,, United States	73	117	+ 44
Electrical machinery, apparatus and parts (unspecified)—			
Total	17,625	6,726	−10,899
From United States	13,892	3,235	−10,657
,, Germany	2,245	933	−1,312
,, Great Britain	1,080	2,477	+1,397

[Peso = 6d.]

Electrical Imports of Peru.

Figures for 1926 and 1927 Compared.

THE following figures show the values of the imports into Peru of electrical goods and apparatus in 1927. Comparative figures for 1926 are also given, together with a note of increases or decreases. The Peruvian £ = about 20s.

	1926. £P.	1927. £P.	Inc. or dec. £P.
Electrical accessories, e.g., switches, cut-outs, plugs, lampholders—			
Total	22,500	20,700	− 1,800
From Germany	9,500	6,400	− 3,100
,, Great Britain ...	1,100	1,200	+ 100
,, United States ...	9,500	9,100	− 400
Accumulators and batteries—			
Total	17,700	22,200	+ 4,500
From Germany	1,300	800	− 500
,, United States ...	14,000	17,600	+ 3,600
Insulators and tubes—			
Total	30,000	15,000	−15,000
From Germany	3,000	1,800	− 1,200
,, United States ...	21,000	10,000	−11,000
,, Great Britain ...	3,700	2,300	− 1,400
Copper wire, covered, except with silk, up to 3 mm. in diam.—			
Total	16,000	13,700	− 2,300
From Germany	5,000	2,600	− 2,400
,, United States ...	7,000	7,500	+ 500
,, Great Britain ...	2,400	1,000	− 1,400
Ditto more than 3 mm. in diam.—			
Total	18,600	14,000	− 4,600
From Germany	2,700	2,400	− 300
,, United States ...	11,000	8,800	− 2,200
,, Great Britain ...	1,600	700	− 900
,, Italy	2,700	500	− 2,200
Telegraph apparatus, including wireless—			
Total	11,400	15,000	+ 3,600
From United States ...	1,500	3,300	+ 1,800
,, Great Britain ...	9,200	11,500	+ 2,300
Telephone apparatus—			
Total	6,300	6,500	+ 200
From United States ...	2,700	3,200	+ 500
,, Great Britain ...	800	1,500	+ 700
Lighting fittings—			
Total	14,100	14,000	− 100
From Germany	6,900	8,000	+ 1,100
,, United States ...	1,800	2,300	+ 500
,, France	2,100	1,400	− 700
Heating and cooking apparatus—			
Total	2,400	8,300	+ 5,900
From Germany	1,100	900	− 200
,, United States ...	1,000	2,500	+ 1,500
,, Belgium	—	3,500	+ 3,500
Cables, copper—			
Total	72,000	92,000	+20,000
From Germany	6,000	27,000	+21,000
,, United States ...	30,000	8,000	−22,000
,, Italy	6,800	17,000	+10,200
,, Great Britain ...	19,000	28,000	+ 9,000
Electric bells—			
Total	800	1,100	+ 300
Insulating tape—			
Total	1,700	2,100	+ 400
Covered copper flex—			
Total	7,000	2,900	− 4,100
From Germany	4,200	1,400	− 2,800
,, United States ...	400	500	+ 100
,, Belgium	1,300	100	− 1,200
Meters and instruments—			
Total	5,200	3,200	− 2,000
From Germany	1,900	500	− 1,400
,, United States ...	2,700	1,500	− 1,200
Metal filament lamps—			
Total	29,000	41,000	+12,000
From Germany	12,700	18,800	+ 6,100
,, United States ...	9,300	12,000	+ 2,700
,, Holland	4,500	6,400	+ 1,900
Magnetos—			
Total	1,700	1,500	− 200
From Germany	1,100	400	− 700
,, United States ...	600	800	+ 200
,, Great Britain ...	—	300	+ 300
Electric light meters, domestic—			
Total	1,800	14,000	+12,200
From Germany	1,100	13,700	+12,600
Motors up to 1 h.p.—			
Total	2,000	2,200	+ 200
Switchboards—			
Total	13,000	28,000	+15,000
From Germany	3,400	2,200	− 1,200
,, United States ...	8,000	24,000	+16,000
,, Great Britain ...	300	1,200	+ 900
Fans—			
Total	2,600	2,800	+ 200
From Germany	700	200	− 500
,, United States ...	900	1,300	+ 400
,, Italy	500	850	+ 350
Current transformers—			
Total	21,000	34,000	+13,000
From Germany	3,000	4,000	+ 1,000
,, United States ...	16,000	27,000	+11,000
,, Great Britain ...	800	2,900	+ 2,100
Total of electrical goods and apparatus	334,000	391,000	+57,000
From Germany	70,000	98,000	+28,000
,, United States ...	166,000	164,000	− 2,000
,, Great Britain ...	48,000	56,000	+ 8,000
,, Italy	21,000	24,000	+ 3,000

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Vertical Switchgear.

Metal-clad equipment recently developed by Messrs. Ferguson, Pailin, Ltd., in extension of their former range of oil-immersed circuit breakers.

CLAIMING to be the pioneers of the vertical drop-down principle of isolation as applied to heavy-rupturing-capacity e.h.p. metal-clad switchgear,* Messrs. Ferguson, Pailin, Ltd., make the interesting announcement that they have now put on the market a smaller type of metal-clad switch that extends their range in a downward direction and gives a complete line of metal-clad switchgear with rupturing capacities of from 1,500,000 down to 25,000 kVA. The new gear embodies a number of what are stated to be novel features and, whilst maintaining the advantages and reliability of existing F.P. designs, enables manufacturing costs to be considerably reduced so as to render its use an economic proposition in even the smallest sub-stations.

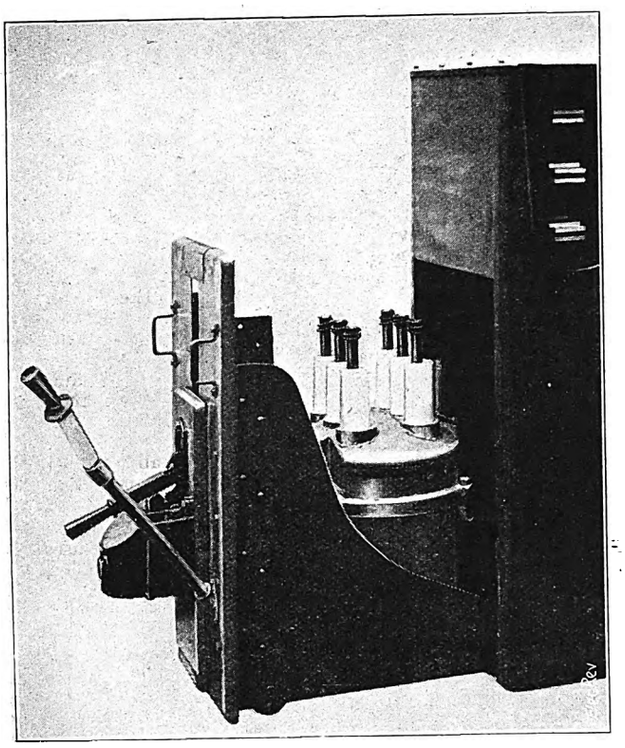

Fig. 1.—New Breaker Isolated and Withdrawn from Housing.

The whole of the component parts are manufactured to jig and template, and are interchangeable; the equipment will also be strictly standardised, so that mass production methods of manufacture can be employed and considerable stocks carried to render quick delivery possible. The space economy effected by the use of vertical gear has been fully emphasised: for example, in the case of simple equipment, including an oil breaker of 25,000 or 50,000 kVA rupturing capacity, the overall height is only 4 ft. 4 in., the width 2 ft., and the depth from back to front 2 ft. 8 in., with an additional 10 in. for the operating handle. If a potential transformer is required, the overall height will be increased to 5 ft. 11 in., the other dimensions remaining unaltered. The floor space required for the installation and operation of a complete equipment is only 11½ sq. ft., which, of course, compares very favourably with truck, or stationary-cubicle, type gear.

The general construction is interesting in that cast-iron has been entirely eliminated; the fixed portion is built up of substantial boiler plate with welded joints, separate chambers being provided for the bus-bars and circuit connections. Porcelain insulation is employed in all places requiring mechanical strength, and the clearances and insulation employed are such that filling is optional. Automatic shutters are provided for screening all live metal when the oil-immersed breaker is withdrawn, and the relative dispositions of the various parts, together with a simple interlocking arrangement, prevents incorrect sequence of operation and renders the gear "fool-proof." The isolating plugs and sockets are of the Ferguson, Pailin self-aligning pattern, which has been described.

The movable portion consists of a truck carriage which carries the oil circuit breaker, together with its raising and lowering gear; despite the simplicity of the gear, each equipment retains its own raising and lowering mechanism, so that it is not necessary to use a portable racking device for isolating or transportation purposes, and any number of units can be inspected simultaneously. Furthermore, as will be seen from the first of the accompanying illustrations, no tank truck is required, as it is incorporated in the moving portion.

The oil-immersed triple-pole circuit breaker is of the latest design with a fabricated domed top and a single circular tank with a domed base; circular tanks for breakers of this class increases the factor of safety, and special groove and gasket joints between the tank and top plate prevent oil-throwing under heavy pressure. The tank is lined throughout with insulating material, and arcing barriers are also fitted, whilst the tank is fastened to the top plate by four short steel bolts which, even under heavy pressure, do not elongate sufficiently to destroy the efficiency of the gasket. The contacts are of the wedge and finger type, and the whole of the operating mechanism is enclosed inside the breaker. An efficient pebble vent of the latest type is fitted to each breaker, and discharges into a pipe which carries all gases outside the switch. The operating lever is of the standard pattern, embodying a true free handle, and the trip coils are readily accessible on the front of the carriage.

This gear has been primarily designed for simple equipment, but potential transformers can readily be fitted on the top of the fixed portion of the switch, and they form complete units in themselves, and can be added, or replaced, at any time whilst the equipment is in commission. Instruments are accommodated on a special panel mounted in front of the fixed portion. The question of extension has received careful consideration, and arrangements have been made so that the time of shut down is reduced to an absolute minimum.

Fig. 1 shows equipment with the circuit-breaker isolated and withdrawn from the housing, while in the view of the equipment shown in fig. 2 the truck portion of the apparatus is withdrawn and the top of the circuit breaker is raised for inspection.

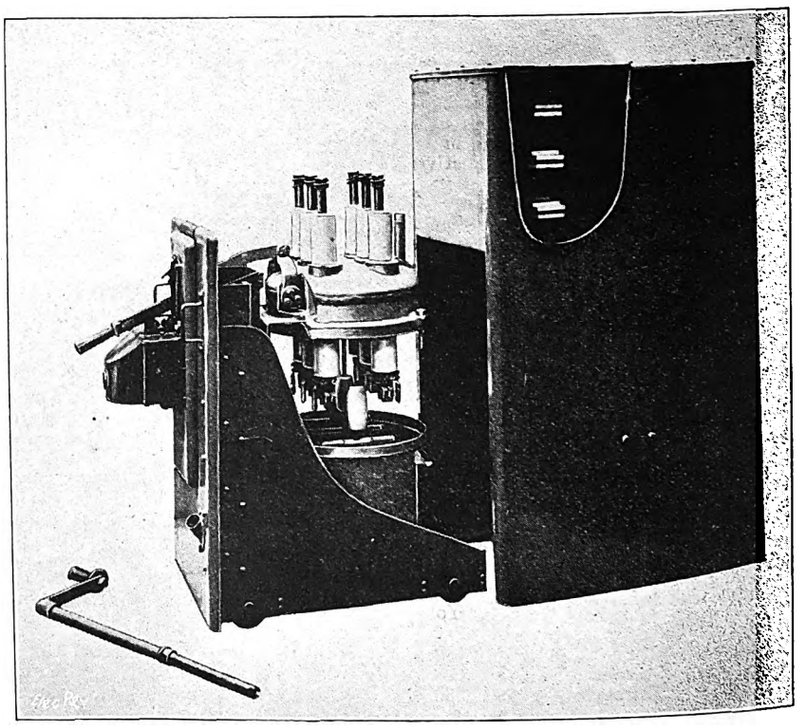

Fig. 2.—Truck Portion Withdrawn and Breaker Top Raised.

* ELEC. REV., June 15th, 1928, p. 1044; also December 14th, 1928, pp. 1011, 1013 and 1017.

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The "Grid" Transmission System.

An outline of the chief constructional features of the 3-phase, 50-cycle, 132-kV (between phases) overhead lines being erected by the Central Electricity Board, the definite engineering costs included being reduced to a kVA basis to serve as a guide to the present economic position of e.h.p. systems in Great Britain.

By J. WRIGHT, M.I.E.E., and C. W. MARSHALL, B.Sc., M.I.E.E.

(*Extracts from paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 219.)

Central Scotland Scheme.—Part 2 of the paper describes some of the essential features of the actual construction of a section of the grid, so as to illustrate the application of the general principles outlined in Part 1.

The Central Scotland scheme involves the interconnection of 13 supply stations, the overhead system consisting of two ring mains,* the total transformer capacity provided being 695,000 kVA. At the Port Dundas and Yoker power stations one of the two transformer banks is divided into two sections, which departure from the normal practice of having two identical transformer banks at each station was rendered necessary by the requirements of the frequency-standardisation programme.

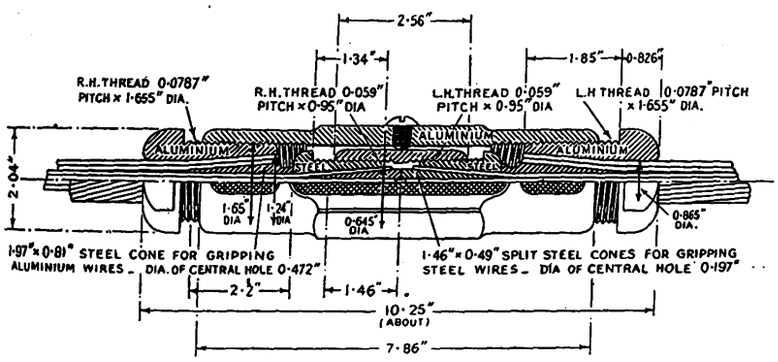

Fig. 4.—Pairard Overhead Conductor Joint.

The Pairard conductor clamp (fig. 4) in which the steel core and aluminium outer layer are joined separately is used for all joints. The mechanical strength of this joint is 95 per cent. of that of the actual conductor.

The most important divergencies from standard line construction in Scotland occur at the crossings of rivers. The River Cart is crossed near Renfrew, part of the Yoker-Greenock single-circuit line; the total extent of the crossing is 2,550 ft., comprising the approach spans of 1,000 ft. and 900 ft. on the Yoker and Greenock sides, respectively, and the actual crossing length of 650 ft. The crossing towers are of the suspension type, 202 ft. in height to the bottom of the lowest cross-arm, and 218 ft. overall. The clearance between the conductors and high-water level is 188 ft.

and connect with the Greenock and Paisley lines at special terminal towers.

It was originally intended to cross on the Forth Bridge at Queensferry, but it was not found possible to carry out the project and the line routes were diverted to a crossing-point near Kincardine. The actual crossing span extends between two suspension towers each 338 ft. high. The length of the span is 3,050 ft. and the high-water clearance is 158 ft.; the span is anchored at each end on 60-ft. towers. Owing to the great span length, special conductors are used, the line and earth conductors all consisting of 18/.125 aluminium and 19/.125 steel. At the suspension towers the conductors are carried over special fittings in which they rest without any fixing attachments, instead of being clamped to the insulators.

The suspension-insulator units are standard, but double chains of 11 units are used. The tension insulators for the Cart and Clyde crossings are double chains of 12 units. On the Forth crossing triple strings of special heavy-duty insulators are used. The usual disposition of arcing rings and horns has been adopted on all crossings. The working stress in the case of the Forth crossing is 20,000 lb., and it was necessary to adopt 3-point heavy-duty insulator chains. The triangular disposition of the chains is particularly favourable for obtaining equal stresses in each individual chain. Each crossing span and its approaches has been treated as a whole. The conductors are only supported at the crossing towers, thus reducing the stresses on the high towers required to give the clearances demanded by the river authorities. The conductor support consists of a grooved aluminium casting suspended from the parallel strings of the suspension insulator.

Costs.—The overhead-line constructional costs for Scotland are shown in Table I; wayleave and board management charges are not included in the figures quoted, and the cost of the river crossings is not included in the tabulation; the constructional work for these cost £33,000, while piling and foundations for the crossing towers cost £12,000. The total distance accounted for by the crossings and approaches is 1.53 miles, giving an average cost per mile of this special work of almost £35,000.

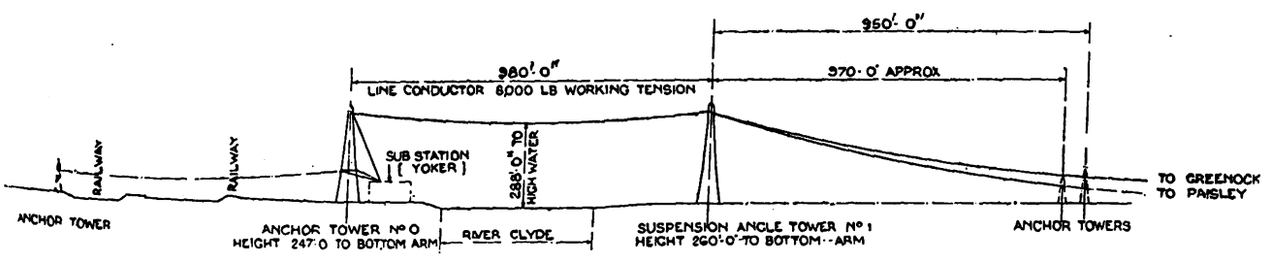

Fig. 5.—The River Clyde Crossing at Yoker.

The River Clyde is crossed at Yoker by a double-circuit line on the Yoker-Paisley and Yoker-Greenock sections, fig. 5, and fig. 6 shows a special anchor tower of a total height of 270 ft. and giving a clearance of 228 ft. at high water; the incoming double-circuit line from Port Dundas and Dalmarnock is anchored on this tower at a low level. One circuit is then carried to the Yoker sub-station and thence to the top of tower X; the other circuit goes direct to the top of tower O, both circuits then making the crossing, which is 980 ft. in width. The other side of the crossing is carried by a suspension tower 283 ft. in height; the two circuits then separate

* Elec. Rev., July 20th, p. 98.

On the normal run of the lines the percentages of the total costs (arranged in descending order of magnitude) for the chief constructional parts are :—

	Per cent.
Towers	48.7
Line conductors	29.9
Insulators	11.1
Earth conductors	5.2
Special works	5.1

All these prices include erection, and the costs of some of the standard tower types are given separately in Table II.

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The transformer contract amounted to £286,789 for a total capacity of 695,000 kVA. The average price per kVA was £0.413, the range from 10,000 to 60,000 kVA being £0.7 to £0.26 per kVA.

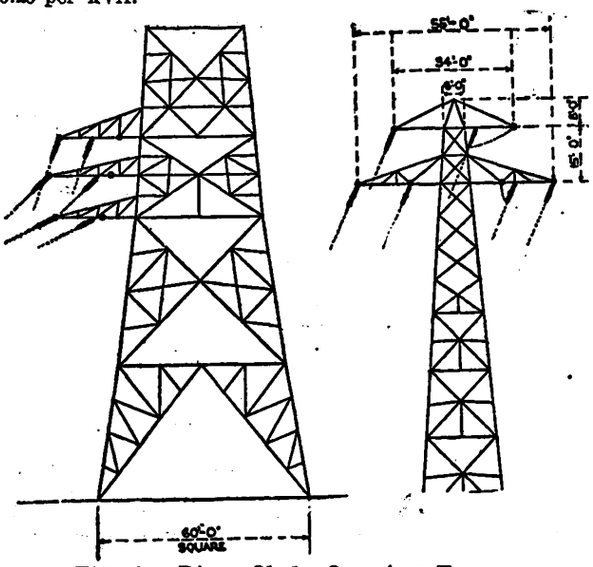

Fig. 6.—River Clyde Crossing Tower.

The switchgear equipment for 13 sub-stations cost £316,420. The prices of the standard 3-switch sub-station equipment ranges from £17,000 to £24,000 per station. The L3 type and D.B. type sub-stations cost £33,000 and £47,000, respectively, in the Scottish scheme. The foundation costs for these stations vary considerably with local conditions, but they may be assumed to be of the order of from £4,000 to £5,000 per sub-station.

The lower-voltage switchgear used for connecting the grid system to the busbars of undertakings varies in voltage and rupturing capacity; the cost of a standard equipment of the lowest rupturing capacity used is approximately £8,000.

These figures give the costs of the essential components of the Scottish section of the grid.

TABLE I.

Part.	Single-circuit lines.	Double-circuit lines.
	£	£
Line conductors	89,072	25,961
Earth conductors	17,304	2,574
Insulators	27,762	14,832
Towers	135,623	51,971
Special works	16,443	3,286
Total	£286,204	£98,624
Cost per mile	£1,438	£3,400*

TABLE II.

Type of tower.	Angle of divergence.	Single circuit.	Double circuit.
Straight line	$<2°$	£95	£172 14s.
Small angle	$<10°$	£127 11s.	—
Medium angle :—			
Single circuit ...	$>10°<30°$	£153 2s.	£256 7s.
Double circuit ...	20°		
Large angle and strain	$>30°<60°$	£206	£423 10s.

* The double-circuit lines in Scotland pass through particularly difficult districts, so that the costs are high relatively to those of the single-circuit lines.

Electric Motor-car Startors.

An account of a Duddell oscillograph investigation of the battery voltage and operating current of the electric motors ordinarily used for starting motor-car engines.

By R. L. SMITH-ROSE, D.Sc., Ph.D., A.M.I.E.E., and R. S. J. SPILSBURY.

(*Extracts from a paper published in the* INSTITUTION OF ELECTRICAL ENGINEERS' *Journal.*)

THE investigation was carried out at the National Physical Laboratory, having originated in the drawing up of a schedule of tests suitable for application to the type of battery employed in the electrical equipment of the modern British motor-car. In addition to carrying out charge and discharge tests at the normal 10-hour and 5-hour rates, and the measurement of the ampere-hour efficiency of the battery, it was desired, if possible, to subject the battery to a test in which the discharge was comparable with that experienced in operating the electric motor used for starting the engine of the car. A certain amount of information on this matter was already available*, but it was considered desirable to carry out further experiments under the somewhat different conditions usually obtained in British cars.

A standard commercial Duddell oscillograph was employed, two vibrating loops being used to record the stator current and the voltage at the battery terminals, respectively, the currents dealt with amounting in some cases to 270 amperes. Three light cars of different makes were tested: No. 1 was fitted with a nominal 12-h.p. 4-cylinder engine, started by a combined dynamotor unit, permanently connected to the engine shaft by a chain drive. Nos. 2 and 3 were also of the 4-cylinder type and of 11 and 14 h.p. rating, respectively, fitted with a separate startor motor, the driving pinion of which was only engaged with the engine flywheel during the actual starting operation. Tests were made with the engines both hot and cold.

The conclusions that may be drawn from the results are conveniently divisible into four parts:—

(*a*) *Comparison of Loose Pinion and Chain Drive.*—The results for cars Nos. 1 and 2 show that, although the nominal horse-power of the car fitted with the loose-pinion startor is the lower, the current obtained when the pinion engages with the flywheel is considerably greater than the peak current taken by the startor permanently connected to the engine, the mean values being respectively 220 and 185 amperes. If, in cars fitted with the loose-pinion type of startor, some simple arrangement could be provided by means of which the pinion could be moved into engagement with the flywheel before the startor switch was closed, the peak value of the current drawn from the battery would be considerably reduced. For example, in the tests in which this was done the above average peak value of 220 amperes was reduced to about 170 amperes. In addition, the operation of the startor would cause much less noise.

(*b*) *Comparison of Hot and Cold Conditions.*—While it was not possible to ascertain the effect of starting an extremely cold engine, the initial rushes of current through the startor motor on closing the switch are sensibly independent of the engine temperature, and are determined by the type of startor and whether it is operated light or under load. In the latter case the initial current peak is the same as that taken by the startor motor when prevented from rotating. At the higher temperatures employed there was a reduction of about 40 per cent. in the current required to turn over the idle engine, which also ran at a 50 or 60 per cent. greater speed; also, the time required to start the engine was in general appreciably less when hot than when cold.

(*c*) *Time and Electrical Quantities Involved in the Starting Operation.*—With the chain-drive type of startor employed on car No. 1 (of 12 h.p.) this first rush of current attained a maximum value of from 180 to 195 amperes; with the loose-pinion type of startor fitted on cars Nos. 2 and 3 the maximum initial current under normal starting conditions was from 207 to 228 amperes for an engine of 11 h.p. and from 254 to 270 amperes for the 14-h.p. engine, which values are probably important in determining the deterioration of the car battery due to the displacement of paste from the electrodes. In spite of the existence of such large currents, however, the total quantity of electricity discharged from the battery during the normal starting operation is extremely small. Cold engines started in from 0.39 to 0.75 sec. after pressing the switch, the corresponding total discharge from the battery being from 63 to 128 coulombs; when the engines are warm the times of starting ranged from 0.20 to 0.49 sec., the corresponding discharges

* G. W. Vinal and C. L. Snyder: "Oscillograph Measurements of the Instantaneous Values of Current and Voltage in the Battery Circuit of Automobiles," Technological Papers of the Bureau of Standards, No. 186, 1921, Vol. 15, p. 1.

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being from 39 to 81 coulombs. These quantities of electricity are surprisingly small, and, assuming a normal charging rate for the batteries of about 8 amperes, the coulombs discharged can be returned to the battery in about 15 or 20 seconds of charge. Of course, on very cold days the above times of starting may be considerably exceeded. Even so, however, 5 seconds is quite a long time for an intelligent owner, or driver, to operate an electric startor on a motor-car engine which has been correctly prepared for starting, and the discharge during this period can be completely replaced in 4 or 5 minutes' charging. It therefore appears evident that in the case of the normal car there is little danger of the battery becoming discharged on account of the frequent use of the startor. While the batteries in the three cars were approximately one, two, and three years old, respectively, their internal resistances were almost identical, the average value being 0.017 ohm for 12-volt batteries of different manufacture and approximate capacity of 50 ampere-hours. For 6-volt startors, which are fitted to some British cars, it is to be expected that the current values determined above will be approximately doubled; therefore, the maximum discharge may be expected to be anything from 360 to 540 amperes, values which are in good agreement with those of Vinal and Snyder.

(*d*) *The "Overshoot" Phenomenon.*—The excessive current taken by the loose-pinion startor was difficult at first to understand, but subsequent tests made it evident that the main cause of the overshooting current is the spring fitted to the shaft of the startor motor, the object of which is presumably to relieve the mechanical shock which results from the sudden stoppage of the startor motor due to the engagement between pinion and flywheel. The spring allows the armature shaft to continue rotating for a small fraction of a revolution after the pinion and flywheel are engaged, and then after conditions have become stationary it causes an actual reversal of the direction of rotation of the armature for an instant, during which the armature e.m.f. is in the same direction as the battery voltage, and so a transient increased current is obtained, which falls immediately the armature resumes its original direction of rotation.

The Shannon Water-power Scheme.

The River Shannon hydro-electric power development scheme and its economic consequences to the Irish Free State.

(*Extract from a Paper read before the* Royal Society of Arts.)

WITHOUT entering into much electrical or general mechanical detail, Mr. George Fletcher described the main hydraulic and electrical aspects of the scheme and gave a short account of the history that has led up to its adoption. The author was a member of the Sub-Committee of the Board of Trade which dealt with the water-power resources of Ireland, concerning which he read a paper before the Royal Society of Arts in 1922. The Committee agreed that such large rivers as the Shannon should be in the control of a Department of State, and the paper related how in September, 1924, the Free State Government submitted the scheme prepared by the Siemens Schuckert Co. to four experts (Messrs. Waldemar Bergquist, of Stockholm; Eugen Meyer-Peter, of Zurich; Thomas Norberg Schulz, of Christiania; and Arthur E. Rohn, of Zurich) for report, and the scheme now in progress was passed by the Dail Aireann on April 3rd, 1925, the Shannon Electricity Act being passed in June of the same year.

After a general account of the hydraulic and civil engineering features of the scheme, it was pointed out that electricity would be generated at 10,500 volts, the pressure being then stepped up to 110,000 and 38,000 volts for distribution over nearly the whole of the Free State. The 110,000-volt lines, which formed the primary distribution system, would run from Ardnacrusha to Dublin (six conductors) and from Ardnacrusha to Cork (three conductors), distances of 116 and 59 miles, respectively; at each of those points would be installed 110,000/38,000-volt transformers. The 38,000-volt secondary system was arranged for loop distribution which, when completed, would cover some 1,040 miles; at certain points would be installed transformers of 38,000/10,000 volts, which would supply other subsidiary networks serving various towns and villages where the pressure would be transformed down to 380 and 220 volts adopted for industrial and domestic users. The 110,000-volt lines would be supported on lattice steel masts in the southern area and on wooden poles in the northern area, whilst wooden poles were used exclusively for the 10,000-volt lines. The erection of the transmission lines was the first work taken in hand and was now in a very advanced stage. Rapid progress had been made with the generating station and it appeared to the author probable that supplies would be available by October of this year.

The latter part of the paper was concerned with the economic effect of the scheme upon the national life of the Irish Free State, which point was dealt with mainly also in the discussion. Although some people were still most concerned about whether the scheme would pay, the author's view was that the water-power resources of Ireland should be utilised without waiting for a mathematical demonstration that any such scheme as the Shannon would be a financial success; at the same time he thought that financial success was assured. The position to be faced was that the population of Ireland was still declining, notwithstanding that it had already fallen from over eight millions to slightly over four millions in 50 years and the area of land under crops had also fallen at about the same rate. Many once-flourishing towns were falling into decay and had ceased to provide for the needs of the rural areas surrounding them, and articles which they once manufactured were now imported. That unhappy state of things was due largely, but not entirely, to lack of fuel resources; to-day industry in the Irish Free State called for cheap power. Therefore, the primary need of the Free State was cheap electricity for power and lighting, which it would be the function of the Shannon scheme to provide. There were approximately 130 towns and villages with a minimum population of 500 in which no electricity was available at present, but contracts had been placed for the erection of distribution networks in more than 30 of them. It was not possible at this stage, continued the author, to estimate to what extent the supply would be availed of by the agricultural industry, but with adequate propaganda it was certain to play a very important part in the staple national industry.

Discussion in London.

Prof. T. Wibberley said that not only was it necessary to electrify industry in Ireland, but also to electrify the mentality of the people to get a new outlook and to encourage them to live for the future. He looked to the scheme playing an important part, not so much in the application of electricity to agriculture, as to the manufacture of synthetic nitrogen for the purpose of fertilisation. He spoke of the many ways in which electricity could also be applied with successful results to the farm, and instanced many of the things which some people have had the opportunity of seeing on Mr. R. Borlase Matthews' all-electric farm.

Mr. Ll. B. Atkinson said that a few days prior to the meeting he had had the opportunity, with the president of the Institution of Electrical Engineers, of going over the Shannon scheme and the work being carried out, and in one respect the paper had disappointed him, inasmuch as it did not deal so much with the economics of the scheme as the title would lead one to hope. The whole thing was on a much more vast scale than the author's illustrations indicated, and in many respects he had not seen elsewhere in Europe such wonderful machinery as was being used in connection with the Shannon scheme. Eventually 180,000 h.p. would be available and the great question was what was going to be done with it. Prof. Wibberley had spoken of its connection with the manufacture of synthetic nitrogen, but the more advanced processes of manufacture of synthetic nitrogen had nothing to do with water power utilisation and the production of electrical energy, but were rather catalytic processes for uniting nitrogen with other materials. At the same time, the feature of the Shannon scheme was that it was a gesture of a change which was coming over Ireland, and from that point of view the scheme was more than an engineering scheme. It was an economic and psychological gesture that Ireland intended to change her methods and come into line with modern conditions. If that was the case, then the whole outlook for industry and farming in Ireland would change in a remarkable way, due to the influence of the supply of electricity which would soon be available from the Shannon scheme. It might interest constructional and electrical engineers to know that of the total cost of roughly £5,000,000 no less than £2,500,000 was being spent on the civil engineering work; another 40 per cent., or £2,000,000, would represent the overhead lines, and only £500,000 was represented by the moving machinery; thus there would be very little maintenance of machinery. The moving parts of the turbines weighed 480 tons and revolved at 150 r.p.m. One of the most interesting features of the turbine plant was the bearings, but in spite of the heavy weighs involved it had been found that the Michell type acted perfectly satisfactorily without the need for pumping oil into the bearings.

Mr. R. Borlase Matthews said he had been particularly interested in watching the Shannon works grow. One point that had appealed to him was that the first thing the contractors

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did was to build generating plant for use on the works and the whole of the constructional work had been carried on with the aid of electrically-operated machinery. A number of difficulties had been encountered which had probably delayed the work for six months: first there had been a strike, then trouble arose because what had been thought to be rock turned out to be soft earth, whilst earth which was thought to be soft turned out to be rock. It was quite likely that a series of small stations throughout the country would have been more economical, but he doubted whether such a policy would have made the wonderful psychological appeal to the nation that the present one had. The statements of the enormous amount of power available would, he believed, lead people to adopt electricity much more rapidly than they would if small local steam stations had been erected. In the Irish Free State he believed the agricultural load would eventually be greater than the industrial load, and that one of the great uses would be for electric ploughing. There were rumours of model all-electric farms being equipped in Ireland, and there was no better form of propaganda.

Mr. THEODORE STEVENS asked the author whether the figures quoted in the experts' report on the Shannon scheme were to be taken as applying to the manufacture of nitrogen compounds. They spoke of from 0.35d. to 0.15d. per kWh at the Shannon works, but he happened to know that the carbide which had to be made before the cyanamide could be produced was made by the Albic Carbide Co. in Norway when its electricity was costing 25s. per h.p.-year. Would the present Shannon plant have sufficient power available, after supplying the needs of Dublin, for manufacturing nitrogen compounds? The figure in the experts' report was an annual output of 150,000,000 kWh, which represented 48,000 kW as the peak load. The average load worked out at about 17,000 kW, and therefore there did not appear to be a lot left for manufacturing nitrogen compounds.

The AUTHOR, replying to the discussion, said that, although he was a great believer in synthetic nitrogen, he was not sure that it would be made by the Shannon plant. The question at issue was the price, and he did not see how the Shannon could compete with Norway; moreover, he believed that nitrogen would be obtained eventually from peat in Ireland before it was obtained from water power, because in the peat deposits there were conditions very favourable for the manufacture of calcium carbide and calcium cyanamide. Whilst agreeing with Mr. Borlase Matthews that electricity must be got on to the farms by introducing labour-saving appliances, he did not think the agricultural use would become greater than the industrial use of electricity.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Miner's Lamp.

BATTERIES, LTD., Hunt End Works, Redditch, have recently placed on the market a new "Nife" miner's electric hand lamp, fig. 1. This is fitted with the "Nife" steel plate alkaline battery which, the makers claim, has a life approximately four or five times as long as the ordinary lead acid battery, and has a capacity sufficient to give 11½ burning hours per charge. The accumulator is fitted with gas release valves, so that it is unnecessary to take out the valve plugs when charging, the gases generated during charge being able to escape. In order to overcome the troubles of sticking plungers and broken springs, fixed terminals are provided in the cell, instead of the usual spring-plunger type, the necessary contact being provided by the spring in the contact assembly in the lamp top. The candle power of the lamp has been increased by the aid of two very ingenious white reflectors, one above and the other below the bulb, and the resultant candle power is higher than that obtained from any other 2- or 2½-volt battery hand lamp on the market. The lamp case is made of fluted steel, giving increased strength combined with lightness, and the construction is such as to reduce repair costs to a minimum.

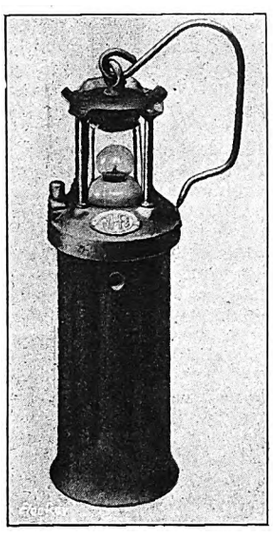
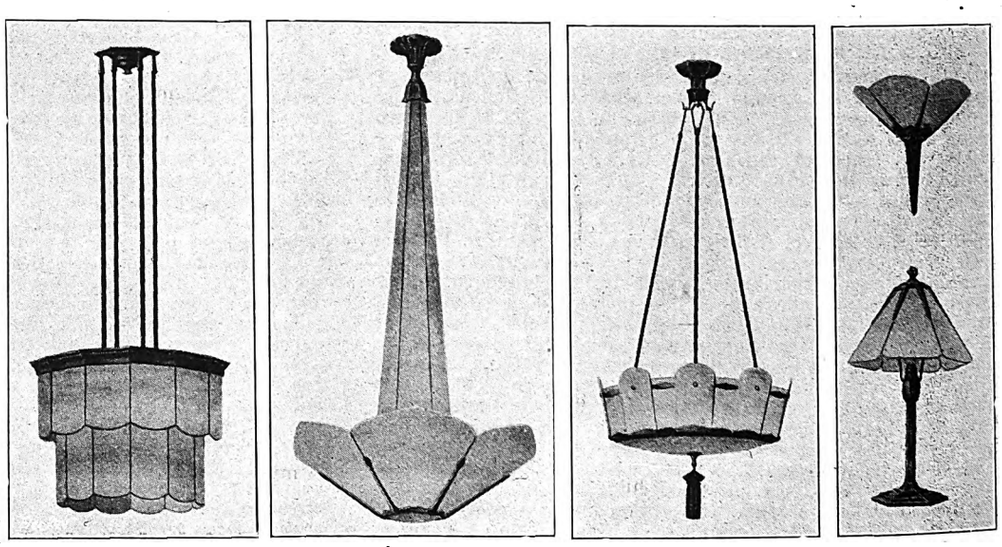


Fig. 1.—"Nife" Miner's Lamp.



Figs. 2 to 6.—"Valhalla" Sun-Tinted Fittings.

New Lighting Fittings.

A very distinctive range of "Valhalla" electric light fittings has recently been introduced by the SUN ELECTRICAL CO., LTD., 118 & 120, Charing Cross Road, W.C.2. The predominant feature of these fittings is a very delicate colouring, which has been arrived at after considerable experimental work, and which, it is claimed, is complementary to any scheme of interior decoration, period or modern. The design of the fittings themselves is a departure from the usual candelabra and gasolier models, and is calculated to lend to the power of expression peculiar to electric lighting. At the same time, an endeavour has been made to remove the rather harsh lines of the ultra-modern style, so as to make the fittings sufficiently decorative to harmonise with any interior. Figs. 2 to 6 are a selection from the range. Fig. 2 is a two-tier panel pendant fitted for three lamps; the dimensions are 42 in. long and 18 in. diameter. Fig. 3 is a six-panel pendant with tapering glass panels covering the suspension. It is fitted for four lamps, three in the bowl and one in the tapering panels; this fitting is 42 in. long, and has a 22-in. spread. A panel pendant with a 4-way ceiling plate and down rods is shown in fig. 4. It is fitted for three lamps and is 42 in. long and 18 in. in diameter. Figs. 6 and 5 show, respectively, a single-light table standard, 17 in. by 10 in., and a 3-panel one-light wall fitting, 12½ in. long (6½-in. projection) by 12 in. wide.

A Novel Lampholder.

The BIRMINGHAM MICA CO., LTD., South Road, Hockley, Birmingham, has recently introduced a lampholder which represents a drastic departure from the usual construction of that type of apparatus. The "Hawker's" lampholder, fig. 7, is of the moulded insulating material, Birmilite, the barrel part being reinforced with a metal lining, increasing the strength at the bayonet joint. The holder consists essentially of three parts, the cap, the barrel portion with the plungers, and an

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intermediate part that carries the terminals. These have sockets which plug on to extension pins from the plungers on the barrel unit. The terminal blocks have two screws each, one of which is intended to act as a cord grip. The top and bottom portions "screw in." A thin metal ring carried by a widely serrated flange on the barrel acts as the shade carrier, and self-adjusting spring buffers on the cap bear on the shade and hold it in the correct position. In this way, it is claimed, breakage caused by vibration or shock is prevented. To fix or remove the shade, after unscrewing the

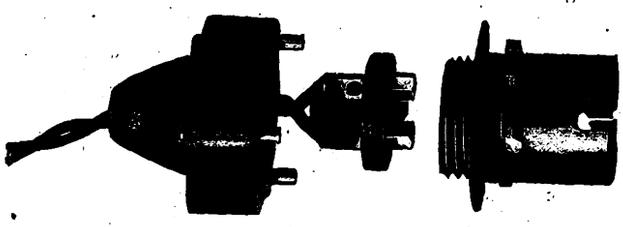

Fig. 7.—"Hawker's" Lampholder.

top and bottom portions, the terminal unit and the bottom are pulled adrift and the terminal block threaded through the shade. Provision is made for ventilation and cooling.

Stainless-Steel Electrodes.

We learn that various firms who specialise in the manufacture of stainless steels have been pleased to confer with Alloy Welding Processes, Ltd., 14-16, Church Street, Islington, N.1, regarding the welding of such steels, and in each case it has been possible for special material to be made which gives entirely satisfactory results, and at the present time no less than eighteen different types of stainless-steel electrodes are manufactured by them. It is claimed that the chief British manufacturers of special steels are convinced as regards the superiority of the A.W.P. method of manufacturing in connection with the deposition of alloy steel. It is very satisfactory to know that in the manufacture of stainless steels England is far in advance of any other country. It is only during the past eighteen months or two years that the welding of such steels has been accomplished in the U.S.A., and then only by the use of material imported from England.

Drive Screws.

It is believed that the Parker-Kalon drive screws, marketed by Messrs. Buck & Hickman, Ltd., 2-8, Whitechapel Road, E.1, have not been used to any great extent in this country. They are intended for making fastenings to iron, brass, aluminium, bakelite, and so on, and claims for economy and efficiency are made for them. The screw is hammered into a pre-drilled hole of the correct size, and its hardened spiral thread cuts into the material like a tap. An unthreaded portion at the tip holds the screw in place before it is driven in, and also guides it so that it will go straight.

A Rural Electrification Film.

Comments on an E.D.A. Production.

(Communicated.)

The very clear and effective kinema film which has been produced by the British Electrical Development Association and exhibited at the Plaza Theatre, London (Elec. Rev., February 1st, p. 203) is, in the main, good, and when exhibited throughout the country will undoubtedly prove a valuable instrument of propaganda. The scenes and backgrounds are typically English, and those farmers and other rural dwellers whose premises are shown must have taken a great deal of trouble to facilitate the work of the photographer, as it was obvious in many cases that corrugated iron had been taken away, or equipment rearranged in positions where the light was better; in fact, the production of such a film must have involved the expenditure of a considerable amount of time and patience. A little novelty was added to the private view of the film in that the audience was asked to suggest a more popular title than that at present given to the film—which is "Rural Electrification." A very large number of suggestions was sent in, and with commendable promptitude on the very next day the Association announced that the prize-winning title was "Country Currents," which was suggested by Miss H. M. Johnston. A consolation prize was awarded to Mr. G. B. Hony, who proposed "Country Current." If inclined to be facetious one might, out of compliment to the prominent politicians present, have been inclined to call it "The Flapper Film," not referring, of course, exclusively to the rural vote-catching value of the pictures, but to the rather excessive number of flapping belts visible. Having always taken a keen interest in the application of electricity to agriculture, it is only proper that attention should be drawn to some of the deficiencies of the film from the technical point of view, and in commenting thereon it may be remarked that it is not with a view of belittling the splendid effort of E.D.A., but rather with the hope that it will add one more reel to make the film more up-to-date. The standard of electric driving exhibited was of a pre-war era, compared with modern practice. In the whole series of pictures there were apparently only two up-to-date electric drives, those of a cream separator and of a horse-clipper; there were too many exposed long belt-drives and counter-shafts, for over twenty-five years of farm electrical equipment experience has taught many manufacturers and farmers that electrically-driven agricultural machinery can be constructed as compactly and conveniently as is the apparatus for other industries. It is fortunate that farms do not come under the Factory Acts, otherwise this revelation of how driving is carried out in Cheshire would have severely shocked the factory inspectors. In the case of the substitution of electric for hand-operated water pumps, instead of the crude devices shown on the film, much smaller motors directly connected to the pumps could have been advantageously employed; motor pumps should be arranged to deliver into a pressure storage tank with an automatic controller so devised that the water is delivered at a pressure of about 40 lb. per sq. in., thus giving all the advantages of a town supply, such as being always on tap, the quick filling of buckets, &c. A smaller motor has, of course, to work longer hours to pump the required amount of water, but that condition improves the load factor.

It was refreshing to see a hay elevator operated by an electric motor, but painful to notice a farm labourer pitching hay from a cart on to the elevator in fork-fulls, for the modern farm practice, with the aid of electric power, is to raise each cartload of hay, or corn, in one lift from the cart into the barn, transporting it to the exact position where it is to be stored. Barn machinery is very much more useful to the farmer if it forms a complete unit with its electric motor, for each such complete machine can then be placed exactly in the position where it will do its most useful work, instead of having to consider the location of an electric motor, or a counter-shaft. In accordance with modern practice, all machinery on a farm should be so designed as not to require more than 5 h.p. to operate it, as owing to the farmer's custom of operating his machinery in series instead of in parallel, an automatic limit for the maximum demand is provided, which results in an improved load factor and, accordingly, a lower price for electricity to the farmer. The silo filler shown on the screen was obviously absorbing too much power, as the same amount of work can be done with proper equipment with a 5-h.p. motor only. In the case of the thrashing machine drive, the same belt that had formerly been used for a steam-engine drive had obviously been employed, for the portable motor was situated some distance away; incidentally, the motor was not properly chocked and, further, modern portable motors do not operate when resting on their transporting wheels as the earlier type certainly did, for it has been found necessary to improve the design in order to avoid this and thus give a better drive. To obtain the most satisfactory result, the thrashing-machine motor should be mounted on the thrasher itself.

An entire absence of water-heating apparatus for dairies was a serious omission; in fact, all the dairy operations were very disappointing from the point of view of the cleanliness always associated with electric drives, and as an exhibit of modern electrified dairies. Even heavy churns were being man- or woman-handled, and cheese curds hand mixed; one electrically-driven churn was also running too fast to make good butter. A horse-clipping machine was shown with a flexible shaft directly connected to the motor, a good illustration of a modern farm drive.

The photography of the barn machinery was very ineffective, in that unless the onlooker was perfectly familiar with the machines he would not get a proper idea of what they were intended for: further, he could not get much assistance from the titles. It is appreciated that there are difficulties in photographing such machinery on site, but photographs from alternative positions and also close-ups would have made the film of very much more technical and propaganda value.

Some most dangerous examples of how not to use a circular saw were exhibited: logs, of course, ought never to be sawn on a flat table, but should rather be carried in the Y blocks of a proper log-saw carrier, such as forms a part of the construction of the modern bascule type combined table and log saw which is now so popular among farmers when electric power is available. Members of the National Electric Lamp Manufacturers' Association and others particularly experienced in scientific illumination would have been very grieved to see how very little use is apparently made of suitable reflectors on Cheshire farms, the only modern example of such illumination being in the up-to-date bakery, which was shown as a portion of the rural industry section of the film. One of the best educational features of the whole film was the illustration of the twitch of a switch with which it concluded.

A number of very commendatory comments on the film were heard, nothing adverse, except about that difficult question of titling and a clear understanding of what a number of the pictures represented. If the audience, however, had been composed entirely of farmers, the machines were such as to be quite familiar to them. The film was certainly not up to the

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standard of the practice shown in some of those that have been exhibited in connection with papers read before the Institution of Electrical Engineers. In spite of some defects, pointed out in the hope that they will be remedied in a new reel, we feel that it is certainly a film which, as it stands, will do an enormous amount of good if shown everywhere up and down the country.

Parliamentary News.

(By Our Special Parliamentary Reporter.)

The B.B.C. and Income Tax.

On January 28th, Capt. MARGESSON informed Sir A. HOLBROOK that assessments to income tax had been made on the British Broadcasting Corporation in respect of its profits, including any profits derived from publishing newspapers, &c., but the Corporation disputed liability, and the matter was at present under discussion.

London Electricity Charges.

On January 28th, Sir W. DAVISON asked the Minister of Transport what was the present cost per kWh of electricity for light and power, respectively, in each of the London boroughs and the City of London, and when it was expected that uniformity of price would be secured.

Colonel ASHLEY said that as regarded the first part of this question, the particulars desired were summarised in a statement published by the London and Home Counties Joint Electricity Authority. As regarded the second part, he did not think that there was at present any prospect of the introduction of complete uniformity in the charges for electricity in London, but the Joint Electricity Authority was reviewing the existing tariffs and proposed to consider how far a greater uniformity in the methods of charge could be recommended.

Tyneside Electricity Charges.

On January 29th, Mr. R. WILSON asked the Minister of Transport if representations had been made to him by the local authorities in the Tyneside area regarding the high charges made by private electricity supply companies to consumers in their districts; and, if so, would he state what action he proposed to take in the matter.

Colonel ASHLEY said he had noticed statements in the Press to the effect that the question of electricity charges in the district referred to had been under discussion between some of the local authorities and companies concerned, but no representations had been made to him in the matter.

Telephony on Trains.

On January 29th, Mr. MALONE asked if the Ministry of Transport was aware of the progress made in Germany in the development of communication between railway trains and the telephone service; and whether any experiments were being conducted in this country.

Sir W. MITCHELL-THOMSON, who replied, said he had asked for and received reports from time to time from the German authorities concerning an experimental service which was in operation on certain trains running between Berlin and Hamburg for the provision of telephonic communication between passengers in trains and telephone subscribers. Similar experiments conducted in this country had demonstrated the practicability of establishing telephonic communication with moving trains, but at present the demand for such communication did not seem likely to be sufficient to justify the expense involved to the railways in the provision of facilities.

Television.

On January 29th Mr. MALONE asked the Postmaster-General whether his department had at any time suggested to the British Broadcasting Corporation that facilities for experimental transmissions should be afforded to the Baird television system, such as had been arranged with the "Fultograph" apparatus.

Sir W. MITCHELL-THOMSON said he had informed both the British Broadcasting Corporation and the Baird Television Development Company a few months ago that, so far as his Department was concerned, he would be prepared to agree to the use, subject to suitable conditions, of one of the Corporation's stations for experiments with television apparatus. The Corporation decided, after its officers had witnessed a demonstration of the Baird system, that it did not then fulfil the conditions which would justify a trial through one of its stations, although it expressed its readiness to review this decision if and when development justified it. A further demonstration was being arranged, after which the question of using a broadcasting station for television would be reconsidered.

Signatures by Wireless.

On January 31st Lieut.-Commander KENWORTHY asked the Postmaster-General whether his attention had been drawn to the telautograph apparatus in use in the French postal service by which signatures could be sent both by telegraph or by wireless; if he was aware that since 1924 it had been possible to send telegraphed signatures and photographs between several of the main cities of France; whether the system had been investigated by his officials; and, if so, with what results.

Lord WOLMER, the Assistant Postmaster-General, said that the system had been inspected abroad, and some time ago a demonstration of it was given in London, and it had since been used on certain private wires in this country. So far, however, the results had not been sufficiently definite for the Postmaster-General to feel justified in introducing it into the telegraph service, but it was being kept under observation.

Electricity Schemes.

On February 1st, Major GLYN asked the Minister of Transport whether any further schemes under the Electricity (Supply) Act, 1926, were about to be issued in addition to those already published.

Colonel ASHLEY said that in addition to the schemes referred to, the Electricity Commissioners expected to be able during the course of the present year to complete the preparation of schemes for North-East England, South-West England, and East England, respectively, in that order.

The Lighting of Trains.

On January 31st Mr. BUCHANAN asked the Minister of Transport if he was aware that on passenger trains between Glasgow and London carriages were being lit by gas; and, in view of a recent accident and the findings of the court of inquiry thereon as to lighting trains by this method, if he would take steps to secure electric lighting in all carriages in future.

Col. ASHLEY said he was informed that all the passenger rolling stock on the scheduled services between Glasgow and London on the London and North-Eastern Railway was lighted by electricity, and that, as regarded the London, Midland and Scottish Railway, about 99 per cent. of the vehicles of express passenger trains between London and Scotland were at present electrically lighted. With regard to the last part of the question, he was unable to add anything to previous answers.

Legal.

Welding Machine Patent Appeal.

IN the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Lawrence and Russell, on February 1st, the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., appealed from a judgment of Mr. Justice Eve in the Chancery Division holding that it had infringed the letters patent of the plaintiffs, the Rose Street Foundry and Engineering Co., Ltd., for a welding machine.

The plaintiffs alleged that the defendants (appellants) had caused to be altered a manually-operated butt welding machine so that it infringed the patent No. 190,734 of 1922 covering the automatic control of the welding operation. The improvement claimed by the plaintiffs was one which provided means for automatically controlling a pre-arranged speed of approach during the "flashing" and butting periods, and a pre-determined point of increase, thus dispensing with the skilled operator and securing uniformity of repetition work.

The defendants pleaded that the plaintiffs' invention was insufficiently described in their specification, and alleged that it had been anticipated by prior publications, prior public user, and prior common general knowledge.

Mr. Justice Eve, however, upheld the validity of the patent, and granted the plaintiffs the injunction claimed, an inquiry as to damages, and the delivery up of the infringing machines and the costs of the action. He also granted a certificate of validity. The defendants now appealed.

Mr. WHITEHEAD, K.C., in support of the appeal, said the two issues in the appeal were as to the validity of the plaintiffs' patent and the question of infringement. He contended that the Judge had not come to a proper decision on the construction of the plaintiffs' patent in finding that it was valid. He also submitted that the Judge was wrong in finding that there had been infringement, as the defendants' machine was enormously different from that of the plaintiffs. The construction of the plaintiffs' specification was the fundamental question for the Court, and the learned Judge had really not dealt with it at all. He (Counsel) contended that the defendant's machine was so different from that of the plaintiffs' that it could not be held to be an infringement. The defendants had purchased from the plaintiffs' predecessors a manually-operated electric welding machine and later on they purchased from the plaintiffs one of their patent machines. Finding the latter very useful they desired the original machine to be converted. The plaintiffs offered to supply a new machine for about £180. The defendants thought that this was excessive and they had the machine converted by someone else. They had no idea of infringing the plaintiffs' patent, and were surprised when the claim was made against them. The plaintiffs' claim was of the widest possible nature, because it was of a functional character and on that account he contended that it was unquestionably bad.

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Mr. TREVOR WATSON followed on the same side and at the conclusion of the arguments on behalf of the appellants the hearing was again adjourned.

Attorney-General v. London and Home Counties J.E.A.

MR. JUSTICE ASTBURY, in the Chancery Division, on January 31st, heard a motion by the Attorney-General at the relation of the Richmond (Surrey) Electric Light & Power Co., Ltd., the County of London Electric Supply Co., Ltd., the Chiswick Electricity Supply Corporation, Ltd., and the Hendon Electric Supply Co., Ltd., for an injunction against the London and Home Counties Joint Electricity Authority. Plaintiffs sought to restrain the defendants until judgment in the action or further order from applying any of defendants' funds in or towards the payment of any costs or expenses in connection with a Parliamentary Bill entitled "A Bill to transfer to the London and Home Counties Joint Electricity Authority the powers of local authorities to acquire electrical undertakings in their district, to extend such district, to confer further powers upon the said authority, and for other purposes."

Mr. TYLDESLEY JONES, K.C., for the plaintiffs, said that defendants were a body created by the Electricity Commissioners under the Act of 1919 under a resolution approved by each House of Parliament. Under the Act of 1919, and later Acts, they had power to levy contributions on the plaintiff bodies, who were bound to contribute to the defendants' administrative expenses. Thus the defendants were in the happy position, if they were right, in being able to promote a Bill to which the plaintiffs strongly objected, at plaintiffs' expense, and if the plaintiffs fought it they did so at their own expense. In counsel's view the Bill in question was contrary to the scheme, and was *ultra vires*. The principle of the Act was that the distribution should remain in the hands of the distributors, but that the generation of the energy should be in the hands of joint authorities. Generating stations or undertakings of distributors might be acquired by agreement, and the joint authority was to supply electricity in bulk to the distributors. Under the Electricity Act of 1926 an entirely different scheme was prescribed, and the Central Electricity Board was created, which was to operate for the whole of England, and was to do practically what each joint authority was supposed to do. The Central Board had its staff of engineers and the Commissioners had their engineers and staff, all of whose expenses had to be paid by the consumer. Hence electricity was cheap and abundant. (Laughter.) The defendants promoted a Bill authorising them to construct a large generating station at Chiswick, to which there was considerable opposition. A clause was put in the Bill by Parliament to the effect that the scheme was not to be carried out unless within five years the Central Board made the station a "selected" one. Within two years the Board said that it would not "select" the station, and the result was that the constituent bodies of the joint authority had had to pay nearly £9,000 as administrative expenses of a Bill which was now waste-paper.

Mr. STAFFORD CRIPPS, K.C., for defendants, said that the Commissioners urged the Authority to promote the Bill.

In reply to his Lordship, Mr. JONES said the Bill was objected to because it altered the scheme and extended the district and altered the powers of the Joint Authority, and because it also enabled the authority to delegate its powers to committees not of itself, and indeed to go right outside the whole scheme.

When the hearing was resumed on February 1st, Mr. R. STAFFORD CRIPPS, K.C., for the Joint Authority, said the Bill dealt with several matters, and each of these must be judged separately. His Lordship might come to the conclusion that one part of the Bill was outside their powers and another part within their powers, and he would require an undertaking from the defendants not to proceed with a particular clause, and that of course could be given. But in order to get the injunction which was asked for the onus was on the plaintiffs to show that the whole of the things in the Bill and each of them was something upon which the defendants were not entitled to spend money. There had never been a case where the Chancery Division had granted an injunction against the promotion of a Bill. The question, however, was whether the defendants had power to spend money on promoting a Bill which was entirely a different proposition from having power to promote a Bill. He submitted that there was no limitation on the expenditure of the administrative fund in question.

His LORDSHIP said that according to this the Authority might spend it in engaging in trade.

Mr. CRIPPS replied that he did not know how far the Authority should be stopped, but there was no limitation upon the expenditure of the fund in the incorporating documents. He submitted that there was both an express and an implied power for the defendants to vary their incorporating documents.

His LORDSHIP said that if the plaintiffs showed that the defendants were authorised to do various things none of which was the promotion of a Bill, it was for the Authority to show that that was not a complete code in respect of which it could spend money.

Mr. CRIPPS replied that the plaintiffs had not shown that there was a limitation on the expenditure of the fund, and it was not necessary therefore for him to show that the defendants had an express power to spend the money in promoting a Bill. The expenditure was only limited to administration for the improvement of the organisation of the supply of electricity in any electricity district. Administrative expenses covered a number of other expenses besides anything mentioned in the Act or the scheme.

The hearing ended on Tuesday last. At the conclusion of Mr. Cripps's arguments, Mr. TYLDESLEY JONES replied on behalf of the plaintiffs, and contended that the Authority was created for limited purposes, and thus the Act limited the expenditure of the fund. The Authority could not promote a Bill and spend its constituents' money to try and get rid of a prohibition imposed by the Act. There would be hundreds of petitions against the Bill, which meant an enormous expenditure if the Bill was not stopped. His Lordship said that he would deliver judgment later.

Belgian Breeding Stock Farm Co., Ltd., v. Tidal Power Syndicate and others.

THIS case came before Mr. Justice Avory in the King's Bench Division on January 30th, the plaintiff company suing for principal and interest due in connection with a mortgage. Mr. M. WEDDERBURN, for the plaintiffs, said that the defendant company was not represented. The body of Mr. W. H. Butler, another defendant, had been taken from the Thames last year, and nobody had come forward on his behalf.

Judgment was given for the plaintiffs for £18,000 and costs.

Correspondence.

Correspondents should forward their communications* as early as possible. *No letter can be published unless we have the writer's name and address in our possession.

Collecting Money from Prepayment Meters.

The collecting of money from prepayment meters becomes a very big job when there are thousands of meters to be emptied every quarter, or oftener. It will be very useful if some engineers who have had experience of this work would give some details of their methods. Do they have one man, or two men, working together? What arrangements are there for preventing systematic fraud? Is it a good scheme to have a man with a barrow to visit the collectors several times in the course of the day to take the money from them? What time do they start in the morning at the offices and what time do they get into the houses?

Any information on these heads and on the subject generally will be much appreciated.

Prepayment.

January 29th, 1929.

A Speed-variation Scheme.

On reading Mr. G. F. Heath's contribution dealing with a scheme for obtaining speed variation with an induction motor, I found myself at a loss to conceive of circumstances under which the arrangement would be of any utility.

He definitely proposes to employ a motor (induction motor, obviously) to drive a rotor in an excited stator, and so obtain a temporary frequency changer which will supply the final-drive motor at a frequency differing from that of the mains supply.

The first difficulty would be to find a motor whose rotor voltage equalled the mains voltage, and it would, of course, be disastrous to apply, say, double voltage at normal frequency to an induction motor. Assuming, however, that all such difficulties were overcome, the problem of varying the speed of the frequency changer would have to be dealt with. It will be found that the speed range of the motor driving the rotor will have to be greater than the range of speed required at the final drive.

The last paragraph of the article is misleading, because, in the arrangement proposed, it is not the flux and frequency which are variables, but the voltage and frequency. The power-factor of the scheme, too, will be low as current will have to be supplied by the mains to magnetise three distinct motors.

W. S. Jordan.

Gainsborough, *January 28th*, 1929.

Service Boxes.

I shall be interested to have the opinions of mains engineers and jointers on the best type of service box for lead-covered, armoured, cables laid direct in the ground. One still finds many undertakings using c.i. service boxes filled with compound, and in some cases wood bushes are still being employed.

Cast-lead service boxes, protected by a c.i. shell, appear to me to make a far more reliable job. What is the objection to them? Can it be said that a properly designed and properly filled c.i. service box is as reliable, in waterlogged ground, as a cast-lead box, plumbed on to the main and the service cable?

January 30th, 1929. **Service.**

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The Salaries of Technically-trained Engineers.

With reference to your footnote to my letter in your January 25th issue, I had not overlooked the Society of Technical Engineers. Unfortunately, I am afraid that Society devotes most of its energies to the promotion of research work in various forms. Its Council is mainly formed of gentlemen who, whilst very highly respected in academic circles, can hardly be said to represent technical engineers. Furthermore, although the Society certainly has as one of its objects the improvement of the status of the technical engineer, I fear that this object is only a secondary one, at any rate so far as concerns any direct attempt to improve salaries.

In the case of the society which I am attempting to form the sole object will be to endeavour to raise the salaries of engineers. Only when this is accomplished would the scope be enlarged, and even then only in a way acceptable to the whole body of technical engineers.

Organise.

Bottom or Side Heat?

The correspondence on this subject has been most informing, and one may hope that others will add their quota. Electric cooking is really "it" when the apparatus is right, and everything that will tend to eliminate unsuitable cookers will help the cause. Incidentally, I have been puzzled over Mr. Ellerd-Styles's statement that I was doing a little bluffing in referring to packing of a woolly nature, which he himself says is slag wool. Surely slag wool is of a woolly nature! For all I know there may be other types of packing, but anything liable to settle and to change through dampness and heat is undesirable. I was glad to have his support for this.

The ancient oven to which I referred had bare heating coils inside and a hot plate at the bottom, and it was splendid, except that the bare heating coils were liable to damage. The direct radiation was very good for browning purposes, and I think that it is the best way of getting economical browning. The point needs investigation. My present oven has a low-voltage hot plate: the element is short and very thick, like a rod, and the voltage is so low that it does not matter if a pan touches it. The results are excellent, but the cost is high, which is unfortunate.

May we hope for remarks from other manufacturers?

The Writer of the Article.

January 26th, 1929.

The correspondence arising out of "Station Engineer's" comments on "Side or Bottom Heat" has no doubt proved of interest not only to manufacturers, but also to supply authorities, who in many cases have very definite views on this subject.

As most of the supply authorities have had considerable experience through their clients of the results of the various methods adopted for heating ovens, it would be extremely interesting to hear their views, or those of their demonstrators. Unanimity is perhaps too much to expect, but if we are ever to get down to a standard cooker, it is essential that the views of all sides should be well aired.

It would appear that the efforts of the manufacturers to improve "Station Engineer's" "new" oven were not altogether satisfactory, for they only made half a job of it by increasing the amount of bottom heat, and decreasing the amount of side heat. If they had eliminated side heat and substituted top heat along with bottom heat, controlling each by a separate three-heat switch, "Station Engineer," or the cook, would have been in a position to vary the relative amount of bottom heat to top heat at will, and thus to cater not only for bread baking, but also for all other baking requirements. A definite unvarying distribution of side and bottom heat cannot prove satisfactory for all baking operations; greater flexibility of control is required, and this can be best attained with top and bottom heat.

The contention of your correspondent, Mr. S. F. Bickell, regarding the stratified formation of heat in a well-filled oven fitted with top and bottom heating elements cannot be taken seriously, for if an oven is so chock-a-block full as to retard the natural circulation of heated air, it is difficult to see how "induced" circulation is going to help matters.

We, as manufacturers, always *recommend* top and bottom heat, as we are satisfied that this method is the simplest, and provides the correct means of obtaining the best and most economical results in the hands of an inexperienced cook; but at the same time, we are open to conviction if a really sound case can be put forward for any other method of heating, by cooks who have had genuine experience in all methods of heating the oven.

For this reason the sincerely expressed opinion of a lady of Mrs. Mole's experience, however much it may vary from our own, should be welcomed, and it is hoped that many more of these ladies will give us the benefit of their experience through the "Correspondence" columns, of your journal.

J. J. McKenna,

DOMESTIC ELECTRIFICATION, LTD.

London, *January 29th*, 1929.

Mr. S. F. Bickell contributes a very interesting letter in your publication of the 25th inst., and indicates that he has, by using side heat in the form of elements behind shields and by the introduction of bottom heat, obtained a system which gives ideal circulation under all conditions of baking and that top heat is not required. The problem is solved!

It is quite true that I have a lot to learn before I can pose as an authority on domestic cooker design, but does it not appear that Mr. Bickell is in the same category; in fact, *all* who are engaged in baking by electricity?

However, as the ideal system has been found by Mr. Bickell, is it not extraordinary that this gentleman should suggest that *cooks* should conduct research, presumably to determine the correct location for heating elements and the amount of lagging required, &c. Why is it necessary to refer to an unbiased body? Surely bias does not enter into the subject when a Standards Committee gets to work. Certainly I have not found electrical manufacturers biased; on the contrary, they are very open minded. Why talk about research when Mr. Bickell has obtained the ideal?

When I sell an oven it is with the knowledge that experience enables me to show the cook, or baker, or chef *how to use the oven* and *how it bakes*, to show the cook how the oven will bake joints, poultry, puddings and pies; if required, make from a batch of bread to a tray of meringues and bake them so as to justify my claims about electric baking, and show the intended user that the electric oven is capable of giving him better results by practical demonstrations. This gives the prospect confidence. Will Mr. Bickell get the same results by asking the prospect where he wants the heating elements in his oven?

One of the hindrances to the extended use of electric baking is the ignorance of certain manufacturers, or their representatives, of the practical use of their products. They leave it to the user to find out what he can do with the oven.

With my limited experience I am prompted to conclude that the ideal design for electric domestic cookers does not yet exist, and, until your suggestion is acted upon, the well established gas cooker can more than hold its own. When something is done—following your lead—we must hope that it will embrace electric baking of all food products, covering the requirements from the flat to the factory.

W. Ellerd-Styles.

London, N.1, *January 29th*, 1929.

P.S.—By a coincidence a catalogue of family cookers is just to hand, which states: "Alternative combinations of heating are provided, side and bottom, top and bottom, or bottom heating only." Who is to decide which is best?

The Electricity Schemes.

I read with great interest the electricity schemes prepared by the Central Electricity Board towards the construction of the national network of 132,000-volt main transmission lines and transformer stations, yet I still doubt whether electricity will become as cheap as the Commissioners anticipate.

My reason is simple, but one must admit very sensible About fifteen years ago reciprocating sets and low-speed alternators were in general use for the generation of electricity, the era of high-voltage transmission had only just begun, d.c. being the most popular form of supply. To-day the central station is a different place: high-speed turbo-alternators are almost universal, high-voltage transmission, standardisation of a frequency of 50 cycles and l.t. a.c. distribution is in vogue, whereas the old system of d.c. supply is gradually becoming obsolete.

What a big change has been made in such a short time, yet the Commissioners are designing stations for fifteen years ahead. Are they not taking too much for granted by thinking we have reached the age when electricity generation, transmission, and distribution are perfect, and thus in the long run will incur more expenditure than the scheme justifies? By all means "scrap" the inefficient stations, but leave the efficient ones alone.

Can the Commissioners safely state that the "load" is certain to increase in any part of the country at the present time, yet they are taking it for granted it will, and are erecting stations accordingly? In fifteen years' time I don't think one would be greatly surprised to find the central station methods of transmission and distribution as different as they were fifteen or twenty years ago.

Onlooker.

January 28th, 1929.

Gramophone Reproduction.

Mr. P. K. Turner's criticism of the above-named article, although savouring of advertisement, is perhaps worthy of comment, if only to prevent readers from being still further misled on this somewhat debatable subject. I therefore answer Mr. Turner's remarks in his own order:—

1. Mr. Turner does not apparently appreciate the difference between a "tone" and a "note"; the latter may be defined as a sound having a definite frequency, since it is the same for all instruments, whereas a "tone" is, in a sense, that qualification of a "note" which enables one to differentiate between one instrument and another, and depends upon the amplitude of the harmonics of the "note," the presence of "overtones" only forming modulations of the "tone."

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2. May I refer Mr. Turner to the paragraph, preceding his quotation, at the end of p. 140, wherein I state "Record wear. . . . Lateral reaction may be divided . . . and that due to the mechanical resistance offered to the motion of the stylus . . . except when caused by *excessive* damping, is doing useful work and is unavoidable."

I regret that my suggested general test for "pick-ups" does not meet with approval, although I cannot see any reference in my article to "feeling" a pick-up for resilience. I take it that readers of this journal are capable of understanding the terms employed and of devising their own means of testing for these defects.

3. Mr. Turner's placing of the lower limit of recording at only 150 cycles suggests that he is not quite as up-to-date as he would imply.

4. It would appear that I overestimate the difficulties of amplifier design, and that neither of my suggested circuits meets with approval. Whilst frankly admitting the possibility of improvement in those designs, complete with further complications and expense, I know of no commercial amplifier with better, if as good, characteristics over the whole audible frequency range, whether for "broadcast" or "gramophone" reproduction.

5. Except that in largely-displayed advertisements wherein two well-known experts boosted, if I may use the term, the reed-type loud-speaker mentioned, I know of no authority for the claims made, although the fact that one of the said experts has since returned to the design of moving-coil speakers, tends to coincide with my own opinion on the matter. I regret to add that, although I have only heard two of Mr. Turner's loud-speakers, opinions which have reached me seem to agree with the remarks made in my article.

6. The use of "choke-fed transformer," coupling to the loud-speaker, although possibly aiding in the preventing of back-coupling (due often to manufacturers' niggardly use of sufficient capacity in mains eliminators), apart from the complications involved, no d.c. current flows in the primary of the transformer, which is therefore not only inefficient, but also almost certain to cause considerable amplitude distortion.

7. Since my article, prior to publication, received the approval of a firm whose experience in musical reproduction is not even second to Mr. Turner's, I prefer to hold my own opinions on the subject of gramophone reproduction.

Ernest W. Braendle.

Blackheath. *February 2nd*, 1929.

[Owing to pressure on our space, several letters have unavoidably had to be held over.—Eds. Elec. Rev.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

17,859. "Excess-current safety devices for electric circuits." International General Electric Co., Inc. July 7th, 1926. (274,083.)

17,875. "Reproduction of pictures, views, scenes, images, and the like." J. L. Baird and Television, Ltd. July 5th, 1927. (303,771.)

23,894. "Electric arc-welding." M. Zack. August 31st, 1926. (277,005.)

23,467. "Ebonite and the treatment thereof, more particularly ebonite sheets such as those employed as panels for wireless apparatus." British Hard Rubber Co., Ltd., and P. E. Wells. September 6th, 1927. (303,814.)

26,256. "Acoustic arrangement for loud-speakers and similarly operating acoustic apparatus." E. D. Feldman. January 11th, 1927. (283,492.)

26,320. "Electric synchronising apparatus." A. Reyrolle & Co., Ltd., and T. R. Warren. October 5th, 1927. (303,779.)

26,497. "Automatic train-control systems." Associated Telephone and Telegraph Co. October 6th, 1926. (278,730.)

26,690. "Vacuum electric discharge tube devices." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. October 8th, 1927. (303,767.)

26,889. "Hand-set telephones and the like." D. S. S. Steuart. October 11th, 1927. (303,848.)

26,941. "Coin-collecting apparatus for telephone services." Hall Telephone Accessories, Ltd. December 14th, 1926. (282,351.)

26,970. "Telephone systems." Associated Telephone and Telegraph Co. October 11th, 1926. (278,763.)

27,097. "Electric motors." S. Baxter. October 12th, 1927. (303,920.)

27,106. "Key-operated impulse-sending devices." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. October 12th, 1927. (303,921.)

27,210. "Methods of treating magnetic materials." W. E. Beatty (Bell-Telephone Laboratories, Inc.). October 14th, 1927. (303,928.)

27,350. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. October 14th, 1927. (Addition to 265,653.) (303,929.)

27,351. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Flenley. October 14th, 1927. (Addition to 241,287.) (303,930.)

27,472. "Submarine cables." W. E. Beatty (Bell Telephone Laboratories, Inc.). October 17th, 1927. (303,919.)

27,492. "Switching devices for potential transformers." British Thomson-Houston Co., Ltd., and J. G. Wellings. October 17th, 1927. (303,926.)

27,554. "Devices for supplying direct voltage, and more particularly a grid bias to the grids of the valve or valves of a radio installation." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 17th, 1927. (Patent of addition not granted.) (303,933.)

28,139. "Insulating enamels, varnishes, or the like coatings." British Thomson-Houston Co., Ltd., H. W. H. Warren and A. T. Ward. October 20th, 1927. (303,936.)

28,609. "Electric switch-fuses." R. T. Norton and E. Long. November 4th, 1927. (303,951.)

28,669. "Electric battery testers." J. H. Runbaken. November 5th, 1927. (303,952.)

28,725. "Electric selective switches." Coventry Automatic Telephones, Ltd., and C. C. Puckette. November 7th, 1927. (303,954.)

31,676. "Electric protective or alarm arrangements." General Electric Co., Ltd., H. C. Turner and A. Sherwin. November 24th, 1927. (303,973.)

29,725. "Electric selective switches." Coventry Automatic Telephones, Ltd. (303,976.)

32,116. "Magneto-electric machines." E. Morel. November 29th, 1927. (303,977.)

32,677. "Electrolytic manufacture of metallic powders." H. Wade (Soc. Anon. Trefileries et Laminoirs du Havre, Anciens Etablissements L. Weiller, Soc. Cooperative de Rugles, et la Canalisation Electrique Réunis). December 3rd, 1927. (303,984.)

32,854. "Electromagnetic gramophone reproducers." Graham Amplion, Ltd., and J. D. Dunthorne. December 5th, 1927 (303,986.)

33,155. "Electromechanical distance-indicating device for liquid levels." Soc. Amary & Poulet. January 27th, 1927. (284,277.)

33,318. "Electrical instruments for indicating instantaneous pressures or currents." J. T. Irwin. December 9th 1927. (303,992.)

33,723. "Arc-welding electrodes." Alloy Welding Processes, Ltd., and E. H. Jones. December 13th, 1927. (303,996.)

35,000. "Construction of overhead electric travelling hoist." J. W. Coldman and Scruttons, Ltd. December 24th, 1927. (304,006.)

35,144. "Magnets or magnet systems for magneto-electric machines." F. Quast and A. F. V. Eichert (trading as Berko-Werke Quast & Co.). April 8th, 1927. (288,232.)

35,227. "Anchoring connection or dead-end clamp for electric cables." T. Yamanouchi. December 29th, 1927. (304,007.)

1928.

1,025. "Anode batteries." Berliner Batterie-Fabrik Ges. January 17th, 1927. (283,856.)

1,796. "Electroplating of annular articles and apparatus therefor." Dunlop Rubber Co., Ltd., and H. Trevaskis. January 19th, 1928. (304,029.)

1,836. "Sparking plugs for internal-combustion engines." Imperial Airways, Ltd., G. E. Humphery and H. L. Hall. January 19th, 1928. (304,030.)

2,009. "Electrical conductors." J. Collier. January 21st, 1928. (304,031.)

2,295. "Process for the determination of voltage equivalents of electric currents at varying potentials." Egyesult Issolampa es Villa-Mossagi Reszveny-Tarsasag. January 24th, 1927. (284,225.)

2,461. "Ignition devices for internal-combustion engines." British Thomson-Houston Co., Ltd., C. J. Morton and L. M. T. Bell. January 25th, 1928. (304,035.)

3,217. "Lightning-arresters." Metropolitan-Vickers Electrical Co., Ltd. February 1st, 1927. (284,635.)

3,715. "Headlamps of motor vehicles." F. E. Higgins and A. D. Hawkesby. February 6th, 1928. (304,048.)

4,111. "Excess consumption electricity meters with direct-current motor." Allgemeine Electricitats-Ges. February 9th, 1927. (285,039.)

4,226. "Electrolysis of ferrous chloride." S. I. Levy and G. W. Gray. February 10th, 1928. (304,053.)

5,027. "Electric motors, suitable more particularly for electric meters." International General Electric Co., Inc. February 18th, 1927. (285,496.)

5,050. "Electric switches." Siemens-Schuckertwerke Akt. Ges. April 26th, 1927. (289,395.)

5,079. "Electrical insulators." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). February 19th, 1928. (Addition to 195,593.) (304,057.)

5,144. "Protecting glasses and globes for electric lamps." P. Rosenkaimer. February 18th, 1928. (304,058.)

6,657. "Electric liquid-heaters." W. Schott. March 23rd, 1927. (287,520.)

7,759. "Electric signalling systems." British Thomson-Houston Co., Ltd. March 23rd, 1927. (Addition to 286,691.) (287,524.)

7,847. "Automatic reclosing circuit breaker systems." International General Electric Co., Inc. March 16th, 1927. (287,142.)

8,315. "Apparatus for use in radio and other high-frequency installations." Marconi's Wireless Telegraph Co., Ltd. March 19th, 1927. (287,462.)

8,760. "Protective means for single or multi-phase rectifiers operating in parallel with other direct-current machines or apparatus." Akt. Ges. Brown, Boveri et Cie. March 30th, 1927. (287,926.)

9,534. "Shades for incandescent electric lamps." Siemens-Schuckertwerke Akt Ges. April 1st, 1927. (288,152.)

9,873. "Electric measuring instruments." British Thomson-Houston Co., Ltd. April 2nd, 1927. (288,186.)

10,364. "Electric motors." "Electro-transmission." April 8th, 1927. (288,329.)

11,488. "Current-collectors for high-speed railways." F. Kruckenberg and C. Stedefeld. April 21st, 1927. (289,057.)

12,499. "Installations for rectifying alternating current." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 6th, 1927. (289,882.)

14,182. "Automatic train-control systems." Associated Telephone and Telegraph Co. October 6th, 1928. (Divided application on 278,730.) (290,587.)

14,184. "Automatic train-control systems." Associated Telephone and Telegraph Co. October 6th. 1926. (Divided application on 278,730.) (290,588.)

14,534. "Vacuum or gasfilled incandescent electric lamps." G. Main. July 26th, 1927. (294,565.)

17,930. "Electricity meters." Landis & Gyr Soc. Anon. July 5th, 1927. (293,386.)

18,543. "Laminated-core body for electric machines and apparatus." Siemens-Schuckertwerke Akt. Ges. July 6th, 1927. (293,420.)

19,095. "Manufacture of electric incandescent lamps, thermionic valves, and the like." General Electric Co., Ltd. July 2nd, 1927. (293,313.)

19,498. "Variable-ratio transformers." British Thomson-Houston Co., Ltd. July 6th, 1927. (293,426.)

19,719. "Automatic train-control systems." Associated Telephone and Telegraph Co. October 6th, 1926. (Divided application on 278,730.) (293,431.)

19,720. "Automatic train-control systems." Associated Telephone and Telegraph Co. October 6th, 1926. (Divided application on 278,730.) (293,432.)

19,889. "Manufacture of electric incandescent lamps." General Electric Co., Ltd. July 21st, 1927. (294,242.)

21,438. "Filaments for electric incandescent lamps." Falk, Stadelmann and Co., Ltd. September 13th, 1927. (297,052.)

21,464. "Transformers with oil-filled terminals." Siemens-Schuckertwerke Akt. Ges. August 1st, 1927. (294,938.)

29,501. "High-frequency signalling." Telefunken Ges. fur Drahtlose Telegraphie. October 14th, 1927. (298,647.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 30th :—

Truvox. No. 486,492. All goods in Class 8.—Radofone (1928), Ltd, 22, Queen Street, E.C.4.

Orthophonox. No. 496,787. Class 8. Apparatus for use in radio-telegraphy and telephony.—W. L. Colassi, 130, Fenchurch Street, E.C.3.

Lecoid. No. 496,014. Class 40. Components composed principally of gutta-percha and india-rubber for sealing electric cable boxes and for the like purposes.—Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Fish meal factory, for Fisado, Ltd.
ABRAM (WIGAN).—Housing scheme (33), for the U.D.C.; surveyor (returnable deposit of £2 2s.).
ALDERSHOT.—Sports stadium, with dirt track; A. H. Dungay, architect, South Farnborough.
BAGNALL.—Extensions, smallpox hospital; North Staffs. Joint Smallpox Hospital Board.
BARNSLEY.—Church and school, Monk Bretton, for the Wesleyan trustees; secretary.
BECKENHAM.—Elementary school, Elmers End (£33,400); S. Burgoyne. Housing scheme, 46 acres; Croydon borough engineer.
BEDWELLTY.—Housing scheme (34), for the U.D.C.; Dan Price, surveyor, New Tredegar.
BISHOP STORTFORD.—Works extensions, Thorley, for Millar's Machinery Co., Ltd.
BLACKBURN.—Cinema, Audley Lane, for Liverpool syndicate.
BROMLEY (KENT).—Extensions, Phillips Memorial Hospital; E. Ford Duncanson, architect. Houses (40), Palace View, for H. F. Thoburn.
CAMBUSLANG.—Housing scheme (100), for Lanarkshire C.C.; clerk.
CARDIGANSHIRE.—Smallpox hospital; medical officer of health.
CHELMSFORD.—Extensions, Rectory Lane; Hoffmann Manufacturing Co., Ltd.
CHORLEY.—Store, Chorley works; Leyland Motors, Ltd.
COCKERMOUTH.—Secondary school, for Cumberland E.C.; director of education, Carlisle.
COVENTRY.—Extensions, Priestley's Bridge depôt (£7,000); Corporation Transport Committee. Maternity home: medical officer of health. Public abattoirs and market (£100,000); borough surveyor.
CREWE.—Additional 70 houses, for the T.C.; borough surveyor.
CROYDON.—31 houses, London Road; F. T. Woodings and Sons. Shops and offices, North End; Browett, Taylor and Co. 34 houses, Biggin Hill; Thomas & Son.
DARLINGTON.—School, North Road, for the borough E.C.; Ernest Minors, borough surveyor (returnable deposit of £1 1s.).
DENNY.—Housing scheme (28), with electrical work, for the T.C.; James Strang & Wilson, architects, Falkirk.
DEVONPORT.—Houses (38); E. H. A. Barron, architect, 11, The Crescent, Plymouth.
DORKING.—Extensions, 85, High Street, for Timothy White (1928), Ltd., 30, Chandos Street, Portsmouth.
DUDLEY.—Housing scheme (52), Bowling Green site, Netherton, for the T.C.; F. H. Gibbons, borough engineer (returnable deposit of £1 1s.).
DUMFRIES.—Restaurant buildings, for P. T. Ferguson; J. McLintock Bowie, architect.
EARLESTOWN.—Central school, Haydock (700 places), for Lancs. E.C.; director of education, Preston.
EDINBURGH.—United Free Church (£50,000); L. G. Thomson, architect. Chapel (£9,000), for Good Shepherd Home, Colinton (electrical work); clerk of works, Good Shepherd Home, Colinton.
EPPING.—Electric lighting installation, Institution, for the Board of Guardians; clerk.
GLASGOW.—Schools at Hamiltonhill and Ruchill, for Education Authority; master of works, Education Authority, Bath Street. Eight-storey building in Renfield Street, for J. Woodhouse & Sons, house furnishers (£150,000); J. Miller, architect.
GUILDFORD.—Telephone exchange, Shere, for H.M. Office of Works, King Charles Street, London, S.W. (returnable deposit of £1 1s.). Extensions, public garage, London Road; Rice & Harper. 104 houses, Southway Avenue; borough engineer.
HALIFAX.—Extensions, fever hospital, for the T.C.; borough surveyor.
HARROW.—Elementary school, Kenton site (£13,817); J. Stewart & Sons, Tottenham.
HAWICK.—Housing scheme, Greenheads (15 blocks), for the T.C.; housing director, Municipal Buildings.
HULL.—United Methodist Church, Hessle Road, West Hull; trustees.
IRISH FREE STATE (BRAY, Co. WICKLOW).—Concert hall (£5,000); J. P. Meghan, Commissioner administering the affairs of the Council.
(CORK).—Motor showroom, offices, &c., for Service, Ltd.; D. M. O'Connor, architect, 29, South Mall.
(DUBLIN).—Insulation work and installation of refrigerating plant at the city abattoir, for the City Commissioners; F. McArdle, architect, 29, Rosemary Street, Belfast.
KENDAL.—Housing scheme (38), for the T.C.; F. W. Oxberry, borough surveyor.
LEAMINGTON.—Additional 56 houses, for the T.C.; borough surveyor.
LEITH.—Church (£6,500), for Lochend United Free Church trustees.
LONDON (ILFORD, E.).—Development, Mossford Green estate; W. J. Hobbs.
(HOXTON, N.).—Block of 54 tenements, Whitmore estate; L.C.C. architect.
(FOREST HILL, S.E.).—Boys' secondary school (450 places), for London E.C.
(LEWISHAM, S.E.).—72 flats, Winchfield Road; borough engineer.
(ROTHERHITHE, S.E.).—Extensions, St. Olave's and St. Saviour's Grammar School (£9,000); governors.
(WIMBLEDON, S.W.).—Extensions, mantle factory, Ravensbury Terrace; J. R. W. Maxwell.
(W.).—Stores in Oxford Street (£250,000); Garrett, White and Poland, estate agents, Hanover Street, W.
(BLOOMSBURY, W.C.).—Extensions, Bedford College for Women (£16,000); governors.
LUTON.—Factory extensions, Dominion Record Co., and W. Wright & Sons, Old Bedford Road.
MIDDLESBROUGH.—Additional housing scheme (100), Whinney Banks, for the T.C.; S. E. Burgess, borough engineer.
NORTH SHIELDS.—Offices, Tynemouth Road; G. Park, Ltd.
RAWTENSTALL.—Housing scheme (40), for the T.C.; borough surveyor.
RUGBY.—Additional 50 houses, for the R.D.C.; surveyor.
SALFORD.—Housing scheme (368), Pendleton, for the T.C.; borough surveyor.
SALISBURY.—Additional 56 houses, for the T.C.; city surveyor.
SHIPLEY.—56 houses, Albert Road site; U.D.C. surveyor.
STAFFORD.—Police station (£11,500), for the T.C.; borough surveyor. Extensions, Lichfield Road High School, for Staffs. E.C.; F. A. Hughes, director of education, Stafford (returnable deposit of £5 5s.).
STIRLING.—Additional 120 houses, for the T.C.; burgh surveyor. Electric light and power installation, slaughter house, for the T.C.; burgh surveyor.
STOKE-ON-TRENT.—Cubicle ward, isolation hospital; W. H. Ward, architect.
SWINDON (WILTS.).—Secondary school, Groundwell Road, for Holy Rood Roman Catholic managers; Canon J. J. Noonan.
TAMWORTH.—Additional housing scheme (130), for the R.D.C.; H. L. Kent, surveyor.
THORNE (YORKS.).—48 houses; tenders to J. T. Smith, clerk to the Council, Council Hall; particulars from H. Plewes, architect and surveyor, Council Hall (deposit £2 2s.); February 11th
UXBRIDGE.—Motor showrooms, 73, St. Andrews; A. N. Reeves.
WAKEFIELD.—School (deposit £1 1s.); P. Morris, architect, Town Hall.
WALLINGTON.—Secondary school; Surrey Education Committee.
WALSALL.—Fire station and quarters (£6,500), for the T.C.; borough surveyor.
WEST BROMWICH.—School, Charlemont, for the borough E.C.; A. O. Chatterley, architect, 16, Pembroke Road, Bootle, Liverpool.
WEST LAVINGTON.—Extensions, including biological laboratory, Dauntsey School, for the governors; A. C. Martin, architect, London.
WREXHAM.—Re-erection of Abbot Leather Works, for Hugh Price & Co.
YORK.—Extensions, St. John's Diocesan Training College, with electrical work; Ward & Leckonby, architects.

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The

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Mechanical Vibration.

IN bygone days when super-power stations were perhaps dreamt of, but never discussed, when even the most brilliant of the electrical prophets who have lived long enough to see the refutation of the pessimist had not designed a "grid" system of distribution, other electrical engineers concerned with small non-condensing steam-driven stations had occasion to study the law of nuisance and to contest allegations of nuisance caused by noise and vibration. To-day such cases, in which generating stations are concerned, are few and far between; but a far larger proportion of the community is now concerned with the effects of vibration on a scale and over areas which are very extensive.

We refer to the alleged effect of traffic vibration: the popular Press is concerned with recording almost daily some gas explosion, or some failure of a water main ascribed to this cause; our office walls and windows are not sound proof against traffic noises, very often the walls themselves crack, or a ceiling falls down; but, in comparison with undertakings supplying gas and water. authorised distributors of electricity are better placed, for their troubles, when leaking gas has accumulated in the bricked pits in which joint boxes are placed, are not of such a costly nature as, say, a fractured water main.

We have written "alleged" effect of traffic vibration: the presumptive evidence appears to be strong, but direct evidence which will connect any given failure with either abnormal vibration due to certain classes of heavy traffic, or the smaller almost ceaseless vibration due to normal traffic, is lacking. In this respect there is a reasonable analogy between engineering and medical science: medical men giving evidence in criminal cases in which poisoning is alleged have to deal with the cumulative effect of minute doses of poison administered day in day out to patients unaware of its presence in their food; while in other poisoning cases the expert has been concerned with the rapid and fatal effect of one, or two, large doses, in which case diagnosis is relatively easy and conviction of the guilty sooner assured. So, also, with respect to vibration (in its severe forms), cause, effect, and remedies are obvious; but when it is a matter of small doses, causes may be disputed, and effects may be ignored until the damage has been done. As that climax may be the resultant of

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several causes, the remedies admit of almost more debate than the causes.

There is therefore need to study the effects of attenuation, reflection, and amplification of vibration. In any uniform medium attenuation (or diminution) of amplitude probably varies inversely as the square of the distance between the source and the point of reception. The soil is not uniform, so further coefficients will be necessary for different media. Reflection is largely a matter of mass; the deep foundations of a modern building reflect the earth waves impinging on them, and when such reflected waves meet the next oncoming wave, there is an aggravation of effect at the point of meeting. Amplification, too, is important; in a moderate sea a small coasting steamer will roll severely when a large liner is unaffected. In any building the horizontal vibrational movement increases with the height above the street level, but in different buildings the effect at the same height will differ with its mass and also with its rigidity. The problem being complex, the sooner it is studied systematically, and direct evidence produced, the better. Then, and not till then, can remedies receive their correct amount of attention.

A British Trade Delegation to Russia.

Evidence accumulates to confirm the views repeatedly expressed here regarding the desirability of British manufacturers and traders devoting attention to the Russian trade situation. A good deal of electrical information will be found in the Electrical Review volumes of the past year or two which may be of practical utility even now, in spite of its apparent lack of value when published. Since the publication of our leading article on "Electrical Trade with Russia?" (Elec. Rev., December 7th, 1928, p. 965), indicating American electrical activity, the chief event that has taken place, so far as we know, is the meeting of manufacturers and others which was held in London on February 5th, at which it was resolved to arrange for a representative delegation to proceed to Russia not later than March 8th. The visit is to be paid as the result of an intimation from the Russian Government that it would welcome such a delegation. The concerns which were represented at the meeting are in the main well known substantial industrial companies and associations. From the engineering and associated industries there are such names as Armstrong-Whitworth, Mather and Platt, Clayton & Shuttleworth, Ruston & Hornsby, Ransomes, Sims & Jeffries, Stewarts & Lloyds, Beardmore, Dunlop Rubber, the Associated British Machine Tool Makers, and the Society of Motor Manufacturers and Traders. It is stated in one paper that a representative of Callender's and the Anchor Cable companies was present, also Mr. George Balfour, M.P., and they add to the electrical character of the meeting. That the delegation should have a good quota of electrical men is appropriate in view of the great chance that electrical equipment may have of meeting the deficiency of technical productive capacity in Russia which we have commented upon in our articles. There is already some British electrical activity in Russia and possibly more than we think. At any rate, there is still time for more British electrical manufacturers or their associations to be identified with the visit and show enterprise in this latest export trade move. The delegation is being organised by the Anglo-Russian Committee, of 4, Dean's Yard, Westminster.

An engineer experienced in Russian affairs is reported in one of the advertising journals as stating that from information lately received, very large Russian orders for hydro-electric equipment and engineering supplies could be placed in this country almost immediately if business relations could be re-opened.

The result of the investigations of the delegation will be awaited with keen interest.

Applications of Coloured Light.

Dr. L. C. Martin's paper on the above subject, read in London recently at a meeting of the Illuminating Engineering Society, touched the fringe of a most fascinating subject. Much of the paper was concerned with physical problems, such as colour-measurement, nomenclature, and the design of a satisfactory standard of "white light"; but the author did not allow his audience to forget that the study of colour really rests on physiological phonomena, some of which were very strikingly illustrated by Mr. C. F. Smith's demonstration of mutochrome apparatus. Colour-photometry, colour-matching, and the uses of "artificial daylight" are closely related to these physiological aspects. It was not surprising that a considerable part of the discussion was devoted to these problems. Are we, or are we not, to imitate daylight in artificial lighting installations of the future? There seems to be some justification for the impression that modified artificial daylight is restful for the eyes, though the exact explanation is obscure; but a certain degree of care is needed to prevent the sensation of "coldness," and no one would suggest that lighting in future should consist in a slavish imitation of daylight. In certain arts, those of the theatre and the picture palace, for example, coloured light has special opportunities, for in such cases the novelty of the effects and the contrast with everyday conditions enthrall the senses. Illuminating engineers can do good service by devising more flexible and efficient methods of obtaining coloured light in abundance; but it will be agreed that the application of coloured light in the manner suggested above is an art, rather than a science, and those speakers in the discussion who contended that the successful production of pleasing colour-harmonies and contrasts is chiefly a matter of taste and artistic instinct were right, for no system based on mathematical formulæ, or physiological laws, can act as a substitute.

Electrical Research Finance.

Prefacing his reply to the toast of "The Institution of Electrical Engineers" at its largely attended annual dinner last week with the announcement that H.R.H. the Prince of Wales had consented to become an Honorary Member, which honour all sections of the profession and industry will appraise at its true value, Lieut.-Col. K. Edgcumbe, T.D., R.E.T. (Ret.), needlessly apologised next day at the luncheon of the British Electrical and Allied Industries Research Association for being on his legs again so soon; his happy manner of address always assures him a ready hearing, and in any case he rose to plead on behalf of a cause which no one can afford to neglect.

With its 16 main sections and 64 technical committees, the E.R.A. has during its eight years of existence won the recognition and wholehearted support of all grades of engineers and associations connected with the electrical industry, yet the Association has failed to attract sufficient financial support to enable it to tackle adequately the problems which confront it. While the Association has been able during the past year to maintain its expenditure without drawing upon its reserves, to remain within those bounds it has been again necessary to delay, and even to postpone indefinitely well-considered programmes of work, capable of bringing as good returns to the industry as any hitherto undertaken.

The rate of progress in any enterprise depends largely on the rate of expenditure: no section of the industry has benefited more from the work already completed than the electricity supply section, the investment in which cannot be much less than £300,000,000, its gross annual revenue being £45,000,000. As Mr. C. P. Sparks observed, would one-tenth of one per cent. of that sum be missed? Yet, if contributed to the E.R.A., it would provide all the funds needed for a full programme. Strange, indeed, how eager we are to commend, and withall how niggardly with the means of producing that which we can commend!

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Water-Power in Tasmania.

The Waddamana electricity supply undertaking of the State Hydro-electric Department has a plant capacity of 66,000 h.p.

THE Hydro-Electric Department of Tasmania was established for the purpose of controlling all the water power of the State, constructing hydro-electric works and operating them after construction. A survey of the State has resulted in a number of schemes being projected, with a total capacity of about 600,000 h.p., of which the Waddamana undertaking, of 66,000 h.p., is in operation and the Shannon station is under construction.

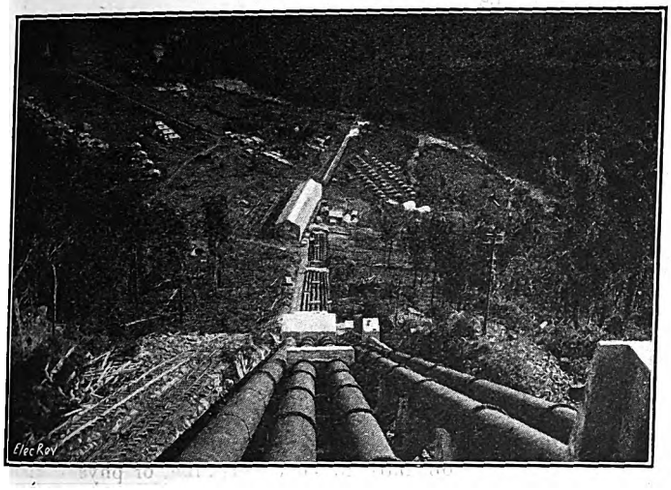

Fig. 1.—Pipe Line, looking Down.

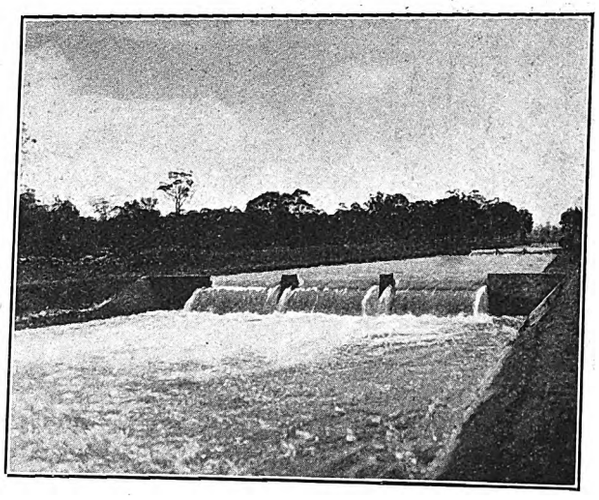

Fig. 2.—The Waddamana Canal.

The Waddamana scheme operates from the Great Lake of Tasmania, which has an area of approximately 60 sq. miles and an elevation of 3,360 ft. above sea level. The Great Lake is dammed by means of a multiple-arch concrete wall, fig. 4, which is claimed to be one of the largest of its type in the world. There are 27 arches, each of 40-ft. span, the central arches being 40 ft. high above the outlet sill level. Near the centre the structure is screened to protect the actual outlets from drift wood, and so on, and the outlets themselves are operated from behind the dam. The tops of the beams shown in the illustration rising above the water in front of the dam are the remains of an earlier dam now submerged. The lake is now full to within a few feet of the top, and contains three years' supply of water as an insurance against drought. Something like 1,150,000 acre-ft. of water is impounded.

The water from the lake is conveyed to the head of the pipe-lines leading to the power house by means of a canal 3½ miles long. At the near point in the illustration, fig. 2, the canal is 60 ft. wide at the bottom. The small "falls" along the canal were necessitated by the steep slope of the ground, as without them the water would flow fast enough to destroy the banks and bed of the canal. About 600 cu. ft. of water is passed by the canal per second, and the water is actually discharged into a lagoon of about 350 acres in extent, from which the pipes lead off. This lagoon acts as a settling basin, removing from the water grit which would injure the turbines, and also allows the turbines to take as much water as they require without regulating the head gates of the canal.

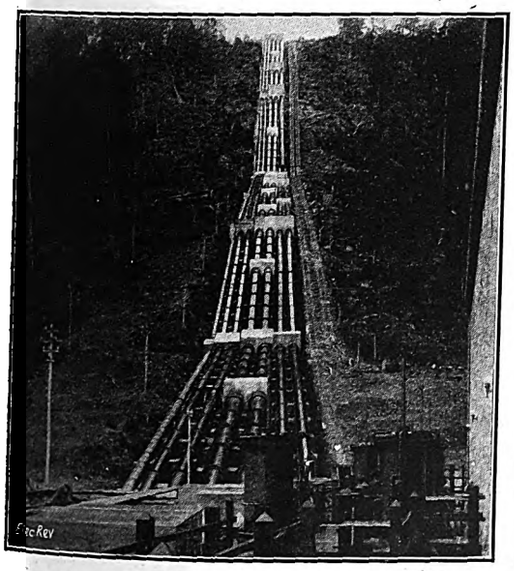

Fig. 3.—Pipe Line, from Station.

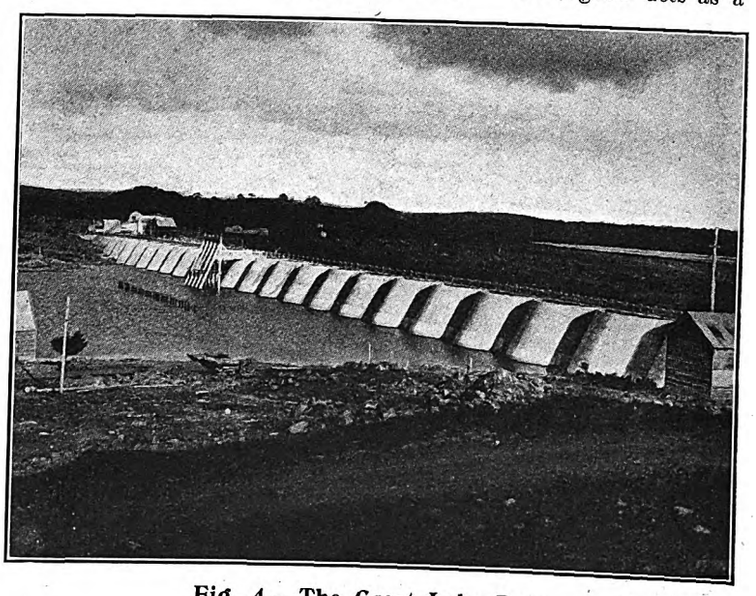

Fig. 4.—The Great Lake Dam.

Fig. 1 is a view looking down the pipe lines, showing the power house and the tail race in the distance. The

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two steel pipes on the right were installed in the early stages of the scheme, the other three pipes being added later. One of these is of wood stave construction and held together by screwed steel bands; this construction

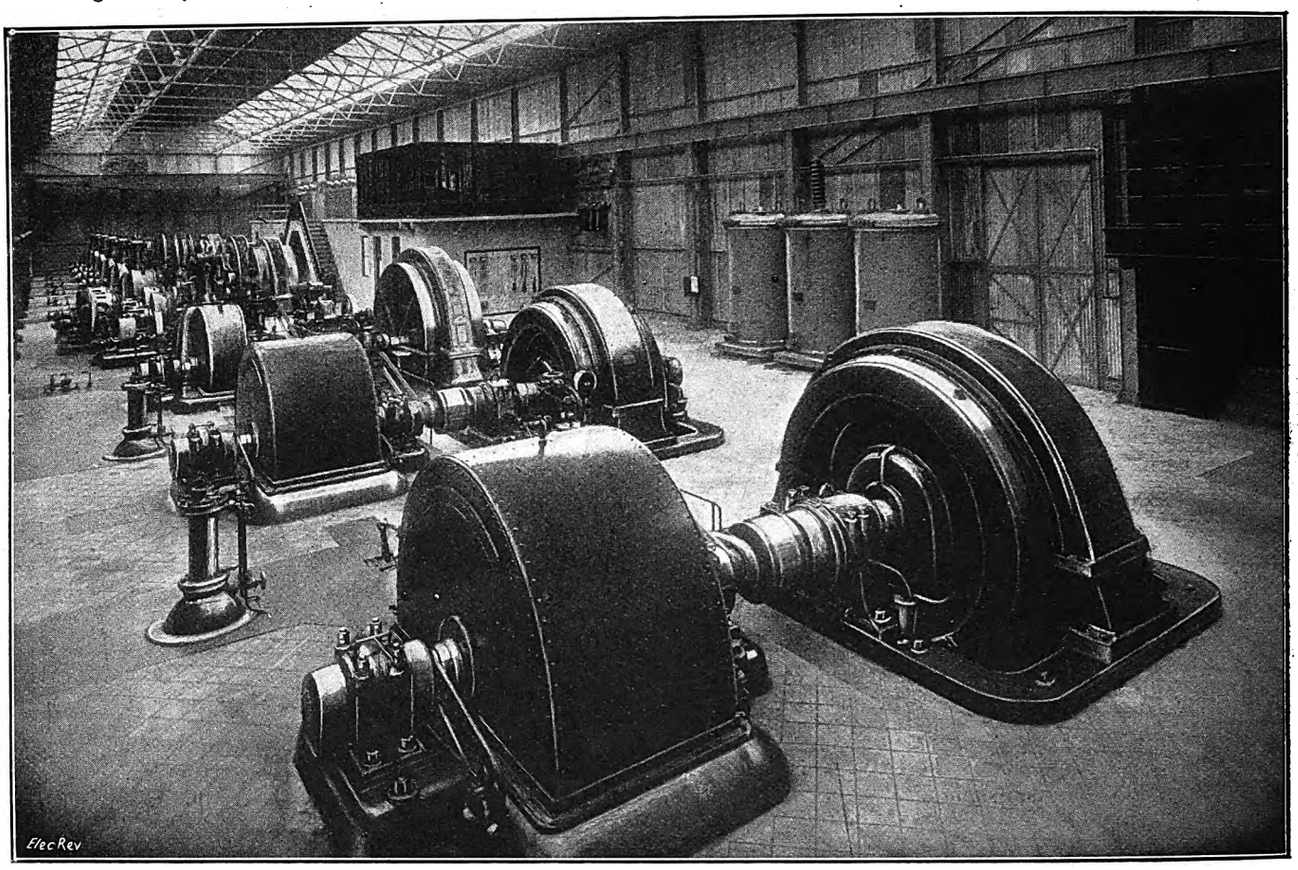

Fig. 5.—The Waddamana Turbine Room.

was necessitated during the war, when steel pipes were not procurable. All the pipes are laid above ground to facilitate inspection and repairs. The steel pipes are laid on concrete piers, and the wood pipe on wood logs spaced 4 ft. apart. The scattered houses shown comprise the village of Waddamana. Fig. 3 is a view

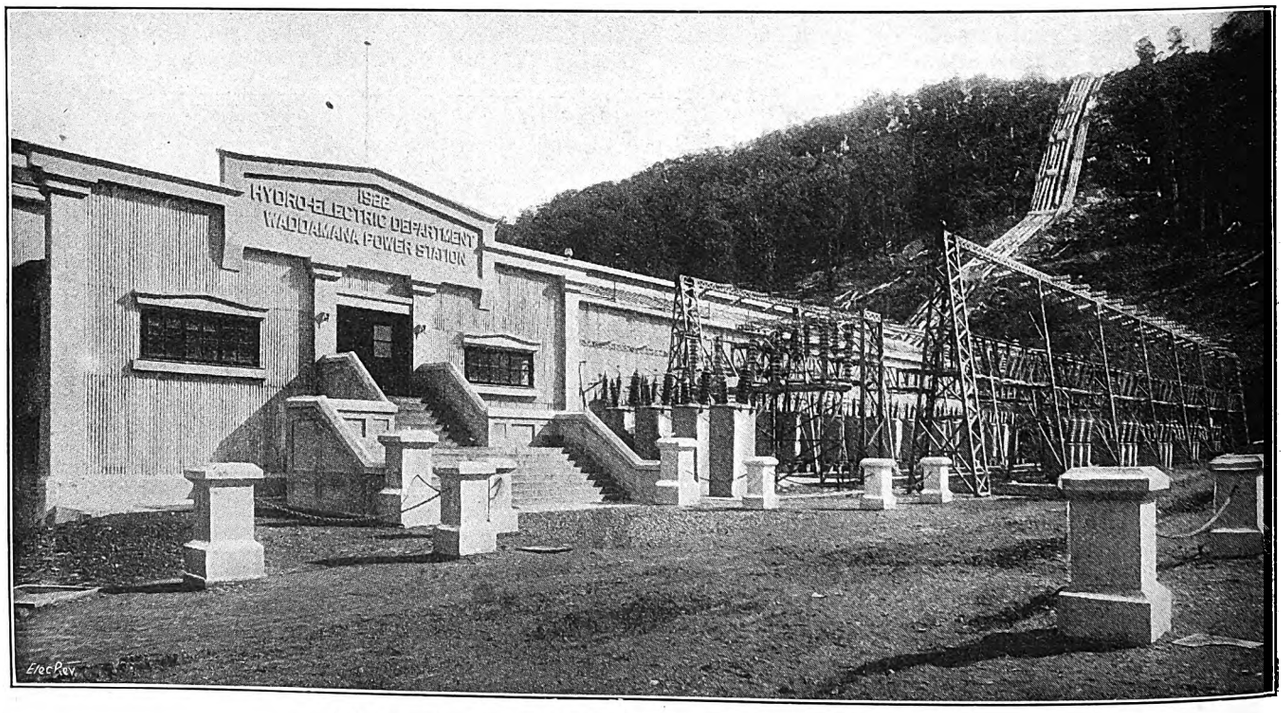

Fig. 6.—Station Exterior and Outdoor Sub-station.

of the pipe-line, looking upward. The large pipes at the lower end, where the water pressure is 500 lb. per sq. in., are 4 ft. in diameter and of metal 1 in. thick. All the pipes join into one common bus pipe 3 ft. in diameter, just visible on the right-hand side of fig. 3, where is also depicted the power-station wall. The bus pipe is equipped with the necessary valves, which are operated from the wood platform. The pipes are anchored at various points by means of concrete blocks.

The power station is equipped with nine turbine sets, fig. 5, which operate under a head of 1,120 ft. There are seven 8,000-h.p. double-jet Pelton-wheel turbines, coupled to 7,050-kVA alternators, and two 5,000-h.p. single-jet Pelton-wheel machines, coupled to 4,050-kVA alternators. The turbines were supplied by Messrs. Boving & Co., Ltd., the larger alternators by the General Electric Co., Ltd., and the smaller ones by the old

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British Westinghouse Co. The machines run at 375 r.p.m. and generate at 6,600 V, 50 cycles, 3-phase. The equipment is controlled from the glassed-in room shown in fig. 5, back left. A 25-ton electric crane serves the turbine room.

Fig. 6 is an exterior view of the station, showing the outdoor transformer and switchgear equipment by means of which the pressure is raised to 88,000 V for transmission. The power station is situated almost in the centre of Tasmania, and power is transmitted in the southerly direction by double-circuit lines carried on lattice steel towers to Hobart, a distance of 62 miles, and then a further distance of 15 miles to an industrial centre at North-West Bay on the River Derwent. Fig. 7 shows one of the transmission lines on the west side of the State. The Electrolytic Zinc Co. and the greater portion of Hobart and its suburbs are supplied at 11,000 V from a sub-station at Risdon, fig. 8, the terminus of the four 88,000-V lines going south. This "sub" has a capacity of about 55,000 h.p., and it supplies various consumers at 11,000, 6,000, 415, and 240 volts. Two 88,000-V lines also run northward, one terminating at Launceston and another at Railton in the north-west, and various feeders stretch out in all directions to the country districts where sufficient consumers are available. Power is delivered to the sub-station at Railton and stepped down to 22,000 V for delivery to Devonport, Sheffield, Penguin, Ulverstone and other towns. There is a further transmission line delivering power purchased from the Mount Lyell Mining and Railway Co. at 44,000 volts from Lake Margaret to Zeehan and Rosebery in the West-Coast District. A transmission line from Bothwell to Campbell Town, connected with the Great Lake scheme, supplies power to the midlands.

The maximum demand on the Waddamana plant in 1927 was 38,400 kW, the total connected load being 61,114 kW. The average load factor for the year was 94.2 per cent.

Among the many important industrial developments in Tasmania which are closely concerned with electricity supply may be mentioned the Mount Lyell mine where ore is obtained containing 0.5 per cent. copper, 1.5 ounces of silver per ton, and 0.04 oz. of gold per ton. Fig. 9 is a general view of Mount Lyell from the haulage summit. The haulage is used to transport the ore over the steepest part of the route, and a ground tramway line then takes the ore to the smelter. The haulage consists of a ground tramway track on which the trucks are raised and lowered by means of rope winding gear. The winding drums are driven by a 90-h.p. motor. One thousand tons of ore can be transported in 24 hours, the trucks being drawn at 1,000 ft. per min. Fig. 10 shows the Mount Lyell smelters where ore is treated. There are two or three blast furnaces which work intermittently. During 1926 nearly 45,000 tons of ore and concentrates were smelted. The photographs and most of the above information were supplied to us by Mrs. E. M. Storey, who has just returned from Tasmania, and their publication is made possible by the courtesy of Mr. G. H. Evans, electrical engineer to the Tasmanian Hydro-electric Department.

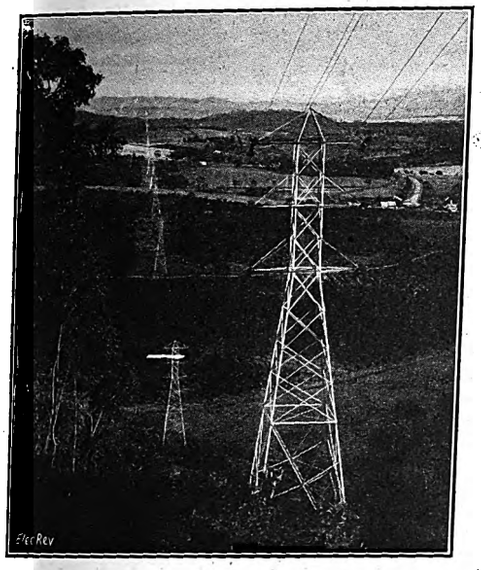

Fig. 7.—88,000-V Transmission Line.

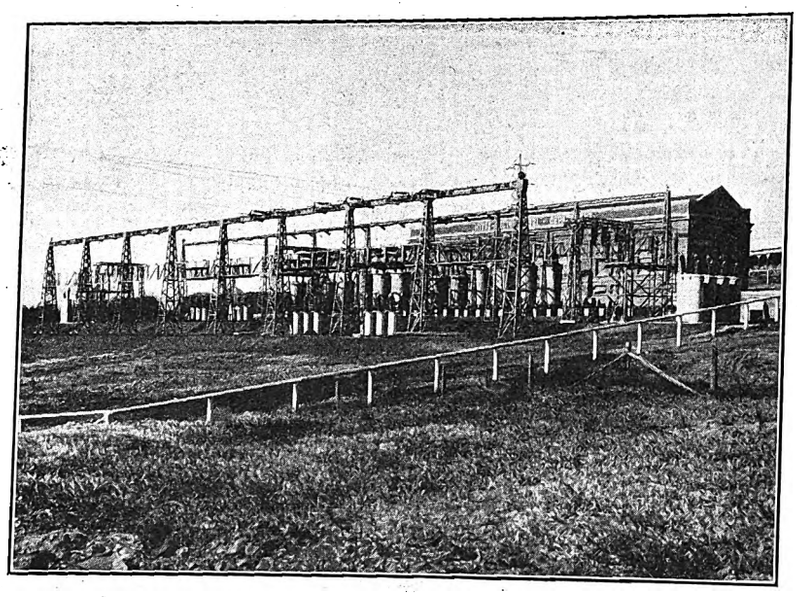

Fig. 8.—Risdon Sub-station; 55,000 h.p.

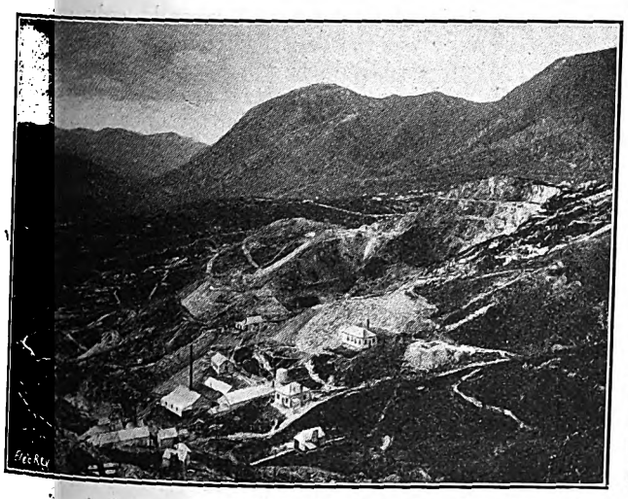

Fig. 9.—Mount Lyell Mine.

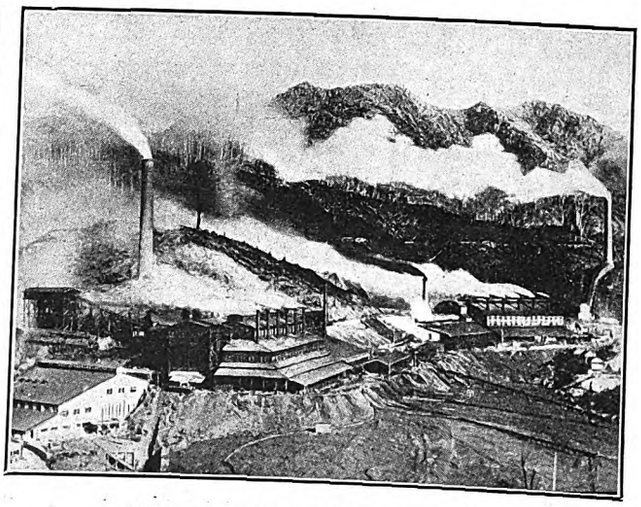

Fig. 10.—Mount Lyell Smelters.

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Switchboard Instruments.

A Review of Modern Practice in the Design and Use of Indicating Electrical Equipment.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

(*Concluded from page* 232.)

The overload capacity of the moving-iron instrument is probably greater than that of any other type, but the new induction instruments at least approach them, repeated overloads of a high order being insufficient to upset the calibration appreciably. In this connection it is of importance to note that moving-iron ammeters—as being more subject to overloads than voltmeters—can be made with a scale that is open at the middle of the range, and closes rapidly towards the top. If the normal load of a particular circuit is 100 amperes, an ammeter of range 0-200 A may be supplied which has its 100 mark at about three-quarters of the scale length, so that lower loads are read easily, and overloads up to 100 per cent. are still shown on the scale. This type of scale is most useful on circuits where overloads are prone to occur, and some makers make a speciality of this pattern. For fluctuations such as occur in power stations, this feature is certainly very desirable.

The range of a.c. instruments is probably not quite as wide as that of moving-coil instruments, except that the upper limits may be higher on account of the isolating properties of instrument transformers. For use with transformers, the standard ranges are 5 amperes and 110 volts, respectively, for an ammeter and voltmeter.* By this means a change of range is easily effected by exchanging the transformer, together with the re-scaling of the dial. Self-contained instruments are not usually easily altered, especially ammeters. A voltmeter may have its range increased, or decreased if it is not below about 50 volts, but ammeters are difficult to alter without fitting a new coil; generally it is best to return the instrument to the manufacturers.

Old types of moving-iron instruments were generally calibrated at, and supplied for a given frequency, and if for d.c. use as well they had two scales. Except for low-voltage ranges (say, less than about 50 volts), this practice is not now necessary, as any reputable ammeter or voltmeter is equally accurate over the usual power frequency range (25-100 cycles), and sometimes for d.c., but except in the case of recent instruments the latter does not always follow. Recent improvements, due to a large extent to the introduction of Mumetal or Permalloy in place of Stalloy for the iron in the field, have provided instruments which are of first-grade accuracy on d.c. as well as on a.c., and with the same calibration, and most makers are now producing or working on these instruments, but mainly for portable use at present, where the scope of multi-range and multi-frequency instruments is greater. For higher frequencies of the order of 300-600 cycles, such as are used for some radio transmitting stations, moving-iron instruments are possible, but they need to be calibrated at the working frequency, as eddy-current losses tend to become appreciable—as well as the increased hysteresis in the iron. The alternative is to use thermal instruments—preferably of the thermo-e.m.f. type.

Induction instruments will not read on d.c., and therefore must have a frequency error. It is not very great, however, over the usual limits of frequency variation, and with the new patterns on the market is negligible, especially for power-station switchboard use, where the frequency variation is generally very small indeed. For small isolated plants where frequency is not finely controlled, such as motor-alternator sets where the speed of the set, and therefore the frequency, depends on the load and other considerations, the frequency error of an old induction instrument may be more serious.

If a change of frequency is contemplated it is necessary to consider whether the instruments, apart from their transformers, will be suitable for the altered frequency. As the standard frequency in this country is 50 cycles, the required change would usually be either from 25 to 50 cycles, or 100 or less to 50 cycles; in either case a change of about two to one. With modern moving-iron instruments no alteration will be necessary, but very old voltmeters may need recalibration, especially if of a fairly low range. If induction instruments are in use they will be useless on the new frequency and are best dealt with by arrangement with the makers. They may possibly be used on an altered frequency if the range is changed at the same time, and in the same ratio, but this is rarely feasible, and is certainly a matter upon which the manufacturer should be consulted.

Dynamometer instruments should be quite satisfactory with an altered frequency.

Wattmeters are used extensively on a.c. circuits. They may be of the dynamometer or the induction type; the former is usually more accurate, but the scale arc is restricted to about 90 deg., and so where uniformity with long-scale (300 deg.) ammeters and voltmeters is required, the induction type has to be used. As for ammeters and voltmeters, until recently only second-grade accuracy was the best that could be attained, but now that improved induction wattmeters are available the type is reviving. Wattmeters are necessarily bulky, especially the three-phase pattern for unbalanced load, and it is doubtful if any instrument will be produced in the 3- or 4-inch size to match the small ammeters and voltmeters of those sizes which are used on some control boards.

Temperature and frequency errors can be reduced by correct compensation as for the corresponding ammeters and voltmeters, and the instrument transformers, if any, used with wattmeters need to have a lower phase-angle between primary and secondary vectors than can be the case for voltmeters and ammeters, which are unaffected by phase-angle errors. When installing wattmeters of fairly high voltage range without transformers, it is desirable to connect, if possible, so that the difference of potential between the current and potential coils is a minimum, to minimise electrostatic attraction between the coils.

Frequency indicators are necessary in any a.c. supply station, although only one or two are generally required. Recently a master-clock arrangement for maintaining a constant frequency has been brought out, and its adoption should proceed apace, as correct frequency is of great importance to interconnected stations. Deflectional frequency indicators are generally preferable to the reed type, mainly on account of their continuous scale, that of the reed type being essentially discontinuous; and for ease of reading, the

* Ratings from B.S.S. No. 81-1927.

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scale of the deflectional type being more nearly like that of other indicating instruments in appearance. The limited range required, however, usually restricts the scale arc to about 90 deg., and there is thus no real scope for a very long scale, except, possibly, for laboratory use, where the frequency range to be covered may be between wide limits, and for portable instruments.

One or two synchroscopes in a station are all that are required, and it is preferable that these should be of a large size, and easily visible from a distance, if necessary. There is not much variety of type on the market; most are of the revolving-pointer type and intended for working in parallel with voltmeters across potential transformers. Lamps are useful as a stand-by, but are obsolete for all except the smallest installations or laboratories, and the question of synchronising "bright" or "dark" is by no means settled, both methods being advocated and in general use.

Power-factor indicators of the "complete circle" type are most used, the movement being unconstrained and capable of a full 360 deg. motion. They are especially useful for installations where a particular machine may generate or motor under certain conditions. These are essentially circular-dial instruments, unlike those of limited range, which are often of the edgewise type.

Graphic instruments on an a.c. switchboard are not numerous, as a rule, and are generally confined to one or more voltmeters, and, when called for, to wattmeters, both single-element instruments for single-phase and three-phase balanced load and double-element instruments for three-phase unbalanced load (sometimes used for feeders for recording the loading), reactive current indicators, for showing the wattless component, EI sin ϕ, as against the true watts EI cos ϕ, and to power-factor and frequency recorders.

Instrument Transformers.

The use of instrument transformers, for both current and voltage, is now so common that manufacturers provide numerous types and sizes for different purposes, and there is a British Engineering Standards Association specification defining their use (B.S.S. 81—1927.) Current transformers are used, not only for indicating ammeters, but for wattmeters, power-factor indicators, and relays, whilst voltage transformers similarly are used for wattmeters, power-factor indicators, frequency indicators, synchroscopes, and relays. Frequently a number of instruments, often a combination of the above, are operated by a single instrument transformer, to save expense. Where this is the case, it is necessary to choose a transformer of suitable "burden" or secondary load. Where integrating instruments are used it is often better to run them from separate transformers, and this is particularly the case if relays are used as well, as the alteration of volt-ampere burden due to variation in the position of the relay may interfere with the accuracy of a meter which may be used for revenue purposes.

The errors of instrument transformers are of two kinds, ratio and phase angle. For operating ammeters and voltmeters, and some types of relay, the ratio error only is of moment. For other instruments using a combination of current and voltage elements it is necessary that phase-angle errors are within certain limits.

For current transformers certain ranges are standardised, and the following are the standard ratings.*

Class "A."—Portable precision type, 7½ VA.

Class "B."—Switchboard and portable industrial type for close accuracy, 5 and 15 VA.

Class "C."—Switchboard and portable industrial type for ordinary industrial requirements, 5, 15 and 40 VA.

Class "D."—Switchboard and portable industrial type where phase-angle error is unimportant (ammeters, &c.), burden not exceeding 40 VA.

The usual frequency rating is 50 cycles; other frequencies are specially marked. If, however, it is required through change of station frequency or other reason to use a standard 50-cycle transformer on a different frequency, or a non-standard on 50-cycle the following may be considered. The change in burden is approximately proportional to the frequency, but at a reduced frequency the burden should be reduced still more, so that if a 100-cycle instrument transformer is to be used on a standard 50-cycle circuit it should supply a burden of not more than 40 per cent. of its original rating. Class "A" transformers thus have no applicability to switchboards, and Class "D" a very limited application, as the permissible errors are approximately equal to those of second-grade indicating instruments (for a.c.). Approximate figures are given later for the consumptions of various types of instruments for calculating the burden on a transformer. Ammeters and current coils are, of course, connected in series across the secondary of the transformer. The accuracy of current transformers is generally unaffected by change in frequency over the usual power range. Some makers refer to Class "A" or "B," &c., in different terms, but the above are the standard B.E.S.A. definitions.

On e.h.p. circuits where the transformer is for isolating purposes only it is necessary that the transformer should be able to withstand a high voltage between primary and secondary, and for this reason and because the primary should be of small reactance in order not to break down on short circuit, the use of straight-through or single-turn transformers is very desirable.

In the past it has not been permissible to use less than about 400 ampere-turns for a Class "C" transformer primary and 800 for Class "B," in order to maintain the accuracy, but lately transformers using nickel-iron cores have been introduced for very much smaller currents, and are satisfactory, where only an ammeter or an ammeter and relay are used. Class C is less suitable for use with instruments where phase-angle error is of consequence. In any case the difficulty of maintaining the accuracy as the primary voltage increases is greater, as although the pressure drop in the transformer is low, the insulation must provide for the full voltage to neutral of the system. This generally necessitates a larger core and consequent trouble due to stray fields, as well as extra losses due to the larger quantity of iron involved.

Voltage Transformers.

These are rated somewhat similarly to current transformers, the types being as follows:—*

Class "A."—Portable precision type, 10 VA, single-phase.

Class "B."—Switchboard and portable industrial type, 15, 50, 100, and 200 VA for single-phase and 25, 50, and 100 VA for three-phase.

Class "C."—Switchboard and portable industrial type, for ordinary and industrial use, burdens as for Class "B," above.

Class "D."—Switchboard and portable industrial use where phase angle is of no consequence and a large ratio error is permissible, no standard burden.

As with current transformers, Classes "B" and "C" have most application on switchboards. The frequency range of voltage transformers is limited, the standard transformer for 50 cycles not being suitable beyond the limits of 45 and 100 cycles.

A change of frequency from 50 to 25 cycles thus requires new potential transformers, but if from 25 to 50 cycles, as is more likely, the 25-cycle transformer will generally be suitable. The actual permissible frequency depends on the maker, and it is best to consult

* (Abstracted by permission from B.S.S. 81-1927, Instrument Transformers, official copies of which may be obtained from the British Engineering Standards Association, 28, Victoria Street, S.W.1. Price 2s. 2d., post free.)

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the maker if a transformer is to be used on a frequency different from that marked on it, or 50 cycles.

Consumption of A.C. Instruments.

The actual consumption for any particular type varies widely with different makes, and different patterns by the same maker, so that only very wide limits can be stated here. More detailed figures are available, either from a manufacturer's list or from him directly. An approximate idea of the consumption of instruments is necessary when transformers are used, otherwise the consumption is immaterial. The rated burden (or load) of an instrument transformer is that at which the prescribed accuracy is obtained, with other fixed conditions. This burden may be increased by a considerable amount, but the accuracy then falls off somewhat. The following consumptions are representative:—

Moving-iron voltmeters, about 4-10 volt-amperes per 110 volts; ammeters up to about 300 amperes, about 2-4 volt-amperes; induction voltmeters 3-15 volt-amperes per 110 volts; ammeters 5-12 volt-amperes for a 5-ampere instrument; dynamometer voltmeters, ammeters, and wattmeters, consumption depends entirely on the range, being as large as 100 volt-amperes for a range of a few hundred volts.

The consumption of different types of relays varies considerably, and the following table is based on B.E.S.A. specification 142—1927, Electrical Protective Relays:—

Type	Over-current or under-current.	Over-voltage or under-voltage, at 110 volts.
Induction	20	—
A.C. other than induction	0·15—20	20
D.C. moving-coil	0·2 volt on shunt	5
D.C. motor pattern, 5 amperes, instantaneous	0·2 volt on shunt	—

A.C. DIRECTIONAL RELAYS WITH VOLTAGE WINDINGS.

Type.	Current winding.		Voltage winding.	
	Voltage compensated	Non-voltage compensated	Voltage compensated	Non-voltage compensated
A.C instantaneous or time lag	3	2	25	15
A.C. combination of over-current and directional relays	10	6	25	15

The figures refer to volt-amperes, and are per phase in the case of polyphase relays.

Electrolytic Copper Extraction.

Some Notes on Modern Current Theory and Practice.

(Specially Contributed.)

THE current arrangements required for the electrolytic extraction of copper have changed considerably since the introduction of the process, although the basic principles remain unaltered. Electrolytic processes are now used for extracting copper from alloys and waste material which previously were regarded as being unworkable. Poor ores which required very complex treatment can now be successfully handled by an almost direct system, and it is claimed that before long electrolytic processes will supplant all others, both for efficiency and for economy. The following notes relate to the current employed, after the raw material has been suitably treated.

To produce good copper, the solution must circulate as rapidly as possible, since the metal deposited at the cathode is purer and more malleable the more actively the liquor is circulating. When the solution is not in motion, it becomes richer in copper at the anode, but poorer at the cathode. The poor solution rises in the bath, and thereby a layer of liquor offering great resistance is introduced into the circuit; in this way an opening is made for other metals to be separated along with the copper. The solution diminishes in conductivity (as it becomes neutralised) at such a rate that with unaltered conditions and using electrodes two inches apart, the difference of potential in the bath may rise from 0.1 volt to 0.25 volt. Foreign metals interfere with the reaction, and the current density no longer suffices to decompose completely the copper solution in the required manner, a certain proportion of cuprous oxide being deposited at the cathode. This is remedied when the solution is acid, as the oxide is redissolved and again deposited by a secondary reaction; neutral solutions, however, leave this deposit in the copper on the cathode, and hence the product remains less pure.

A table has been compiled for electrolytic operators, showing the influence of the solution upon the difference of potential in the bath.

Regarding the relation which exists between strength and voltage of the current, the same weight of copper is deposited by a current of high strength and low voltage, as by one of low strength and high voltage, the ampere-hours remaining unchanged. The current density per square yard of electrode in present-day practice is about ten times what it was when the process was introduced, and it is greater for a pure copper anode than for an impure one. Liberal allowance has still to be made when calculating the energy required, as losses arise from various causes.

By theoretical calculation there should be one ounce of copper deposited per ampere-day, but in practice the actual amount is much less. This is due to the redissolving of some of the deposited copper, short-circuiting, and leakage to the ground. Up to about 1 per cent. of copper is lost by re-solution of the cathodes; leakage losses are about 1 per cent., and short-circuiting losses about 5 per cent. of the total. On the average, the efficiency of the current is between 90 and 95 per cent.

The total tank resistance is the subject of controversy between numerous electrometallurgists, but is generally accepted as showing about 60 per cent. for the electrolyte, whilst the metallic resistance and contacts make up the remainder, including about 5 per cent. for counter electro-motive force.

The number of baths to use, and their dimensions, can be selected to correspond to the current strength and voltage, after the production and power have been determined experimentally. The volume of the baths can be calculated when the distance between the electrodes is known. In each bath the surface of the electrodes is the quotient of the total current strength by the current density.

Originally very-low-voltage dynamos only were used, but these have been superseded by machines having a voltage upwards of 200 volts. These necessitate the use of a purer anode copper and continual purification of the electrolyte. With low-voltage machines short and thick leads are required, and the operations generally are much more liable to be disturbed by any undue

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increase of resistance in the baths than where higher voltages are employed.

There are two main systems used in the electrolytic refining of copper: the parallel and the series. These correspond to the arrangement of the electrodes and the claims made for the parallel system are that it is applicable to all grades of copper, permits of the use of both high- and low-current densities in lead-lined baths, and can be conducted with a minimum loss of current.

In the best series systems at present in operation, the quantity of copper in the baths is smaller, which is an advantage over the parallel system: The electrodes are not so massive, and are placed closer together; the copper dissolves more rapidly, and the whole plant is smaller. Against the series system may be pointed out the necessity of using good copper and electrodes, which must be rolled. The voltage between anode and cathode must be high, and the loss of electrical power is considerable. Owing to the high voltage and the risk of short-circuiting, the usual lead-lined baths cannot be used, and where wood baths are substituted they are readily worn out of commission. With the parallel system, the tanks are constructed of various dimensions, but the bottom must be far enough below the lower ends of the electrodes to prevent any short-circuiting through the deposited mud. The cathodes are smeared with oil, paraffin, or petroleum ether and the edges with paraffin to facilitate the removal of the deposited copper.

The points of contact must be above the surface of the liquid or protected from the electrolyte by a layer of paraffin. For many different current-densities employed it has been found most satisfactory to use electrodes two inches apart, which distance appears to be generally accepted throughout the world at the present time.

Catalogues.

The Author considers that their First Essential is Convenience both for the Estimator and for the Buyer.

By H. R. TAUNTON.

FEW business firms require and receive more catalogues than electrical contractors. From alternators to zincs, from silk shades to telegraph poles, their needs on occasion are all those of the builder, the furnisher, the civil engineer and a dozen other trades. Of necessity they are always asking for catalogues; and for every one they ask for they receive a score unasked. Every morning's post is heavy with them. Encyclopædic catalogues, under whose impact the wicker of the waste-paper basket squeaks in protest; expensive catalogues, whose consignment to it wrings the frugal soul; artistic catalogues, cheap and nasty catalogues, catalogues fat, and thin, and limp, and squat, of every size and shape; all the small fry of pamphlets, folders, leaflets, circulars and posters; they are doomed, nine out of ten of them, to the same inglorious end—the dustbin.

A certain number of them the contractor must keep. He must therefore adopt a process of rough selection, and the net result follows the great law of the survival of the fittest. Now, since every maker or factor who issues a catalogue does not do so to amuse the leisure of his publicity man or to foster the printing trade, but in the hope that it will bring him orders; and since that hope is contingent on its being kept and used; it is clearly of importance to him to know, and to embody in it, those points which will secure it the greatest expectation of survival. Those points are not those which delight the compiler and the printer, such as artistic paper and type, or original details of design and format, but only the two points which appeal to the user: utility and convenience.

The point of utility need not be discussed. Naturally every publisher of a catalogue considers it not merely useful but a necessity; and naturally, too, he uses a certain discrimination in issuing it. He does not send price-lists of turbines to a tobacconist, or of electric fires to a gas company. He sends them to those whom he thinks most likely to buy the goods he sells. The final arbiter, however, is the man who receives it. An electrical contractor will not keep a catalogue of saxaphones. He may or may not keep a catalogue of electric signs, but he is more likely to discard it until he has a definite inquiry. He will welcome almost any fittings catalogue, because he is always lending them and losing them. For the rest, what he keeps and what he throws away is largely a matter of inertia. The new catalogues of firms with whom he usually deals go to his shelves as a matter of course, and long custom or trade friendship may induce him to use them even if they are badly compiled. The catalogues, too, of well-known firms, whose goods are commonly specified, he will generally keep, if only for reference. But for the others, innumerable, only those have any chance of survival which can make an immediate appeal by their obvious convenience, just as, out of the many salesmen who besiege him, only the ready and informative have any chance of a useful hearing.

A convenient catalogue, one which is kept and used, is in effect the manufacturer's best salesman. In these strenuous days any contractor to whom it is worth sending an expensive list works under the constant pressure of the clock. He has not time to waste in searching for a price-list which by reason of its faulty make-up has lost its place on a crowded shelf; nor having it, can he afford minutes to find the particular item he needs. Of several catalogues dealing with similar goods he will tend more and more to use that which jumps most readily to his hand, and in which he can find most quickly what he wants, with all its relative information.

This is more particularly the case in the estimating department. When he has secured an order the contractor can afford the little time needed to weigh the merits of competitive makes against their prices. When he is estimating, working feverishly against time, he will, as far as possible, use only those lists with which he is familiar, which will give him the information he wants in the least time and with the least trouble. In other words, he will use the most *convenient* catalogues. Then, having adopted a certain maker's patterns and prices in his estimate, he will more often than not follow the line of least resistance when he secures the contract, and place the order with the same maker. From the maker's point of view, to have his products included in a contractor's estimate is half the battle (so far as that particular contractor is concerned). It follows, then, that those makers will get the best return on their publicity expenses who compile their catalogues with an eye to the convenience of the estimator.

Take, for example, cables. The first manufacturer who thought of issuing a net price-list of standard types of cables conferred an inestimable boon on estimators,

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saving them the laborious calculations of pounds-per-mile to pence-per-yards, with a couple of discounts. His example has been followed by all the other cable makers, and no contractor now uses their larger catalogues except for special types of cables. Their net price-lists are all very much alike; but each estimator uses that only with which he is most familiar—to him the most convenient—and almost invariably he orders, when the time comes, from the firm whose list he used. With a standardised article such as cable there is no reason why he should give his choice a second consideration. The same principle applies in varying degrees to other goods. The estimator uses that catalogue which he personally finds the most convenient, and naturally turns first to the same catalogue when he has to place an order.

What, then, constitutes that "convenience" which so appeals to an estimator? The question may be considered under two heads: convenience in filing, and convenience in use.

The manufacturer who wants his publications kept must make them easy to keep. Awkward shapes and sizes, and eccentricities in format, are a nuisance on a bookshelf. Folios and sexto-decimos, narrow books and books broader than they are high, which will not keep their dressing in the row, are anathema; as are the anæmic volumes which persist in losing themselves between the pages of a stouter neighbour. On the other hand, such a massive tome as that issued by one of the leading firms, though useful for occasional reference, is useless to an estimator because it is too heavy to be easily handled.

There is no reason why catalogues should be of more than two sizes, quarto and octavo; and of these the latter is the more convenient. It depends, of course, on the amount of matter to be listed, but generally a stout octavo is better than a flabby quarto. And the only excuse for any size smaller than octavo is that the matter is insufficient to make a reasonable number of pages in the standard size, *e.g.*, in the case of the net price-lists mentioned above.

Next in importance is the binding. Thin paper covers are useless; or any cover which will not stand the hard usage of a busy office. Every catalogue should have a binding, whether boards or cloth or manilla, stiff enough to allow it to stand on its own bottom. A thin quarto which collapses as soon as an adjoining volume is removed, infallibly gets crumpled under it when it is returned, or else crushed out of sight behind it.

Again, if the back of the book is not wide enough to carry a title, as is often the case, some other means of distinguishing it at a glance is essential. Nothing is more irritating to a hurried user than having to finger a shelf-full of slim, neutral-tinted booklets which can only be told one from another by examining their covers. Something more original than the usual browns and greys is wanted; and such devices as a different coloured stripe or a projecting tab quickly impress themselves on the memory of the user.

In short, so far as convenience in filing is concerned, the publisher's aim should be to ensure that his catalogue will stand stout and upright where it is put, and be easily found there when it is wanted.

Turning next to convenience in use, his aim should be to assist the estimator to find quickly the item he seeks, give him succinctly all the information he needs about it, with price and discount, and offer him, if he wants it, any possible alternatives. That sounds very obvious and simple, and yet how many compilers fail in it. (I should like here to pause and praise the few who succeed, and I should love to pillory some of the many who don't; but as I should certainly get for my pains more bricks than boxes of cigars, I resist the temptation.) No two catalogues of accessories, for instance, agree on the sequence in which their items are listed: in many, indeed, it is hard to trace anything which could be called a sequence. I have in mind one catalogue in which the arrangement has evidently been dictated solely by the size of the blocks. There are, of course, certain classes of goods where any rational sequence is difficult—but there is always the alphabetical on which to fall back. An index is no substitute for a definite, easily-remembered arrangement. Indexes, indeed, are essential, both numerical and nominal—and how often one or both are missing!—but the hurried user will not refer to them if he can avoid it. He usually finds it quicker to flip over the few pages where what he wants ought to be. And if he can't do that, he tends to use some more convenient catalogue.

Anything, therefore, which will assist his search counts enormously towards the efficiency of a price-list. In the case of a bulky catalogue, a thumb index, tabs, or tinted sections are useful as minimising the original defect of bulk. Clear type, liberal spacing and bold headings—which should be at the outer edges of the pages—all help. Most of all do illustrations help. There can hardly be too many: not only for the information they convey, but for the aid they give in finding their attached letterpress. A picture of a lampholder not only gives at a glance more detail than a page of print, but it catches the hastening eye in a tenth of the time it takes to apprehend the title, "Lampholder." Economy in blocks is fatal to the chances of a catalogue. Everything that can be illustrated should be illustrated, in all its varieties—and not with the block made for the pattern of the year before last!

Finally, when the required item is found, comes the important point of its price. One would think that nothing could be simpler than to attach a plain and unequivocal figure to every article listed. Even the untutored costermonger can do as much for the bananas on his barrow but not the average compiler of an electrical catalogue. Some tabulate their figures horizontally, others vertically, many both ways, at hazard—with catalogue numbers strewn erratically among them. The illustration may be at one corner of a page and the price at another, or even on the opposite page. One well-known maker of accessories, whose list is well compiled and illustrated, refers the estimator to a separate booklet for his prices. Nearly every maker insists on pricing all but the largest items in quantities: in hundreds, grosses, or dozens. They argue that the buyer commonly buys in quantities—or they would like him to. The wise contractor, however—particularly in London—prefers to buy no more than his exact requirements; and the estimator, whom we are here considering—and the catalogue compiler is not—almost always wants a price for odd numbers. Why should he be put to the trouble of the extra calculation?

That brings us to the question of discounts. Pricing an estimate from catalogues is a long whirl of mental arithmetic. The discounts vary with the catalogues; in some—necessarily in factors'—they vary in different sections. One or two of them offer a code against each page or item; others carelessly refer the user to a separate table. None takes any further trouble to relieve him of the irksome and recurrent labour of reducing their printed figures to actuality.

I believe the E.C.A. is averse to any extension of the practice of the cable makers in issuing net price lists. Their argument is that they may fall into the hands of non-trade users. Why should they any more than do the cable lists? What layman, for instance, is likely to ask to see a conduit list? In certain cases, admittedly, it would not be so easy to divorce the prices from the full descriptions—say, in the case of fittings—but some compromise might be attempted. It would be something if the compilers left a definite space opposite each figure where the estimator could write the net figures as he calculates them. As it is, he jots them down as best he can in the margins—and quite callously, by the way, takes the risk of his secrets falling into the hands of the uninitiated.

Let us suppose, after so much criticism, that the contractor has a selected library of good and useful catalogues. Then arises the problem of keeping it up to date. A very difficult problem. It is one primarily for the publisher, torn between efficiency and economy. He should not expect any help from the user in its

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solution—why should the buyer in an open market help the seller in his selling?—and yet he persists in doing so. A universal electrical provider sends him sectional reprints and asks him to remove the old from their elaborate folder and bind in the new. Folders, apart from their defect of bulk, have the further defect that they handicap classification. A folder containing sections dealing with switchgear, fittings, wireless, and what not, belongs nowhere; whereas, divided, each section can be filed in its appropriate class. A manufacturer of switches and wall sockets sends him a bundle of loose leaves and expects a typist to be detailed for an hour's work in placing them. A firm of conduit makers sends a sheet of revised prices which can only be folded up and placed in the covers of his catalogue, whence—if it ever gets so far—it is presently lost. Yet others send, every few weeks, folders, leaflets and printed slips, with or without adhesive, to be fixed in their scattered publications. To cope with the daily "literature" in a busy contractor's office on the lines confidently suggested by its senders would mean the half-time services of an intelligent clerk. All these attempts of makers to keep their catalogues up to date without going to the expense of a complete reprint depend on the co-operation of the users; so they are doomed to failure. The average contractor has not the time to act as an honorary librarian, and, if he had, he has not the inclination. He has the average human component of inertia, and he finds it easier to use the waste-paper basket.

The manufacturers' point of view demands a certain sympathy. He cannot be continually issuing new editions of his catalogue with every new development and every fluctuation in price, yet at the same time he must supply his customers with the latest information about them. He will not, however, satisfactorily or permanently solve the problem by any means which puts a tax on their energy and goodwill. His best chance, as things are, is to secure that goodwill by a catalogue which may so far work its way into their favour as to induce them to take a little—but only a very little—trouble with it: the trouble, for instance, of handing it to a representative who would then and there make the necessary revisions in it; or of returning it, facilities being provided, in exchange for a corrected copy. That would entail on the publisher a certain amount of work—but it would be no more than he now expects his customer to do for him.

It would cost him something, too; but little more than his present methods, and there would be a known return for it. That little more, and something over, he could save by cutting out all the odd magazines, booklets, folders and pretty-pretty publications with which he now overwhelms us. An excellent thing, postal publicity, but to-day a little overdone. The bulk of it is waste paper and serves rather to irritate than amuse us. We can, if we choose, ignore a newspaper advertisement, but we are put to the trouble of handling and disposing of the rubbish which clutters our mail. Certainly to electrical contractors one good catalogue—that, I repeat, means a catalogue designed as much for the estimator as for the buyer—is worth a year's output of the "literature" of the whole electrical trade. That doesn't appeal to the busy estimator. What does, is a catalogue which saves him time and useless work. And the buyer follows in his footsteps.

The South Wales University.

Some Electrical Features of the Laboratory and General Equipment at the New University at Cardiff.

There are some interesting points in connection with the electrical installation at the new South Wales University, at Cardiff, which has now been in operation for some months, and has, it is claimed, fulfilled all the requirements and given every satisfaction.

The new buildings, which were designed by Mr. W. D. Caroe, comprise physics, chemistry, botany, veterinary and agricultural laboratories, in addition to a lecture theatre, workshops, professors' rooms, and so on. The whole of the buildings and equipment are on the most modern and up-to-date lines, and are believed to form one of the finest laboratory blocks in the country.

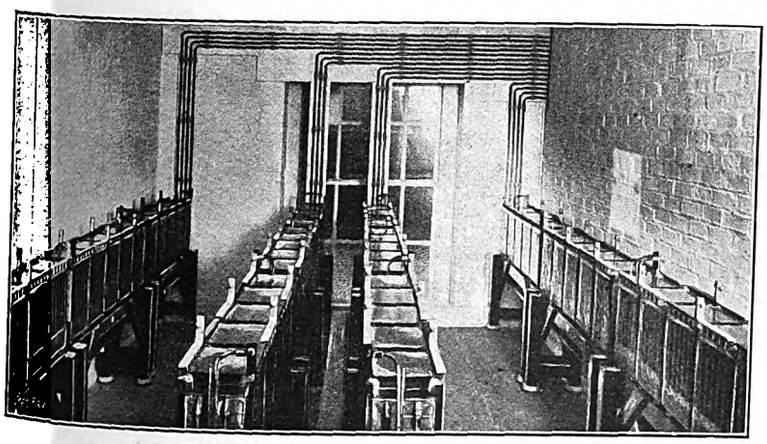

Fig. 1.—Physical Laboratory Battery.

The general electrical installation, which was carried out under the supervision of Mr. S. E. Thornton, includes circuits for lighting, power, ventilating, lifts and the experimental section, current for which, both a.c. and d.c., is obtained from the Cardiff Electricity Department. V.i.r. cables in solid-drawn conduit with iron-clad switchgear, switches, and plugs, are used throughout, with the exception of the Memorial Research Block, where, owing to the nature of the experiments carried out—magnetic research—the wiring is partly lead covered and partly v.i.r. in heavy-gauge copper tube, with phosphor-bronze boxes and wood-cased switchgear.

The centre of electrical interest is the experimental section, in which, for the Physics Department, is the following equipment: a Pritchett & Gold battery consisting of 14 banks of 5 cells of 250 ampere-hour capacity each; a 10-kW motor-generator for charging two or more banks of cells; a booster for charging individual banks of cells; and a main switchboard, laboratory exchange switchboards, and terminal connecting boards. Fig. 1 is a view in the battery room, showing the cell runs. These are served by 7/.064 twin "Maconite" cables supported on porcelain button insulators affixed to a teak facia board.

The main switchboard, which was manufactured and erected by Messrs. A. Dean & Co., Ltd. (the contractors for the whole of the electrical installation) under the supervision of Messrs. Arthur Ellis & Partners, consult-

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ing engineers, is, it is claimed, practically fool proof, and designed for extreme flexibility. It is of the open type, 22 ft. in length, and contains control panels for the motor-generator and booster, reception panels for the d.c. and a.c. mains supplies, and main distribution panels. The board is designed to enable two or more banks of cells to be charged from the motor-generator, or from the d.c mains supply through a variable resistance, and for charging single banks of cells from either the booster or mains supply.

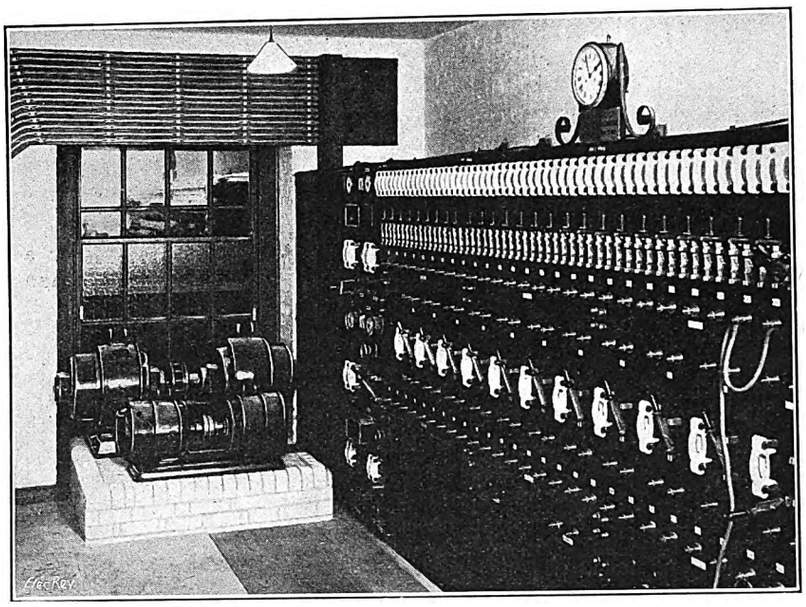

Fig. 2.—Main Switchboard, Motor-Generator and Booster.

Change-over switches are provided to enable current to be taken to the laboratories from the battery, or direct from the generators or mains supply, both d.c. and a.c., at one and the same time, and at any voltage from 2 to 250 V. Each bank of cells is connected to two pairs of heavy terminals on the board, and connection is made to the outgoing terminals by means of heavy rubber-covered flexible leads, the necessary voltage being obtained by closing the single-pole series switches. Fig. 2 is a view of the main switchboard, depicting the method of connection by the flexible leads, and also of the motor-generator and the booster. The distribution to the laboratories is by means of thirty-two pairs of 7/.052 cables, each protected by a d.p. switch and fuse, terminating in an exchange board. These exchange boards, which vary in size according to the requirements of the laboratory in which they are fixed, are equipped in a similar manner to the main distribution switchboard panels, and in all cases the number of outgoing pairs feeding the terminal boards is at least twice the number of the incoming pairs from the main switchboard. This provision is made as it frequently happens that two or more students at one time carry out similar experiments. Interconnections are made by means of rubber-covered flexible leads as previously described.

The chemistry department is equipped with a similar installation, but on a smaller scale, which consists of a 2-kW motor-generator, a 60-Ah battery, and a main switchboard, comprising motor-generator control panels and distribution panels, together with a subsidiary panel for charging portable accumulators—which are used by the Professors for research work—from either the motor generator or mains supply. The operation of this switchboard is on similar lines to that in the physics department, as described above.

An interesting view of one of the physical laboratories is given in fig. 3, which indicates, as does the other illustrations, the particularly neat general wiring, and shows some of the special switching arrangements. On the left side of each of the two rear "pillars" is a variable-voltage connecting board, while 5-A lighting plugs are arranged on the fronts of all three pillars. The wall plugs at the back are for lighting and d.c. and a.c. power, respectively.

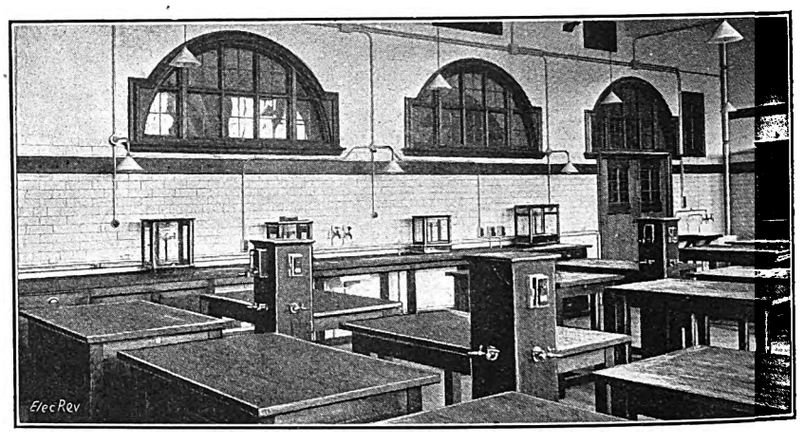

Fig. 3.—One of the Physics Laboratories.

Fig. 4 shows a corner of one of the balance rooms, and an interesting feature is the specially designed sliding lighting fittings.

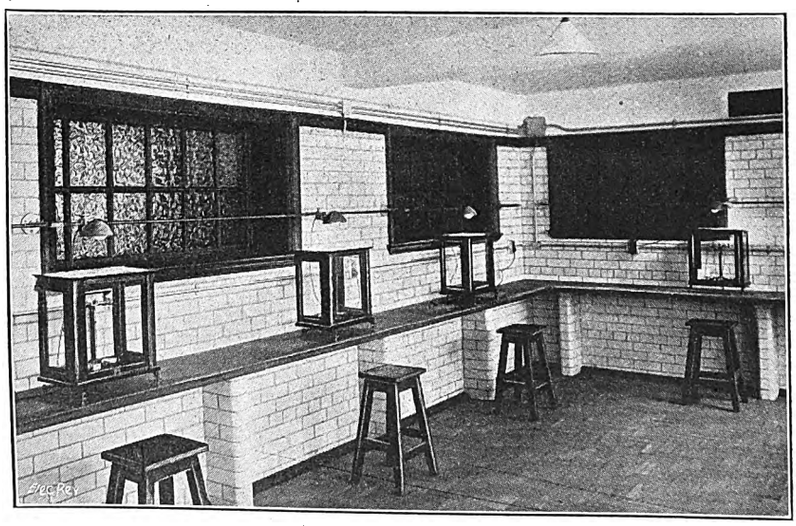

Fig. 4.—Corner of Balance Room.

The motor generators were supplied by Messrs. H. J. Scott & Co., Ltd.; the switchgear by Berry's Electric, Ltd.; fuse boards by Messrs. J. H. Tucker and Co., Ltd.; conduit, General Electric Co., Ltd.; cables, Hackbridge Cable Co., Ltd.; switchplugs, M.K. Electric, Ltd.

We are indebted to Messrs. Dean and Co. for the above information and illustrations.

The Principal of the new college is Dr. A. H. Trow, F.L.S., and the heads of the physics and engineering departments, respectively, are Dr. H. R. Robinson, Ph.D., and Dr. A. J. Sutton, M.B.E.

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Legal.

Attorney-General v. London and Home Counties J.E.A.

THE hearing of this action, in which four London electricity supply companies sought to restrain the defendant Authority from expending funds in the promotion of a Parliamentary Bill, was reported in our last issue. On February 6th Mr. Justice Astbury gave judgment. He said the Bill which the defendants were promoting sought to extend the district set up by the scheme so as to include any further areas in the administrative counties of Buckingham, Essex, Hertford, and Surrey, and part of the county of Sussex. It also sought to transfer to them the rights of local authorities to purchase the whole or any part of the undertakings authorised by the Electricity Acts and Orders, and to give the defendants several powers in excess and in contradiction, as he held, of the provisions of the scheme. The relators were authorised undertakers in their respective districts and were liable to contribute towards the administrative expenses of the defendant authority. The defendants had no electricity undertaking at present and had no revenue except the contributions to their administrative expenses payable by county councils, the railway companies and the authorised undertakers in the district. The defendants had contended that there was an implied right in the Authority to take proceedings for the purpose of obtaining an Act or a Special Order and to spend their money in doing so. In his opinion the section of the Act they relied on gave nothing of the kind. He had come to the conclusion that the Bill was one which the defendant authority had no power to pay for out of its funds; and it had no right, in his judgment, to levy upon its constituent members the costs of promoting such a Bill which many of its members strongly opposed and which, if the matter went through, they would have to pay for both with regard to its promotion and their opposition. The Bill appeared to be outside the purposes of the defendants' scheme, and it could hardly be incidental to those purposes. So far as the district and the powers of the defendant authority were concerned they were fixed and determined by the Order incorporating the Authority and by the scheme. The attempt to prove that there was some implied authority from expressions in the Act or scheme, outside the express authority in the Act, had entirely failed. The result was that he must grant the injunction as asked.

Clarke v. Greene.

MR. JUSTICE EVE, in the Chancery Division on February 8th, appointed a receiver of a business of electric lighting engineers carried on at 518, Leadenhall House. The appointment was made on the application of the plaintiff in a partnership action —Clarke *v.* Greene. Mr. KNIGHT, for the plaintiff, said the terms of the agreement of partnership were that the defendant should find the necessary capital and that plaintiff should devote himself to the work of the business at £5 a week salary and expenses, and the profits were to be shared in certain proportions. The partnership business went on until the beginning of this year, when the relations between the parties became strained as the result of the refusal of the defendant to join in opening a banking account, and ultimately defendant took exclusive possession of the premises, of which he was only a joint tenant with plaintiff, and the latter had not been allowed access to the place. Defendant issued a summons against the plaintiff at the Mansion House for "fraudulently converting" three cheques, and the magistrate adjourned the summons till the present application came before this court.

Mr. SWORDS, for the defendant, said the business was to proceed for a year, after which the question of partnership was to be discussed. The banking account was operated on by defendant, and plaintiff never asked for a joint account to be opened. Defendant put into the business approximately £400. It came to his knowledge that plaintiff had been collecting sums due to Clarke & Greene for goods supplied, and had converted certain monies to his own use. The business had been carried on at a loss, and if a receiver was appointed it meant that the defendant would have to pay for him. Plaintiff had no interest in the assets.

Mr. KNIGHT said that plaintiff denied that he had appropriated money and not accounted for it.

His LORDSHIP said he would appoint a receiver, but he would not allow the plaintiff to nominate him and would refer the matter to chambers and the receiver would be nominated by the defendant.

Welding Machine Patent Appeal.

ON February 6th the Court of Appeal reserved judgment in the appeal of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., against a decision of Mr. Justice Eve in favour of the respondents, the Rose Street Foundry and Engineering Co., Ltd. The action, which concerns a welding-machine patent, was reported in our last issue.

Llandudno Tramway Co. Fined.

AT Colwyn Bay on February 6th the Llandudno and Colwyn Bay Electric Railway Co. was summoned by the Colwyn Bay Council for failing to maintain in proper condition the roadway over which its cars run. It was alleged that accidents had occurred as a consequence of the bad state of the track. Mr. J. A. Brodie, Liverpool, said that the condition of the track was very bad indeed, and ultimately the company would have to put in a much better foundation. A solicitor for the defence said that as the track was laid in a private road, the company could not be proceeded against under the Order on which the Council relied.

The magistrates fined the company £5 upon each of the two charges brought and 10s. per day during the continuance of the offence. They also ordered the company to pay counsel's fees amounting to 25 guineas.

Institution of Electrical Engineers.

Annual Dinner and Reunion.

THE annual dinner of the Institution of Electrical Engineers, the total membership of which has now reached 13,305, was held at the Hotel Cecil, London, on February 7th, Lieut.-Col. K. Edgcumbe, T.D., R.E.T. (Ret.), the president, being in the chair. Supported by past- and vice-presidents and members of Council, he presided over a gathering which numbered about 650 members and distinguished guests, who included representatives of the principal scientific societies, engineering institutions, and kindred bodies.

Lieut.-Col. C. B. LEVITA, C.B.E., M.V.O. (chairman, London County Council), following the loyal toasts, which were proposed by the chairman, in asking the company to drink to the continued success of the I.E.E., referred to its wide and varied activities. English people lacked somewhat that "boosting" attribute which was so noticeable a characteristic of some other peoples; nevertheless, they could take credit for electrical engineering if for nothing else. Electrical progress owed much, he observed, to improved educational facilities, for they had produced a body of intelligent people who could handle the scientific implements provided by engineers. Referring to the increasing use of electric light, heat, and cooking on L.C.C. housing estates, he said it had reached 7 kW per tenement in some cases.

The PRESIDENT's announcement that H.R.H. the Prince of Wales had consented to become an hon. member of the Institution was received with enthusiasm: those who had heard his speech at their dinner two years ago had been struck, he recalled, with his insight into matters electrical, and all would be grateful to him for his continued interest and the honour he had done all members of the profession.

Replying to the toast, the President pointed out that civilisation took different forms at different periods; to-day it was obsessed with a desire for speed, all bustle and hurry, and the only things that saved them were electrical aids, methods, and labour-saving devices. The average cost of electricity was now slightly lower than the pre-war figure, in spite of the fact that that of coal was 80 per cent. higher, which was an index of what the engineer could do if left alone without too much interference from the human element. His interest had recently been aroused by the Board of Trade cost-of-living index, so far as it concerned fuel and light: he found from the figures that that item was recorded as being 70 per cent. above its pre-war cost. As electricity was cheaper now than it was before the war, he investigated, and inquiry led to the discovery that the Board had apparently never heard of electricity, for the only fuel and means of producing light it credited the man-in-the-street with using were coal, oil, candles, and gas! "I venture to think it is about time the Board revised that index," commented the Colonel.

Mr. W. B. WOODHOUSE (past president) toasted the guests, remarking that there were those amongst them who controlled mighty means of communication; the recent decision of the Governments of the Empire in that respect was of vast importance. They were also honoured with the presence of Mr. P. Bunet, president of the Société Française des Electriciens, which had invited the I.E.E. to hold its summer meeting this year in France.

The EARL OF CLARENDON, D.L. (chairman of the British Broadcasting Corporation), in returning thanks on behalf of the guests, said he believed that one in every three households in this country was equipped with some form of broadcast radio-telephone receiving set; some 25 to 30 million people indulged in listening, and about half that number were regular listeners. He believed that the forces which made for discord would soon recognise that in wireless they had a most formidable and relentless foe; before long "nation would speak peace unto nation."

Mr. H. T. TIZARD, C.B., F.R.S. (secretary of the Department of Scientific and Industrial Research) also responded, expressing his gratitude for the assistance that the cause of research had always received from the Institution.

During and after dinner a programme of music was performed by the British Imperial Orchestra, and the reunion in the Victoria Hall afforded an appreciated opportunity of renewing acquaintanceship and strengthening friendship.

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The Electrical Research Association.

The Eighth Annual Luncheon.

FOLLOWING the eighth annual general meeting of the British Electrical and Allied Industries Research Association on February 8th, a somewhat formal function of short duration, the annual luncheon was served at the Savoy Hotel, London, Mr. C. P. Sparks, C.B.E., M.I.E.E., president, occupying the chair; members and guests numbered some 170.

LIEUT.-COL. K. EDGCUMBE, T.D., R.E.T.(Ret.), president of the I.E.E., after the loyal toast had been honoured, proposed the continued success of the E.R.A., expressing his unbounded faith in research. It was the only really safe investment, for money spent on it was sure to be returned; nevertheless, it was extraordinarily difficult to persuade people to give money. At the annual meeting that morning Mr. E. B. Wedmore, director and secretary, had pointed out that if they could charge commission on the savings that resulted from research they would have an enormous income. Of the saving effected he estimated that 75 per cent. was derived by the public, 20 per cent. by the electricity supply industry, and the remaining 5 per cent. by manufacturers; as the supply section stood to benefit so largely, it was fitting that Mr. C. P. Sparks had been persuaded to accept the presidency.

MR. C. P. SPARKS, C.B.E., M.I.E.E., in responding, appealed for more financial support, observing that, in round figures, £160,000 had been expended during the last eight years, an average of £20,000 a year, the present rate of expenditure being some £25,000 per annum. The real investment was represented by a much larger figure, as it was supplemented by the valuable services of some three hundred voluntary workers and the use of plant and facilities afforded by some of the large supply undertakings and manufacturers. The main results so far secured were primarily of value to the electricity supply section of the industry: those results had effected a saving in capital expenditure, maintenance, and running cost of the supply undertakings. The annual saving arising out of the work of the E.R.A. from the following seven researches was estimated as already saving a figure approaching one million pounds per annum. The seven researches referred to were those on underground cables, insulating material, insulating oil, dielectrics, overhead transmission, switchgear and control apparatus, and steam turbine nozzles. This country lived by export trade, and, owing to the high standard of living, high wages, and heavy taxation, overseas sales were dependent on producing the best article; thus, any development which tended to improve their knowledge and place them ahead of other countries was of vital importance.

The scale of operation at home being small, compared with some of the great world undertakings, it might be expected that their delegates attending international conferences would take a secondary position, but, through the work of the E.R.A. and associated bodies, the position of engineering delegates representing this country had been greatly strengthened and, as a result of first-hand information, has enabled them to take a leading position held by no other country, and, in general, the opinion of our delegates had been endorsed by those international conferences. This must be a factor in expanding overseas trade, while, from a personal point of view, the attention paid to the views of their delegates made him proud of being an Englishman.

The last report of the Department of Scientific and Industrial Research recorded that certain researches of the E.R.A. had been "curtailed, or suspended, for lack of the necessary funds." That had been the position for the last two years, and the 1928-29 programme, involving an expenditure of £36,000, which the staff organisation was well able to handle, had been curtailed to some £25,000. To meet the whole position an important conference was held in June last with Sir Richard Glazebrook in the chair, who asked: "Is it to go on? Is it to go on with increased means? Has it proved of sufficient value to the industry, to the country, to the users of electricity, and to practically all of us, to make it worth while that that scheme of work which has been developed during the past six or seven years should be continued on a larger scale than before, with more full and more complete support from the various branches of industry?" Important resolutions were passed at that conference, amongst others to recommend (*a*) extension of the present scale of expenditure (£25,000 per annum) and to double it within five years; (*b*) to widen the Articles of Association to give adequate representation to all contributing interests, and the whole matter was now under consideration by a committee representative of all the interests concerned. From the conference of last June £50,000 per annum should be found within the next five years. In 1928 some £5,000 (1-5th of their income) had been derived from the supply section of the industry, the E.R.A. being supported by statutory undertakings which supplied 95 per cent. of the energy sold. While the proportion which should be found by each section of the industry was now the subject of inquiry by a committee appointed last June, he could not but feel that the supply section (subject to adequate representation on the Council) should find a much greater proportion in future. The investment in the electricity supply industry at home was over £300,000,000; the gross revenue was some £45,000,000 per annum, and if 1-10th of 1 per cent. were contributed to the E.R.A., it would have all the funds necessary for a full programme. Any such expenditure by supply undertakings would ultimately be met by the public, who would be recouped by improved service, increased reliability, and ultimately lower cost.

MR. R. W. PAUL, M.I.E.E., chairman of the E.R.A. Council, asked the company to drink to the health of the chairman. He thanked Mr. Wedmore and his staff for their past work and drew attention to the dependence of the future upon the attitude of the electricity supply industry. One's sense of fairness and generosity generally consisted of 50-50; if the supply section would assist to the extent of 50 per cent., the Association would no longer have cause to worry about cheeseparing.

The chairman returned thanks.

Reviews.

Matter, Electricity, Energy: the Principles of Modern Atomistics and Experimental Results of Atomic Investigations. By W. GERLACH, translated by F. J. FUCHS, Ph.D. Pp. xii+427; figs. 119. London: Chapman and Hall, Ltd. Price 30s. net.

Professor Gerlach is one of those physicists who are able to transfuse into their writings some of the enthusiasm and almost divine curiosity without which research is impossible, and it is obvious why his book, in the German, has come into wide use amongst advanced students. There is probably no other in existence which could serve as a better introduction to the original literature. The material dealt with in its thirty chapters touches upon the majority of the important experimental researches made between the discovery of the electron and the time of publication (August, 1926), and the controversial points which have inevitably to be introduced, such as the question of the existence of sub-electrons, and the still unsolved problem of the origin of the discrepancies between the Cambridge and Viennese radioactive measurements, are presented and assessed in an unbiased and perfectly fair way. It is impossible to refer here to all of the sections individually, but the titles of a few chapters, Super-conductivity, Crystal Conduction, Infra-Red Frequencies of Chemical Radicals in Crystals, The Physical Basis of Photochemistry, Ionisation in Chemical Reactions, Chemical Reaction by Electronic Impact, and Photochemical Catalysis, for example, will probably appeal to anyone taking up the book, as they do to the reviewer, as subjects about which they have often wished to know more, but for which they have been unable to spare the time necessary to arrive at the essence of the detailed original publications. Two chapters are also of some technical value: Structure Analysis by X-Rays (XXIII) includes descriptions of several bulbs (one due to Prof. Gerlach himself) which can be constructed readily in a laboratory workshop, whilst Practical Applications of the Photoelectric Effect (XX) bears the stamp of being written from experience. Mathematical derivations have been avoided throughout. In fact, the only fault to be found, but that unfortunately a serious one, is in the way that Dr. Fuchs has made the translation. His English does not run fluently, and his choice of words (*e.g.*, "Mix Crystals" on page 353, and "Experimentation" on page 147) is often most irritating. Anyone who is unable to read the German, and who takes up the book in its present form, must be prepared for these imperfections, but we believe, nevertheless, that he will be amply repaid and stimulated in its perusal.

K.G.E.

Heaviside's Electrical Circuit Theory. By L. COHEN. Pp. ix+169; figs. 28. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

Heaviside's contributions to electromagnetic theory have been notoriously neglected, probably because he was both mathematician and physicist, but too loose in his ideas for the former and too abstract for the latter. H. Jeffrey's Cambridge Tract constitutes a sort of belated apology for this from the one, and it will not be Prof. Cohen's fault if this book of his does not make Heaviside's methods a common working tool of electrical engineers. The value of the methods lies in their wide applicability; a single broad principle, that of applying operational methods without initially questioning their validity, suffices for the solution of a whole set of problems which would otherwise have to be attacked, each by the special appropriate analysis.

Prof. Cohen's book falls naturally into three parts. Chapter I is a general introduction to the operational calculus; Chapters II and VII develop the expansion theorem; and Chapters III-IV are mainly concerned with applications of the latter to typical electrical problems. The first section, although it already takes the reader a long way, and contains several important fundamental conceptions, such as that of the "unity function," is really subsidiary to the second. In this, Prof. Cohen first derives the expansion result by a method of his own (Chapter II), and then obtains it by Heaviside's reasoning

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(Chapter VII). Prof. Cohen's method is direct and simple to follow, and makes use of the resolution of the expression for the current into a series of partial fractions; he does not consider the special case when two or more of the roots of the impedance equation happen to coincide, but these will be readily understood by reference elsewhere, once the case of unequal roots has been mastered. Heaviside's derivation, on the other hand, does not appear to be stated completely in any one place in his publications, but Prof. Cohen has been able to show that, contrary to an opinion sometimes expressed, he did give a formal but scattered proof, based on general considerations of the dynamics and energy of an electromagnetic system; the appropriate quotations, together with Prof. Cohen's comments upon them, constitute Chapter VII, and are a valuable piece of historical research. The remaining chapters, on applications of the methods, particularly of the expansion theorem, are both examples in these, and valuable in themselves. The importance of electrical filter circuits (III), ocean cables (IV)—perhaps the main interest of Heaviside himself—the more general cases of propagation over transmission lines (V) and over artificial lines (VI) need not be emphasised here. As already pointed out, the results can be obtained in a variety of other ways, but by Heaviside's way they are obtained in a connected manner.

There is an appendix which includes a note on Bessel functions, a list of useful mathematical formulæ, and abbreviated tables of the Bessel, exponential, hyperbolic and error functions. We have noted a few typographical errors, but these are almost inevitable in a semi-mathematical treatise, and we can unreservedly concur in the opinion expressed by Prof. Pupin, in a foreword, that "Dr. Cohen's presentation of this subject is so clear that many of the difficulties which the student finds in Heaviside's original work have disappeared." Dr. Cohen is to be congratulated on having made a valuable addition to the electrical engineer's library.

K.G.E.

Wave Mechanics and the New Quantum Theory. By A. HAAS, Ph.D. Translated by L. W. CODD, M.A. Pp. xviii+124; figs. 3. London: Constable & Co., Ltd. Price 7s. 6d. net.

This book is Prof. Haas's "Materiewellen und Quantenmechanik," amplified in some few points to allow for advances between the appearance of the German edition (February, 1928) and the completion of its English equivalent (July, 1928). The author's preface states that it aims to appeal "to the layman as well as to the professional physicist," and anyone who has read other books by the same writer will not need further incentive to take up this one; Prof. Haas is almost as well able to make mathematical physics intelligible as Prof. Sommerfeld himself.

After starting off with a few preliminary remarks on the nature of the special problems presented by atomic physics, Chapter I proceeds to the need for a new quantum theory occasioned by the difficulties in that of Bohr and Sommerfeld. Chapters II, III and IV give the development of the ideas of de Broglie, and include statements of the principles of Fermat and Maupertuis, and of certain parts of the theory of relativity, as well as giving a derivation of the expression for the group velocity of waves travelling in a dispersive medium. Chapter V is an interpolation on experimental results, giving, in bare outline, the work of Davisson and Germer on electron diffraction from nickel, and that of G. P. Thomson and of Rupp on diffraction by transmission through thin foils; readers of the ELECTRICAL REVIEW should perhaps be warned not to attach too great weight for the present to the results of Dymond on electron scattering by helium, which have recently been called into question, but any who have lingering doubts as to the wave nature of the electron must have them immediately dispelled if they look at Kikuchi's recent beautiful mica diffraction photographs in the *Tokio Proceedings*, which appeared too late, unfortunately, for inclusion in Prof. Haas's book. Chapter VI again takes up the theory, now in the form of Schrödinger's generalisations—analogous to the transition from geometrical optics to physical optics—and we find the mathematical basis of quantum numbers in the characteristic values of differential equations; in Chapter VII these are applied to some particular problems. Chapters VIII-XI are an introduction to the matrix mechanics of Heisenberg, Born, and Jordan, connected formally with the wave-mechanics of Schrödinger, and having the far-reaching implication that "causality can only be accepted for statistical probabilities, whilst for the elementary processes of physics it must be denied" a matter further discussed in the last chapter (XVI), where we find it stated that ". . . it does not appear possible to give . . . elementary particles either a definite localisation or a sharply defined boundary"; and "A question . . . is that of whether there is in Nature any other kind of regularity than the purely statistical. . . ."

The actual development of quantum statistics occupies three of the remaining chapters, Pauli's principle of the unique assignation of quantum numbers being extended in the ways proposed by Bose and Einstein, and by Fermi. To anyone who would question the value of this apparently abstract work we would point out that in the hands of Sommerfeld it has already led to a solution of most of the outstanding problems connected with the electrical resistance of metals. The other chapter (XV) is concerned with miscellaneous applications of the new work. There is a chapter synopsis at the beginning of the book, a list of symbols, one of constants, and a bibliography, besides the usual indexes.

Quantum theory is not an easy subject—nor, for that matter, is Newton's theory of gravitation, or many other more familiar branches of physics. We believe, nevertheless, that Prof. Haas's presentation of its newer developments is not likely to be improved upon, and that it should open up an otherwise inaccessible field to anyone who has a pass knowledge of mathematics. Its philosophical aspects alone are sufficiently important to justify the spending of time in reading the book. Mr. Codd's translation is excellent.

K.G.E.

Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

Heating Houses Electrically.

A new system of heating houses, the invention of Mr. Chester I. Hall, an American electrical engineer, has been given a trial in Fort Wayne, Indiana, U.S.A., this winter, and is reported to have been successful. According to the *Wall Street Journal*, the system is said to be adaptable for hot air, hot water, and vacuum forms of house heating, and operation is entirely electrical and automatic. Steel cylinders (their size and number depending on the radiation area to be served) filled with water and equipped with large "hot points," form the basis of the system, a sheathing of five inches of asbestos with "Johns-Manville" wallboards on the outside forming the enclosure; further equipment consists of a pressure regulator, electric fan, pump, control box for "night" and "day" temperatures, master fuse, and meter. In the living part of the house the only equipment is a small thermostat, by which the householder controls his day and night temperature during the heating season. In the case of a hot-air system, the usual two or more cold-air registers lead to a point outside the heater, where an electric fan is installed, and automatically controlled to operate at below the temperature desired and to stop running when that is reached. The revolving fan opens a shutter arrangement in the wall of the heater, and the inrush of cold air starts hot air circulating through the house. The hot air is contained in the compartment throughout the night, or "off peak" period, heating the water in the cylinder by the "hot points." The clock arrangement automatically starts the "hot points" functioning at night, usually about 10 p.m., and stops heating about 6 a.m. The heated water is supposed to be sufficient to supply hot air for 16 hours, the thermostat automatically bringing the house temperature up to the day range at whatever hour in the morning the clock is set for heating. In the case of a hot-water system operation is somewhat different: the electric clock and thermostat controls for day and night ranges of temperature and use of electricity are the same, but the outlet valve has an ordinary plumbing trap to prevent natural circulation and over-heating; a centrifugal electric pump connected to the return pipe starts pumping water through the system by thermostat control, circulating hot water until the temperature reaches the desired figure, and then it automatically stops pumping. Each radiator is equipped with a thermostatically-controlled flapper valve, to prevent overheating the radiator. The company which supplies the electricity has worked out contracts for house-heating and hot water on a yearly basis, which is equivalent to one cent a kilowatt-hour. The house-heating season runs from October 15 to May 15th, and 50 degrees temperature for eight hours and 70 degrees for 16 hours a day (during zero outside temperature) during the season are guaranteed; the hot-water contract covers the entire year. The electric control of the heating system is so fixed that electricity is used during the period of the smallest demand on the power station (10 p.m. to 6 a.m.) The cost of heating a house of seven rooms and a bathroom and supplying constant hot water works out at $210 a year. A low "off peak" rate is possible under these conditions.

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A New Electric Iron.

The "Type Two" electric iron, fig. 1, is a recent introduction of the TELEPHONE MANUFACTURING CO., LTD., Hollingsworth Works, West Dulwich, S.E.21. It is strongly built and cleanly finished with heavy nickel plating, including the flexible cord connector. Among the features which are claimed to assure easy working are the rounded corners at the point and heel of the under surface. The design of

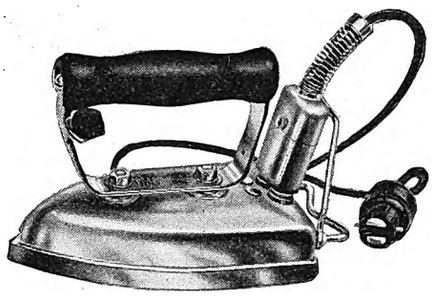

Fig. 1.—"Type Two" Electric Iron.

the special heating element ensures, it is claimed, a high degree of reliability. A 8½-ft. length of flexible cord and the necessary connectors are supplied with the iron. The apparatus weighs 5 lb., and is supplied for standard voltages up to 250 V. The loading is 400 W.

A Large Cooking Installation.

At the Public Hospital, Wellington, New Zealand, has been installed an electric baking oven and a large island kitchen range to cater for its 600 or so patients. The apparatus selected was from the "Magnet" equipment manufactured by the General Electric Co., Ltd. The result of the installation, which has now been working for nearly six months, has been a remarkable improvement in the cleanliness and in the cooking of the food, and complete satisfaction to the cooking staff. One feature which has won unqualified appreciation as opposed to the old coal-fire ranges, has been the absence of soot and grime within the kitchens, and this factor alone, it is estimated, represents a saving of approximately £20 a year for repainting. In June the ovens were inspected while in actual operation by 25 engi-

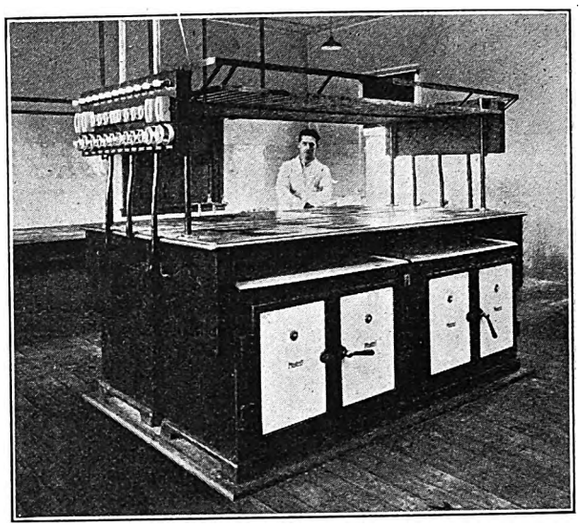

Fig. 2.—Kitchen Range Installed at Wellington, N.Z., Hospital.

neers representing electricity supply authorities from all over New Zealand, and the demonstration given on that occasion was a most satisfactory one. The accompanying illustration, fig. 2, shows the kitchen range.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Our Foreign Electrical Trade.

The following table shows the value of exports and imports of electrical goods and machinery during January:—

	Jan., 1929. £	Inc. or dec. as as compared with Jan., 1928. £
Exports.		
Electrical goods and apparatus ...	950,862	+ 5,251
Machinery	5,077,573	+272,590
(Including electrical machinery) ...	663,439	+ 62,359
Imports.		
Electrical goods and apparatus ...	441,441	+ 16,783
Machinery	1,627,372	+282,803
(Including electrical machinery) ...	156,654	+ 8,558
Re-exports.		
Electrical goods and apparatus ...	11,012	− 3,021
Machinery	123,689	+ 487
(Including electrical machinery) ...	8,555	+ 411

Metro-Vick Social Work.

The annual gathering of the committees engaged in social or welfare work at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., took place in the M-V Club Hall on February 4th. This was the twelfth gathering, and 25 committees were represented, indicating the amount and variety of work of this nature which is carried on. The chair was taken by Mr. G. E. Bailey (director), supported by Mr. A. McKinstry (director); the chairman of the company, Sir Philip Nash, was also present. The orchestra, the male voice choir, and the dramatic society provided items of entertainment, and an abstract from the report of each committee was read. Mr. G. E. Bailey, in a short speech, thanked the members of the committees for the voluntary work they were doing, which did so much to keep up the good spirit which pervaded the organisation. Sir Philip Nash congratulated the members of the committees on the good work of the past year, and pointed out the necessity of further fostering the spirit of goodwill in order that it should spread throughout all the branches of the new amalgamation into which the company had now entered. He particularly stressed the necessity for more export business. Mr. Ritchie, as president of the M-V Australia Works Welfare Association, compared conditions in Australia with those in this country, and mentioned that he intended to interview some of the members of the various committees, and see what he could learn that might be useful when he went back to Australia. Mr. McKinstry also congratulated the committees on their activities, and said that the sales side was aware that it could not be successful unless the goodwill and good work of the whole organisation was behind it, and he believed the spirit fostered by the social and welfare committees was a great asset to the company.

Callender's Hospital Fund.

The annual meeting of Callender's Hospital and Distress Fund was held at Belvedere on February 2nd. Mr. J. F. Watson presided, and the 26th annual report which was presented showed total receipts of £1,505 (including £55 brought forward, and an expenditure of £1,441, leaving a balance of £64. Grants were made to 16 hospitals and institutions and assistance was afforded in about 300 cases.

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United States Electrical Exports.

During November last electrical goods and machinery valued at $10,851,811, were shipped from the United States, bringing the total for the first eleven months of 1928 up to $100,474,387 (against $92,290,548 in January-November 1927). The figure for November, 1927, was $10,062,204. The principal increases during the month occurred in the following items:—D.c. generators under 500 kW, from $85,875 to $135,121; self-contained lighting outfits, from $96,035 to $131,469; flashlight batteries, from $222,573 to $333,267; watt-hour and other measuring instruments, from $17,049 to $117,310; stationary motors, 1 to 200 h.p., from $313,671 to $449,544; domestic heating and cooking devices, from $136,989 to $193,374; radio apparatus, from $1,259,764 to $1,629,451; ignition apparatus, from $128,694 to $225,008; and refrigeration sets, up to one-ton capacity, from $328,067 to $799,872. There were several large decreases, including the following:—D.c. generators, 500 kW and over, from $243,981 to $48,764; a.c. generators, 2,000 kVA and over, from $277,602 to $23,196; steam turbo-generator sets, from $109,112 to $50,419; switchboard panels, from $230,396 to $110,883; switches and circuit-breakers, over 10 A, from $278,682 to $147,659; mining and industrial locomotives, from $128,794 to $26,065; and industrial electric furnaces and ovens, from $139,459 to $20,820. The outstanding features of the figures for the first eleven months of last year are the rises in the value of exported refrigerators, up to one-ton capacity, from $3,315,044 to $5,907,409; and of radio apparatus from $8,147,650 to $10,639,755. The principal customer during November last was, as usual, Canada, her share amounting to $3,364,612. The next in order were Argentina ($799,549), Australia ($772,801), the United Kingdom ($639,359), Mexico ($507,457), and Cuba ($424,113). The imports of electrical goods into the States during November were valued at only $365,443, the largest item being lamps ($213,375).

A Long London Lift.

What, it is claimed, will be the longest lift in London, has just been ordered by the Westminster Cathedral authorities, to convey sightseers from the ground floor to the upper platform of the tower, a distance of 185 ft., in a little over half a minute. The makers are Messrs. Marryat & Scott, Ltd. The upper platform of the tower is one of the highest vantage points in the Metropolis accessible to the public. The lift will provide accommodation for ten passengers, who will be saved the effort of climbing over three hundred steps.

The East African Electrical Market.

In the course of a report on the trade and commerce of East Africa (Department of Overseas Trade. Published by the Stationery Office, 2s. net), Mr. C. Kemp, Deputy Trade Commissioner at Nairobi, says that in electrical and industrial machinery and internal combustion engines, British manufacturers are holding their own. Austria and Czecho-Slovakia have entered the market for electric lamps, against Dutch predominance, and from different Continental sources there have been offers of cables and general accessories which are reported to be somewhat below ruling British prices. Appendixes to the report give some particulars of the electrical import trade. In the first six months of 1928 Kenya and Uganda imported electrical goods and apparatus valued at £22,420 (against £16,420 in the first half of 1927). Of this Great Britain supplied £16,560 (against £9,977) and Germany £1,322 (against £880). In the same period the Tanganyika Territory imported goods valued at £11,650 (as compared with £8,452), Great Britain supplying £10,507 (against £7,132), and Germany £915 (against £971). Zanzibar's imports were valued at £10,210 (Great Britain £8,755, Germany £993), against £1,865 (Great Britain £635, Germany £942). During the whole of 1927 Northern Rhodesia imported electrical machinery to the value of £128,052 (Great Britain £124,595, United States £2,337), as compared with £25,024 in 1926 (Great Britain £17,782, United States £5,778).

Local Exhibitions.

Ashford (Kent).—An electrical exhibition was opened on February 7th under the auspices of the Ashford Circle of the British Electrical Development Association, in conjunction with the local branch of the Electrical Association for Women, members of which gave cooking demonstrations. The exhibition was opened by Mr. E. E. Hoadley, borough electrical engineer of Maidstone.

Bradford.—The exhibitors at a Better Housing and Housekeeping Exhibition which was recently held at Bradford included the Gem Labour Saving Device Co., Ltd. ("Ohio" and "Gem-de-Luxe" vacuum cleaners); Messrs. F. Grandison & Co. (radiators); Frigidaire, Ltd. (refrigerators); Hoover, Ltd. (electric cleaners); Brittain Bros., Ltd. (radiators); H. Taylor & Co., Ltd. (electrical appliances, lamps, cleaners, &c.); the British Vacuum Cleaner and Engineering Co., Ltd. ("Goblin" vacuum cleaner); the Hurley Machine Co. ("Thor" electric washer and cleaner); and Electrolux, Ltd. (cleaners, &c.).

Liverpool.—The General Electric Co., Ltd., recently co-operated with the Liverpool Corporation Electricity Department in a three-weeks' exhibition of large-scale cooking. The display of apparatus included examples of the company's baking ovens for bread and pastry, doughnut cookers, fish fryers, roasting ranges, urns, &c. A local firm of bakers carried out demonstrations of bread-baking, the preparation of confectionery, &c.

For Sale.

Bournemouth and Poole Electricity Supply Co., Ltd., has for disposal two Babcock & Wilcox water-tube boilers with superheaters and mechanical stokers, one Browett-Lindley vertical compound condensing engine direct coupled to a 200-kW, d.c. generator, one 12-h.p. vertical open type steam engine, one 8,000-gal. c.i. tank. The Salisbury Electric Light and Supply Co., Ltd., invites offers for one 95-h.p. Crossley gas engine with compressor, suction gas plant and accessories, 550-V dynamo, 500-V motor-generator, switchboard, &c. Grant Bros., of Croydon, have for disposal one 72-kW Metropolitan-Vickers generator, one shunt field rheostat, three double-pole circuit breakers, also a quantity of ammeters, voltmeters, and recording meters. (See our advertisement pages to-day.)

Bankruptcy Proceedings.

H. S. Stephens and S. Weill, trading as Stephens & Weill, wholesale accessories merchants, 55, Great Eastern Street, E.C.—An application for an order of discharge was made on February 4th to Mr. Registrar Mellor at the London Bankruptcy Court on behalf of Weill, a member of the above firm which failed in August, 1927. Mr. Gaine, Official Receiver, reported that the provable debts amounted to £36,770; the assets had realised £1,224 and the trustee expected to pay a dividend of 4½d. in the £. The bankrupts began business in May, 1922, and the failure was attributed to losses by bad debts and by sale of goods slightly below cost price; also to excessive drawings. A loss on trading of £24,657 had arisen through the failure of a German firm to which the bankrupts had advanced £25,000. The debtor Stephens went out of the business in December, 1926, and Weill sent a circular to the creditors suggesting the formation of a company and that the creditors should accept shares for their claims. The suggestion was rejected and bankruptcy proceedings followed. The application was opposed by the Official Receiver on various grounds, including unjustifiable extravagance in living, fraud, and grave misconduct. His Honour upheld the Official Receiver's report and suspended the discharge for three years.

J. Westnutt (J. V. Westnutt), electrical engineer, 40, Alfred Street and High Street North, Dunstable.—Last day for proofs for dividend, February 22nd. Trustee, Mr. A. J. Rogers, Official Receiver, The Parade, Northampton.

C. H. Pearson (B.O.A. Engineering Co. and Pearson & Co.), electrical, mechanical, sanitary engineer, &c., 51a, Mosley Street, and Stockton Street, Manchester, and 4, Manchester Road, Hyde.—Bankrupt discharged January 21st, 1929.

W. J. Warren (Coleman & Warren), wholesale electrical supplier, 66, Victoria Street, S.W.—Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C., released January 22nd.

O. L. Jones (Jones & Evans), wireless dealer, River View, Hendre Road, Llangennech, Carmarthen.—Trustee, Mr. H. W. Thomas, Official Receiver, 4, Queen Street, Carmarthen, released January 16th.

A. P. & J. P. Pacifico and R. Feitelson (Comton Wireless Manufacturing Co.), 26-28, Bartholomew Square, E.C.—Last day for proofs for dividend, February 26th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

K. Jolivard & Co., electrical engineers, 66, Victoria Street, S.W.—Receiving order made February 6th on a creditor's petition. First meeting, February 18th; public examination, March 15th; both at Carey Street, W.C.

H. H. D. Radcliffe and F. Haddleton (City Electric Services), electrical engineers, 51, Islington Row, Birmingham.—Receiving order made February 4th on debtors' own petition.

E. C. Jenkins, wireless dealer, 124, Cheltenham Road, Bristol.—First meeting, February 20th, at the Official Receiver's office, 26, Baldwin Street, Bristol. Public examination, February 22nd, at the Guildhall, Bristol.

W. T. Jacob, wireless engineer, 14, Meyrick Street, Pembroke Dock.—First meeting, February 15th, at the Official Receiver's office, 4, Queen Street, Carmarthen; public examination, February 18th, at the Shirehall, Haverfordwest.

Company Liquidations.

Truphonic, Ltd.—Winding up voluntarily. Liquidator, Mr. J. W. Attworthy, 121 and 123, Rosebery Avenue, E.C. A meeting of creditors was called for February 14th.

Attaix, Ltd.—Winding up voluntarily. Liquidator, Mr. K. M. Scott, 32, Finsbury Square, E.C. Meeting of creditors, February 19th, at the Institute of Chartered Accountants, Moorgate Place, E.C.

Pye (Radio), Ltd.—Winding up voluntarily. Liquidator, Mr. W. J. Lovell, 199, Piccadilly, W.

Berry's Electric, Ltd.—A meeting of members is called for March 12th at 85 and 86, Newman Street, W., to hear an account of the winding up from the liquidator, Mr. C. F. Saffery.

Private Arrangements.

R. E. A. Eaves and H. D. Cameron, trading as the Empress Radio & Electrical Co., Stonehouse, Plymouth, and as the Westminster Radio Co., at Plymouth, Bridgwater, Taunton, and Newquay.—A meeting of creditors was held on February 5th at the Great Western Hotel, Paddington, when the debtors' accountant, Mr. White, stated that the liabilities amounted to £4,966, of which £2,424 was due to the trade, while there were partly secured creditors for £1,392, who held security valued at £1,200, leaving £192 to rank as unsecured. The net assets amounted to £1,300, leaving a deficiency of £3,666. The debtors had consulted relatives with regard to

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their position, and if it were the wish of the unsecured creditors, sufficient cash would be forthcoming to pay the preferential claims in full, the costs of the deed of assignment, and the unsecured creditors 6s. in the £. The business was started in July, 1922, with a capital of £50 and tools. For the year to March 10th, 1927, the sales were £14,227, and there was a net profit of £236. The next year the sales were £18,065, and there was a profit of £28. In April, 1928, the firm suffered a serious loss through fire as they were under insured. Soon after that date the debtors opened branch shops. It was decided to accept the debtors' offer of 6s. in the £, and to confirm the deed of assignment already executed.

Social Events.

On January 30th the Beckenham Electricity Department held a departmental dinner, at which the chair was taken by Mr. F. Healey, deputy chairman of the Electricity Committee. Mr. Healey, in proposing the toast of "The King," said he had sent a telegram to His Majesty, hoping for his rapid recovery, and a reply had been received. Mr. Healey, in proposing the toast of "The Undertaking," referred to the absence of the chairman of the Committee, Mr. Jeff, through illness. Mr. J. E. Tapper (engineer and manager) responded to the toast, following which Mr. J. P. Wooller (commercial assistant) proposed the toast of "The Chief." After further toasts an excellent musical programme was provided by members of the staff, and "The Arcadians" dance band.

About 120 members of the staff and their friends assembled at the Moorgate Station Restaurant for the annual dinner of the Wholesale Fittings Co., Ltd., on February 2nd. Mr. John Alton, managing director, presided. Speeches were also made by Mr. S. Rose, director, Mr. E. Francis and Mr. John. After dinner there was a concert.

The annual staff dinner of Messrs. Abell & Smith's Electrical Co., Ltd., was held at Worcester recently. Mr. C. E. Abell presided, and other directors and guests (including Mr. J. H. Legge, S.W. & S. Power Co., and Mr. C. M. Shaw, city electrical engineer) were present. A musical programme followed the toasts.

On February 7th, the twenty-first "birthday" of F. and A. Parkinson, Ltd., Guiseley, was celebrated by a party at Horsforth, Leeds, attended by 450 members of the staff. This business, which recently amalgamated with Crompton & Co., Ltd., was founded by Mr. Frank Parkinson in 1908. The party was preceded by a complimentary dinner at the Queen's Hotel, Leeds, to the employés with over 10 years' service. The chair was taken by Mr. Frank Parkinson, supported by the Lord Mayor of Leeds (Alderman D. B. Foster), the Lady Mayoress, and Mr. Albert Parkinson. At the conclusion of the dinner the company proceeded to the party. Immediately preceding supper, members of the works Dramatic Society presented a play entitled "A Pantomime Rehearsal." Later, Mr. Frank Parkinson presented to Miss N. Senior (office staff) a gold wristlet watch and shares to the value of £50 in Crompton-Parkinson, Ltd.; to Mr. J. Ackroyd, works foreman, a gold cigarette case and shares to the value of £50; and to Mr. F. Dixon (works staff) a gold watch.

The Mayor of Leyton, on February 5th, entertained the members of the Corporation Electricity Committee to supper in celebration of the undertaking having enrolled its ten-thousandth customer.

Heads of departments of the Ribble power station, Preston, had a private dinner on February 7th. The guests included Councillor T. G. Lumb, J.P. (chairman of Blackpool Electricity Department), Councillor G. Whittaker, J.P. (vice-chairman), and Mr. C. Furness (manager).

Great Britain's Radio Exports.

The *Wireless World* states that the exports of radio apparatus from this country during November last had a value of £84,049 (including valves £9,960). The principal buyer was the Netherlands, whose share was valued at £11,241 (valves £60). The next in order were Australia, £10,111 (valves (£2,285); France, £7,301 (valves £174); Irish Free State, £6,042 (valves £929); India and Burma, £3,349 (valves £241); Rumania, £3,175 (valves £373); Germany, £3,167 (valves £82); and Italy, £3,126 (valves £16).

An Electrical Band Broadcast.

On Saturday last the Revo Electric Works Prize Band, under Mr. W. Taylor, rendered a programme of music which was broadcast from 5GB (Daventry experimental station). Another electrical company's band—Callender's—is already familiar to listeners.

A Useful Tool.

Messrs. R. E. Collingwood & Son, Ltd., March Street Works, Rochdale, have sent us a sample of a little tool (the "Nipsit") which should be very useful to electricians. It is a reversible screw-driver, one end of which is of the normal pattern, the other having a spring tongue which inserted in the slot of a screw holds it tightly to give the thread a start. The blade, although easily removed, is firmly held by the ferrule in the handle.

Polish Foreign Electrical Trade.

The imports of "apparatus, conductors, and other electro-technical materials" into Poland during November last were valued at 12,193,000 zloty (£280,000), and exports of the same class at 61,000 zloty (£1,400).

Showroom Problems.

Mr. W. Millner's paper upon "Organising for Better Selling in Electrical Showrooms" (Elec. Rev., October 26th, 1928, p. 709) was discussed at an E.D.A. (North-Western Area) Conference held in Manchester, on February 6th, Mr. J. Thomas presiding.

Mr. L. Romero (Salford) questioned the wisdom of compelling consumers to journey to the showroom in order to pay accounts. In cities like Manchester and Salford the distance might be great. As a supply engineer he was chiefly interested in showrooms from the point of view of their influence upon the sale of energy, and in his opinion cooking, room heating and water heating were most important fields of extension.

Mr. Rayner (Manchester) also disagreed with the idea of consumers being required to pay accounts at the showroom, and said it could not be expected that they would walk four or five miles for that purpose.

Mr. Shaw (Stockport), speaking as a contractor, remarked that people fancied many things which they saw in the showroom but could not afford to purchase them at the present figures. It was important that showroom assistants, when selling radiators, should inquire whether the place where they were to be installed was properly wired for the purpose.

Mr. Arnett (Bolton) said that cost was the greatest difficulty in selling appliances. He hoped that manufacturers would do something to reduce prices. In Bolton the showroom had been very successful and the load had been increased; they were now endeavouring to improve the domestic demand, but it was difficult to do so under existing conditions.

The Chairman pointed out that in London the unemployment figures were less than 5 per cent.; in Lancashire they approached 20 per cent.; there was still a feeling that electrical fittings and appliances were luxuries.

Mr. Curley thought contractors did not make sufficient use of the showrooms provided by the supply authorities. It would be to their advantage to bring customers to see displays.

Mr. Lockett (Stoke) said that his department had a working arrangement with the contractors by which the trade discount was split. For general development it was a good scheme to appoint lecturers to visit secondary schools and impress upon the young people the great advantages of electricity over other means of heating and lighting. Classes from these schools could be taken to showrooms when demonstrations were being given.

Miss Coles asked what was Mr. Millner's experience of the effect upon contractors when supply authorities adopted the hire-purchase system.

Mr. Southwood (Liverpool) said that in Liverpool the discount was given to the contractor whether the sale was made through him or through the showroom.

Mr. Barlow said the electrical contractor was the unpaid canvasser for the supply authority but did not get much support from it. Something ought to be done in that respect. Did contractors have showrooms in Mr. Millner's district? If so, could they be made to pay despite the competition by suppliers?

Mr. Tommins (Manchester) suggested that contractors themselves were to blame for the opening of showrooms by the supply authorities. Their laxity had resulted in the ironmongers and large stores reaping a harvest which should have gone to the contractors.

Mr. Wrigley said that appliances were now cheaper and better than they were a few years ago. Salesmen handling household appliances should show confidence in the articles they offered.

Mr. Rayner said that contractors should get together and arrange combined displays.

The Chairman said that the showroom cost was part of the selling cost. The question of stock was important. Appliances that went out of fashion or deteriorated very quickly were a serious charge.

Mr. Millner said that he did not suggest that it should be compulsory to pay accounts at the showroom. When customers were buying appliances the assistants might talk about the wiring installation and show the different types. If consumers could get appliances on easy terms progress would be rapid. His company's scheme was limited to articles costing £3 or more. If contractors could not run elaborate showrooms they could make reasonable window displays and have space for demonstrations.

Large American Acquisition.

It is announced that the Associated Gas and Electric Company, a holding concern, has contracted to acquire control of the General Gas and Electric Corporation, another holding company, controlling public utility services in Pennsylvania, New Jersey, New York, South Carolina, and Florida. The resulting corporation will have gross earnings totalling some $70,000,000 (£14,000,000) a year.—*Reuter* (New York).

Fire.

On the night of February 6th a serious fire caused considerable damage to the premises and stock of Philips Lamps, Ltd., 27, Womanby Street, Cardiff. Arrangements have been made whereby business will not be interrupted.

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Book Notices.

"Southampton Docks; Handbook of Rates, Charges and General Information." (Pp. xxxviii+168). Southampton: The Southern Railway Co.—This new edition of the handbook is, like its predecessors, full of useful and interesting information and should be of great service to shippers and merchants.

"The Blue Book Electrical Trades Directory and Hand Book."—The 1929 edition of the Blue Book is the forty-seventh consecutive yearly issue. The whole work has been thoroughly revised and brought up to date. The geographical section for Great Britain, Scotland, and Wales has been considerably amplified, and Northern Ireland is now included. A new feature is a complete list of electrical contractors; in this list the names of those who are enrolled on the National Register, members of the Electrical Contractors' Associations of England and Scotland are distinctly marked. The increase in the number of the guide cards facilitates reference to any section, and in other respects the high standard of production has been fully maintained.

"Physics in Industry."—Reprints of four lectures recently delivered before the Institute of Physics, relative to the food industry, glass industry, photography, and astronomy.

"Practical Primary Cells," by A. Mortimer Codd. Pp. viii+127; figs. 53. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

"Technologisches Handbuch der Elektrotechnik und der Elektrochemie eine Encyklopädie der Elektrotechnik," by A. Schlomann. Pp. xviii+897; illustrated. Berlin: Technische Wörterbücher-vertag G.m.b.H. Price Rm. 80.

"Electricity applied to Mining," by H. Cotton. Pp. xi+625; figs. 359. London: Sir Isaac Pitman & Sons, Ltd. Price 35s. net.

"Yarrow Boilers." Scotstoun: Yarrow & Co., Ltd.—A brief description, with two drawings, of a 600-lb. per sq. in. steam boiler installation.

"Pulverised Fuel Plant." Pp. 12; figs. 12. Manchester: Simon-Carves, Ltd.—Reprint of an article descriptive of the application of powered-coal plant to collieries.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during December last were valued at £69,752, bringing up the total for the whole of the past year to £552,999, as compared with £385,898 in 1927.

New Italian Companies.

Among the companies recently formed in Italy are the Società Industrie Elettriche Ponzini, Milan, capital 150,000 lire; and La Società Idroelettrica Venaschese, Venasca (Cuneo), capital, 1,200,000 lire.

Salford and Dutch Cable.

Salford City Council by 29 votes to 19 on February 6th confirmed the Electricity Committee's decision to accept the tender of a Dutch firm amounting to £9,358 for electric cables. A councillor said that the difference of price in tenders from British and foreign firms that were suitable was £2,080. One British firm said that it was impossible to reduce the tender price, but the firm was selling cable in Holland at a cheaper rate than the Dutch company.—*Financial Times.*

Unemployment.

During the week ended January 28th there was a fall of 31,520 in the number of registered unemployed. The total at that date was 1,394,100, as compared with 1,425,620 on January 21st, and 1,168,941 on January 30th, 1928.

The G.E.C. in South Africa.

Electric lighting has just been installed throughout the Divisional Council Offices in Dorp Street, Cape Town, and a large number of special fittings designed and supplied by the Cape Town branch of the British General Electric Co., Ltd., are used for illuminating the various sections. The Post Office is illuminated by means of 10-in. "Verilux" bowl pendants, finished in real bronze colour and equipped with "Superlux" glassware. "Britalux" lighting units are used in the ground floor offices. A number of specially designed bronze colour fittings are installed in the Council Chamber, while the even lighting of the Committee Room is contrived by a number of superb electroliers. The whole of the fittings were designed to be in keeping with the dignified architecture of the building. Several other Cape Town premises have been similarly equipped by the British G.E.C.

New Catalogues and Lists.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—A coloured poster (20 in. by 30 in.), advertising the company's l.t. accumulators for radio work. The centrepiece is an illustration of the "DTG" 2-V type. Prices are given.

Messrs. Allen West & Co., Ltd., Brighton.—A folder illustrating examples of the company's liquid rotor starters and regulators.

The British Thomson-Houston Co., Ltd., Rugby.—Spare Part List No. 6,845 (d.c. circuit breakers, tramcar pattern); and Descriptive List No. 5,270-A (hand-operated three-phase auto-transformer starters).

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet B.C. 4911, illustrating and describing the "Gecophone Portable Screen-Grid Four" receiving set. Priced.

Dixonia, Ltd., 4, Portsmouth Street, Kingsway, W.C.2.—A series of illustrated and priced leaflets giving particulars of electrical fittings and wires for saloon coaches.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., U.S.A.—A collection of pamphlets dealing with many of the company's varied products—motors, switchgear, &c.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—List No. 118, containing illustrated details and prices of the company's ironclad switch- and fuse-gear.

Messrs. Verity's, Ltd., Aston, Birmingham.—A distinctive and attractive folder advertising "Orbit" oscillating electric fans.

Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.—A small representation of a telephone kiosk drawing attention to the "Venner" time switch which is used to control the lighting.

The Lea Recorder Co., Ltd., 28, Deansgate, Manchester.—Booklet C.M.6 dealing with the use of the Lea coal meter in connection with mechanical stokers. Photographs of actual installations are reproduced.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—List No. 600. In spite of its modest description this is a very comprehensive electrical buyers' guide. It comprises 616 pages of illustrated details and prices of wiring materials and accessories, motors and dynamos, switch- and fuse-gear, instruments, lighting fittings for special purposes, lamps, domestic appliances, &c. A complete and convenient index is provided. It is noteworthy that 82 per cent. of the goods listed are British.

Korting & Mathiesen Electrical, Ltd., 711 and 715, Fulham Road, S.W.6.—List No. L. 91028, dealing with "Kandem" industrial lanterns for general exterior and interior lighting. Illustrated and priced. Also the "Kandem Quarterly Review" for January.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—February stock list of motors, generators, &c.

Messrs. Wolf & Morgan, Ltd., 66, Victoria Street, S.W.1.—An illustrated folder describing the "Wagner" split-phase motor.

American Electrical Engineers in Russia.

It is reported that early this month representatives of the American General Electric Company, Messrs. Tron and Prax, arrived in Moscow. They came from New York to enter into negotiations with the General Electrical Commission with regard to the carrying out of the agreement recently entered into with this company concerning the purchase of electrical plant on credit. At the same time representatives of the Robinson company, which is said to be the largest American constructional firm in electrical work, have arrived to negotiate respecting participation in Russian electrical work. The Americans are now about to pay visits to Soviet undertakings in existence or progress as represented by the Dnieper station, the Schatur station, &c., for the purpose of making themselves acquainted with Russian work.

Recent Contracts.

During the past month Messrs. Johnson & Phillips, Ltd., have booked the following orders for transformers:—

Two 5,000-kVA, 3-phase, for the Woolwich Corporation.
Four 2,500-kVA, 3-phase, for the East Anglian Electric Supply Co., Ltd.
Four 2,500-kVA, 3-phase, for the Ipswich Corporation.
Two 1,800-kVA, single-phase, for the New South Wales Government Railways.

The gymnasium and swimming baths at the Y.M.C.A. headquarters, Tottenham Court Road, W., have recently been illuminated with 500-W "Osram" gasfilled lamps housed in "Geco" dispersive reflectors with galvanised steel guards. The electrical contractors were Messrs. T. W. Coffin & Sons, Ltd., 17, Arthur Street, W.C.2.

An Unofficial Directory.

The attention of the Department of Overseas Trade has been drawn to the proposed issue by a private firm of a "Consular Directory." This directory is neither an official nor a semi-official publication, and is in no sense being issued with the approval of the Government. The Department of Overseas Trade issues for the use of commercial diplomatic officers, trade commissioners, and consular officers an official directory of British manufacturers known as the Trade Index. No charge is made for the entry of particulars as to the manufactures of any British firm in this index. British manufacturing firms whose names are not entered in this should make application to the Department for an entry form.

Correction.

We regret that a printer's error destroyed the sense of the fourth line of the advertisement of the Products Corporation, Ltd., in our last issue (p. ix). The line in question should have read:—"in eight alloys from 20% tin/80% lead."

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Trade Announcements.

Messrs. James McNeill & Co. (Sheffield), Ltd., Napier Street, Sheffield, inform us that in order to cope with the increasing demand for their "Eclipse" hack-saw blades and frames they have constructed a new machine shop at their Sheffield premises.

Dixonia, Ltd., 4, Portsmouth Street, Kingsway, W.C.2, announces that it has purchased the plant and goodwill (with the exception of the experimental engineering and tool-making departments) of Fluid Pressure Pumps, Ltd., Clifton Street, W.11.

Messrs. Griffin, Harding & Bryant, Ltd., electrical engineers, Swindon, have transferred their showroom from 66, Devizes Road, to larger premises at 1, Park Lane.

Messrs. Veritys, Ltd., have taken additional premises at 7, New Station Street, Leeds, to deal exclusively with plant and switchgear, in the charge of Mr. R. J. Millard. Mr. Hoyle and Mr. Richard have joined the Manchester staff, and Mr. H. S. Stoppard the Newcastle staff, to deal with the new range of "Maxlume" fittings and fires, for which additional premises have been acquired.

Mr. Alexander McKay, Aberdeen, has removed to larger premises at 41, The Green.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, February 12th:—Electrolytic copper bars, £84 10s., £5 15s. inc.; ditto, ditto sheets, no change; ditto, ditto wire rods, £94 10s., £5 15s. inc.; ditto, ditto h.c. wire, 11⅝d., ⅝d. inc. silicium bronze wire, 1s. 0⅝d., ⅝d. inc.

Messrs. James & Shakespeare report, February 12th:—Copper bars (best selected), sheet and rod, £108, £4 inc.; English pig lead, £24 15s., 20s. inc.

Messrs. Edward Till & Co. report, February 12th: No change in the price of India-rubber, Para fine.

Reporting on February 9th, Messrs. James Forster and Co. stated that the lead market maintained a firm tone throughout the week and prices registered a daily advance. Conditions in America have also remained firm, and prices have advanced. Last week considerable buying was done by the cable trade as a result of orders placed by the Post Office. This week an exceedingly good demand is reported for manufactured lead, and manufacturers have been busy covering their requirements in the market. Arrivals meanwhile have not been over plentiful; there is a shortage of prompt lead, while the prospect for next month is for small arrivals.

Lighting and Power Notes.

Barnstaple.—New Diesel Set.—The Town Council has received sanction to a loan of £6,222 in connection with the installation of a 300-kW Diesel set at the electricity works.

Bebington and Bromborough.—Street Lighting.—Electricity for street lighting has been adopted by the Urban District Council. The supply will be provided by the Birkenhead Corporation and Lever Bros. It is intended to erect 108 standards and the annual cost of operating the scheme will be £1,692.

Birkenhead.—Loans.—The Corporation Electricity Committee is applying for sanction to borrow £5,000 for the equipment of sub-stations on consumers' premises and £1,360 in connection with the extension of h.p. mains and the installation of an additional switchgear cubicle at the Singleton Avenue sub-station. Sanction has been received to the borrowing of £16,468 for the provision of a 33,000-V transmission line between Birkenhead and Wallasey power stations.

Overhead Lines.—The consent of the Ministry of Transport has been received to the placing of overhead lines in the parish of Thornton Hough for the transmission of electrical energy at pressures of 11,000 V and 240 V for the purposes of the Wirral and Neston Electricity Special Order, 1925.

Blackpool.—Loan.—The Corporation is applying for sanction to a loan of £8,000 for the purchase of cookers, wash boilers, &c., to be let out on hire.

Bradford. — Switchgear. — The Corporation Electricity Committee has approved a scheme submitted by the city electrical engineer (Mr. T. Roles) for reorganisation of the e.h.p. switchgear at Valley Road generating station, at a total estimated cost of £75,460. The town clerk has been authorised to apply for sanction to a loan, and the city electrical engineer authorised to invite tenders.

Street Lighting.—The conversion of street lighting from gas to electricity (the electricity to be supplied by the Corporation) in the areas within the Bradford boundary at present lighted by the Pudsey Gas Co. and the Drighlington and Gildersome Gas Co., is expected to cost £10,415. The annual charge to the Finance Committee for maintenance and for electricity supplied by the Electricity Department will be £2,672 per annum. The scheme involves the use of 622 electric lamp standards in place of the existing 500 gas lamps, and includes time-switch control.

Bristol.—New Switchgear.—The Corporation Electricity Committee reports that, in consequence of the growth of the undertaking, and in order to comply with Home Office requirements, it is necessary to replace e.h.p. switchgear at Feeder Road by larger and more up-to-date switchgear. The cost of the new work will be approximately £26,090, which includes £7,000 for building work.

Canada.—Queenston Plant Extension.—The Hydro-Electric Power Commission of Ontario has decided to install the tenth and final unit of 65,000 h.p. at the Queenston plant on the Niagara River. The new generator will cost approximately $500,000, and the total expenditure on the completion of the power house will be $5,000,000. This addition will give the Commission a normal operating capacity in its three plants on the Niagara River aggregating over 900,000 h.p. The additional requirements of the Commission in the Niagara district are being met by the introduction of purchased power, principally under the 260,000 h.p. contract with the Gatineau Power Company. Rapid expansion in the power requirements of the 300 municipalities in southern Ontario served by the Niagara distribution system is expected to call very soon for the maximum of power available from existing sources.

Rural Transmission.—During the fiscal year ended October 31st last, the Ontario Provincial Legislature approved the extension of rural hydro-electric power lines in that Province by 925 miles at an approximate cost of $2,250,000, of which the Provincial Government pays one-half. Rural lines operated by the Ontario Hydro-Electric Power Commission now total 4,190 miles, and have involved a total expenditure of about $8,600,000.

Continental.—Italy.—The new San Bernardo hydro-electric station of the Società Elettrica Interregionale Cisalpina was recently put in operation. The plant, which is located in the Splugen valley, near Chiavenna, 3,280 ft. above sea level, utilises the water power of Lake Truzzo. So far, two 12,000-kW turbo-generators have been installed, but space has been provided for a third set of similar capacity at a later date.

France. — A short-circuit on one of the main cables at about 9 a.m. on February 6th at the Saint-Ouen power station resulted in the failure of the electricity supply in 14 of the 20 arrondissements of Paris which lasted for the greater part of the day. Fire was seen coming from a manhole, and the fire brigade discovered that the seat of the fire was an underground gallery containing a number of 12,000-V cables. It was after midday before it was extinguished. Nearly all the tramcars ceased running, and the "Metro," which possesses an emergency plant, maintained a reduced service.

A fire which broke out at the power station in the Rue Honoré Sauvan, at 6.30 p.m. on February 7th, caused a failure in the electricity supply in the quarter of the town where the Casino, largest hotels and shops are situated. The supply was not restored for the rest of the evening.

What is stated to be the first underground cable for the transmission of d.c. at 300,000 V, has recently been completed by the Société Grammont for the Société Générale de Force et Lumière.

Germany.—The municipal authorities of Stuttgart are considering the question of erecting a new steam-operated power station which would have a capacity of 90,000 kW.

Hungary.—The new power station which is being erected at a lignite colliery at Banyhida under the auspices of the Hungarian Government will have a capacity of 90,000 h.p. and in addition to supplying electricity for lighting and power purposes in the Budapest district will also provide electricity for the railway between that city and Hegyeshalom.

Eastbourne.—Sub-station Extensions.—The Corporation Electricity Committee has approved the erection of four new sub-stations, the installation of eight transformers with a total capacity of 2,000 kW at various sub-stations, and a number of h.p. cable extensions, at a total estimated cost of £11,350. Application is to be made for sanction to a loan for these purposes.

Glasgow.—Street Lighting.—In his report on the working of the Corporation Lighting Department for the year ended May 31st last, the inspector of lighting (Mr. S. B. Langlands) states that the net ordinary expenditure on the lighting of streets, courts, &c., was £211,763, and on the lighting of common stairs, £146,588. The length of additional streets lit by electricity was 32 miles, bringing the total mileage up to 160, with a consequent increase in the number of lamps in use from 6,485 to 8,594.

Mains Extensions.—The Corporation Electricity Committee has recommended that distributing mains be laid at a cost of £14,000.

Gloucester.—Loan.—The Town Council has decided to apply for sanction to a loan of £90,345 to cover past and prospective expenditure. The prospective expenditure includes £10,000 for rotary convertors, £10,000 for mains and services, and £550 for public lamps.

Hastings.—Mains Extensions.—The Corporation Electricity Committee is to carry out mains extensions at a cost of £2,312.

Loan.—Application is being made for sanction to a loan of £1,000 for transformers.

Knaresborough.—Price Reduction.—The Urban District Council has reduced the charge for electricity for lighting from 7d. to 5d. per kWh, and it is expected that when negotiations

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now proceeding with Harrogate Corporation are completed the price will probably be reduced by a further 1d. per kWh.

Lancaster.—Extension of Area.—The Electricity Committee has had under consideration the cost of extending the area of electricity supply to include the rural district of Lunesdale and parishes in the rural district of Lancaster. Negotiations are to be opened with the Rural District Councils, and if they have a satisfactory outcome, the Town Council will apply for a Special Order.

Laugharne (Carmarthen).—Proposed New Station.—Application has been made to the Electricity Commissioners by Messrs. Tudor Williams Bros. for consent to the erection of a generating station in the town.

Liverpool.—Commercial Cooking Tariff.—A special rate has been introduced for electricity for heavy and commercial cooking apparatus at ⅝d. per kWh, except between the hours of 4 p.m. and 6.30 p.m., from October 1st to March 31st inclusive. During these hours the lighting rate applicable to the districts in which the premises supplied are situated will be charged.

Lochaber.—Ben Nevis Tunnel.—Mrs. Halcrow, wife of the consulting engineer, fired off the last shot on February 9th, which opened up the 15-mile tunnel through the Ben Nevis range in connection with the Lochaber water-power scheme. Although boring operations have now been completed, the tunnel has for half its length still to be lined with concrete. The undertaking is being carried out for the British Aluminium Co., and there will be a total development of 120,000 h.p.

Longbenton (Northumberland).—Inquiry into Charges.—At a meeting of the Urban District Council on February 7th it was decided to apply to the Electricity Commissioners for an inquiry into the charges for electricity.

Manchester.—Reduction of Tariff.—The *Daily Dispatch* reports that electricity on easier terms is now being granted by the Corporation to its tenants on the municipal housing estates. The deposit for installation has been reduced from £1 to 10s. The reduction has been made retrospective for the benefit of old consumers, who, provided their accounts are not in arrear, can obtain a refund of 10s., plus accumulated interest, on application at the Town Hall.

New Zealand.—Wellington.—The accounts of the city electricity undertaking (general manager, Mr. M. Cable) for the year ended March 31st last show a total income of £340,018, and working expenses of £144,352, leaving a gross profit of £195,666. The figures for the preceding year were: Income, £286,821; working expenses, £126,500; gross profit, £160,321. Interest, sinking, renewal and reserve funds, and appropriations absorbed £144,049, and there was a net surplus of £51,617, as compared with £23,941 in 1926-27. The electrical energy purchased in bulk from Mangahao decreased from 32,458,396 to 26,665,630 kWh, and the electricity generated from 6,505,528 to 19,648,139 kWh. During part of the year the Public Works Department was short of power and the City Council supplied 8,529,865 kWh through the Khandallah sub-station. The sales of electricity increased from 27,161,009 to 30,212,973 kWh, and the maximum demand from 11,400 to 12,910 kW. The Council in changing over the system of supply from 100 V, 80 cycles, to 400/230 V, 50 cycles, and this work is nearly completed.

Scotland.—Water-power Opposition.—A number of petitions have been lodged against the Grampian Hydro-Electric Scheme, including those of 24 town and county councils, two railway companies, the Forestry Commissioners, and several landowners. The West Highland scheme has also aroused considerable opposition. The objections to the schemes are based principally on loss of rating, destruction of fishing, and damage to shooting rights and scenery, the disorganisation of forestry, and the additional burdens the schemes would impose on local authorities.

Sheffield.—Mains Extensions.—The Corporation Electricity Committee is to extend mains at a cost of £7,000.

Southport.—Loan.—The Corporation Electricity Committee has decided to apply for sanction to a loan of £1,900 for new h.p. and l.p. mains, kiosk, switchgear, and transformer, in order to provide an electricity supply to Scarisbrick.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by the Holderness Trust, Ltd., authorising it to supply electricity in the urban district of Hornsea, and part of the rural district of Skirlaugh. The Minister of Transport has confirmed a Special Order, made by the Electricity Commissioners, authorising Blackburn Corporation to supply electricity in the township of Pleasington.

Stoke-on-Trent.—Change-Over.—The Corporation Electricity Committee has authorised the following change-over in supply to 50 cycles: From d.c. supply in the High Lane, Burslem, £2,300; Church Street, Longton, £1,200; and Porthill, Wolstanton, £2,300; and from 100-cycle supply in the central area of Hanley, £5,000.

Stretford.—Loan.—The Urban District Council Electricity Committee has applied for sanction to borrow £20,000 for the provision of mains and services.

United States.—Domestic Electrification.—Estimates prepared by the Statistical Department of the National Electric Light Association in the United States indicate that 842,000 homes and farms were wired for electricity during the first nine months of 1928. By the inclusion of farms in the total number of homes, two-thirds of all homes in the United States now have electricity; excluding farms, about 82 per cent. of all homes are wired. New Hampshire leads with 97 per cent. of all homes wired on September 30th last, followed by New Jersey with 95 per cent., Rhode Island with 93, Utah with 89, Connecticut with 88, and Illinois with 85.

New Power Station.—According to *Power*, a definite step toward the erection of one of the world's largest electric power stations has just been taken by the Public Service Electric and Gas Company, a subsidiary of the Public Service Corporation of New Jersey, with the purchase of about 125 acres of land on Arthur Kill, just north of Sewaren, N.J. The ultimate capacity of the new station will be 1,000,000 kW. Although preliminary surveys and subsoil studies are now being made, it will probably be several years before actual construction will begin. The new station is planned in view of the expected growth of the territory in which the company operates. Power from the proposed Sewaren station will not only feed the rapidly-growing industrial section of Central New Jersey, but the station will constitute one more power source, feeding into the Public Service Co.'s so-called "inner ring." This ring at present, through a series of transmission lines, receives power from major stations at Kearny, Essex, and Marion. It will also tie in with the interconnected systems of the Public Service, Philadelphia Electric and Pennsylvania Power and Light Companies. Thus the territory served by the three companies has available electrical energy from one of the largest power pools in the world.

Hell Gate Turbo-Generator.—The 160,000-kW turbo-generator constructed by the Brown-Boveri Co. for the Hell Gate power station in New York has lately been completed and put in preliminary operation. The new set is notable in that it occupies no more floor area than was formerly occupied by a 30,000-kW set.

West Lothian. — School Lighting.—The Education Authority has agreed to convert the lighting systems in a number of the schools under its supervision from gas to electricity.

Wrexham.—Assisted Wiring Scheme.—The Town Council has adopted a scheme for installing electric light in houses on the hire-purchase system, with a maximum of five points, and a loan of £6,000 is to be applied for to meet the estimated cost of 400 installations during the first year. The wiring is to be carried out by electrical contractors to the Corporation's specifications, and the charge for electricity is to be 8d. per kWh through 1d. slot meters for the first 800 kWh, after which the ordinary lighting rate for slot meters generally will be charged. A net surplus of £280 per annum is anticipated.

York.—Change-over.—The Corporation is applying for sanction to change over the system of electricity supply to all consumers who are at present taking a d.c. supply at 230 and 460 V to a.c. at 230 and 400 V, 3-phase, 50 cycles.

All-Electric Houses.—The city engineer has recommended the Corporation Housing Committee to erect all-electric houses on the Nursaws estate, where there is accommodation for about 174 houses.

Tramway and Railway Notes.

Australia.—Sydney.—Steady progress is being made with the electrification of the Sydney suburban railways and the construction of the city underground railway. According to the *Electrical Engineer of Australia and New Zealand*, the report of the Railway Commissioners for the year ended June 30th last states that the whole of the work in connection with the electrification of the Hornsby to Milson's Point line, including the construction and erection of a carriage shed at Hornsby, has been finished, and a full electric train service is now running. The electrification and provision of two additional roads from Illawarra Junction to Homebush have been completed. Work of electrification is in progress on the Homebush to Parramatta section, and several new sub-stations have been erected or are under construction. The section of the city railway from Central station to St. James' has been in satisfactory operation for some time. Work is being pushed ahead on the construction of other sections. Excavations and tunnelling are in progress at Wynyard and the Town Hall stations and in the section adjacent to these. Tunnelling is also in progress between Wynyard station and Circular Quay.

Barking.—Abandonment of Tramway.—*The Times* reports that the tramcars belonging to the Barking Urban District Council, which run between Barking and Beckton, will cease to operate in a few days. These tramcars are the only ones now owned by the Council, the other tramway section which runs through the town having been leased to the East Ham and Ilford Town Councils. The tramways to Beckton have always been a burden on the rates, but as they carried the men living at Barking to their work at Beckton Gas Works, the Council have deemed it advisable to keep them running, although the loss has been about £6,000 a year. Some two or

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three years ago the London General Omnibus Co. was approached with a view to running a service of omnibuses to Beckton. The company stated that it was prepared to run the omnibuses if a suitable road were constructed. This has now been done at a cost of about £26,000, and omnibuses will take the place of the tramcars.

Chatham.—Abandonment of Tramway.—The Chatham and District Light Railways Co., Ltd., is seeking powers to abandon the electric tramway in the district, and the City Council was to hold a special meeting on February 12th to consider the question of opposing the application.

Chile.—Railway Electrification.—According to the *Financial News*, at the annual meeting of the Chilian Transandine Railway Co., Ltd., held on February 5th in London, it was stated that the year's operations had resulted in a deficiency of £8,004. This had been occasioned by a decrease in the number of passengers carried, by a serious decrease in the cattle and public goods traffic, and by extra expenditure in connection with repairs and renewals of the track, which were necessitated by the installation and inauguration of electric traction, which took place in October, 1927. The electric service, however, from a technical point of view, had been a complete success.

Continental.—Sweden.—The signalling and switch systems at the Stockholm and Gothenburg railway stations are to be electrified and centralised. The reconstruction work will be completed before the end of April, 1930.—*Reuter's Trade Service* (Stockholm).

Italy.—The Florence correspondent of the *Daily Mail* reports that good progress has been made with the construction of a tunnel, over 11 miles in length, through the Apennines in connection with the new railway between Bologna and Florence. The new route is over 60 miles in length, and it will be covered by electric trains in about 1½ hours. When the line between Rome and Florence has been completed and the Florence-Bologna line is open, there will be a direct and rapid train service through the whole of Central Italy.

Spain.—Tenders are expected to be invited shortly for the electrification of about 2,000 km. of railway in Spain. The saving in coal resulting from the change is estimated at 600,000 tons a year. It is thought likely that the contract for the lines to be electrified will be awarded as a whole, so that the material will be all of the same type, which will mean a saving of money and simplification in orders. It would not be surprising if this principle were also applied to material for the railways under construction that are to be worked directly by the State, or leased in groups.—*Reuter's Trade Service* (Madrid).

Dearne Valley.—Transport Agreement.—The Dearne district Light Railway Committee and the Yorkshire Traction Co. have entered into an arrangement under which the municipally-owned tramcars and the privately-owned 'buses are to be operated under one control in the Dearne Valley district of South Yorkshire. The Committee is responsible for the tramway system constructed four years ago at a cost of £300,000 by the Wombwell, Wath-on-Dearne, Bolton-on-Dearne, and Thurnscoe Urban District Councils.

Increases of Charges.—The Minister of Transport has made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, authorising certain fare charges by the following tramway and light railway authorities:—The Corporations of Colne, Burton-on-Trent, Luton, York, the Corporation of Gloucester and the County Council of Gloucestershire, the Urban District Councils of Bexley and Dartford, the Bath Electric Tramways, Ltd., the Scarborough Tramways Co., the Swansea Improvements and Tramways Co., the South Lancashire Tramways Co., the Norwich Electric Tramways Co., the London United Tramways, Ltd., and the Llandudno and Colwyn Bay Electric Railway, Ltd. These Orders will remain in force until December 31st, 1931.

Jarrow.—Abandonment of Tramway.—The Jarrow and District Electric Traction Co., Ltd., is seeking power to abandon its tramway and substitute motor-'buses.

London.—S.M.E. Tramway Cars.—The South Metropolitan Electric Tramway Company has announced its intention to re-model its tramcars so as to provide greater comfort for passengers. Work is now in hand, and it is hoped to introduce them in service rapidly on the Sutton-Croydon route; the re-modelling process is so complete as to alter entirely the appearance of the vehicle. The usual ornamental fittings on the exterior, including the waist rail, have been removed, and the cars now present a "streamlined" appearance; dashboards have been broadened and painted red with black streamline bands, whilst the grille-work of the top deck has been replaced by steel sheeting in order to give a better appearance and afford fuller protection for passengers in inclement weather. Considerable alterations also have been made to the interior: the wooden longitudinal seats have been replaced by comfortable moquette-covered cross seats; the roof has been enamelled white; gasfilled electric lamps have replaced those of older type; and another improvement is the introduction of hardwood flooring. On the top deck the seats have been rendered more comfortable by giving them a "kneed" back; they have also been placed further apart. Advertisements and traffic notices have been restricted to a few positions only, instead of being dotted promiscuously all over the car as heretofore. Several cars are already in service on the Sutton to Croydon route and others will be introduced upon the same route as they are completed.

Telegraph and Telephone Notes.

Chile.—Photo-telegraphy.—A company has recently been formed in Santiago, with a capital of £75,000, to introduce wireless picture telegraphy into Chile.

France.—Telephone Tariff.—Telephone rates are to be raised in consequence of the deficit shown in the past. Government officials are of the opinion that the telephone system should be made self-supporting as in Britain and the United States.

International Telephony.—Sweden-Argentina.—Telephone communication was established on February 9th between Stockholm and Buenos Aires by means of a wire circuit to Berlin, thence by wireless to the Villa Elisa station, near Buenos Aires.—*Reuter* (Stockholm).

Post Office Cables.—Year's Work.—Post Office statistics show that last year ducts and cables containing approximately 600,000 miles of telegraph and telephone wire were laid underground at a cost of £4,280,000. About 40,000 miles of this represented diversion of overhead wires. Damage to telegraph and telephone lines by gales during the year cost the Department £400,000, which figure was above the average, owing to the exceptionally severe weather. During the last four years £44,000,000 has been spent on capital account for the development of the telephone service, with the result that five-sixths of the telephone wires of the country are now laid underground.

The Telegraph Service.—The Association of British Chambers of Commerce recently addressed an inquiry to the Postmaster-General relative to the action which had been taken by the Post Office upon the recommendations contained in the report of Sir Hardman Lever's Committee on the inland telegraph service. In his reply, the Postmaster-General states, according to the *Daily Telegraph*, that five recommendations are still under consideration. Arrangements have been made which will facilitate more frequent adjustments of staff to traffic in the larger telegraph offices. The telegraph supervising force in London and the larger provincial post offices has been reduced in the last two years by about 160 posts. The replacement of Morse by teleprinter apparatus is being carried out as rapidly as possible, regard being had to the rate at which teleprinter apparatus can be manufactured and telegraph operators can be trained to work it. The question of concentration of traffic is being pursued, and circuits unnecessary for traffic purposes are being suspended.

United States.—Telephone Service.—According to *Telephony*, the organ of the industry in the United States, 860,000 telephones were added to the American systems during 1928, making the total in service 19,380,000. The United States has now more than five times as many telephones as the whole of the British Empire, and more than eleven times as many as Great Britain, although America's population is only two and a half times as great. The expenditure last year on extension and improvement of the American service totalled £100,000,000, of which £90,000,000 was spent by the Bell Company, and £10,000,000 by the American Telegraph and Telephone Co. Expenditure authorised on the British telephone system for the year ended March last was only £12,000,000. Manned by 400,000 men and women, the United States systems handled 76,000,000 completed calls daily, making a year's total of 28,000 millions, of which more than 1,100 millions were toll or distance calls.

Radio Notes.

Canada.—Licences.—More than a quarter of a million Canadians using receiving sets had paid the Government tax of one dollar up to the end of November, 1928, an increase of 17,000 compared with the end of November, 1927, reports the High Commissioner for Canada in London. According to the *Board of Trade Journal*, the returns indicate that there are 226,240 private receiving licences, although it is believed that more than 100,000 sets exist on which no licence has been issued. The revenue from the issue of licences is devoted by the Department of Marine and Fisheries to the improvement of radio services, about a score of radio interference investigation cars being in use.

Short-Wave Conference.—Seeking agreement on the allotment and control of the 639 short wave-lengths used principally for ship-to-shore, aeroplane, and other non-commercial broadcasting, representatives of the Governments of the United States, Cuba, Newfoundland, and Canada opened a conference in Ottawa on January 21st. The chairman, Mr. Sykes, of the United States delegation, made it clear that there was no disposition on the part of his country to establish a monopoly of short wave-lengths, and that in spite of the fact that of all the 639 channels but 245 had been set aside by international agreement for amateurs, the Conference was undoubtedly free to discuss the disposition of all those channels. Drastic provi-

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sions for the prevention of interference with non-commercial and service waves have been drafted: the recommendations are intended to apply only to the band between 15,000 and 6,000 kilocycles, and to stations capable of causing international interference. Their recommendations were later reported to the plenary conference which, it is expected, will approve of them.

According to *World-Radio*, the recommendations are as follows:—The Governments agree to adopt a frequency standard based on the unit of time, and to compare at least once every six months the actual radio-frequency measuring standards; all stations other than mobile and amateur stations to tune their transmitters within an accuracy of 0.025 per cent., or better, of their national frequency standard; and to maintain their frequency with an accuracy of 0.05 per cent., or better, at all times. Each Government agrees to adopt for the present separation of 0.2 per cent. between channels; for commercial telephony a band width of six kilocycles will be permitted; for the present, a 100-kilocycle band width will be considered standard for television; to use transmitters which are as free as practicable from all emissions (such as harmonics, decrement, spacing waves, frequency modulation, key clicks, type of keying, mush, &c.) not essential to the type of communication carried on, which would be detrimental to communication being carried on by stations in other countries.

Holland.—RADIO COUNCIL.—The Radio Council recently formed by the Dutch Government for the purpose of exercising general control over all wireless-telegraphy and telephony in the country has held its first meeting. The Minister of Waterstaat, under whose Department the Council will work, pointed out that as yet broadcasting in Holland was not in a satisfactory state, and many difficult problems would have to be solved by the Council.

Luxemburg.—LIMITED SERVICE.—The Grand Duchy now possesses a broadcasting station, Radio-Luxemburg, which can, it is reported, be heard throughout the whole State. At present the sole resources of the station are derived from the subscriptions of members of the Association of Friends of the T.S.F. for the development of broadcasting in the Duchy, says *World-Radio;* owing to the limited income, it is not possible to give daily transmissions.

Switzerland.—CANADIAN COMMISSION.—The Canadian Broadcasting Commission, which is now examining various broadcasting systems in Europe, visited Geneva on February 8th and had discussions with members of the Communication and Transit Section of the League of Nations and with the Secretary-General of the Union Internationale de Radiophonie.

United States.—"BEAM" BROADCASTING.—Station WTIC, situated on the top of Avon Mountain, near Hartford, Connecticut, is to experiment with directional broadcasting with a beam transmitter next June; it is proposed to transmit from eight to ten times greater power towards the west than towards the east (50 kW directed one way and only 5 kW the other), so that waste of power over the Atlantic Ocean will be avoided.

MONOPOLY DISPUTE.—With reference to the recent note on this subject (January 11th issue, p. 70), it is reported that a suit against the "Radio Trust" licences was to be heard in the United States Court at Wilmington, Del., on February 11th. The *Financial News* points out that the "Trust" has lost twice, and that the present suit is to make an injunction permanent. The case involves the alleged monopoly of radio valve licence contracts; the General Electric, Westinghouse, A. T. & T., and 27 other manufacturing companies have been named in the action.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—March 12th. Posts and Telegraphs Department. Telephone relays. (B.X. 5078.)*

April 2nd. Jumper rings and terminal strips. (B.X. 5066.)

March 18th. State Electricity Commission of Victoria. Insulators and accessories. (B.X. 4997.)*

April 8th. Galvanised steel transmission line towers. (A.X. 7401.)*

April 29th. Two or three steam turbo-generator sets with condensers for Yallourn Power Station extension. (B.X. 5062.)*

Aylesbury.—Electricity Department. Materials for 12 months, including cables, insulators, meters, joint boxes, &c. (February 8th.)

Bedford.—February 22nd. Electricity Department. E.h.p., h.p. and l.p. cables, incandescent electric lamps. (February 1st.)

Blackburn.—February 19th. Manchester Board of Guardians. Renewal of a 98-cell electric storage battery at the Colony for Epileptics, Langho. Particulars from Mr. E. Hargreaves, superintendent of works, Union Offices, All Saints', Manchester.

Bristol.—February 20th. Board of Guardians. Electrical fittings for six months. Mr. Thomas S. Lamb, clerk, St. Peter's Hospital.

Bromley.—March 4th. Education Committee. Installation of electric lighting at the Raglan Road Council school. Specifications, &c., from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

Dumfries.—February 21st. Electricity Department. One 1,500-kW turbo-alternator and condensing plant. (February 1st.)

Edinburgh.—March 25th. Electricity Supply Department. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuse-boards, electricity supply meters. (See this issue.)

Egypt.—CAIRO.—March 27th. Ministry of Interior. Supply and installation of an electric lighting system for the town of Fashu. (B.X. 5037.)*

March 6th. Underground and overhead transmission line from the Mit Chamr electric power station to the town of Kom el Nour. (B.X. 5074.)*

Erith.—March 4th. Electricity Department. H.p. and l.p. cables, joint boxes, &c. (February 1st.)

Hastings.—February 25th. Corporation. Electrically-driven pumping plant for the Kent Street pumping station. Specification (£5) from the engineer, Mr. G. M. C. Taylor, of Messrs. John Taylor & Sons, Caxton House, Westminster, S.W.1.

Hove.—February 20th. Corporation. Electric lamps for 12 months. Schedules from the borough surveyor's office.

India.—March 1st. India Stores Department. 200,000 insulators, 49 drums dry core telephone cable, 500 tons g.i. wire. (See this issue.)

Lancaster.—February 18th. Electricity Department. 400/600-Ah station battery with reversible booster, automatic switchgear, &c. (February 1st.)

Leeds.—Electricity Department. March 9th. 2,000- and 6,600-V single-phase, and 3-phase (6,600-V) Scott-connected transformers for a period of two years; 11,000-V, 3-phase transformers. (See this issue.)

Linlithgow.—February 28th. District Committee. Erection of lamps and electric lighting fittings in the special lighting districts of Winchburgh and Kirkliston. Specifications from J. G. B. Henderson, district clerk.

Liverpool.—Water Committee. Electrically-driven pumping sets for the Aubrey Street pumping station. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

March 2nd. 66,000-V and other transformers (London Area) in connection with the South-East England Electricity Scheme. (February 1st.) 33,000-V overhead line—Luton to Aylesbury—in connection with the South-East England Electricity Scheme. (February 8th.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (January 11th.)

March 4th. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area), and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (January 18th.)

METROPOLITAN ASYLUMS BOARD.—February 20th. Installation of electric lighting at Southwark Casual Ward. (February 1st.)

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London County Council.—February 26th. One 10-cwt. electric goods lift for the Hammersmith Building Trade School. (February 8th.)

Lourenco Marques.—March 19th. Port and Railways Board. 50-kVA Diesel-driven generating set and an electrically-driven water pumping set. (B.X. 5050.)*

Newcastle-upon-Tyne.—February 18th. Tyne Improvement Commission. One 1½-ton portal electric travelling level luffing crane. Specification (21s.) from Mr. A. Blacklock, secretary, Tyne Improvement Commission Offices, Bewick Street, Newcastle-on-Tyne.

Newton Abbot.—February 28th. Board of Guardians. Installation of electric lighting at the Institution, Newton Abbot. (February 1st.)

New Zealand.—Dunedin.—March 20th. Tramways Department. Tramway equipment. (A.X. 7441.)*

Northern Ireland.—Belfast.—February 18th. Electricity Department. Materials for 12 months, including electrical accessories, lamps, carbon brushes, cables, joint boxes, meters, &c. (February 1st.)
February 26th. Tramways Committee. Stores (including electrical accessories, carbon brushes, armature and field coils, &c.) for 12 months. (February 8th.)

Plymouth.—February 25th. Electricity Department. Electricity meters, cables, transformers, and sub-station switchgear. (See this issue.)

Roscommon.—February 23rd. County Board of Health. Electric lighting installation at Roscommon County Hospital. Specifications from J. P. Tierney & Co., consulting engineers, 44, Kildare Street, Dublin.

Rhyl.—February 26th. Electricity Department. 1,750 yd. 3-core e.h.p. cable, 1,100 yd. 4-core armoured cable, 1,750 yd. of telephone cable, e.h.p. switchgear, two 250-kVA static transformers, and l.p. switchgear.

South Africa.—Cape Town.—March 15th. City Council. Metal-clad switchgear. (B.X. 5004.)*
March 21st. 300-amp. fuses. (B.X. 5080.)*
Pretoria.—March 28th. Posts and Telegraphs Department. Telephone switchboard cords. (B.X. 5048.)*
Johannesburg.—March 4th. Town Council. 6,600-V switchgear. (B.X. 5087.)*

Southend-on-Sea.—March 4th. Electricity Department. 1,200 d.c. house-service electricity meters. (See this issue.)

West Ham.—February 18th. Education Committee. Installation of electric lighting at South Hallsville new school, Agate Street, Tidal Basin. (January 25th.)

Worsley.—February 23rd. Urban District Council. Electric lamps required during year ending March 31st, 1930. Form of tender from Mr. J. Howard, surveyor to the Council, Town Hall, Walkden, near Manchester.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Cable (£1,952).—W. T. Glover & Co., Ltd.
Transformers (£163).—English Electric Co., Ltd.
Switchgear cubicles.—New Switchgear Construction Co., Ltd. (£329); English Electric Co., Ltd. (£156); Ferguson, Pailin, Ltd. (£100).

Bradford.—
Electric lighting at schools.—Green Lane school (£534); Lorne Street (£301); Priestman and Marshfield schools (£353); Usher Street (£395); Whetley Lane (£355).—W. P. Holt & Co. Thorpe school (Idle) (£208).—J. Carter. Hutton school (Eccleshill) (£267).—H. Simonett.

Burnley.—Electricity Committee. Accepted:—
Electric passenger lift at the Corporation electricity showroom (£514).—J. Bennie, Ltd.

Doncaster.—Town Council. Accepted:—
Extra-h.p. cables (£106).—Callender's Cable and Construction Co., Ltd.
L.p. cables (£369).—Enfield Cable Works, Ltd.

Durham.—County Education Committee. Accepted:—
Electric lighting installation at Brandon Colliery new Council school, Co. Durham (£370).—Falconar, Cross and Co., Ltd. At Usworth Colliery new Council school (£289). At Seaham Harbour new Council school (£167).—Simm & Richardson.

East Ham.—Electricity Committee. Accepted:—
1,500-kW motor-convertor (£4,370).—English Electric Co., Ltd. Machine panel (£430).—Bertram Thomas. Switchgear (£1,389).—A. Reyrolle & Co., Ltd.
Tramways Committee. Recommended:—
Two spare trucks (£300).—Brush Electrical Engineering Co., Ltd.

Finchley.—Electricity Committee. Recommended:—
Cooling tower and foundations (£2,336).—Premier Cooler and Engineering Co., Ltd.

Gillingham (Kent).—Town Council. Accepted:—
Cable for the extension to Rainham, Wigmore, and Hempstead (£7,807).—Callender's Cable and Construction Co., Ltd.
Cable covers (at 9d. per yard).—Concrete Utilities, Ltd.

Glasgow.—Health Committee. Recommended:—
Lighting installation in grounds of Mearnskirk Sanatorium (£3,358).—Alexander Anderson, Ltd.

Kirkburton.—
Installing electric lighting in business premises for the Industrial Co-operative Society.—H. C. Stringer.

Leeds.—Electricity Committee. Accepted:—
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£4,753); Enfield Cable Works, Ltd. (£3,008); Macintosh Cable Co., Ltd. (£20,776); Hackbridge Cable Co., Ltd. (£1,865); Greenwich Cable Works, Ltd. (£4,119).
Tramways Committee. Accepted:—
10 tons tie bars (£13 10s. per ton).—William Bain & Co., Ltd.
1,000 yards earthenware conduits (£264).—Leeds Fireclay Co., Ltd.
Two miles trolley wire (12 7/16d. per lb.).—Thomas Bolton and Sons, Ltd.

Manchester.—Tramways Committee. Accepted:—
Tram rail bonds.—Forest City Electric Co., Ltd.; T. Bolton & Sons, Ltd.
Electricity Committee. Accepted:—
Electricity meters.—Ferranti, Ltd.; Measurement, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Education Committee. Accepted:—
Electric lift at High School of Commerce.—Waygood-Otis, Ltd.
Electric lighting installation at Apollo Street school centre.—Sudlow & Co.

Plymouth.—Health Committee. Accepted:—
Electric lighting at smallpox hospital (£257).—W. G. Heath & Co.

Ramsgate.—Town Council. Accepted:—
Re-wiring the electric lighting system at the Royal Victoria Pavilion (£137).—A. E. Pinto.

Tonbridge.—Urban Council. Accepted:—
Switchgear for a substation.—English Electric Co., Ltd.

West Lothian.—Education Authority. Accepted:—
Electric lighting at Broxburn R.C. School (£95).—Mr. C. V. Campbell.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, February 15th. Institution, Storey's Gate, S.W. 6 p.m. Annual meeting. Friday, February 22nd. Informal meeting. 7 p.m. "Electrical Precipitation." Mr. G. Baker.

British Electrical Development Association.—Friday, February 15th. Royal Society of Arts, John Street, Adelphi. W.C. 7.30 p.m. "Organising for Increased Sales—Spring Cleaning Season, 1929."

British Industries Fair, 1929.—Monday, February 18th to Friday, March 1st. White City, London, W., and Castle Bromwich, Birmingham.

Institution of Electrical Engineers.—Informal Meeting.—Monday, February 18th. Institution, London, W.C. 7 p.m. "Modern High Power Rectifiers: Their Development and Use." Mr. R. L. Morrison.

(Western Centre).—Monday, February 18th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Construction of the Grid Transmission System in Great Britain." Mr. Johnstone Wright and Mr. C. W. Marshall.

(Irish Centre, Dublin).—Thursday, February 21st. Trinity College, Dublin. 7.45. "The Erection of the Mechanical and Electrical Part of the Shannon Scheme." Dr. K. Ott.

(Mersey and North Wales (Liverpool) Centre).—Monday, February 18th. University, Liverpool. 7 p.m. Faraday Lecture: "How Electricity Does Things." Mr. Ll. B. Atkinson.

(North-Western Centre).—Tuesday, February 19th. Engineers' Club, Manchester. 7 p.m. "Voice-Frequency Telegraphs." Mr. W. Cruickshank.

(Sheffield Sub-Centre).—Wednesday, February 20th. Royal Victoria Hotel, Sheffield. 7.30 p.m. Address by the President.

(Tees-side Sub-Centre).—Wednesday, February 20th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Ordinary meeting.

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Institution of Electrical Engineers—*continued.*

(London Students' Section).—Friday, February 22nd. (Joint meeting with the Institutions of Civil and Mechanical Engineers). I.E.E. building, London, W.C. 6.15 p.m. "Standardisation." Mr. W. Ford.

(North-Eastern Students' Section).—Friday, February 22nd. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "The Progress of Electrical Installations on Ship Board." Mr. G. Waters.

Overhead Lines Association.—Wednesday, February 20th. Institution of Electrical Engineers, London, W.C. 5.30 p.m. "Timber and Creosoting," Mr. C. Wade; "An Alternative Method of Wood Preservation," Mr. R. H. Herford.

Birmingham Electric Club.—Friday, February 22nd. Grand Hotel. 7 p.m. "Electricity in Agriculture." Mr. G. E. Britton.

Physical Society.—Friday, February 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Electrical Trades Commercial Travellers' Association.—Friday, February 22nd. Connaught Rooms, Great Queen Street, W.C. 7 for 7.30 p.m. Annual dinner.

Association of Mining Electrical Engineers (Lothians Branch).—Saturday, February 23rd. Philosophical Rooms, Edinburgh. Paper by Mr. G. A. McLennon.

(Western Sub-Branch).—Saturday, February 16th. Swansea. "Fault Localisation." Mr. S. T. Richards.

(South Wales Branch).—Saturday, February 2nd. Cox's Café, Cardiff. 6 p.m. Annual dinner.

Association of Supervising Electrical Engineers.—Saturday, February 23rd. Hotel Cecil, London, W.C. Annual dinner.

Notes.

Electrical Engineers' Ball.

The London Electrical Engineers' Ball was held at the Hotel Cecil on Friday of last week, and as usual proved an exceedingly enjoyable function. The occasion was a special one, as it represented the 25th anniversary. Some 750 invitations were issued, and we should think that the number present could hardly have been far short of that figure. All the ladies were presented with fancy handbags as a souvenir of the semi-jubilee. Messrs. Sillar, Hill and Kingsbury and their executive colleagues may once again congratulate themselves on a highly successful evening, very much enjoyed by all those present.

Newcastle Electrical Carnival.

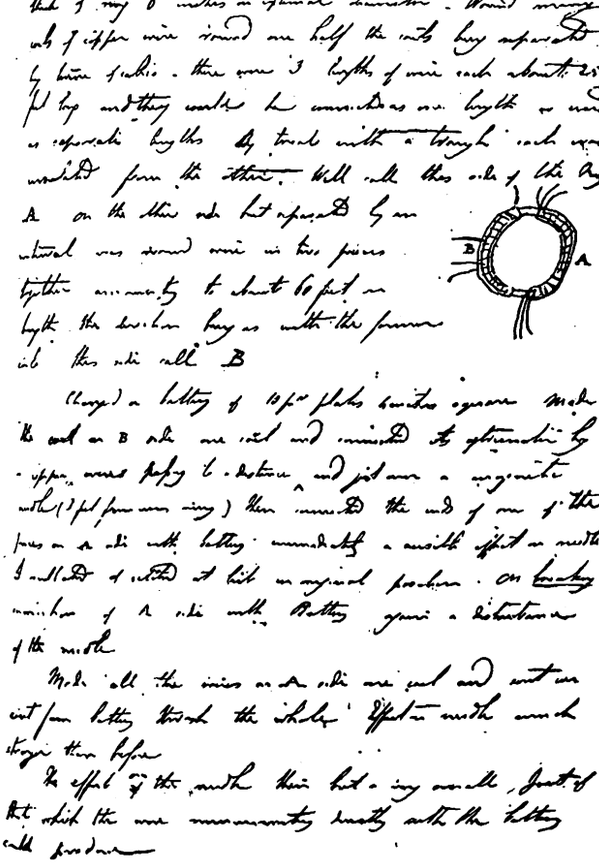
Anything more successful than the Electrical Carnival held at the Oxford Galleries, Newcastle, on January 7th, under the joint organisation of the Electrical Development Association and the Electrical Association for Women, would be difficult to imagine. Over one thousand guests attended the function, and were received by the Lady Mayoresss of Newcastle, Mrs. Arthur Lambert. A shadowgraph competition, when well-known personalities in the electrical world passed before a screen, created great interest, and lovers of humour were excellently provided for. A cabaret, staged by the Misses Lazenby, of Newcastle, caused much merriment, while the climax of enjoyment was reached when a "mock wedding" was performed, the clergyman being let down through the ceiling. Over one hundred prizes were distributed, including electric fans, radiators, and table lamps. Those present included Mr. W. A. Walton, London (president of the Electrical Contractors' Association); Mr. Robson (chairman of the Newcastle Electrical Development Association); Mr. W. Horsfall (General Electric Co.); Mr. R. P. Sloan, Mr. L. C. Penwill, and Mr. J. Edgar (borough electrical engineer, South Shields). The proceeds of the dance are to be devoted to the hospitality fund for the two hundred delegates attending the E.A.W. conference at the North-East Coast Exhibition.

American Rural Line Recommendations.

In a publication of the National Electric Light Association (America)—"Serial Report of the Overhead Systems Committee, 1928-29," Engineering National Section, January, 1929 (price 40 cents)—are contained "Recommended practices for design and construction of rural lines." The recommendations, while not complete, are intended to embody the general features of rural lines and to point out where the construction may differ from that of the generally-accepted short-span construction used in lines constructed in urban territories. The present practice of various operating companies now serving rural territories has been used as the basis for these recommendations, together with the requirements of Handbook No. 3 of the U.S.A. Bureau of Standards (fourth edition of the National Electrical Safety Code). The recommendations in the main are general only, though they have been made somewhat more detailed where it seemed desirable. Such details of construction as tend to decrease the cost of the line without unduly sacrificing strength on tending to increase maintenance costs have been emphasised. The report is not intended to set up standards of construction, but to serve purely as a guide for rural line construction.

From Faraday's Notes.

The following is a photographic reproduction of a page of Faraday's notebook, and is of particular interest at the present time in view of the arrangements which are under consideration for the 1931 celebrations, referred to elsewhere in this issue:—



The transcription of the notes is as follows:—

August 29th, 1831.

Experiments on the production of Electricity from Magnetism, &c., &c.

Have had an iron ring made (soft iron), iron round and ⅞ in. thick and ring 6 in. in external diameter. Wound many coils of copper wire round, one half the coils being separated by twine and calico—there were three lengths of wire, each about 24 ft. long, and they could be connected as one length or used as separate lengths. By trial with a trough each was insulated from the other. Will call this side of the ring A. On the other side, but separated by an interval, was wound wire in two pieces together amounting to about 60 ft. in length, the direction being as with the former coils. This side call B.

Charged a battery of 10 pairs of plates 4 in. square. Made the coil on B side one coil and connected its extremities by a copper wire passing to a distance and just over a magnetic needle (3 ft. from iron ring), then connected the ends of one of the pieces on A side with battery. Immediately a sensible effect on needle. It oscillated and settled at last in original position. On *breaking* connection of A side with battery again a disturbance of the needle.

Made all the wires on A side one coil and sent current from battery through the whole. Effect on needle much stronger than before.

The effect on the needle then but a very small part of that which the wire communicating directly with the battery could produce.

E.A.W. Activities.

The Electrical Outlet Campaign which was launched by the E.A.W. a year ago has undoubtedly done very much good work. A very successful meeting held in Newcastle on January 24th, was addressed by Miss Margaret Bondfield, M.P., and Mrs. L. A. Wilson. Miss Bondfield enthusiastically supported the campaign, and she said the time had arrived to do away with obsolete methods in the home, especially in the home of the working woman.

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Fatalities.

An inquiry into the death of Robert Foreman Strang, electrician, Bathgate, who at Riddockhill colliery, accidentally came into contact with an electric switch, was held at Lithgow on January 29th. The mine manager stated that dampness had affected the incoming cables and there was a slight breakdown. In consequence the cables were brought out an inch from the wall and Strang did the work. He gave him clear instructions that he was not to attempt to do anything until he was certain the power had been switched off. A foreman said he saw Strang standing on a cubicle slackening nuts. He had one hand on the wall while he did this and witness thought he was over-reaching himself. Strang put his right hand down to grip the ladder and his left hand came in contact with a switch that was carrying 3,000 V. A formal verdict was returned.

At Dunfermline on January 31st an inquiry was held into the death of a colliery labourer who received a fatal electric shock at Hill of Beath washery plant, Dalbeath Colliery, Cowdenbeath. The bing on which he was working was lighted by electricity, and an electric wire above snapped and fell on him. Under the system in use at the time a wire on the bing was "alive" when the lamps on the bing were out. The jury added to its formal verdict a recommendation that it would be conducive to safety that when lamps on the bing were not in use the electricity should be switched off from the wire on the bing.

Alternator Excitation.

There would appear to be divergence of views regarding the influence of the method of alternator excitation on the even operation of power-distribution systems. There are electrical engineers who consider that the best method of dealing with serious trouble in the distribution system is quick de-excitation of the synchronous alternators, while others prefer to maintain the pre-existing state of flux in the machine.

The subject was discussed at a recent meeting in Paris of the Société Française des Electriciens by Mr. Belfils, of the Société Alsacienne de Constructions Mecaniques, who drew a distinction between the even operation in parallel of the generators in a particular station and the even operation of both the generation and consuming installations. In the latter case, he said, the conditions varied according as the impedance of the consuming plant (motors) was a function of the system voltage or when it was independent thereof, as in the case of lighting and heating installations. Mr. Belfils summed up his remarks by the following four points:—

(1) That the even operation in parallel of the different alternators of a system did not necessitate a practical consistency of flux in the respective machines; on the other hand, such a condition might lead to other difficulties in the case of a short circuit.

(2) Except in the two cases of the utilisation of energy by one or several consuming units of which the apparent impedance dropped as the supply voltage fell away, and that of a power station with advancing power factor, the even operation of the whole of a distribution system was practically always assured.

(3) That it was desirable to get rid of short-circuits as quickly as possible, and that in many cases it was preferable that the generator flux should fall while it lasted, although the drop should not be a notable one.

(4) As soon as the short circuit had been overcome, it was always useful, and often indispensable, that the flux of the machine should be re-established quickly in order to prevent any interference with the operation of consuming units, particularly those which were sensitive to any variation in voltage. It was therefore desirable that generators should be provided with devices to secure that end.

Mr. Belfils is devoting further attention to the subject, and is now engaged in working out methods of excitation that will fulfil the conditions laid down in his paper.

Electrical Equipment at Sunderland Docks.

With the object of improving facilities for handling the increasing import traffic of the port of Sunderland, the River Weir Commissioners have recently installed four new five-ton electric cranes, supplied by Messrs. Babcock & Wilcox, Ltd. These cranes, which have a radius of 47 ft., are fitted with the makers' level luffing jib. Three additional three-ton electric cranes have also been installed at the East Quay.

Another interesting scheme which has been put in hand by the Commissioners is the conversion of Roker Pier lighthouse, one of the best known lights of the North-East Coast, to electric lighting, automatically operated. The fog siren, which is also situated in the lighthouse, is also to be worked automatically by electricity.

Australian Wiring Rules.

The Australian Commonwealth Engineering Standards Association has added to its activities the revision and administration of the electrical wiring rules for the Commonwealth. The work was taken over at the request of the Institution of Engineers, by whom the existing set of rules was issued, and the Association has decided that it will be necessary to make an analysis of the wiring rules existing in all important countries throughout the world. A Wiring Rules Sectional Committee is being established, which will operate in Sydney, with an advisory committee in each State.

Accumulator Standardisation.

A revised sheet of provisional standards in respect of the dimensions of battery crates or moulded containers, terminal posts, and cable connectors for the electric starting and lighting equipment of private motor cars has just been issued by the Society of Motor Manufacturers and Traders. The sheet gives the dimensions of five sizes of containers for both 6-volt and 12-volt batteries, ranging in capacity from 48 to 96 amp.-hours; it also gives the dimensions of terminal posts and drawings and dimensions of positive and negative cable connectors.

Electric Vehicle Progress.

The Ministry of Transport has just issued a return of the number of licensed motor vehicles in use in Great Britain at the end of September last, from which it is interesting to learn that, although they form but a small percentage of the total, there is a slow, but steady, increase in the number of electric commercial vehicles in use in this country. The return shows a total of 1,477 such vehicles, an increase of 114, or about 8 per cent., in twelve months. The total is made up of 168 vehicles for loads up to 25 cwt., 243 for carrying between 25 and 40 cwt., 233 between 2 and 3 tons, 466 between 3 and 4 tons, 289 between 4 and 5 tons, and 78 carrying over 5 tons, each division showing an increase.

Finsbury College Dinner.

The annual dinner of the Finsbury Technical College Old Students' Association is to be held on Friday, March 1st, at the Trocadero Restaurant, with the president, Mr. E. W. Moss, in the chair. As this event will celebrate the jubilee of the opening of Finsbury College, it is hoped that there will be a large attendance. Early application should be made for tickets (12s. 6d. exclusive) to the honorary secretary, Mr. F. R. C. Rouse, 15, Clifton Gardens, Golder's Green, London, N.W.11. Old students who are not already members of the Association are invited to get into touch with the secretary.

The Batti-Wallahs' Society.

On Wednesday, February 27th, the Society will hold its next luncheon at the Hotel Cecil at 12.30 for 1 p.m. Lt.-Col. K. Edgcumbe will be the chief guest, and his address will be on "Prosperity." On Friday, March 1st, the annual dinner and dance will take place at the Hotel Cecil. The reception by the president, Mr. R. W. Hughman, is at 7 p.m. and the dinner at 7.30 p.m.

Educational.

Faraday House Scholarships.—The annual examinations for a Faraday scholarship, tenable for two years in college and one year in works, and for a Maxwell scholarship, one year in college and one in works (each of the value of 50 guineas), will take place at Faraday House, London, on April 9th, 10th, and 11th. Exhibitions may be awarded to candidates who acquit themselves creditably, but do not qualify.

University of London.—A course of five lectures on "High Voltage Cables" will be given (in English) by Mr. L. Emanuel, of Milan, chief electrical engineer of the Pirelli Cable Manufacturers' Organisation, at the Institution of Electrical Engineers on February 20th, 22nd, 26th, March 1st and 5th, commencing at 5.30 p.m. Admission free without ticket. (See our advertisement pages to-day.)

Nickel-Plating Solutions.

A publication of the research and development department of the Mond Nickel Co., Ltd., "The Control of Acidity in Nickel-Plating Solutions," contains a copy of a paper, "The Acidity of Certain Electro-plating Solutions," by A. W. Hothersall, M.Sc., read before the Electroplaters' and Depositors' Technical Society. In the paper Mr. Hothersall explains that somewhat difficult term "pH," and describes the various methods used for its determination. He also adds some remarks on the need for acidity control and the use of buffering agents. No doubt, if no method of acidity controls is at present used, the adoption of one of the methods mentioned in the paper will lead to improved regularity and quality of product.

Appointments Vacant.

Installing engineer (300 taels per month) for the Shanghai Mutual Telephone Co., Ltd. Provincial sales manager for the Tungsram Electric Lamp Works (Gt. Britain), Ltd. Borough electrical engineer (£1,000) for the County Borough of Stockport. Junior scientific officer (£259) for the Admiralty Scientific Pool. Lecturer in engineering (£400) for the East London, South Africa, Technical College. Teacher for electrical drawing, demonstrator for advanced electrical machines, assistant instructor for installation workshop for the Hackney Technical Institute. Consumers' accounts and records clerk (£150), shorthand-typist, corerspondence and filing clerk (£110) for the Watford Corporation Electricity Department. Working manager for the Sidmouth U.D.C. Electricity Department. (See our advertisement pages to-day.)

Ex-B.W. Association Annual Reunion.

The next dinner and reunion of Ex-British Westinghouse men will be held at the Hotel Cecil, London, on Friday, March 8th. Particulars and tickets (15s. each, including one year's subscription) can be obtained from the honorary treasurer, Mr. W. E. Warrilow, 40, Mildred Avenue, Watford. Mr. F. Massingberd Rogers will preside.

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Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting on February 4th (Mr. F. Pooley in the chair), Mr. W. Rawlings opened a discussion on "Earthing and the Safety of the Public." The importance of the subject was reflected in the very large gathering present, and so many wished to contribute to the discussion that it was necessary to enforce a five-minute time limit on each speaker; even so, a number were precluded from speaking. Mr. Rawlings said the public should know the risks that were liable to occur with electrical apparatus, and he did not fear that proclamation of the dangers and how to avoid them could do any harm to the industry. He stated that the reports of H.M. Senior Inspector of Factories showed that of fatal accidents ten were caused by a.c. circuits for every one by d.c. It was, therefore, obvious that regulations for d.c. supply were not sufficiently stringent for a.c.; yet many new connections were being made to a.c. services without regard to the precautions, or suitability of the apparatus. It was necessary everywhere, without exception, to earth all metal liable to become alive; he believed it would be cheaper in the long run, while there would be no difficulty about creating a large demand for three-pin plugs and portable apparatus provided with earthing terminals. He was prepared to agree with those who advocated the insulation of everything if it could be done, but until they can insulate small radiators, irons, vacuum cleaners, fans, &c., including the special light and violet-ray apparatus which was frequently installed in bath rooms, there would be no protection at the most dangerous points. Mr. Rawlings advocated a system of concentric wiring, and concluded with an appeal for publicity. He said knowledge of the dangers of electricity when mishandled would not alarm people. It was such an excellent servant that the public would have it and insist on the improved safeguards that could make it ideal.

Mr. A. H. Dykes was in full accord with Mr. Rawlings. With concentric metal-sheathed wiring an earth was obtainable at all points; earth currents were avoided, the cost of wiring was reduced, and safety assured.

Mr. Ll. B. Atkinson said the subject could not have too much publicity; people must be taught not to play with 230 V, and they could be taught in a way that would not alarm them. He thought too much already existed of systems and apparatus wired in other ways for a general and sudden enforcement of earthing rules, but it was not beyond hope that the Commissioners could ensure that all apparatus on sale should have provision for a third wire.

Dr. A. Ekström said that a.c. at 40 V was fatal to some human beings, and it was therefore imperative to provide protective devices. He showed lantern-slide diagrams of three-phase mains and protective resistances, and pointed out how difficult it was to find a suitable earth under certain conditions.

Mr. R. Borlase Matthews said the discussion showed extraordinary diversity of opinion. He pointed out how different earthing was in towns where water mains were available to country districts where it was frequently difficult to find a satisfactory earth. In Holland it was compulsory to instal a transformer and reduce the supply pressure to 25 V for hand lamps.

Messrs. J. J. Bacon, F. W. Blanchard, T. C. Gilbert, R. Grierson, B. Higgs, A. Kirk, S. W. Melsom, C. C. Paterson, O.B.E., Napier Prentice, F. C. Raphael, E. Ridley, and Major Smith also spoke.

Institution of Mechanical Engineers.

KINEMA FILMS.—On March 8th, at 7 p.m., it is proposed to hold an informal meeting of the Institution (Storey's Gate, St. James' Park, S.W.), at which a collection of recent industrial kinematograph films of engineering subjects will be displayed, including one on "Electro-Farming," by Mr. R. Borlase Matthews.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review posted concerning their movements.

After a long discussion at its last week's meeting the Manchester City Council refused to increase the salaries of a number of its principal officials, including the chief engineer and manager of the Electricity Department, Mr. H. C. LAMB, although Alderman Dagnall pointed out that Mr. Lamb had virtually been promised an increase "when he had proved his worth" upon succeeding Dr. S. L. Pearce.

The Eccles Town Council has increased the salary of the borough electrical engineer from £850 to £900 per annum.

The wedding took place last Saturday, at All Saints' Catholic Church, Hassop, near Sheffield, of Mr. DENIS ZIANI DE FERRANTI, son of Dr. and Mrs. S. Ziani de Ferranti, of Baslow Hall, Derbyshire, and Miss ELIZABETH ESPLINE THOMSON, of Bellevelle, Newark, U.S.A. Misses Yvonne Ziani, Yolande and Valerie de Ferranti and Miss Wanda Ord were the bridesmaids. After the ceremony a reception was held, and among the guests were Sir John and Lady Snell. Among the wedding gifts were an oak table from the employés and a case of cutlery from the staff of Messrs. Ferranti, Ltd.

The Massachusetts Institute of Technology invited Prof. Dr.-Ing. REINHOLD RUDENBURG, the chief electrical engineer of the Siemens-Schuckert Werke Gesellschaft, of Berlin, to deliver a series of public lectures at Cambridge, Mass, U.S.A., from February 5th to March 26th.

The *Daily Telegraph* states that Sir HUGO and Lady HIRST are expected back in London on February 22nd from Australia and New Zealand.

The Middlesbrough Town Council has increased the salary of the electrical engineer, Mr. R. H. SCOTSON, from £750 to £800 per annum.

Burnley Town Council is recommended to increase the salary of the electrical engineer, Mr. J. E. STARKIE, from £731 to £900 per annum.

Mr. R. HOGGARD, manager of the Lincoln Corporation Transport Department, who is leaving to take up a similar position at Chesterfield, has been presented by the tramway and 'bus employés with a silver tea and coffee service and a silver tray. From the city officials he received an electric lamp standard in oxidised silver.

At the works of Messrs. T. W. Broadbent, Ltd., at Huddersfield, on February 1st, a presentation was made to Mr. MAURICE EDWARD BROADBENT, only son of the founder of the firm (the late Mr. T. W. Broadbent), and a student member of the Institution of Electrical Engineers, on his coming-of-age. The workmen presented him with a suit-case, the gift being handed over by Mr. Law Brook, the oldest employé. Mr. G. A. Broadbent, chairman of the company, presented each workman with a monetary gift varying in amount according to length of service, ranging from 34 years down to 11 years.

On the occasion of the twenty-fifth anniversary of the London Electrical Engineers' Ball, Mr. A. M. SILLAR, who has acted as honorary secretary during the whole of the twenty-five years, was presented with a handsome silver Treasury-pattern inkstand, suitably inscribed. The presentation was made by Mr. J. E. Kingsbury during the dance, and Mr. Sillar expressed the gratification which he felt at this kindly recognition of his services.

Press reports state that only a few days after his return to New Zealand following a lengthy absence in England and Malaya, Mr. BEALE, H.M. Trade Commissioner in New Zealand, received instructions to return to London immediately to confer on urgent questions.

On February 4th, Alderman R. S. PILLING, J.P., chairman of the Colne Electricity Committee, was installed as W.M. of the Colne Lodge No. 4402 by the retiring W.M., Mr. J. H. Thompson, M.I.E.E., borough electrical engineer.

Mr. F. A. DRACUP has resigned his position as motors and hiring superintendent in connection with the Birkenhead electricity undertaking.

The retirement is announced of Mr. R. DUMAS, works manager at Rugby for the British Thomson-Houston Co., Ltd., a position he has filled since 1908. Mr. R. C. CLINKER, chief of the engineering laboratory, has also relinquished his position, and is succeeded by Mr. H. W. WARREN. Mr. Clinker joined the company in 1895 in London, and Mr. Warren joined the Rugby staff in 1911, and in 1913 went to Coventry; he was responsible for the introduction of insulation manufacture at both Rugby and Coventry.

At the end of February Mr. J. W. FAWCETT is severing his connection with the Holmfirth Urban District Council, with which he has been electrical engineer and manager for the past five years. He is taking up the position of resident engineer with the Electric Development and Securities Trust, Ltd., and will reside at Withernsea.

Mr. W. DALE, foreman mechanic at Burnley electricity works, who recently retired after 35 years' service, has served under four engineers and managers: Messrs. Thursfield, Wright, Birkett, and Starkie (the present manager). He has received a farewell presentation, consisting of an inlaid clock, from his colleagues.

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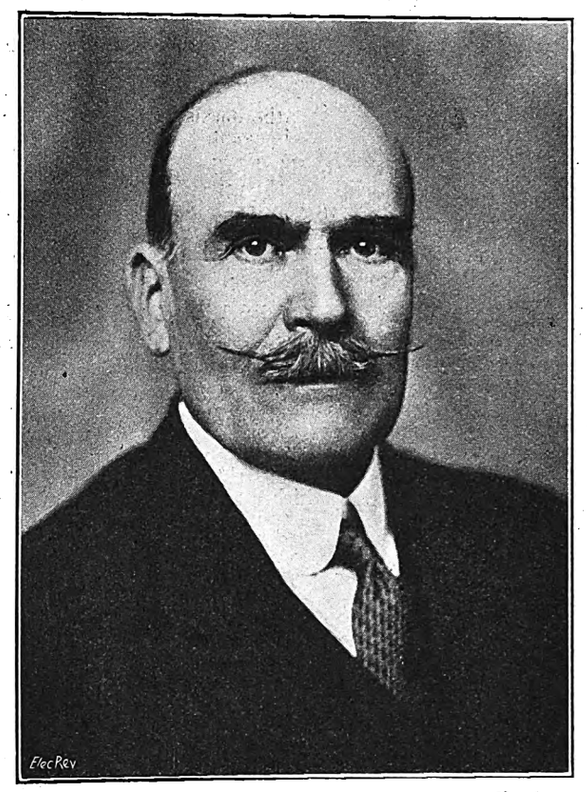
We publish accompanying these notes a photograph of Mr. W. A. Wilson, who retired from the post of assistant to the general manager of British Insulated Cables, Ltd., in London, at the end of last year. Mr. Wilson joined the Contract Department of the company in April, 1901, as engineer. He supervised various contracts, including a complete network of h.p. cables in Amsterdam, and the laying and jointing of some 100 miles of 11,000-V feeders in connection with the electrification of the Underground Electric Railways. He was transferred to the commercial side of the company's business in



Elliott & Fry] [*London.*

Mr. W. A. Wilson.

1905 and placed in charge of a new branch opened by the company in Birmingham. He took over the management of the Scottish branch in 1906, and was appointed manager of the company's telephone instrument works at Liverpool in 1911. In the following year he was appointed commercial manager, involving the management of agencies and publicity, to which was added, on his transfer to the general manager's office in London in 1919, the role of assistant to the general manager, and he continued those duties up to the time of his retirement. His retirement, and the death of Mr. James Taylor, J.P., the late chairman, in September, 1927, have of necessity caused various changes in the staff appointments. Readers who are in personal touch with the chiefs of the various departments in British Insulated Cables, Ltd., will be interested in a list of the new appointments. On the death of Mr. James Taylor, Mr. Dane Sinclair, director and general manager, became chairman of the company; Mr. G. H. Nisbett, chief engineer and director, was made managing director; Mr. B. Welbourn, contract manager, was appointed chief engineer; and Mr. N. K. Bunn, assistant contract manager, was appointed contract manager. On the retirement of Mr. W. A. Wilson it was arranged that a committee should be appointed to take over his duties. The Committee is constituted as follows: Mr. R. B. Paul (agency manager), Mr. A. J. Macphail (publicity manager), Mr. W. P. Ward, Mr. L. J. de Wynter, Mr. C. E. Newton, Mr. E. A. Eaton (joint sales managers). Mr. C. E. Newton was, up to August, 1928, engineering representative at the London office. This appointment has now been taken over by Mr. N. H. Miller and Mr. E. A. Sayers.

Mr. J. H. Dutton, of the Gloucester Electricity Department, has been appointed a junior charge engineer at Portsmouth generating station.

Obituary.—Mr. A. H. Allen.—It is with feelings of deep sorrow that we have to state that Mr. Arthur Hinton Allen, M.I.E.E., Technical Editor and Director of the Electrical Review, has passed away at the moment of going to press, after a very brief illness from pneumonia. He was in his 57th year. We shall refer to the matter further next week.

Mr. H. T. George.—The death occurred at Margate on January 31st of Mr. Howard Trevelyan George, of Cardiff, late Senior Chief Assistant, X-ray Department. St. Bartholomew's Hospital, and Honorary Medical Officer in charge, X-ray department, St. Andrew's Hospital, Dollis Hill, London.

Sir John Cowan.—On February 7th Sir John Cowan, chairman and managing director of Redpath, Brown & Co., steel constructional engineers, passed away in Edinburgh in his 85th year. Sir John was chairman of Bruce Peebles & Co., Ltd., and a director of Bolckow, Vaughan & Co., Ltd.

Mr. F. Beardmore.—The death is announced, in his 61st year, of Mr. Frederick Beardmore, who was in business as an electrical contractor at Blackfriars Street, Salford.

Mr. W. L. Wilcox.—The death took place on January 30th of Mr. William Langley Wilcox, who had for five years been electrician at Marlborough College. He was 42 years of age.

Mr. G. M. Boddy.—The death occurred on February 8th, at the age of 73 years, after a short illness, of Mr. George Marlett Boddy, inventor of the Boddy Star and other life-saving jackets, and about twenty years ago connected with the manufacture and sale of electric lamps in this country.

Mr. T. C. Stephens.—The death took place on February 2nd, at his residence, at Weston-super-Mare, of Mr. Thomas C. Stephens, superintendent at Weston for the Commercial Cable Co. He succeeded Mr. J. P. Gorton in this position in December, 1927, and he had been with the company for 40 years.

Mr. J. Gobin.—The death is announced at the age of 82 years of Mr. Joseph Gobin, who was for many years associated with the old Tramway Co. at Wigan; he was engineer prior to the trams being taken over by the Corporation.

Will.—The late Mr. R. A. Dalzell, formerly Director of Telegraphs and Telephones, left £2,741 gross and £2,606 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Polperro Electric and Cold Storage Co., Ltd.—Public company. Registered February 1st. Capital, £6,000 in £1 shares. Objects:—To adopt an agreement with the liquidator of the Polperro Electric and Cold Storage Syndicate, Ltd., and to carry on at Polperro and elsewhere in Cornwall the business of an electric light and power company, cold storage proprietors, &c. The directors are:—J. P. Briggs, 100, Langham Road, Teddington, architect; Lt.-Col. Sir Geo. A. E. Hussey, K.B., 29, High Street, Southampton; S. W. Taylor, Park House, Thames Ditton, dentist. Solicitors: Spring and Co., 13, Henrietta Street, W.C.2.

Pertrix, Ltd.—Private company. Registered February 1st. Capital, £10,000 in £1 shares. Objects:—To carry on the business of electricians, electrical and mechanical engineers and contractors, suppliers of electricity, and manufacturers of and dealers in primary and secondary electric batteries of all kinds, and to adopt an agreement with A.F.A. Accumulators, Ltd., for the purchase of the trade mark "Pertrix," and the acquisition of the business of that company in "Pertrix" batteries. The first directors are:—E. G. Lind, 20, Bryanston Mansions, York Street, W., chartered electrical engineer; J. F. Monnot, 36, Blandford Street, W.1, engineer. Registered office: 120, Tottenham Court Road, W.1.

Eirco (Wholesale), Ltd.—Private company. Registered in Belfast on January 18th. Capital, £100 in £1 shares. Objects:—To carry on the business of electrical engineers, wholesale manufacturers of electrical equipment, dealers in wireless apparatus, &c. The subscribers are:—L. Scop.

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37, Glandore Avenue, Belfast, electrical engineer; F. A. Newell, B.Sc., 1, Ashfield Crescent, Belfast, electrical engineer. The first directors are not named. Registered office: Kingscourt, Wellington Place, Belfast.

Aldsuneed, Ltd.—Private company. Registered February 2nd. Capital, £100 in 1s. shares. Objects:—To manufacture and deal in stoves, engines, and other conveniences calculated to promote the consumption of electricity, &c. The first directors (to number not less than two nor more than five) are:—R. F. Weekey, "Alameda," 22, Selwyn Road, New Malden; G. J. Bird, "Shirley," 7, Selwyn Road, New Malden, secretary; A. H. Bird, "Shirley," 7, Selwyn Road, New Malden, designer. Registered office: 35, Bucklersbury, E.C.

Dorian Wireless Co., Ltd.—Private company. Registered February 1st. Capital, £2,000 in 1,950 ordinary shares of £1 each and 1,000 deferred shares of 1s. each. Objects:—To carry on the business of merchants and manufacturers of and dealers in wireless, electrical, magnetic, telegraphic, telephone and other appliances, machines and apparatus, &c. The first directors are:—B. A. Emly, 5, Sheffield Terrace, W.8, managing director of Halcyon Wireless Co., Ltd. (life director); C. A. Gamlen, 25, Buckingham Chambers, Victoria Street, S.W.1, radio engineer. Solicitors: Kennedy, Lindo & Co., 79, Coleman Street, E.C.2.

Truphonic Radio, Ltd.—Registered as a public company February 4th. Capital, £75,000 in 2s. shares. Objects:—To acquire the undertaking of Truphonic, Ltd., and to carry on the business of manufacturers of and dealers in radio, television and electrical apparatus, gramophone, record and accessory manufacturers, importers and exporters, electrical engineers, &c. The first directors are:—Geo. E. Spero, 10, Lancaster Gate Terrace, Hyde Park, W.2 (chairman, Truphonic, Ltd.); J. H. Benjamin, 19, Lancaster Gate Terrace, W.2 (director, Truphonic, Ltd.); James A. Whatnall, 31, Fillebrook Road, E.11, consulting engineer; Lt.-Col. Sir Rhys Williams, Bt., D.S.O., 47, Eaton Place, S.W.1. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.2.

East Devon Electricity Co., Ltd.—Public company. Registered February 5th. Capital, £10,000 in £1 shares. Objects: To carry on the business of an electric supply company in all its branches. The first directors are: J. L. Walsh, 73, Prince of Wales Mansions, Battersea Park, S.W.11, solicitor; S. S. Grant, O.B.E., 12, Third Avenue, Hove, chartered electrical engineer; F. J. Bayley, 16, Hereford Square, Kensington, S.W.7, engineer. Solicitor: Horace Davey, 47, Parliament Street, S.W.1.

Emery & Co., Ltd.—Private company. Registered February 7th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, lighting, heating, wireless, mechanical and general engineers, &c. The provisional directors are:—E. W. Carryer, Friarswood House, Newcastle, Staffs., house furnisher; H. E. Emery, 61, Lower Street, Newcastle, Staffs., electrical engineer. Manager: H. E. Emery. Solicitors: Sproston & Son, Newcastle-under-Lyme.

Official Returns of Electrical Companies.

Hightensite and Ebonite Manufacturing Co., Ltd.—Third debenture dated January 24th, 1929, to secure £1,400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—Sir Robert L. Powell, J.P., Flowers Hill, Pangbourne.

Birmingham Mica Co., Ltd.—Particulars filed on January 26th, 1929, of £1,500 debentures authorised July 19th, 1928, charged on the company's property, present and future, including unpaid calls and liability of members, the amount of the present issue being £750.

Hambling, Clapp & Co., Ltd.—Debenture dated January 24th, 1929, to secure £1,700, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. H. Sayers, 14, Rectory Road, Beckenham.

Bower Electric, Ltd. (Old Company).—F. E. Kewley, 27, Grosvenor Court, Acton Hill, W.3, ceased to act as receiver or manager on December 31st, 1928.

Precision Radio & Manufacturing Co., Ltd.—Debenture dated January 26th, 1929, to secure £300 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. C. Powers, 56, Fleet Street, E.C.4.

Keswick Electric Light Co., Ltd.—Satisfaction to the extent of £550 on December 31st, 1928, of debentures created June 10th, 1901, securing £15,000, of which only £10,100 was issued.

Marple & Frisby, Ltd.—F. S. Wilks, 31, Lombard Street, E.C.3, was appointed receiver on January 28th, 1929, under powers contained in a debenture dated June 3rd, 1927.

Finston Manufacturing Co., Ltd.—C. O. Skey, of 10, St. Swithin's Lane, E.C., ceased to act as receiver or manager on January 28th, 1929.

South London Electric Supply Corporation, Ltd.—Satisfaction in full on December 21st, 1928, of trust deed dated February 2nd, 1909, securing £130,000.

Belbin & Bowden, Ltd.—Debenture dated January 28th, 1929, to secure £135 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Capt. S. V. Bowden, 78, Brook Green, Hammersmith, W.

Midhurst and District Electricity Co., Ltd.—Debenture dated January 24th, 1929, to secure £5,000 and premium of 5 per cent. on the maximum amount at any time due charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Johnson and Phillips, Ltd., Columbia House, Aldwych, W.C.

Vidal Engineering Co., Ltd.—Particulars filed of £8,000 debentures authorised January 18th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £5,500.

T.V.E. (Triplex-Blade Ventilating Engineering) Co., Ltd.—Debenture dated January 29th, 1929, to secure £500 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. M. Kenny, 32, Nunnery Fields, Canterbury.

Rhyader Electric Light and Power Co., Ltd.—Capital, £2,000 in £5 shares. Return dated September 27th, 1928. All shares taken up. £2,000 paid. Mortgages and charges at date of return, £1,000.

Kartret Switchgear Co., Ltd.—Capital, £2,500 in £1 shares. Return dated January 4th, 1929. All shares taken up. £2,500 considered as paid. Mortgages and charges nil.

Keighley Electrical Engineering Co., Ltd.—Capital, £10,000 in 7,000 ordinary and 3,000 preference shares of £1 each. Return dated November 21st, 1928. 4,200 ordinary and 1,800 preference shares taken up. £3,988 paid. £2,012 considered as paid. Mortgages and charges, £5,000.

S. Barnett & Co., Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated December 24th, 1928. 807 preference and 950 ordinary shares taken up. £1,007 paid on 807 preference and 200 ordinary shares. £750 considered as paid on 750 ordinary shares. Mortgages and charges, nil.

Mawdsleys, Ltd.—Capital, £20,000 in 13s. 4d. shares. Return dated November 7th, 1928. 26,525 shares taken up. £9,683 6s. 8d. paid. £8,000 considered as paid. Mortgages and charges, £10,665 5s. 9d.

City Notes.

Yorkshire Electric Power Co.

The accounts for the year ended December 31st last show a net profit of £310,070 (after the payment of debenture charges), as compared with £294,371 in the preceding year. To this is added £74,096, making £384,166. A final dividend of 5 per cent., making 8 per cent. for the year, is recommended; £100,000 is to be placed to general reserve (making £475,000); and £78,233 is to be carried forward. The report states that the demand for electricity has again increased notwithstanding the trade depression, particularly that of the coal industry. The increase in the net profit was principally due to further economies resulting from the greater use of the Ferrybridge power station. There has been a substantial increase in the demand for supply in bulk, and a number of important new agreements have been made for additional supplies. A large number of mains extensions were made during the past year and others are in progress. The initial plant installed at Thornhill power station has now been removed to make room for larger and more efficient plant. The cost has been met out of reserves. In February last, 897,000 ordinary £1 shares were issued to the shareholders at 24s. per share. 20,000 6 per cent. cumulative preference £1 shares have been set aside to enable the company's employés to increase their interest in the company. Applications have been made to the Electricity Commissioners for authority to supply in parts of the counties of Derby, Lincoln, Nottingham and York (East Riding). These await decision. The parts in question adjoin the company's existing area of supply.

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London Power Co., Ltd.

Mr. W. F. Fladgate (chairman) presided at the annual meeting on February 8th and said that the company was now operating all the stations taken over and by laying the 22,000-V mains it had completed the first portion of the programme. Although the output had shown a large increase they had been able to reduce their total charges for it, giving the constituent companies an actual cash benefit of £152,000. As a proof of the benefits of the combined system, the chairman said that although during the floods early in 1928 one of their stations had been put out of action, there was actually no interruption of supply. Even more important were the economic effects. In 1924 the average operating cost of the ten companies was 0.55d. per kWh; last year the company's average cost was 0.278d. per kWh, and by the end of this year he hoped that this figure would be reduced to 0.225d. The work at the Deptford West station was progressing and the station would be in commission, to some extent, before the end of the year. They would at once proceed with the work at the Battersea station, which would give them a further ultimate capacity of 400,000 kW. Four of their stations had been "selected" by the Central Electricity Board under the South-East England scheme, and the two new stations were also "selected" stations. With reference to the London and Home Counties Joint Electricity Authority, its proposal to ask Parliament for further powers had been actively and successfully challenged by the County of London Company. In his opinion it would be necessary for the company to appear before the Committee of the House, if the Bill should ever arrive there, to protect the position secured to the company by its Act. Mr. Fladgate concluded with a reference to the Holborn explosion and stated that the company's chief engineer had given evidence before the commission of inquiry.

The "Underground" Group.

The companies forming the London Underground Railways group last week declared dividends as follows:—

Central London Railway Co.—Final dividend of 2½ per cent. on the undivided ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927); final dividend of 2 per cent. on the preferred ordinary stock, making 4 per cent. for the year as for 1927; dividend of 6 per cent. on the deferred ordinary stock (against 4 per cent. for 1927). The reserve receives £40,000.

London Electric Railway Co.—Final dividend of 2½ per cent. on the consolidated ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927). The allocation to reserve is £157,198.

Metropolitan District Railway Co.—Final dividend of 2½ per cent. on the ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927); £90,000 to reserve.

City and South London Railway Co.—Final dividend of 2½ per cent. on the consolidated ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927); £25,000 to reserve.

London and Suburban Traction Co.—The directors state that they are unable to recommend the payment of a dividend on the 5 per cent. cumulative preference shares.

Underground Electric Railways Co. of London, Ltd.—Final dividend of 4 per cent. on the ordinary shares, making 7 per cent. for the year (against 5 per cent. for 1927). The "carry forward" is increased from £169,762 to £262,804.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Altrincham Electric Supply, Ltd.—50,000 cumulative participating ordinary shares of £1 each, fully paid, Nos. 56,651 to 106,650; 140,000 deferred shares of 1s. each, fully paid, Nos. 49,651 to 189,650.

London Power Co., Ltd.—£3,000,000 new 5 per cent. redeemable debenture stock, issued at £99½ per cent., partly paid and fully paid (February, 1929, issue).

Sofina (Société Financière de Transports et d'Entreprises Industrielles, S.A.).—3,750 ordinary shares of 500 fr. each, fully paid, Nos. 68,164 to 71,913.

Underground Electric Railways Co. of London, Ltd.—1,475 new ordinary shares of £1 each, fully paid, Nos. 7,056,721 to 7,058,195.

New Issue.

Truphonic Radio, Ltd.—The registration of this company is recorded in the "New Companies" section of this issue. Last week the company offered for subscription 425,000 shares of 2s. each at par. Of the balance 225,000 shares are to be issued as fully paid to the vendors, who also have an option of purchasing the remainder (100,000) at 2s. 6d. each. The company is to carry on the manufacture of portable radio receivers, loud speakers, electric gramophones, &c. It is expected that £30,000 of the proceeds of the issue will be available as working capital. The registered office of the company is at 121, Rosebery Avenue, E.C.1.

Lanarkshire Tramways Co.

The company has applied for sanction to abandon its tramways, substituting omnibuses, and changing its name to "The Lanarkshire Traction Co." The reasons for this are stated to be that the company has suffered severely from unrestricted and unfair competition, with the result that it is unable to earn a return upon its capital.

Singapore Traction Co., Ltd.

Speaking at the annual meeting on February 6th, the chairman (Mr. L. W. Hawkins) said that it was satisfactory to find that the company had again become able to pay a dividend (5 per cent. on the cumulative preference shares). The position during 1928 was much better than in the preceding year when a boycott of the company's services took place. During the first sixteen weeks of the current year the number of passengers carried and the receipts showed an increase of 25 per cent. There was good evidence that the company had not yet reached "saturation" and the policy of development was fully warranted. The directors consider that the reconstruction of the old company and the conversion of its almost derelict tramway had been fully justified. They looked forward to steady progress based on efficient catering to the public needs.

St. James' and Pall Mall Electric Light Co., Ltd.

The report for the year ended December 31st last shows a net profit of £103,851 (against £123,933 for 1927). To this is added £81,807 brought forward, making £185,658. The final ordinary dividend is 9.949d. per share, making up the "standard" dividend of 1s. 6.949d. per share for the year. £13,282 is transferred to special reserve fund "ordinary shareholders' benefit under the 'sliding scale' for the years 1926, 1927, and 1928," and £112,377 is carried forward. During the year the connections rose from 31,733 to 35,626 kW and the sales of energy from 28,414,097 to 32,322,499 kWh. The report refers to the death of Sir A. B. W. Kennedy, who was a director and chief engineer of the company, and to the appointment of Lord Wargrave to the board. Meeting: February 26th.

Everlite, Ltd.

The Marquis of Winchester (chairman) presided at the statutory meeting of the company on February 4th. In the course of his speech he said that the company had acquired ample accommodation in a factory acquired by Metropole Industries from Imperial Chemical Industries, Ltd. One of the largest metal lamp manufacturing concerns in the country had arranged to co-operate with the company; commencing with 40,000 lamps a week, the company would supply, in due course, as many as 100,000 a week. After referring to the circumstances in which Mr. S. R. Mullard resigned from the board, the chairman said that Mr. G. Langford had been appointed factory manager at Waltham Abbey.

West Highland Water Power Co.

This company has applied to the Secretary of State for Scotland for incorporation. The initial capital will be £1,000,000 and powers will be taken to double this figure. The borrowing powers will be limited to half the amount of the issued capital. The first directors of the company are Lord Meston, the Hon. R. H. Brand, and Mr. P. J. Pybus. These gentlemen and Sir Charles E. Ellis and Sir George E. May are the promoters of the scheme. The company proposes to construct and operate hydro-electric works at Glenelg, Inverness, and supply electricity at a maximum price of 1½d. per kWh. The works would be completed within 10 years.

Power Securities Corporation, Ltd.

The gross income for the year ended December 31st last rose from £111,796 to £123,159, and after meeting all expenses there was a net profit of £85,239 (against £84,678). To this is added £15,630 brought forward, making £100,869. The reserve receives £20,000 and the dividend equalisation fund £10,000; it is proposed to pay an ordinary dividend of 7 per cent. (as for 1927), and to carry forward £14,869. The directors state that the investments have an aggregate value in excess of the figure shown in the accounts. The company holds the entire share capital of Balfour, Beatty & Co., Ltd. Meeting: February 20th.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

Particulars of the proposed reconstruction scheme were published last week. It was shown that the total losses were £14,117,537. To meet these £9,499,688 of the share capital (£10,012,500) is to be cancelled. The loan capital is to be reduced by £3,363,986; interest, amounting to £988,468 is to be cancelled; and £76,098 is to be taken from the reserve. A number of other arrangements are to be made and the existing company will become a holding company with interests in eight engineering, shipbuilding, and colliery concerns.

Tyneside Tramways and Tramroads Co.

The report for the half-year ended December 31st last shows that the expenses exceeded the receipts by £1,049, and after providing for debenture interest, &c., the total deficit is £2,530. Against this are set a balance of £61 brought forward and £2,500 from the general reserve, leaving £31 to be carried forward. The traffic receipts for the whole year showed a decrease of £3,181, the number of passengers carried falling from 6,686,216 to 6,615,942. The car-mileage, however, rose from 549,642 to 551,275. The company has deposited a Bill with the object of obtaining powers to abandon the whole or any part of the tramways and to run omnibuses instead of, or in addition to, the tramway services.

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Electrical and Industrial Investment Co., Ltd.

This company, which is controlled by the British Electric Traction Co., reports a profit of £22,147 for the past year (against £19,454). A dividend of 6 per cent. is to be paid on the deferred ordinary shares and £3,748 is transferred to the undivided profits account. A sum of £85,500 has been capitalised and distributed as a bonus to the deferred ordinary shareholders in the form of 1,710,000 fully-paid 1s. deferred ordinary shares. The whole of the issued and unissued deferred ordinary shares have been consolidated into £1 shares. Since the close of the year 10,000 £1 deferred ordinary shares have been subscribed at par, making the total issued 100,000. Meeting: February 19th.

Bankside Investment Trust, Ltd.

This trust offered for subscription on Monday last £700,000 of 5 per cent. first mortgage debenture stock at 97½ per cent. The prospectus showed that the company has an authorised capital of £250,000; of this £200,000 has been issued, the City of London Electric Lighting Co., Ltd., holding £199,991. It was formed in 1920, as a private company, to acquire and develop lands and buildings and to carry on other business projects. The payment of interest and sinking fund instalments is guaranteed by the City of London Electric Lighting Co., Ltd., and shareholders in that company were to receive preferential consideration.

Atlas Light and Power Co., Ltd.

It is reported that the company has entered into an agreement with the American and Foreign Power Co. for the sale of the Atlas electricity supply and tramway holdings in Argentina. The sum involved is £8,500,000. The company's other South American holdings will be retained. One of the conditions of the sale is said to be that British manufacturers shall be given preference in the placing of orders for equipment for at least ten years.

Fife Tramway, Light and Power Co., Ltd.

Presiding at the annual meeting on February 7th, Mr. William Low (chairman) said that on the power and lighting side of the business, which had contributed approximately 65 per cent. of the total trading profit, the improved results were undoubtedly attributable to the steps which had been taken to develop the outlying districts of the area of supply and to popularise the use of electricity by domestic consumers.

City of Buenos Ayres Tramways Co. (1904), Ltd.

The balance of net revenue for the past year is £73,345 (as compared with £74,885 for 1927). As previously announced, the final dividend is 1s. 3d. per share, making 5 per cent. for the year, £10,000 is placed to amortisation and general fund, and £1,345 is carried forward.

Ruths Steam Storage.

To operate the Ruths steam accumulator patents in the United States, Ruths Steam Storage, Inc., has been formed in New York with a capital of $1,500,000. A Canadian company, Ruths Steam Storage (Canada), Ltd., has also been formed, with a capital of $300,000 to exploit the Canadian rights.

Yorktown (Camberley) and District Gas and Electricity Co.

The directors recommend dividends at the rate of 12½ per cent. per annum on the original shares, and at the rate of 8¾ per cent. per annum on the additional shares (including the interim dividend already paid).

American Power and Light Co.

The regular quarterly dividend of 25 cents per share has been declared on the common stock.

Crossley Bros., Ltd.

The balance of the dividend on the 7 per cent. cumulative preference shares is to be paid for the year ended December 31st last. No dividend has been paid on the ordinary shares since 1920.

North Metropolitan Electric Power Supply Co.

The directors recommend a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year, as in 1927. £120,705 is to be placed to reserve, leaving £28,202 to be carried forward, compared with £19,041 brought in.

British Columbia Power Corporation.

The directors report that the net earnings for the six months ended December 31st last amounted to £441,479, an increase of £50,676 over the figure for the latter half of 1927.

Radio Corporation of America.

The total revenue for the past year rose from $65,082 074 to $100,530,720, and the surplus from $8,478,320 to $18,983,394.

Stocks and Shares.

Monday Evening.

The raising of the Bank Rate from 4½ per cent. to the present level of 5½ per cent. came as a complete surprise to the Stock Exchange markets, and had the immediate effect of upsetting prices in most departments. There was no great amount of selling, but jobbers frankly admitted that they marked down prices as a matter of precaution. The depression spread throughout the investment and the speculative markets alike, the only important department of the industrial market which was not affected being that for cable equipment shares, the prices of which show pronounced strength. Most of the issues connected with the United States gave way sharply, and General Electrics, from their recent high estate of 75s., fell back to 62s. 6d. The Underground group of railways announced their dividends at the end of last week and as the distribution on Underground Electric shares was no more than 7 per cent., this served to accentuate the dullness which prevailed in Home Railways. Marconis, after being noticeably strong, relapsed on sales which were made by those who feared that the rise in the Bank Rate would bring in a wave of profit-taking.

Tube Railway Dividends.

The Underground Electric Railways Company of London announces a final dividend of 4 per cent., making 7 per cent. for the year 1928, which is an increase of 2 per cent. as compared with the 1927 results. As mentioned here on many occasions, the market expectations of this dividend had been gradually rising during the past six months, and from 6 per cent. they went up as high as 10 per cent., though the cautious folks pinned their faith to 7½ per cent. That the actual rate should be below that last-named figure is regarded as a disappointment; and, in consequence, the shares fell from 27s. 6d. to 26s. The six per cent. income bonds shed 5 points on top of their fall of 2 in the previous week.

The Metropolitan District dividend, making 5 per cent. for the year, is up to anticipation. This shows a rise of 1 per cent. as compared with the previous year, and, as the allocations are satisfactory, the result is regarded as being good; the price of the stock remains at 80½. The London Electric, City and South London, and Central London Companies are paying 5 per cent. for 1928, as against 4 per cent. for 1927. Central London deferred gets 6 per cent., as against 4 per cent. The London General Omnibus dividend of 8 per cent. for the year, tax free, is 1 per cent. up, and the Associated Equipment Company pays a similar rate—*viz.*, 8 per cent.

Atlas Advance.

Atlas Light and Power shares have fully justified the optimism of the company's supporters, and, with a jump of several shillings, touched 1½. It was but recently that the company made a new issue of shares, offered to its own proprietors, at 40s. for a unit of one ordinary and one preference. This was so near to the market price, at the time the new money fell due, that some of the shareholders thought the offer not worth acceptance, particularly as the value of the rights was quoted as being virtually nil. The dramatic rise last week is due to an offer of 8½ million pounds sterling, by the American and Foreign Power Company of New York, for the Atlas Company's holding in Argentine electric tramway and electric supply undertakings. Anglo-Argentine Tramways first preference shares are 2s. 6d. higher, on anticipatory hopes. Dealings have now started in the shares of the Sofina Company, of which details were given last week, on page 250. Sofina controls, or is interested in, a number of electrical concerns, and is said to have cash resources amounting to ten million pounds sterling. The opening price for the share of 500 Belgian francs was £206. First circles acquired the shares very much more cheaply.

Electric Supply and Power.

The London Power Company was lucky in offering its three million pounds of 5 per cent. debenture stock, at 99½, on the day before the Bank Rate rose to 5½ per cent. No doubt the latter consideration affected the public result of the issue, and underwriters have been left with 47 per cent. of their obligation. The stock is a perfectly safe investment, and its security as absolute as most people require, but the price of issue looked high even with a 4½ per cent. Bank Rate, and the opening price was ¼ discount. County of London Electric ordinary have been a good spot, rising 2s. 6d. to 52s. North Metropolitans advanced to 50s., to the accompaniment of the now-familiar rumour of American buying for purposes of control. The company's new shares stand about 6d. less than the old. Various dividends at what are now regarded as the standard rates have been declared by the group of London electricity supply companies, prices remaining unchanged. London Electrics have gained 6d. at 26s. 6d. In the provincial list, Bournemouth and Poole are 3s. 9d. higher at 73s. 3d. Yorkshire Electrics are maintained at 36s. 6d.; the report shows a reduction in the allocations to reserve, an increase in the carry-forward, and the usual 8 per cent. per annum dividend on the increased capital.

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Cable Stocks and Money.

Money rates must play a fairly important part in the values of Stock Exchange securities standing so high as do those of the Eastern Cable quartette. The 5½ per cent. Bank Rate has had, as might be supposed, an unfavourable effect upon all four issues, Globes, Eastern Extensions and Westerns being each 10s. down, Eastern Telegraph ordinary stock losing 2½ points. It is thought that the delay in the issuance of details as to how the existing stocks and shares will fare, in the distribution of the new securities, may be due to some technical point not yet wholly settled between the British Government and one of the Australian Colonies. There is no suggestion of a hitch having occurred: the negotiations have gone too far for such a thing to happen. But until complete and absolute unanimity are assured on every detail, it is thought that the exchange of the Communication Company's stocks may be held back. Marconis are 1/16 easier after their previous rise. Marines are 3⅝; Canadians dull at 32s. 6d. Great Northern Telegraphs lost 30s. of their recent very substantial improvement. Anglo-American Telegraph deferred dropped half a point, and at the middle price of 24½ the stock looks cheap, on its well-secured yield of 6⅛ per cent. on the money.

The Radio Corporation accounts for 1928, presented with admirable promptitude for so considerable an undertaking, show a surplus of 19 million dollars of receipts over expenditure. The 1927 surplus was 8½ million dollars. The figures just announced give a key to the reason for the big rise that has taken place in the prices of the shares during the past few months. The "A" shares are about £78, and the "A" preferred £11 15s.

Strength of Equipment and Construction Shares.

From New York it is announced that the Associated Gas and Electric Company, a holding concern, has contracted to acquire control of the General Gas and Electric Corporation, which gives utility services in half-a-dozen important American States. It is said that the corporation thus formed will have gross annual earnings of more than 13 million pounds sterling.

The influence of New York as a bull point has been, however, somewhat blunted by the monetary developments, and there have been sharp falls in a good many American industrial shares.

General Electrics have come down to 3⅛, as already noted, and people who would not listen to a suggestion, when the market was strong, that the shares were standing too high, are now asking whether it might not be as well to sell. Other shares in the industrial list are generally good, rises having occurred in Enfield ordinary, Callender's, British Insulated, which are up 5s., British Aluminium, and Johnson and Phillips. The Stock Exchange Committee has given permission to deal in 130,000 new Callender shares, which were issued, it is said, to a financial house, though the price which the company received is not stated. We may add that shares were allotted to certain people in the City at 3⅞, and this is no doubt higher than the price which the later buyers paid. Possibly the company has some special reason for not allowing its shareholders the opportunity for acquiring new shares at what must have been a tempting price.

Armstrong's Loss.

Amongst the lower-priced shares, India Rubber and Gutta Percha are 1/16 better at 12s. 6d., and in the engineering group Babcock & Wilcox strengthened to 72s. The Armstrong Whitworth reconstruction scheme proposes the writing off of £14,117,536 as being lost or unrepresented by assets. The very magnitude of the sum has a kind of numbing effect, for nobody can visualise the amount of personal suffering which the loss inflicts upon many hundreds of genuine investors. Vickers are easier at 12s. 3d.

Miscellaneous Movements.

Manila Electric 5 per cent. gold bonds are 13 points higher at 102. Brazilian Tractions at 70 show a nominal fall of 9, but half of this is accounted for by the deduction of the value of the rights. Mexican Light and Power common shares are 2 down at 98; the 7 per cent. preferred at 78½ have gained a similar amount. British Electric Traction deferred stock holds its extraordinary level of 825, and stock changed hands twice to-day, Monday, at 810 and at 820. The Bombay riots led to a little heaviness in the prices of Indian shares, though prices were not quotably changed. According to the newspaper reports, the trouble is well in hand, and unless it should spread unexpectedly, the prospects are regarded as being favourable to early restoration of order. Hydro-Electrics are 38¼, after being better. The British Columbia Power Corporation, which took over the British Columbia Electric Railway Company, announces an increase in net earnings, for the six months, July 1st-December 31st, 1928, of £50,676, which is considered satisfactory. The "A" shares stand at 58, and the "B" shares at 38. The Electrical and Industrial Investment Trust's profit of £22,148 for 1928 was £2,700 up, and the deferred ordinary shares will receive 6 per cent. dividend. It is proposed to convert these shares into deferred ordinary stock. The company's 4½ per cent. debenture stock is quoted at 62½. Rubber and rubber shares show no fresh indications of activity, although the statistical position is notably better than that of a year ago.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Feb. 11, 1929.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14†	15	73/3	+3/16	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6xd.	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 8 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	52/-	+2/6	2 17 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—	3 18 8
Kensington Ordinary	1	8	8	27/-	—	5 8 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/6	+6d.	5 5 8
Metropolitan	1	8	9	46/3	—	3 18 1
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/6	—	4 5 8
Mid. Elec. Power	1	—	15	2 1/16	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	27/-	—	4 9 0
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref. ...	1	6	6	28/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	—	4 14 2
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	40/9	—	... ...
Westminster Ordinary	1	8⅝	8⅝	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	+6d.	6 1 8
Yorkshire Elec.	1	8	8	36/6	—	4 7 6

†4% of which was tax free.

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	"	3	3	65½	—	5 6 10
do. District	"	3½	4	80½	+½	6 4 8
Underground Electric	£1	1½	5	26/-	—1/6	5 7 8
do. do. Income ...	Bonds	6	6	124	—5	4 16 9

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24½	—½	6 2 5
Automatic Telephone	1	10	10	2 1/16	—3/16	4 16 10
Eastern Extension	10	10	10	27	—½	*3 14 1
Eastern Tel. Ord.	Stock	10	10	270	—2½	*3 14 1
Globe Tel. and T. Ord.	10	10	10	26½	—½	*3 15 8
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	20	33	—1½	... ...
Indo-European	25	10	10	54½	—	*4 11 0
Marconi	10/-	5	*10	3 15/16	—1/16	... ...
Marconi-Marine	1	8¾	12½	8⅝	—	3 9 1
Oriental Telephone Ord.	1	12	12	3	—	... ...
Western Telegraph	10	10	10	27	—½	3 14 1

*Interim.

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8¾	+⅛	7 6 8
do. do. 2nd. Pref. ...	5			3⅝	—	3 5 6
do. do. 5% Deb. ...	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	"	—	—	825	—	... ...
do. do. Pref. Ord.	"	8	8	126	—	6 7 0
Brazil Traction	100	6	7	70xr	—4½	2 17 2
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 4 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	84	—	5 19 1
Mexican Light Common	100	Nil	Nil	98	—2	... ...
do. 7% Pref.	100	Nil	7	78½	+2	8 18 4
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	18	15	72/-	+9d.	*4 8 4
British Aluminium Ord.	1	10	10	47/6	+6d.	*4 4 2
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅞	+¼	8 1 6
Brush Ord.	1	10	10	23/9	—	6 19 2
Callenders	1	15	15	4 5/16	+3/16	3 9 1
do 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 8
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	5 16 6
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	23/9	—	5 16 6
Enfield Cable Ord.	1	20	20	1⅞	—3/16	3 14 6
English Electric	1	Nil	Nil	8/9	—	... ...
do. do. Pref	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6¾	6½	21/6	—	5 6 1
do. Ord.	1	7½	10	58⅝	—13/16	3 4 0
Henley	1	25	25	6⅝	+⅛	4 1 8
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	12/6	+1/16	... ...
Johnson & Phillips	1	12½	10	2 1/16	+1/16	4 17 1
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	25	—	*4 14 6

*Dividends paid free of Income Tax.

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The British Industries Fair.—I.

Functions and Exhibits in London and Birmingham.

On Monday next at the White City, London, and at Castle Bromwich, Birmingham, the British Industries Fair will open its doors, and if present expectations are realised many orders will be placed by visitors from all parts of the world or by their representatives stationed in this country. It is particularly hoped that there will be a continuous hum of trading activity, including the making of new connections and the cementing of existing business relations, in the Electrical Section at Birmingham, for there has been no lack of enthusiasm among British electrical manufacturers in preparing appropriate and representative displays of their products. As we have already given a good deal of information in our pages regarding the Section and its arrangements, it should be needless to recapitulate all the details now. Briefly, however, it may be stated that both sections of the Fair are larger than ever, and in all some 2,000 firms have taken accommodation.

The Birmingham Section, with which we are more particularly concerned, has shown almost phenomenal growth in the last four years. The available space in 1926 was 185,000 sq. ft.; in 1927 it was 255,000 sq. ft.; and last year 345,000 sq. ft. This year there is an area of approximately 400,000 sq. ft., or nearly 12 acres, all of which is continuous and under one roof. Some idea of the size of the exhibition is conveyed by the fact that it has been necessary to provide a free service of petrol-driven cars outside the building to convey visitors to the entrance which best suits their convenience. The improvements and extensions, which have cost about £30,000 each year, have made it possible to arrange the stands in symmetrical lines throughout the length and breadth of the Fair. Parallel avenues a third of a mile long stretch from one end of the building to the other, and they are intersected by similar avenues across the building. A simple system of numbering and lettering has been adopted, and illuminated overhead signs visible from some distance indicate the positions of the stands.

The improvements this year include a new block comprising a reception and luncheon hall (the "Bradford Room"), a public restaurant seating 2,000, a buffet bar and a smoke room; and a new conference hall, adjacent to the main building, seating 280 for lunch and 350 for conferences.

On Friday next week (as we have already reported) the latter hall will be the scene of a large electrical conference convened by the South-Midland Area Committee of the British Electrical Development Association. As it is one of the official visiting days of a number of electrical associations and institutions, there should be a large and representative attendance, and a useful discussion should follow upon Lt-Col. Vignoles's address on "How to Increase the Sales of Electricity and Electrical Apparatus."

The Electrical Section at Birmingham is now the second largest (the Hardware Section leading), with a floor space of 55,000 sq. ft. In this Section and in other parts of the Fair there are about 150 exhibitors of electrical machinery, appliances and equipment, or of goods of direct interest to the electrical industries

Mr. T. R. Martin (J. H. Tucker & Co., Ltd.), a member of the Fair Management Committee and an ex-chairman, has placed before us a number of notes on points that the industry might, in his opinion, be well advised to have in mind. For instance, seeing that the Fair has now thoroughly justified the belief of its organisers that an annual co-operative display of British products is a powerful instrument for use in expanding both overseas and home trade, he suggests that during the run manufacturers, and their Associations and Federations in particular, should carefully consider the whole question of the Fair in all its bearings and formulate plans with regard to the future. He has in mind, for example, what happens at Leipzig Fair, where the principal German industries, such as the electrical and the machine tool trades, have each erected their own permanent building, which is used each year exclusively for their own special displays. Whatever the views of the trade may be with regard to later years, however, and it may happen that ultimately different arrangements from those now in force will be introduced, the chief occupation of the industry from February 18th to March 1st will be in making this particular event as big a success as possible.

It will be remembered that the Castle Bromwich end of the Fair has been organised, and most enterprisingly developed, by the Birmingham Chamber of Commerce. Mr. G. N. Guest is chairman of the General Committee, and Mr. Chas. Stanley is the general manager of the Fair.

The Advisory Committee of the Electrical Section consists of the following:—

Mr. H. H. Berry (chairman); Mr. T. R. Martin (deputy chairman); the presidents of the Institution of Electrical Engineers, the Association of Mining Electrical Engineers, the British Electrical Development Association, the I.M.E.A., the Electrical Wholesalers' Federation, and the Electrical Contractors' Association; the directors of the Cable Makers' Association, the B.E.A.M.A., the E.L.M.A., and the B.E.D.A.; the chairman of council of the B.E.A.M.A. and the chairman of its Heating and Cooking Section; a representative of the Electrical Porcelain Manufacturers' Association, Dr. A. H. Railing, Mr. R. A. Chattock, city electrical engineer of Birmingham, and Mr. E. J. Jennings who once more fills everybody with gratitude for his painstaking efforts as honorary secretary.

As on previous occasions the opening of the Fair will be celebrated by a brilliant function at the Mansion House in London. The Government has invited a large company of distinguished colonial and foreign diplomats and representatives of our industrial and trading community to a banquet which will take place on Monday evening next, February 18th. Sir Philip Cunliffe-Lister, the President of the Board of Trade, will receive the guests and will preside. The Prince of Wales will deliver a speech demonstrating once more his own interest and that of the Royal Household in the encouragement of British trade overseas. The Prime Minister will also be present and the proceedings are to be broadcast.

At the White City the Department of Overseas Trade has a special inquiry office where visitors will be able to obtain practically any information that they may be in search of respecting British trade. Interpreters are in attendance whose services are available free of charge. As already stated, the Trade and Technical Journals also have a bureau of information where services will be gladly rendered, and the Overseas Club will also furnish facilities for the comfort and convenience of those who desire them.

Trade readers of this Review who are visiting either London or Birmingham can avail themselves of the special railway facilities that have been arranged.

With these introductory notes we proceed at once with the first section of our descriptive notes of the electrical and allied exhibits at Castle Bromwich.

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Some of the Exhibits.

A First Instalment of Illustrated Notes.

General Electric Co., Ltd.

A comprehensive selection of the company's products is on view. A special feature is a range of the products of the new "Magnet" Works, Birmingham. On the domestic heating side there is exhibited the new range of "Cosy-Glow" electric fires. In these the maximum radiant heat is obtained from two panel elements mounted at the front, supplemented by a Robertson flame-colour lamp behind, the glow from this being reflected by a hammered copper reflector. Another novelty is the "Magnet" self-protective electric kettle. A safety device incorporated in this takes the form of a fusible link which causes the electrical circuit to be broken as soon as the temperature exceeds that required for boiling purposes, and is easily replaced. A new electric wash-boiler is also shown. Other exhibits include the "Magnet" electric cleaner, an electric gramophone motor, and a complete array of kettles, saucepans, hot plates, &c.

The same works is represented by a new range of domestic electric cookers of which the new "Magnet" pressed steel cooker is of particular interest in that it is suited both for use in this country and for export. It is produced with an amply proportioned oven, grill, hot cupboard and three hot-plates. The oven is placed at a convenient height from the floor. In addition to this the variety of other models shown renders it possible to satisfy all requirements. A display of electric grillers and boiling plates completes a very comprehensive range.

In the industrial heating section two electric furnaces are exhibited. The smaller, an 8-kW furnace (fig. 1), is capable of operation up to a maximum temperature of 1,750 deg. F. The sheel is of steel plate reinforced with angles, while the door, which is of cast iron filled with refractory heat insulating bricks, is operated by balanced mechanism controlled by a hand lever. The muffle is of refractory fireclay, and is wound with high grade nickel chrome wire, arranged to give an even temperature throughout the length of the muffle. This is backed by insulating bricks and finally with special magnesia-asbestos slabs. Automatic temperature control equipment is provided. The 30-kW furnace shown is similar in many respects, but incorporates additional refinements and mechanism necessary for the greater load. A "Magnet" electric japanning oven is also on view. Heavy articles to be enamelled are loaded on trucks and run into the oven, which is sunk to rail level. Doors are provided at both ends to facilitate loading and unloading. The heating elements are entirely encased in steel tubes, and are thus protected from all fumes, while automatic temperature control is provided.

Electrical apparatus for the production of distilled water is to be seen in the form of the "Magnet" electric water still

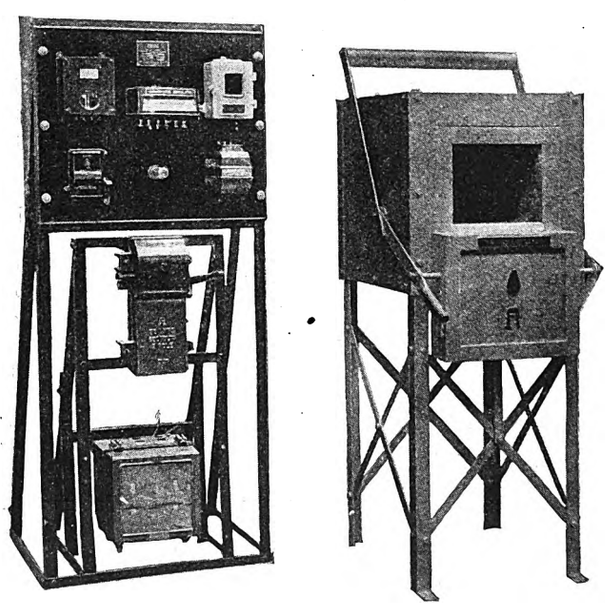

Fig. 1.—A "Magnet" 8-kW Muffle Furnace.

(fig. 2), which is loaded at 4 kW. This still is arranged to deliver one gallon of distilled water per hour. The water is boiled in the lower part of the vessel, and the lid takes the form of an inverted cone inside which cold water is permitted to flow. The steam from the boiled water condenses on the under side of the cone, from which it drifts into a delivery pipe. "Magnet" electric water heaters of 2½, 10 and 20-gal. capacity are shown, the 10-gal. size being in actual operation. Further interesting exhibits include a conforming steamer for hats, in which the felt is steamed for the purpose of shaping, electric glue pots and soldering irons. Electric lighting supplies and fittings are also products of the new "Magnet" works, and the former are represented by a six-sided kiosk. Some fine examples of modern ornamental G.E.C. fittings, industrial reflectors, and "Wembley" lanterns are suspended from the facia board of the stand, while a new range of lighting pendants fitted with "Bakelite" galleries, lampholders and ceiling roses is shown.

A separate section of the stand is devoted to "Osram"

Fig. 2.—A "Magnet" Water Still.

lamps and valves, including the "Pearl" type, colour-sprayed lamps, and projector and "Strip-lite" lamps. A feature of interest is a historical display of "Osram" showcards, going back roughly 20 years. "Osram" valves of all types are shown in this section, from the latest range of receiving valves to large transmitting water-cooled anode valves. The "Osram Music Magnet," a receiver for home construction, is also being exhibited.

The G.E.C. telephone works are represented by a display of bells and accessories, among which is the new "Bakelite" bell. Radio receiving apparatus is another important product of the same factory; the new "Gecophone" "Portable Screen Grid 4" receiver is being shown, together with the "World Wide Screen Grid 4."

The Pirelli-General Cable Works, Ltd., is represented by a large cable drum on which are mounted samples of the company's products.

A large replica of an electro-magnet, the well-known G.E.C. trade mark, made up of conduit, attracts the eye to the "Magnet" conduit display, in which a complete range of conduit and conduit accessories is shown. The Witton display consists of an old Byng-Hawkins motor which has been in continuous use since 1898, surrounded by eight new standard "Witton" motors of the drip-proof squirrel-cage and d.c. shunt-wound protected types. The squarrel-cage motors are for general industrial purposes, and are suitable for all cases where protected or enclosed ventilated machines are required. All the machines comply with British Standard Specification. The louvre covers over the commutator openings offer an unusual degree of protection, and the impregnation of the windings is such that the motors are capable of withstanding tropical conditions.

Examples of ironclad switchgear are shown, including the dwarf circuit-breaker suitable for use in controlling small domestic appliances, cookers, testing and changing circuits, &c.; counter-e.m.f. starters for d.c. motors (push button or pilot switch control); and a 5-amp. flame-proof S.P. quick-make-and-break switch for use in situations where petrol vapour or other inflammable gases are present. A triple-pole 50-A quick-make-and-break switch with fuses is also shown; this complies with Home Office regulations.

Berkeley & Young, Ltd.

The principal feature of this exhibit is a complete range of electric fans for all purposes, for both a.c. and d.c. These include table and bracket types, suitable for general domestic use, offices, shop windows, bedrooms, or in any position where a moderate breeze is required; the "Ellipso" fan, which has an oscillating motion; the slow-speed ceiling fan, suitable for use in kinemas, restaurants, dance halls, &c., or for tropical climates; exhaust or box blade fans for kinemas and other public buildings; and porthole exhaust fans, suitable for ventilating small rooms, warehouses, lavatories, kitchens, &c. Another exhibit is the "Giljay" battery charger, a very compact little set for operation from the mains. It is made in three sizes, 4 A, 9 V; 5 A, 15 V; and 8 A, 30 V. A little switchboard mounted on the frame of the generator bears an ammeter and resistance.

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George Ellison, Ltd.

On this stand there is shown a range of switchgear and accessories for the control of electrically-driven machinery for all industries, and sub-station switchgear for up to 11,000 V pressure. Ellison switchgear is also employed in the Fair sub-station controlling the h.p. supply from the Corporation mains to the transformers, and from the transformers to the various circuits. The exhibits include resistance starters and control panels for slip-ring induction motors; direct-on, star-delta and auto-transformer starters for squirrel-cage motors, automatic circuit breakers of various types; underground switchgear and cable couplings for mines; control equipment for cranes; and several examples of metal-clad distribution and main switchboards. A new design shown is an improved totally-enclosed circuit breaker for power circuits up to 660 V, having an unusually high breaking capacity on short circuits, and accessory fittings, which make the work of installing and connecting up very easy. This gear (fig. 3) can be operated

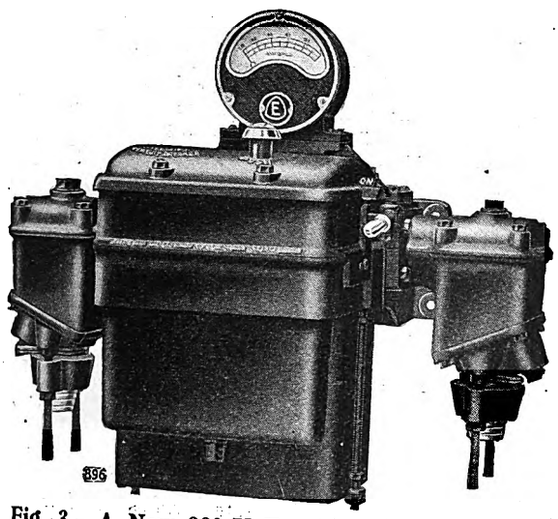

Fig. 3.—A New 660-V Totally-enclosed Circuit Breaker.

with safety by workmen without special knowledge. A new type of switchboard exhibited consists of a group of small automatic circuit breakers mounted up on a busbar enclosure to form a distribution point for branch circuits. This is an alternative to switch-fuse gear, and it is only necessary to move a handle to re-close a circuit. A circuit breaker for use at the coal face in mines, mounted on skids for portability, is another exhibit. It is a welded-steel cased flame-proof unit, fitted with trailing cable plug connector and end coupling for the supply cable. The cable end coupling is a patented accessory which obviates the jointing of cables underground, as when the breaker is moved and another length of cable has to be laid, the new length of cable is readily connected up by bolting together the sealed-end boxes, and connecting the cores by the links provided. The high-pressure switchgear, of which typical units are shown, comprises draw-out, drop-down, truck-type and fixed cubicle metal-clad units all of standardised manufacture. All this switchgear is designed with good spacing of the live parts and made easy of access for maintenance. The sheet-steel enclosures are rigidly bolted and welded in jigs, and units of similar design are therefore interchangeable. In addition to the switchgear, there is a display of insulating material which is made in the Ellison factory for use in switchgear. It includes "Tufnol" in all kinds of shapes and as a plastic compound. This is a laminated synthetic resin material baked under pressure in moulds and is extremely tough, with high dielectric quality.

Electric Furnace Co., Ltd.

This company exhibits plant and photographs illustrating the various types of electric furnace which it installs. These installations comprise furnaces of various types for melting and heat treating all kinds of metals, the standard types of furnaces including the "Héroult" arc furnace for melting steel and nickel; the "Ajax-Wyatt" induction furnace for melting brass and nickel-silver; the "Ajax-Northrup" high-frequency furnace for melting steel and non-ferrous alloys: resistance furnaces of the "Efco," "Efco-Doulton" and "Wild-Barfield" types for heat treatment of steel and non-ferrous alloys, for core drying and enamelling, &c.; the "Snead" equipment for heat treating tubes; furnaces for the manufacture of calcium carbide and ferro-alloys; and amorphous and graphite electrode plants. Most of these furnaces are too large to be shown in operation in an exhibition. The working furnaces accordingly consist only of a small "Ajax-Northrup" high-frequency furnace and an air heater. The former illustrates the principle of high-frequency inductive heating, and is itself a unit suitable for laboratory work or for melting platinum or other precious metals. The body of a one-ton "Ajax-Northrup" furnace is also shown, the furnace being identical with one now being erected in France. This furnace is claimed to be four times as large as any plant yet in operation, and the whole of the plant has been designed and manufactured in Great Britain.

A metal liner, as used in the "Efco" process of formed linings, suitable for use in this furnace, is also shown. A number of electric furnace products are displayed to demonstrate the wide range of electric melting and heating. These include an exhibit by Messrs. Doultons, Ltd., of pottery decorated in a 115-ft. double-chamber "Efco-Doulton" kiln; samples of high-speed steel made in an "Ajax-Northrup" furnace in Sheffield; various articles made of "Silveroid" and other products of high-frequency furnaces; and samples of electrodes, ferro-alloys, &c.

J. H. Tucker & Co., Ltd.

This company's stand is in approximately the same position as it has occupied in past Fairs. The exhibits consist of examples of the company's extensive range of general wiring accessories, including lampholders, ceiling roses and porcelain ware, tumbler switches, ironclad fusegear and switchgear, and switchboards. Special prominence is given to lines which have been introduced since the last Fair. These include a new range of combined switches and sockets, which have been specially designed to eliminate erection difficulties, especially in sunk boxes. The unit consists of a single base of porcelain with corner feet with the switch and the socket mounted thereon. The fixing of the whole unit in either iron or teak boxes is accomplished by two screws, and does away with any form of mounting brackets. In the surface pattern of this range, the unit is entirely enclosed in a "Bakelite" case secured to the case by a single screw. Other new lines are an interlocked heavy-duty switch-plug, "Bakelite" lampholders (both of the ordinary and Home Office types), and similar lampholders incorporating a quick-make and quick-break switch action with push-bar operation. The miniature 5/15-A range of H.O. fuseboards which made their first appearance at last year's Fair in teak cases, are now shown for the first time in iron cases. Special wiring facilities have been incorporated in this new range, including detachable end plates for drilling. An entirely new range of ironclad switches and switch-fuses with quick-make and quick-break action in double-, triple- and four-pole types, makes its appearance. Single- and double-pole service cut-outs incorporating a fuse unit of new design are also exhibited; these are designed to meet I.E.E. Regulations and B.E.S.A. short-circuiting requirements. Another special feature will be the exhibition for the first time of the complete range of 3-pin sockets and plugs made to B.S.S. No. 317, which was issued late last year. This range will consist of the 2-A, 5-A and 15-A sizes in surface, floor and switch plate mounting types.

Messrs. Tucker also show their standard products, such as complete switchboards for country-house lighting, knife switches and fuses up to 1,000 A, &c.

A novelty is provided in the form of a demonstration mechanically operated on the endless-belt system, by which it is hoped to bring home forcibly to customers the very extensive nature of "Tucker" products. A generous amount of space is devoted to products in "Telacite" and "Bakelite."

Taylor & Challen, Ltd.

These manufacturers of production machinery are showing some of their double and single action presses. A new machine which is on view is a high-speed notching press. This will deal with disks from 3½ in. to 17 in. in diameter, and will punch the notches at rates up to 620 per minute.

British Thomson-Houston Co, Ltd.

The exhibits of this company cover a wide field of electrical applications, and many of them are shown in operation. They include electric motors and control gear for industrial use; in addition to a.c. and d.c. motors of the standard types, the company shows single-phase reversing motors of the repulsion-induction type; vertical spindle motors; "built in" motors for the direct drive of machine tool cutters; motor-generators; "Fabroil" silent pinions, &c. B.T.H. single-phase repulsion-induction motors are designed to start up as repulsion motors, and when up to speed to run as induction motors, there being an external or primary winding on the rotor which gives a high starting torque, and an internal or squirrel-cage winding which allows only a very small speed variation from "no-load" to "full-load." They have very satisfactory starting, accelerating and running characteristics, and also a high efficiency and power factor. They require simple starting gear, and are particularly suitable for duties where high starting torque and good acceleration are required, as, for example, on lifts. Suitable equipments for the control of a.c. and d.c. reversing and non-reversing motors of various sizes are shown, these being of both the wall mounting type and pillar type. Included in these is the new B.T.H. thermal type oil-immersed circuit breaker and a.c. motor starter (fig. 4) which has been designed primarily for the direct starting of squirrel-cage motors taking up to 100 A starting current on voltages up to 660, and giving full protection against every kind of fault on all phases. This breaker is only 8¾ in. high, 7⅝ in. deep, and 6 in. wide, has a dust-and drip-proof enclosure, and is under push-button control, either local or remote.

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Thermal overload protection on each phase is provided, and it has an instantaneous short-circuit trip and low voltage release. The high momentary starting currents taken by squirrel-cage motors when started by direct connection to the mains are safely carried without the breaker tripping, but no overload can persist for a sufficient time to cause injury to the motor insulation by overheating.

Among the gear shown for the first time is the new B.T.H. metal-clad vertical plugging switchgear, known as "Class Z" (fig. 5). This switchgear is suitable for service under the most adverse climatic and other conditions, and its introduction makes the metal-clad construction commercially applicable to small circuits. Moreover, the utmost economy is achieved in the use of space and material. The busbars are completely shut off from other chambers, but they can conveniently be rendered accessible. An automatically operated shutter closes the contact socket holes when the breaker is withdrawn, and guide holes are provided for accommodating locating spears carried by the oil circuit breaker, so that it can be lifted into place in correct alignment; circuit breaker units are interchangeable in all respects, and are vermin-proof, and only one simple lifting carriage is required for a complete switchboard. The contacts are of a special self-aligning type, and the current transformers are housed in the circuit breaker top casing, and are readily accessible and interchangeable. Contact is made with the circuit connections below, through the medium of spring pins carried on porcelain insulators in the bottom of the transformer tank. Withdrawal of the fuses through the top isolates the voltage transformer in complete safety. The pedestals do not require precision alignment, and a full system of automatic interlocks prevents inadvertent mishandling. The example illustrated is for 600 A at 11,000 V.

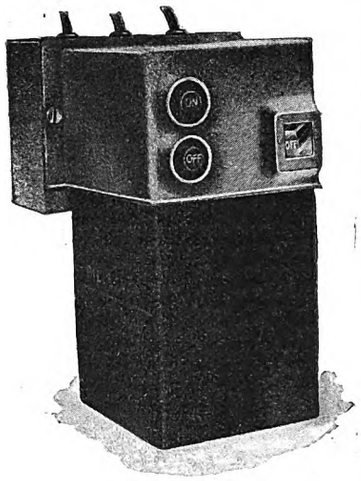

Fig. 4.—A B.T.H. Circuit Breaker and Starter.

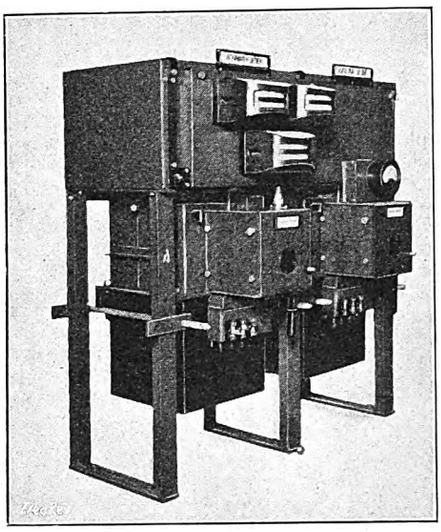

Fig. 5.—B.T.H. Metal-clad Plugging Switchgear.

A section of the stand is devoted to a display of B.T.H. radio apparatus and "Mazda" valves; and an electric gramophone motor, and pick-up, working in conjunction with an "R.K." loud speaker, demonstrate remarkable purity of tone and faithful reproduction of the original. The motor is of the universal type, and operates on any lighting supply from 50 to 250 volts d.c. and 100 to 250 volts a.c., 25 to 60 cycles through an adjustable graduated resistance (for 60 to 100-cycle circuits another model is available). It is absolutely silent (operating at 320 revs. per minute), and drives the turntable through a woven belt which is practically indestructible. Belt slip is prevented, and stretch is compensated by a spring tension device, while constant speed is maintained by a governor of the same design as used on spring motors. A switch automatically stops the motor when a record is finished. In this section also is a display of "Tungar" battery charging equipments and the "Tungar" trickle charger.

Special prominence is given to fittings for industrial purposes, and the scientific use of coloured lighting is demonstrated. A tableau depicting a dancing girl on a draped stage is illuminated by continually changing coloured light, a motor-driven control apparatus being employed. The industrial lighting equipment shown includes fittings suitable for such purposes as street, shop, drawing office and public building lighting. Electric signs are another exhibit.

Metro-Vick Supplies, Ltd.

This stand has been divided into separate compartments, an arrangement lending itself to a more effective display of the various types of apparatus. The front of the stand is devoted to "Met-Vick" electric cookers. Two types are shown, a large size with either two or three boiling plates, and a small model with either one or two boiling plates. Demonstrations of cooking on both models are being given daily. "Met-Vick" extra-rapid boiling plates fitted to table stands are also included in this section, together with this type of plate suitable for fitting to other makes of cookers. There is also a comprehensive range of irons, jugs, urns, &c., the chief item of interest being the "Met-Vick" automatic kettle in 2-, 3-, and 4-pint sizes. This automatic kettle was introduced last June, and since then more than 200 supply authorities have standardised it. For the first time is shown the company's new self-regulating automatic safety kettle. This not only automatically cuts off the current before the kettle can boil dry, but also cuts down the current just enough to bring the water gently to the boil, and maintain it there, thus preventing splutter or overflow from the lid or spout. In addition, the "spring-clear" device is incorporated to prevent damage if accidentally switched on when dry.

Demonstrations are also being given with the "Met-Vick" gyratory washing machine; the large model will wash eight full-size sheets or equivalent, and the small model six full-size sheets or equivalent. Another portion of the stand is devoted to water-heating appliances. The Model "A" wash boiler is being demonstrated. The outer casing and lid are made from steel, blue enamelled, the interior container being stout gauge copper, tinned inside, all being mounted on three cast-iron feet; a tinned-copper spraying device can be supplied to order. Various types of storage water heating and electric geysers are also available for demonstration purposes.

A complete range of fires is shown, including pedestal fires, radiant fires, utility (flat bar) fires in 1- 2- and 3-kW sizes, and various styles and finishes. The latest addition is the "Met-Vick" 3-kW imitation coal fire finished in chromium plate (fig. 6). The company's radio apparatus is also included in the exhibit. This comprises various styles of the "Met-Vick" five-valve set for mains operation, employing "Met-Vick" a.c. valves and eliminators. There are three- and four-valve "A.N.P." sets, complete with a.c. valves, for operation from the mains. For use with these sets a new combined eliminator for l.t., h.t. and grid bias is now available.

The display of wiring accessories includes lampholders and switches in various finishes. The latest additions to this range are shockproof switches, "Bakelite" ceiling roses and lampholders.

Fig. 6.—A New "Metro-Vick" Fire.

Fig. 7.—An example of "Gilbert Riley" Glassware.

Colour lighting is employed for floodlighting of the interior of the stand, this being carried out by means of "Cosmos" pearl lamps with "Met-Vick" ray reflectors and colour screens. A varied selection of standards, brackets, electroliers, &c., have been installed for the general demonstrations of the stand. On the pillars and partitions more than thirty different types of panel wall brackets have been installed with electroliers to match. Several of these incorporate the new "Gilbert Riley" glassware, an example of which is illustrated in fig. 7.

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G. D. Peters & Co., Ltd.

This exhibit consists of two sections, as follows: Wilson "Plastic Arc" electric welding plants and "Colour-Tipt" welding metals; and "Graphol"—rust solvent and penetrating lubricant. The welding section includes a 2-arc stationary motor-generator type welding plant and a single-arc portable motor-generator type set, both of them fitted with Wilson "K.5" automatic current control panels. By means of the latter the current can be regulated to within 5 per cent. The effect of this is that the heat in the weld is kept localised and constant, and it is possible to weld large iron castings without preheating. In this way heavy machines can be repaired without the necessity of being dismantled. The low voltage (18 V at the arc) obviates the use of expensive fluxed or slag covered electrodes. The two-operator stationary welding plant consists of a suitable motor connected through a flexible coupling to an open bracket type level-compounded generator, having a capacity of 300 A at 37-45 V, the variation in voltage being controlled by shunt field regulation. The set complete with motor starter is mounted upon a substantial baseplate, complete with automatic current control panels, and the plant is complete with the usual welding accessories. The single-arc set consists of a suitable motor direct-coupled to an open bracket type welding generator having a capacity of 150 A at 37-45 V. This is mounted together with an automatic current control panel, motor starter, and shunt field regulator on a substantial channel baseplate, being complete with welding equipment. This set is in operation, and trial welds are made for interested visitors. A large quantity of "Colour-Tipt" welding metals is on view.

Chloride Electrical Storage Co., Ltd.

On this stand there is a selection of different types of "Chloride" batteries for house lighting, both open and fully-charged sealed-in cell, adopted as the standard design by the chief lighting set manufacturers in this country. These cells range from 20 to 180 Ah capacity. A special feature is the new patent emergency lighting system ("Keepalite"). This has been specially designed for operating theatres of hospitals and institutions where it is absolutely essential that the light shall not fail for an instant. It consists of emergency lights which can be supplied for approximately one hour from a battery which is controlled by an automatic switch. The change over is entirely automatic, and when the main supply resumes the auxiliary lighting is cut off. The batteries on exhibition include specially designed types for radio work, including the latest developments in high-tension batteries. Among them is the new "WT" 10-V battery with a specially large capacity of 10,000 milliampere-hours for kinemas, public address systems and other high-power work. This consists of a moulded multi-compartment 10-V glass unit. A 30-V assembly in crate with carrying handle is also shown. The "WH" 10-V h.t. unit (5,000 milliampere-hours) supplied in assemblies of 40 and 60 V, is again exhibited. The usual range of l.t. batteries in celluloid boxes is on view, together with cells in glass boxes. A new range of patent unspillable batteries in celluloid boxes for portable wireless sets and h.t. and l.t. batteries suitable for medical purposes are also exhibited. Other batteries shown include types for marine wireless installations, lifeboat sets, gyro compass operation, traction, train-lighting and mining purposes.

Cable Makers' Association.

This exhibit has been prepared to illustrate the various types of cable used for power and lighting purposes, as also some of the more ordinary types of underground telephone cable. It includes rubber insulated cables; flexible cables, with external braiding, flexible armouring, spiral wire armourings, &c.; ship wiring cables; main cables, showing the methods of insulating underground cables with paper, cambric, bitumen or rubber insulations, and exemplifying various styles of armouring and protection; telephone cables; under-water power cables; house wiring systems, including rubber-insulated braided cables run in special conduit tubing; metal-sheathed cables for surface wiring, and fittings for use with them, &c.

Bull Motors, Ltd.

This company again exhibits a comprehensive range of electrical machinery. In addition to the examples of standard d.c. and a.c. motors, some of which are shown in motion, there are a number of interesting exhibits of special machines recently constructed. The h.p. motor generator set, for ships' wireless, is again shown. Since the last Fair a substantial repeat order has been received for these sets. The set is shown in operation with the h.p. end delivering 1 kW at 2,400 V d.c., the output being utilised for illuminating a sign. Another exhibit of interest is a special motor-driven high-frequency alternator, typical of a number which have been supplied to the British Post Office and leading wireless telegraph companies. The alternator delivers a single-phase output of 2 kVA at 450 cycles. A motor-generator set, consisting of a standard squirrel-cage induction motor direct coupled to a standard shunt-wound generator, is shown in operation supplying energy at 500 V to a special series-wound motor direct coupled to a tramway brake compressor. The series wound machine is specially constructed for building into one unit with the compressor. About 540 of these machines have been, and are being, supplied to a leading tramway undertaking. An example of the "Bull" trolley 'bus motor is again exhibited. A special exhibit demonstrating the components and the method of construction of "Bull" induction motors is of interest. A section through the slot shows the high standard of insulation, and demonstrates the efficacy of vacuum impregnation in efficiently filling the slot spaces with insulating varnish.

George Bray & Co., Ltd.

"Chromalox" heating units and examples of their application are exhibited by this company. This form of heater consists of nickel-chromium ribbon or coil embedded in a refractory material under hydraulic pressure, the whole being then enclosed in a sheathing of rustless iron, nickel-chromium or Monel metal. The units are very strong and moisture proof; the terminals are fitted in a special manner. The

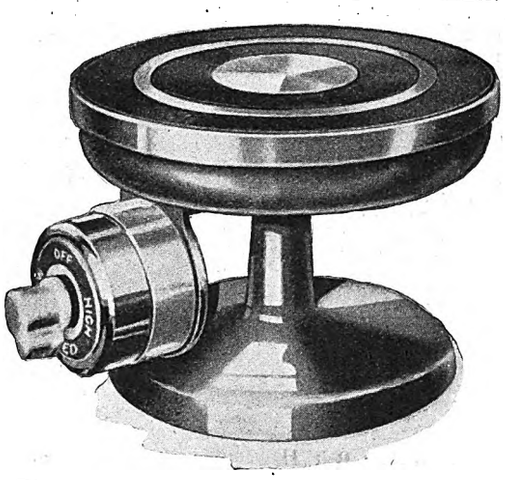

Fig. 8.—A "Chromalox" Urn Heater.

simplest application is space heating, the standard sizes being 12 in. and 24 in., with loadings of 220 W and 500 W, respectively. For boiling purposes ring units are available, with loadings of from 660 W to 1,750 W, the diameters rising from 6¼ in. to 9½ in. The units are also made up as radiators with metal cases. Another application is immersion heating, a very wide range of sizes and loadings being available. Our illustration (fig. 8) depicts a ring-type urn heater with a three-heat snap switch.

Donovan & Co.

As in previous years, this firm has a comprehensive display of ironclad switch- and fuse-gear for medium pressures to comply strictly with Home Office regulations, d.c. motor starters, shunt regulators, fan regulators for the tropics, dimming switches, interlocked-switch wall sockets and plugs, cable connectors and spider boxes for use in kinematograph studios, ironclad switchboards, open-type switchboards, &c.

Siluminite Insulator Co., Ltd.

Two specialities are given prominence by this company. One is a new grade of "Siluminite" panels suitable for switchboards. This is made in fireproof material with a stove-enamel finish on the surface and is said to be the nearest artificial substitute for slate. It is of good dielectric strength and stronger than slate and has been specially made to comply with the regulations of various electricity authorities in the colonies. The other novelty is a special grade of fireproof material of high mechanical strength for fuse handles. This material is of high dielectric strength, non-absorbent, and will withstand considerable arcing without carbonisation. It is baked out up to 450 deg. F. during the process of manufacture. Samples of this material are shown in well-known makes of fuse handles, which the company is now manufacturing, for example, 60-A and 200-A "Fluvent" fuse handles and 250- and 500-A fuse handles for Messrs. G. P. Dennis, Liverpool. In addition to the foregoing there are numerous boxes in moulded materials for combined switch and fuse boxes, electric railway couplings and track insulators, including one as supplied to the G.P.O. electric railway, all of which are in a fireproof grade of material. The company is also showing a large range of overhead telegraph and telephone insulators in its "Ebbinita Grade 2," and a new design of dummy insulator for use as a bird guard on overhead lines.

A. Reyrolle & Co., Ltd.

Owing to limitations of space, Messrs. Reyrolle are unable to show any of their larger standard gear, but have staged a model built to ¼-scale, and showing all the essential features (fig. 9). The model can be taken apart, and sectional diagrams attached to the dividing planes give an excellent picture of details. Switchgear of this type is in successful use for voltages up to 50,000, and is built in sizes up to 1,500,000-kVA breaking capacity. All the conductors, including the busbars,

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are adequately insulated and completely enclosed in earthed metal enclosures, and the spaces between them and the inside walls of the enclosures are filled with solid insulating compound. The switchgear is made up in self-contained units capable of being built together into complete switchboards, and interlocks are provided to make a wrong sequence of operation impossible. Generally, the construction is such as to prevent anyone from touching a live conductor accidentally, or from coming within arcing distance of it. Each unit comprises a fixed portion, which incorporates the busbars, the instrument transformers, the cable dividing boxes, and the supporting framework; and the removable portion, which includes the oil-immersed circuit-breaker and the necessary operating mechanism. The removable portion is capable of being racked out from the fixed portion so as to facilitate inspection of the circuit-breaker, and the connection between the two portions is by means of a plug and socket arrangement, which automatically isolates the circuit-breakers from the live parts of the circuit when it is withdrawn. The interlocking devices make it impossible to plug the removable portion in when the main circuit-breaker contacts are in the closed position; to close the switch when the removable portion is not fully plugged in; to withdraw the removable portion when the main circuit-breaker contacts are in the closed position; or to remove the oil tank before the removable portion is withdrawn. The circuit-breaker cannot be closed until the lock is secure, and, once closed, the lock cannot be released until the circuit-breaker is re-opened.

The company also shows examples of its metal-clad control boards for connecting and controlling the supply of current to electric cookers for pressures up to 250 V. Operation is simple, and provision is made for earthing the casing and interlocking the switch with the lid. On the standard design (fig. 10) the main supply to the cooker is controlled by a double-pole, double-break, 30-A quick-make-and-break switch, fitted with terminals for taking the incoming and outgoing cables either at the top or at the bottom of the box. The fixed contacts of the switch are fitted with self-aligning clips, and they are adequately shielded and protected by means of porcelain caps, which prevent the possibility of sparking. An auxiliary circuit is provided, coupled to the socket of a 5-A or 15-A British Standard plug and socket of the protected type. This circuit is for a kettle, hot plate or other appliance. A small indicating lamp is mounted behind a red bull's eye on the lid to show when the 30-A switch is closed. Another design is shown containing a change-over switch suitable for controlling, in addition, a water-heating circuit which contains a thermal device to disconnect the supply when the water has reached a pre-determined temperature.

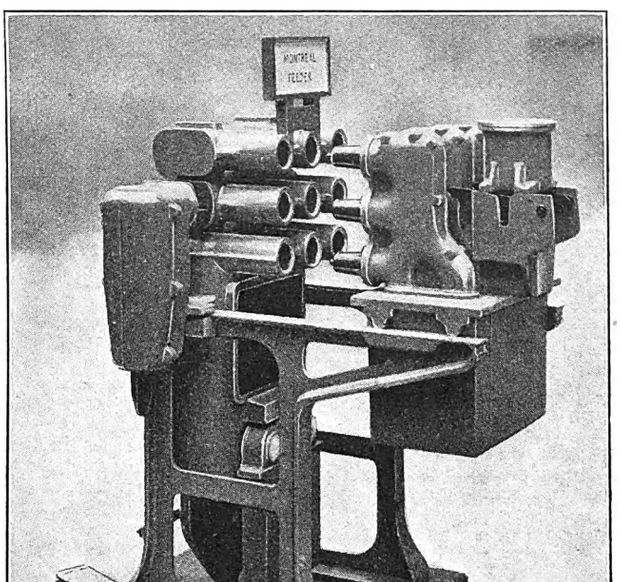

Fig. 9.—Model of a "Reyrolle" Duplicate Bus-bar Unit.

The company shows heavy-duty plugs and sockets for industrial use rated at 100 A and 250 A at 660 V. An example of the smaller size is shown combined with a 100-A switch; the larger size can also be combined with a switch, and both may have fuses added if required. The combined switch and plug equipment comprises three main parts: a cable dividing box, a 100-A brush contact air-break switch, and a 100-A plug and socket. The switch and plug are mechanically interlocked, and the lid of the switch-box is also interlocked with the operating mechanism. Earthing facilities are provided right through to the plant controlled, and the whole construction is water-tight.

Another exhibit is an immersion-type water boiler. The sample shown is of 18-kW capacity, and is capable of raising steam in from 10 to 15 minutes. The steam pressure is 80 lb. per sq. inch, and the boiler evaporates 40 lb. of water per hour. The heating elements are built up of three 6-kW units,

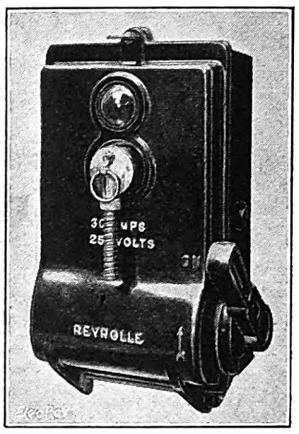

Fig. 10.—A "Reyrolle" Cooker Control Board.

and the required selection is made by means of a standard "Reyrolle" earthed plug. Three sockets are provided, so arranged that either one, two or three are in circuit. The c.t.s. cable, which is employed, is provided with a third core to form part of the definite and continuous earth circuit from the boiler to the earthing terminal of the outlet plug. The fittings are nickel-plated, and the boiler is attractively finished in white enamel.

R. A. Lister & Co., Ltd.

In this exhibit there is a section of particular interest to those concerned with the problem of supplying current for the lighting of country houses and estates, farms, churches, and other buildings which are in districts not reached by power lines. Three "Lister" electric lighting plants are exhibited, and they represent the range of "Lister" plants which can be obtained in various capacities to suit every purpose and pocket. They comprise a 1-kW and a 1½-kW plant, both for battery charging, and a 1½-kW "Lister-Bruston" fully-automatic plant. The power for all "Lister" electric lighting plants is supplied by 4-stroke, slow-speed, vertical, water-cooled engines. These engines vary for different sized plants, but they are all of totally-enclosed design, making them dust, dirt, and grit proof, and are automatically lubricated—oiling is effected from a single oil reservoir in the crankcase which is of ample capacity to run the engine for several months without attention. The sensitive throttle governor employed controls the engine speed to within very fine limits, and most engines include the "Ricardo" detachable combustion head. Five types of such engines, apart from the lighting plant section, are exhibited on Messrs. Lister's stand. The generators are of open protected construction, shunt wound for battery charging, and are capable of developing their full output at the minimum and maximum voltages without overheating. The dynamos are of the 4-pole type fan ventilated, and are fitted with ball-bearings. They are designed with a starting winding enabling the engine to be started electrically with the minimum expenditure of electrical energy. The sets are equipped with switchboards, on which are mounted the necessary instruments, and switchgear. These can either be mounted direct on the plant making it a complete unit, or can be separate for wall mounting. The plants are shown in operation.

Restlight, Ltd.

Various models of lighting units of the "Restlight" system, including a special filter, for eliminating glare and preventing eyestrain, are to be seen on this company's stand. The system owes its inception to Mr. F. E. Lamplough, M.A., and is in use in all types of business houses, factories, schools, libraries, laboratories, hospitals, picture galleries, &c., especially in nurseries and studies. The light given by "Restlight" units resembles mild diffused sunlight. A slight amount of "red" is permitted to pass through the filter to compensate for the coldness usually associated with artificial daylight. This factor has rendered the system of value in the lighting of picture galleries. The company claims that the use of the system in industry abolishes eyestrain, reduces errors in close work, and increases efficiency and output. Another exhibit is the Lamplough "Daylamp" for accurate colour determination, which is extensively used in the British textile and colour industries. The "Daylamp" is said to render a "colour" industry or one engaged in close laboratory analysis completely independent of climatic changes and artificial light.

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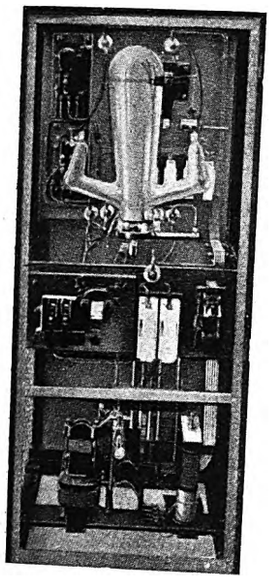
Hewittic Electric Co., Ltd.

"Hewittic" mercury-arc rectifiers are installed in the Fair sub-station, to provide the necessary d.c. power from the 5,000-V, 25-cycle, three-phase Birmingham supply. The equipment is made up of two 92-kW sets, each comprising a step-down transformer, an induction regulator, a 200/0/200-A, 230/0/230-V rectifier unit (three-wire), and automatic pressure and load control. Operation is entirely automatic.

On the company's stand the following equipment is exhibited: A lift type rectifier, capacity 30 A at 440 V d.c., suitable for supplying a 15-h.p. motor. This rectifier enables standard



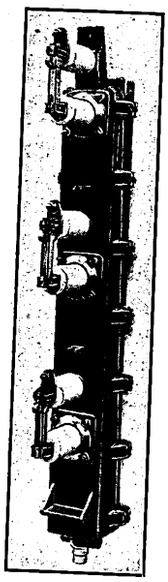


Fig. 11.—A "Hewittic" Lift Rectifier. **Fig. 12.—A "Callender" Link Isolating Unit.**

lift gear to be used on an a.c. supply. The equipment is enclosed in a sheet-steel cubicle with wire mesh for ventilating purposes at the base. Fig. 11 is an interior view of the gear. A switch-fuse is provided where lifts are in fairly constant use, the arc being maintained. Where use is infrequent, an automatic a.c. clapper switch is fitted (as in the illustration), and the rectifier only functions when the lift is operated. An "I.T.6" rectifier, delivering 2-6 A at 6-75 V d.c., from any standard a.c. supply, is shown. The "I.T.M." rectifier which is displayed delivers 3.5 A at 220 V d.c., and is particularly used for feeding ultra-violet-ray lamps and other medical and dental apparatus, small motors, &c. An example of the largest single unit made by the company is on view. This has a capacity of 260 A at 550 V, or 300 A at 250 V.

The stand is illuminated by "Service Light" units, each of 1,200-candle power. Silica lamps as used for high buildings and yard lighting are also exhibited. The current consumption of these lamps is: Long tube type, ½ W per candle power; silica type, ¼ W per candle power. The company shows a single-tube studio stand and various types of tubes—rectangular, M-shaped, &c.—as used for printing, enlarging, &c. A special "Rhodamine" reflector is fitted behind the tube of the studio lamp outfit. This reflector is used wherever it is desirable to have the full spectrum with red rays, such as when using panchromatic films or plates.

Various types of ultra-violet-ray lamps—stand outfits, suspension outfits, &c.—are shown. One of the special features is the "Hewittic-Eidinow" burner, which is similar to the usual quartz burner, but is made of a different material, and cuts off the shorter and more active ultra-violet-rays, allowing, however, a very rich amount of ultra-violet-rays above 2,900 A to penetrate. The more violent rays, which require special application are screened off.

Hackbridge Electric Construction Co., Ltd.

The exhibits of this company, which shares the Hewittic stand, includes drawings and photographs of all types and sizes of transformers, and a number of coils are on view showing insulation and reinforcement for very high voltages. A pole mounting transformer of the company's manufacture, is also exhibited, and Hackbridge transformers are under load in the sub-station supplying the exhibition.

Callender's Cable & Construction Co., Ltd.

This company is showing a complete range of l.p., h.p. and e.h.p. cables, up to and including 66,000 V. The range covers paper, rubber and cambric insulated cables, lead sheathed, armoured, taped and braided; special cables for ship lighting and colliery work; patent rubber c.t.s. cables; "Ancalite" cables for railway signalling work, &c.; insulating tapes and compound, and jointing accessories; "Callender-Kay" poles and accessories for overhead transmission line work. There are also interesting specimens of outdoor type dividing boxes up to and including 66,000 V, indoor dividing boxes up to 11,000 V, and straight joint boxes to suit all voltages; transformer pillars showing standard C.S.W. l.p. fuse-gear, h.p. and l.p. switch pillars and network boxes, chill cast lead sleeves, all types of service boxes, pathway and roadway frames and covers, house-service fuse boxes (including a new standard insulated fuse box), various types of unit gear for pillars and sub-station switchboards, distribution boxes, cable hangers, and sealing ends up to 33,000 V. Fig. 12 illustrates one of the exhibits a l.p. three-phase isolating link unit for use in feeder pillars or sub-stations. Actual demonstrations are being given with the "Callender-Wilson" precision plumbing apparatus, of electrical and mechanical plumbing for fiery mines or for ordinary outdoor use. The company is also making a special exhibit of the "Kalibond" system of wiring.

C. H. Parsons, Ltd.

This company is one of the regular exhibitors at the Fair. As in previous years, the stand bears a comprehensive selection of well-made "Britmac" switches, lampholders, and many other accessories. There is an attractive display of "Bakelite" switchplates among other fittings in this material.

H. C. Slingsby.

On this stand there appears a selection of about 60 of the 1,900 designs of trucks, ladders, barrows, &c., made by this firm. Examples of electric trucks are included.

Crossley Bros., Ltd.

Two new examples of heavy-oil engines not previously shown at any exhibition are mounted on this stand. The first is a vertical 4-cylinder type, and the second a horizontal 2-cylinder type. Both are shown working on fuel oil.

Fig. 13 illustrates the vertical engine, which is a compressorless Diesel engine having a normal rating of 110 b.h.p. It is shown direct-coupled to a Crompton 72-kW, 440-V, d.c. dynamo. The engine is totally enclosed, with all the moving parts protected and self-lubricated under a pressure system. The fuel oil pumps are grouped together in one unit at one end of the engine, and the valve gear is overhead and entirely encased, the inlet and exhaust valves being operated from valve levers without the introduction of push rods. Starting up is effected by means of compressed air, which is applied to all four cylinders, thus giving rapid acceleration; the engine can be started from cold and raised to full speed within a few seconds. The exhibit is typical of a range of Crossley vertical engines of various power ratings with from two to

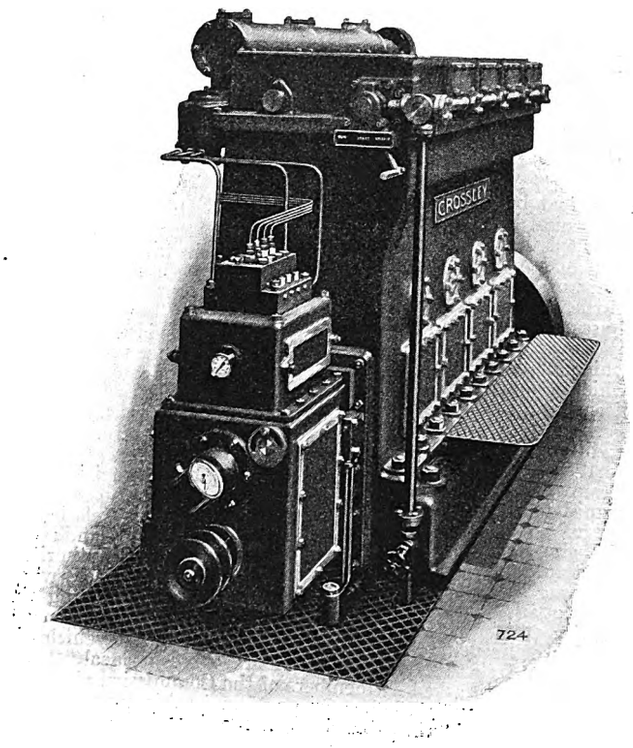


Fig. 13.—A New Crossley Vertical Oil Engine.

six cylinders suitable for driving generators. The other engine is for a normal working load of 44 b.h.p. This engine is also of the enclosed type, to protect the moving parts from dust and dirt, and a very complete system of automatic lubrication has been provided. The sideshaft and gear wheels are entirely abolished; instead, the camshaft, which is arranged across the top of the cylinders, is driven by a silent roller chain, which is enclosed, and works in an oil bath. In both models chain adjustment gear is provided which does not in any way interfere with the valve timings.

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Royal Commission on Transport.

An Outline of Evidence Submitted on Behalf of Municipal Electric Tramway Authorities.

ON January 31st and February 1st evidence was given before the Royal Commission on Transport on behalf of the Municipal Tramways and Transport Association.

Mr. W. CHAMBERLAIN (president of the Association and general manager of the Belfast City tramway and transport undertakings) drew attention to the disabilities under which electric tramway undertakings operated under the Tramways Act of 1870. Special emphasis was laid upon the obligation to maintain the track, notwithstanding that under modern conditions the greatest wear of track was due to other traffic, tramcars only using the rails; also tramways had to pay rates and taxes on their tracks and, so far as municipal tramway undertakings were concerned, they were compelled to go to Parliament, at great expense, to obtain powers if they desired to run omnibuses either within or without their areas. Neither tramway companies nor private 'bus operators were compelled to do that, and special reference was made to the case of the Ramsbottom Urban District Council, which promoted a Bill in Parliament in 1926 for motor-omnibus powers, the cost of obtaining which was £2,025, or 2s. 7d. per head of the population of the district. Another instance mentioned was that of the Leeds Corporation, which last year was compelled to go to Parliament for authority because it wished to change overhead electric trolley vehicles to motor-'buses in the Wharfedale area; the expense involved was increased by the fact that interested people opposed and endeavoured to obtain a restriction of the powers which the Leeds Corporation already possessed. It was contended by the Association that powers should be given to the Minister of Transport to authorise, by the issue of Orders, local authorities to run omnibuses, within or without their areas, along any road which was an extension of any tramway, trolley vehicle, or omnibus route for the time being owned, run over, or worked, by the local authority. This proposal was provided for in the Omnibus Bill of 1926, which was, however, defeated upon second reading by five votes, but the Association strongly pressed the view that those powers should be conferred upon the Minister of Transport in the interests of time and economy.

Municipal transport authorities should be protected against competition by omnibuses run by other concerns, whether inside or outside the local authorities' areas and for a quarter of a mile beyond termini, the point being made that the gathering ground of a tramway extended at least that distance beyond the actual terminus. Under the Railway Companies (Road Transport) Acts of last year, such protection was given inside municipal boundaries against omnibuses run by the railway companies, but the Association urged that protection should be extended to the whole of a municipal tramway undertaking. In support of the claim, reference was made to the Nottinghamshire and Derbyshire Tramway Company's Act of 1928, which, it was stated, in effect, prohibited competition by 'buses with the tramways, trolley vehicles, and 'buses operated by the company, so long as the company provided a service which adequately met the requirements of the routes over which the company operated. That Act stipulated that the licensing authority of the district should also grant 'bus licences subject to conditions as to the routes upon which such additional 'buses should, or should not, ply for hire. It was further pointed out that the Greenock and Port Glasgow Tramway Company's Act of 1928 also contained provisions designed to limit competition with that Company's 'bus service.

Mr. Chamberlain then described the conditions relative to licensing street passenger vehicles in Northern Ireland: the right to licence had been taken away from local authorities and was now exercised only by the Government, which, when issuing any licence, also issued a route card indicating the service which the 'bus must provide. Such complete concentration of licensing and control of routes of motor vehicles in Northern Ireland Mr. Chamberlain regarded as ideal. Many questions were asked by members of the Commission about the possibility of applying the same system in this country. Mr. Chamberlain said that the views of the Association were that licensing should continue to remain in the hands of local authorities; however, he suggested that some form of control might be exercised by the creation of Area Joint Committees which would control through-running arrangements and long-distance journeys in the interests of particular areas; at the same time, there would have to be some over-riding authority which would have the right to give a final decision on any points upon which the Area Joint Committees were unable to agree. In making those suggestions Mr. Chamberlain more or less expressed his own opinions, but there was already a tendency in that direction in the inter-running arrangements that had existed for a long time between various tramway undertakings throughout the country. He felt it difficult, as a municipal employé, to express opinions regarding policy which might have to be adopted by those employing him. Several members of the Commission endeavoured to persuade Mr. Chamberlain to express his own personal views on the matter, having regard to the fact that he had stated the system in Northern Ireland to be ideal, but Mr. Chamberlain replied that he could only express the view of the Association, which was that licensing power should be retained by local authorities. Eventually it was agreed that Mr. Chamberlain should submit a statement to the Commission, expressing his own private views on licensing and control, but he asked that the statement should be regarded as confidential and not for publication.

Referring again to the difficulties under which municipal authorities had to work, compared with private 'bus operators, when endeavouring to provide services outside their borough boundaries, Mr. Chamberlain mentioned an instance in which the Cardiff Corporation desired to run motor-'buses between Cardiff and Newport and was asked by the St. Mellons Rural District Council to contribute £66,916 for adapting a route of nine miles. The suggestion was rejected and a Ministry of Transport inquiry fixed the amount at £15,000, but it was felt that the service would not stand that expenditure, and the project was abandoned. Very soon afterwards, however, private proprietors put 'buses on the same route without having any such condition placed upon them; in fact, he believed nothing had been done to adapt the route in the manner suggested when the Cardiff Corporation made the first proposal. Among other disabilities of municipal tramway undertakings, compared with private 'bus owners, Mr. Chamberlain mentioned the compulsion to run tramway services for workmen at unremunerative fares, the fixing of maximum fares, the provision of regular and comprehensive services, the supervision of design and character of rolling stock by the Ministry of Transport, the fixing of compulsory stops, and the reporting of all accidents to the Ministry of Transport, none of which conditions applied to the operators of competing 'buses.

Continuing, Mr. Chamberlain said the Association was in favour of an efficient system of controlled co-ordination of the services for road passenger transport operated by financially substantial people who could meet their obligations, ensure regularity of services, and recognise proper rates of pay and conditions of service for their employés. Members of the Association were not prepared to enter into co-operation with operators who did not pay fair rates of wages and observe fair conditions of service. The aim of such co-operation must be pre-eminently to serve the public and enable the maximum use to be made of all the means provided for road passengers, whether within or without the area of any local authority. Personally, said Mr. Chamberlain, he would agree to co-operation with the railways, regard being had to the adequacy of the railway or tramway service in a particular district, whichever was the first in the field. Regarding the manner in which the owners of licences for a few 'buses were able to sell their 'buses and licences to larger undertakings at a very much enhanced price (because of the existence of the licence) the Association, said Mr. Chamberlain, held the view that a licensee had no right to sell a licence and no right to claim good-will in respect of the route for which a 'bus had been licensed. There were cases, however, in which as much as £2,000 more than the value of the 'bus had been paid because of the sale with the 'bus of the licence. That position had been completely modified in Northern Ireland, because when a 'bus changed hands the route card had to be returned to the licensing officer and the new proprietor had to apply for it again. Mr. Chamberlain added that at one time in Northern Ireland licences were bought for the purpose of selling them again at a very much higher figure.

To a number of questions about the prospect of electric tramways ceasing to exist in a relatively short time, Mr. Chamberlain replied that he had endeavoured to fix such a date in his own mind, but had failed to do so. One of the first things he did when he went to Leeds four years ago was to spend £500,000 on new tramcars, and that expenditure had been justified. It was necessary in tramway matters to look ahead 20 or 25 years, because a tramcar would last that period, and he believed that the 200 new tramcars would be operating to the benefit of the public in Leeds in 25 years' time, in addition to fleets of motor-'buses and other means of transport. In the case of Manchester, mentioned by one member of the Commission, Mr. Chamberlain said three motor-'buses would be required to carry the same number of people now carried by one tramcar, and he hesitated to conceive the state of congestion of the traffic in Manchester if tramways were abolished and motor-'buses substituted.

The fact that motor-'bus licences are issued by the Watch Committees of the large Corporations in the provinces was suggested by some of the members of the Commission as affording municipal tramways considerable protection, but Mr. Chamberlain's experience had been that Watch Committees

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issued licences without consultation with Tramway Departments and often without any regard to the adequacy of the tramway service over the routes for which 'bus licences were granted. The Association regarded the motor-omnibus industry as a heavily subsidised one, because the taxes paid in respect of 'buses fell far short of the charges which fell upon tramcars, the average figure being £347 per tramcar per annum when the cost of road maintenance and rates and taxes were taken into account. Asked which he thought was the better form of traction (electric tramcars, railless trolley vehicles, or motor-'buses) Mr. Chamberlain replied that there was a field for each of the three methods of passenger transport, according to the particular local circumstances. He admitted that some of the small towns now running tramways would not have installed them had motor-'buses been available at the time the tramways were built, and he also mentioned that one of the inducements to change over to the railless trolley system was that the obligation to maintain the tramway track and to pay rates upon it did not exist in that case.

Discussing long-distance traffic, Mr. Chamberlain said that if some central authority decided that it would be in the interests of the community for any particular local authority to run 'buses long journeys, even from Newcastle to Derby, or Newcastle to London, local authorities would be prepared to undertake that work; but, of course, the primary obligation of local authorities was to provide transport for people residing within their boundaries and also for those smaller places in their vicinities which had community of interest with the larger towns.

This concluded the evidence on behalf of the Municipal Tramways and Transport Association. The Commission adjourned until February 13th, on which date it is understood that evidence will be given on behalf of the Tramways and Light Railways Association.

D.C. Cable-Testing Equipment.

A portable high-voltage thermionic a.c. rectification outfit made by Watson & Sons (Electro-Medical), Ltd., for testing power cables.

HIGH-PRESSURE cables for electrical power transmission have to be tested at pressures considerably higher than their normal working voltage, but, in many cases, the use of alternating current for testing is precluded by the difficulty of transporting to the site of the test plant capable of generating, or transforming, the necessary power. By the use of high-voltage d.c., however, the power required for the

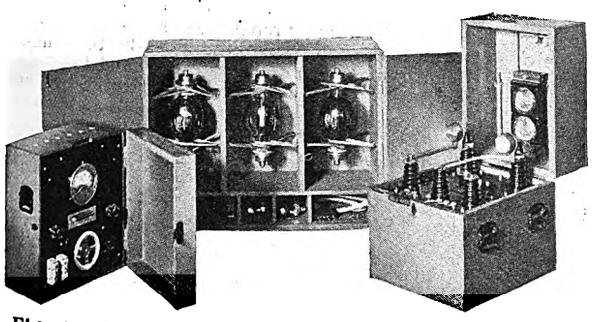

Fig. 1.—High-voltage D.C. Cable-testing Outfit.

test is small, being that necessary to compensate for leakage in the cables and possible corona discharge at the ends. Considering that one of the most satisfactory portable systems of obtaining a high uni-directional pressure is that which utilises rectified a.c., achieved by means of hot-cathode valves, Watson and Sons (Electro-Medical), Ltd., are now manufacturing a small portable set suitable for testing all cables which operate at pressures up to 22,000 volts. The equipment consists of:—

(i) A transformer of special design, oil immersed, capable of delivering an output of 30,000 volts (r.m.s.). Included in the same tank are two other transformers for energising the filaments of the two thermionic valves, their leads being brought out through two ebonite bushes in the "Paxolin" top of the transformer and connected to two Edison screw sockets mounted on the top of the bushes. A small voltmeter reading 0/20 volts is connected across the filament of each valve; one end of the main transformer and the secondary winding is connected to an earth terminal, and the high-pressure end brought out through an ebonite bushing; in addition, two ebonite pillars are mounted on the transformer top to form supports for auxiliary apparatus. The transformer is mounted in a stout wooden case, fitted with a lid with sliding hinges, and the various l.p. connections are brought out to a 5-pin socket. The lid of the case forms storage space for various parts during transport, namely, four protective "Silit" resistance rods, two aluminium connecting tubes, a rod for earthing the cable after test, and a case containing two milliammeters fitted with a shunt switch and arranged to read 0/5 and 0/50 milliamperes.

(ii) The control switch-panel is contained in another wooden case, also fitted with a removable lid; on the black "Sindanyo" panel is mounted the main switch, filament switch, primary voltmeter, fuses, filament rheostats, and a potentiometer with hand-wheel control. Primary control is by means of the potentiometer, so that the voltage on the cable may be varied evenly from zero to the required test pressure. It should be noted that when testing cables by means of high-voltage d.c., the pressure should be increased slowly until the required value is reached.

(iii) The valve case is made of wood, stoutly designed and arranged to accommodate three valves, each supported by means of rubber rings placed around each end and stretched to hooks provided on the sides, the valves being thus slung so that mechanical shock due to rough handling of the case is not communicated to them, with consequent likelihood of damage. At the bottom of the case four small compartments accommodate the sphere-gap voltmeter parts and the flexible cable with a 5-pin plug at each end.

To erect the apparatus ready for a test, the various cases are opened, their lids removed, and the main transformer assembled as follows: the two valves are screwed into their ebonite sockets and the ammeter is plugged into the centre bushing at the front of the transformer; the base of the sphere-gap voltmeter is fixed to the front of the set and the spheres fitted to the base and then clamped into position by means of wing nuts; a "Silit" resistance rod (fitted with a plug at one end and a socket at the other) is placed at the reverse right-hand bushing, two aluminium tubes being used for the remaining high-voltage connections from the top of the (a) "Silit" rod to the top of the right-hand valve, and (b) milliammeter to the top of the left-hand valve; the remainder of the "Silit" rods are fixed into spring clips, making connections between the set and the sphere-gap voltmeter.

The equipment is provided with the necessary connecting leads between the transformer and control panel, encased in a protective metal sheath at each end of which is a 5-pin plug to which the leads are connected; one plug is fitted to the socket of the transformer and the other to the socket of the switch panel.

Complete assembly of the apparatus ready for a test may be carried out in five minutes; the weights and dimensions of the three parts ready for transport being as follows: transformer, 220 lb., 20 in. by 17 in. by 26 in.; control panel, 90 lb., 20 in. by 20 in. by 24 in.; and valve case, 40 lb., 29 in. by 40 in. by 14 in. Fig. 1 shows the three cases with their lids and doors open, whilst fig. 2 shows the transformer and con-

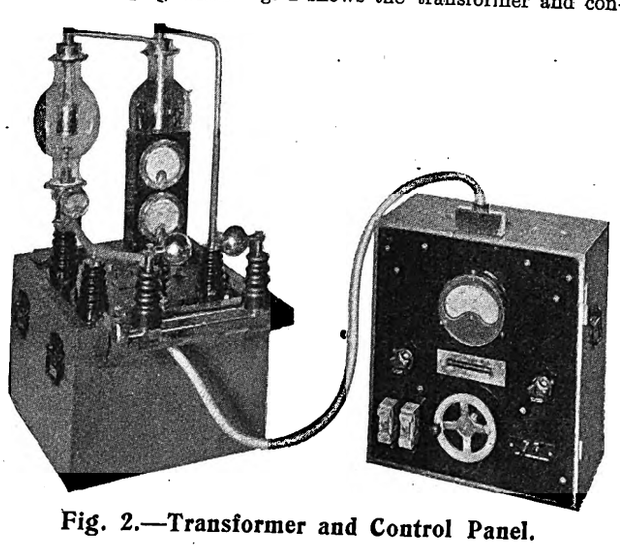

Fig. 2.—Transformer and Control Panel.

trol panel assembled for a cable test. In operation, the apparatus is reliable, and may be used for pressure tests up to 60,000 volts from core to core, or 30,000 volts from core to earth. It may also be used in connection with a h.p. bridge for the rapid location of faults.

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Oxide-coated Radio Valve Filaments.

A review of recent development, outlining present methods of manufacture for commercial purposes, and indicating views on the mechanism of electron emission from alkaline earth oxides.

By B. HODGSON, O.B.E., B.Sc., Ph.D., L. S. HARLEY, B.Sc., (Eng.), A.M.I.E.E., and O. S. PRATT, B.A.

(*Extracts from Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ALTHOUGH some of the earliest valves probably had carbon filaments, when valves first came into commercial use it was to the oxide-coated filament that manufacturers turned as the most convenient source of electron emission, which varies with temperature according to the following law :—

$$I = CT^{\frac{1}{2}} e^{-D/T} \quad \text{.....(1)}$$

where I = emission current per unit area,
C and D = constants dependent upon the emitting material, and
T = absolute temperature.

The chief exponents of this branch of electron physics assumed that free electrons exist in a metallic conductor and are in a state of violent motion like the molecules of a gas, or liquid, which becomes more violent as the temperature rises, and that the energy of the motions finally attains a value large enough to carry some of the electrons through the surface of the hot body, just as the energy of a water molecule at 100 deg. C. is sufficient to carry it through the surface skin into the space above; in an analogous way electrons have to overcome forces acting at the boundary, as do the molecules of a vaporising solid or liquid. The law quoted above can also be expressed in a different form, by making different assumptions concerning the number of free electrons per unit volume as follows :—

$$I = AT^2 e^{-b/T} \quad \text{.....(2)}$$

In this form the number of free electrons is assumed to be proportional to $T^{3/2}$, whereas in equation (1) it was assumed to be independent of T; in the second equation (now more generally accepted) A is a constant theoretically independent of the material, and has been shown to have the value :—

$A = 2\pi mk^2 e/h^3 = 60.2$ amps. per cm.^{2} per deg. C.,
where k = Boltzmann's constant,
h = Planck's constant,
m = mass of an electron, and
e = charge of an electron;

also $b = \phi e/k$, where ϕ = voltage-level which the energy of the electron must attain to break through the forces resisting its escape from the emitting surface.

The evaluation of the emission constants is fraught with difficulties: one of the most difficult conditions to fulfil is that of obtaining and maintaining constant surface properties of the emitting substance, for the oxide cathode undergoes a formation process during its operation and, as the velocity of formation varies both with the temperature of the cathode and with the current drawn from it, time must elapse before the steady condition is attained.

The constants obtained vary considerably in different experiments; the authors collected some of the results, which are shown in Table I.

TABLE I.

Authority.	A.	b.	Current per cm^2 at 1 000° K (obtained from the formulæ) amps.
Koller	4.27×10^{2}	35,900	1.15×10^{-6}
	1.07×10^{-3}	12,100	6.4×10^{-3}
Espe	20×10^{-3}	11,500	2.08×10^{-1}
	0.2×10^{-3}	11,500	2.08×10^{-3}
	C	D	
Wehnelt	7×10^{26}	4.5×10^{4}	2.3×10^{-1}
Jentzsch	2.94×10^{26}	4.16×10^{4}	3.1

The barium-oxide filaments of commerce give emission currents of the order of 1 amp. per cm.^{2}

Table II gives some values for different materials to show how they vary; A varies with the material and does not keep the constant value 60 as theory indicates.

Within the last few years the idea of chemical action has been considerably modified, and we now believe that the emission is "thermionic," as in the case of tungsten or carbon, and that chemical action plays only an indirect part in the mechanism of emission. The theory to-day is as follows: the barium oxide is decomposed electrolytically and oxygen is diffused into the vacuous space, whilst the alkaline earth metal remains at first in the place where it was liberated, but subsequently diffuses to the surface, where it forms small islands or colonies which are emission centres in the sense of Richardson's law (*i.e.*, thermionically). Everything that helps the building of these islands increases the emissivity of the filament: everything that tends to destroy them reduces it. The emission from this type of filament thus becomes steady and constant when equilibrium is reached between the evaporation of the metal and the building of new metal islands under the electrolysis set up by the emission current.

One difficulty hard to explain is: why does such a volatile metal as barium remain on the surface after formation?

TABLE II.

Material.	A. Amps./cm^2/deg. C.	b. Deg. C.	ϕ Volts.
Tungsten	60.12	52,560	4.53
	—	56,000	4.46
	100	53,100	4.57
Thorium	70	39,400	3.27
		34,100	2.94
Calcium oxide	—	21,400	1.77
		—	2.24
		—	2.4-2.5
Strontium oxide	—	15,300	1.27
		—	1.79
		—	2.15
Barium oxide	—	12,000	0.99
		—	1.59
		—	1.85
Mixture of barium and strontium oxides ...	0.001	12,100	1.04

Barium melts at about 1,120 deg. K and vaporises rapidly at 1,220 deg. K. The authors have been unable to find any measurements of the vapour pressure of barium at about

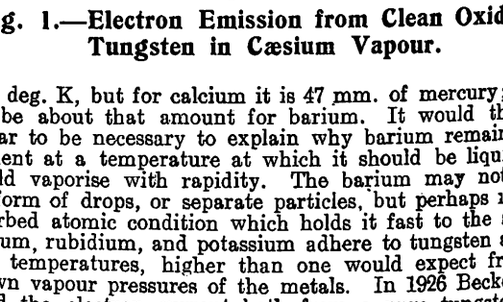

Fig. 1.—Electron Emission from Clean Oxidised Tungsten in Cæsium Vapour.

1,000 deg. K, but for calcium it is 47 mm. of mercury; and it will be about that amount for barium. It would therefore appear to be necessary to explain why barium remains on a filament at a temperature at which it should be liquid, and should vaporise with rapidity. The barium may not be in the form of drops, or separate particles, but perhaps in some absorbed atomic condition which holds it fast to the surface. Cæsium, rubidium, and potassium adhere to tungsten at quite high temperatures, higher than one would expect from the known vapour pressures of the metals. In 1926 Becker measured the electron current both from a pure tungsten wire and from an oxidised tungsten wire in cæsium vapour; what he found is most easily seen from fig. 1. The curves are in

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three parts: from right to left, a rising part I shows an increase of emission with temperature; at II a change occurs, and the falling part III shows a diminution of emission with increasing temperature; at IV the curve changes abruptly and again an increase in emission with increasing temperature results. With pure tungsten similar results occur, but the emission at from 700 to 800 deg. K is considerably smaller than with oxidised tungsten. In stage I emission from a layer of cæsium on tungsten, or oxidised tungsten, persists to a higher temperature than with the unoxidised wire. At stage III the cæsium surface is getting smaller, and in stage IV the emission is that from pure tungsten. The experiments show that cæsium in contact with oxygen can be raised to a higher temperature on a tungsten filament than in the absence of oxygen, without loss of the cæsium by evaporation.

Direct support is given to the theory outlined above in two ways: first, barium and barium-oxide valves appear to have similar properties, and, secondly, oxide is essential as a support or carrier for the barium, which would otherwise vaporise.

The small value of the constant A for barium-oxide filaments has led to the suggestion that the islands, or colonies, of barium only cover 1/1,000th of the surface of the filament. If it were possible to cover the whole surface of the filament with barium, then it is inferred that an emission of 1,000 amperes per cm.^{2} would be possible. With barium filaments the authors find no such increase in emission, and they have no reason to believe that the barium does not cover the whole of the filament. Tungsten appears to be the only substance that gives the theoretical value of 60, and it is probably dangerous at this stage of knowledge to form any conclusions from variations in the value of A.

Manufacture can be carried out in one of four ways, namely, (1) The melting, or fusing, of a barium compound to the core wire; (2) the application to the wire of a resinous, or paraffin, paste containing a barium compound; (3) the evaporation of a solution of a barium salt which is painted on the wire; (4) deposition on the filament of barium from vapour.

In the melting method the core wire, which may be platinum or nickel, is drawn through the fused salt bath; the nitrate of barium is often used. This process tends to make filaments rough in appearance, with loosely adherent coating, and the authors believe that it is not now in very common use.

The paste process is more common; great care is taken to obtain very small particles of the barium carbonate usually used. The carbonate is ground in a mill for from 24 to 48 hours and then the finer particles of the ground mass are selected and made into a paste with paraffin or resin, kept in a molten condition, and allowed to stand. The bigger particles sink first to the bottom, and the upper portion, which contains only the finer particles in suspension, is again mixed to make a uniform paste and is applied to the heated filament wire so that a portion of it adheres. The wire is then heated more strongly to evaporate, with a minimum of carbonisation, the paraffin or resinous carrier. Finally, the core is heated to about 1,000 deg. C. to sinter the emitting substance to the wire and to convert the carbonate to oxide. This process is repeated several times. A process of this nature is used by the Western Electric Co. (Standard Telephones & Cables, Ltd.), and may be carried out by hand or automatically in a series of ovens and pasting pots. With the use of such a machine, 80 metres of filament wire may be prepared per hour, greyish in colour and slightly rough in texture, but if well done the coating is regular along the length of the filament. If the layer is too thick, it tends to crack, giving the appearance of a number of cylinders threaded on a wire. The core metal is usually platinum or nickel, molybdenum or tungsten being rarely used owing to the risk of burning them during the necessary heat treatment.

With both the first and second methods the barium-oxide filament must be protected, before pumping, from the action of carbon-dioxide and water vapour.

The third method, using solutions of salts, is still in use and is probably the oldest of all; the wire is dipped in the solution, taken out, and heated in carbon-dioxide gas. This is repeated, perhaps, 50 or 100 times, and finally a layer of carbonate is formed, almost insoluble in water. With this method the wire must be scrupulously clean before the coating is begun, and the heating carefully carried out, otherwise a "pearl-string filament" is obtained. A filament made by this method is not vitiated by contact with the atmosphere.

The fourth method is the only one in use in which the oxide coating is formed *in vacuo*: the core wire is oxidised before the evacuation of the bulb; for example, tungsten may be used as a core and oxidised in lengths before assembly on the valve-foot, or oxidised on the valve-foot after the assembly has been completed. On the side of the anode towards the filament a piece of barium metal is fixed; when a good vacuum has been obtained, the anode is heated, usually by high-frequency induction, and the attached metal evaporates and surrounds the filament, which is kept at a dull red heat, whereupon the tungstic oxide is reduced and barium oxide is formed upon the filament. Another means of producing the barium vapour is to use barium azide solution, which is painted on the anode and used instead of barium metal. On evaporation, crystals of barium azide are left upon the anode, which is subsequently heated *in vacuo*. Barium azide is a compound of barium and nitrogen, decomposing at about 225 deg. C. into metallic barium and nitrogen. The barium itself acts as a "getter" after this decomposition, but it is usual also to employ magnesium to produce a silvery mirror in the bulb, instead of the brown or black mirror produced by barium alone.

With the first three methods the pumping takes a considerable time. The porous nature of the fused, pasted, or evaporated, coatings makes it necessary to exercise some considerable care in this part of the process. The filament is heated to 900 or 1,000 deg. C. without anode voltage, and the pumps take away the gas evolved. After this stage the anode may be heated, either by induced high-frequency currents, or by bombardment. There is usually sufficient emission at this stage to bombard the anode, especially as the gas still in the bulb enables the current to attain large values by ionisation. Activation commences as the vacuum improves, and as the filament improves in emissivity it can be run progressively cooler before the valve is sealed off. Completion of the process by ageing can be carried out in the usual way, by heating the filament to its normal running temperature and applying a positive voltage to the anode.

If the coating is not of uniform thickness, those parts where the surface is more remote from the core are cooler than the more thinly coated parts. This causes greater emission from the thinner parts, and thus "hot spots" are produced in all types of barium-oxide filaments, and is perhaps the reason why such filaments have not so far been used in valves intended for operation at very high anode voltages. An attempt has been made to remedy this defect by making the emitting layer of a composite nature: the Western Electric filament is coated with barium oxide and strontium oxide, and the filament of the Round valve with barium oxide and calcium oxide. It is stated that the use of mixtures and thin layers minimises the knot or pearl-string formation which is so liable to cause "hot-spot" action. With filaments made by the vapour process the thickness of the layer of emissive coating is under control; the authors have shown it to be a few hundreds of molecules thick.

Filaments made by the vapour process have reasonably constant emission over long periods of life. In the case of those made by the paste method, especially when thin cores are used, the variation from valve to valve is greater. With valves made by the barium-vapour process, the authors have not been able to detect any change in the amount of barium present in a filament after 1,000 hours' life by the direct estimation method, and measurements of the total emission of similar filaments show little change in the emission.

The Faraday Centenary.

Preliminary Arrangements for the 1931 Celebrations.

A MEETING of British engineers and scientists was held at the Royal Institution on February 15th, under the presidency of Sir Arthur Keith, to arrange for the celebration in 1931 of the centenary of Michael Faraday's great discovery of electro-magnetic induction. A number of societies and organisations were represented, including the Royal Society, the British Association, the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Electricity Commissioners, and the British Broadcasting Corporation.

Sir Arthur Keith, outlining the business of the meeting, said that Faraday was one of the greatest of Englishmen. It was fitting that they should meet at the Royal Institution, for it was there that Faraday, not only made his workshop, but also his home for 54 years. It was there that he made the discovery which had revolutionised the conditions under which people lived. Faraday was the Institution. He was glad to see representatives of the British Association present, because the centenary of that body also fell in 1931, and it was hoped that the Faraday celebrations might form part of the B.A. meeting in that year.

Sir William Bragg, director of the Royal Institution, indicated that the last two weeks in September of 1931 were thought to be the most suitable time for the celebrations. A suggestion by him that two committees should be formed, one to organise the scientific side of the celebrations, and one to organise the industrial tribute, was agreed to. The centenary, said Sir William, according to *The Times*, should cause them great pride. Faraday's work had touched so many developments in science and industry that a great many of bodies were interested. Everybody who had been approached had promised help, and he felt that they would start with the sympathy and encouragement of many organisations throughout the world. They were hoping that the electrical and engineering associations would be willing to take charge of the industrial side of the work.

If they could make the centenary a great success they would encourage the people to go on with their work, and would brighten the whole outlook of the nation as to the part it played in the science of the world. It was hoped that the British Association would meet in London that year; if so, the combination would be a very happy one.

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Sir Ernest Rutherford, president of the Royal Society, said it was fitting that the Royal Institution should take the lead in the celebrations; Faraday made the announcements of many of his discoveries in the lecture room in which they met. The centenary of his discovery of electro-magnetic induction was a particularly well-chosen time. Probably no scientific discovery had had so much practical effect on the world as that primary discovery. Plans were also being made for the celebration in 1931 of the centenary of the birth of James Clerk Maxwell, one of the greatest figures in natural philosophy since Newton. In a sense he was the interpreter of Faraday, and put in mathematical form the latter's ideas. The enormous development of radio-telegraphy had practically depended on the utilisation of Clerk Maxwell's electro-magnectic theory. It was fortunate that the two centenaries fell comparatively close together, and though the Clerk Maxwell celebration would be most appropriately carried out at Cambridge, he would like the committees to take into consideration the possible combination of the two events. It would be a great thing to celebrate at the same time two such great men of the scientific world.

Promises of support were given on behalf of the bodies they represented by Lieut.-Col. K. Edgcumbe, president of the Institution of Electrical Engineers; Sir John Snell, representing the Ministry of Transport, the Electricity Commissioners, and the Institution of Civil Engineers; and Sir William Pope (Cambridge University), for the Chemical Society and the Society of Chemical Industry.

Mr. D. N. Dunlop, speaking as the president of the British National Committee of the World Power Conference, mentioned that for international purposes similar committees in America, France, Germany, and elsewhere would be glad to help.

Sir John Reith pledged the B.B.C. to co-operate so far as possible.

Lieut.-Col. W. A. Vignoles, Electrical Development Association, hoped that the committees would be able to discover some way of bringing home to the public those developments which had followed Faraday's discovery, and to show that people in their daily lives on all sides were using the appliances and being helped by the inventions which had come from this one discovery which Faraday made 100 years ago.

Professor F. L. Myers, British Association, said the officers were prepared to recommend to the Council of his Association the most cordial co-operation. It would be a great source of satisfaction to the general officers and, he believed, to the Association if their centenary meeting could be interlinked as closely as possible with the celebration of the period of great discoveries out of which the British Association sprang. It was the hope of the Council that it might be able to use every endeavour to secure that the centenary meeting should be held in London. They would be glad to do everything in their power to ensure that not only the intellectual descendants of Faraday himself, but also the large public which appreciated and was interested in, and benefited from the applications of those discoveries should be fully represented.

Mr. Clifford C. Paterson mentioned that the International Illumination Commission had arranged to meet in England in the first three weeks of September, 1931.

In reply to Sir Richard Glazebrook, who pressed for a definite date in order that their French friends might be informed, Sir William Bragg stated that it would probably be in the third week of September, but certainly in the last fortnight. It was thought possible that these celebrations might occupy the Monday and Tuesday of the third week, and that the meetings of the British Association might follow on the succeeding day.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Gramophone Reproduction.

I regret to see, in Mr. E. W. Braendle's reply in your issue of February 8th to my letter in the previous issue, that some feeling of annoyance is exhibited. If, in the effort to be brief in my previous letter, I wrote too bluntly and gave any cause for offence, I apologise unreservedly. I fear that I must have done so, for surely Mr. Braendle would not otherwise have been led into a lapse from good taste in insinuating that my letter was an advertising one.

Now as to the technical points at issue:—

1. In his article Mr. Braendle quoted Helmholtz to the effect that "the audible quality of any tone depends entirely on the amplitude of the harmonics, not on relative phasing." I disputed the application of this, except for sustained notes of unchanging amplitude. Mr. Braendle replies by a dispute as to the meanings of "note" and "tone." I do not accept his definition; but this is beside the point. The important matter is that one is *not* justified, in the reproduction of notes or tones of varying amplitude as found in music, in neglecting phase change; and herein lies one of the greatest difficulties in the design of apparatus. It is a point which needs attention, and I therefore called attention to it.

2. In his letter Mr. Braendle takes it "that readers of this journal are capable of understanding the terms employed and of devising their own means of testing for these defects," referring to inertia, stiffness, and excessive damping in pick-ups.

While holding a high opinion of the abilities of electrical engineers, I doubt it. It is extremely difficult to find out, without special apparatus, what is the value of these things in a "pick-up," and his suggestion in the original article that "purchasers would be well advised to satisfy themselves that the stylus arm . . . is adequately 'dead' or non-resilient" can only be carried out by each purchaser having access to a special laboratory. A "pick-up" may be very free to slow forces applied to the needle and yet stiff at audio frequencies, or *vice versa*, and my comment was intended to draw attention to the fact that the casual static tests likely to be applied by a non-specialist purchaser give no criterion as to the qualities under conditions of use. It was, I think, a fair comment.

3. Regarding my statement as to recorded frequencies, with existing records the limiting factor as regards low frequencies is the number of grooves per inch, which imposes a definite limit on the amplitude of a "wave" in a record. Since, for equal reproduction, the amplitude of the record "wave" varies inversely as the frequency, there must be a falling off at some point as we go down the scale. The latest information in my hands, obtained from very good sources, is that constant output is maintained down to 150 cycles, and constant *amplitude* below that, so that from 150 cycles downward the output is proportional to frequency instead of constant. My statement was "the recorded range is only 150-4,500 cycles at full volume." If Mr. Braendle has information of newer methods which make that statement incorrect, perhaps he will give it. Otherwise I shall still claim to be "up-to-date."

4. The only possible comment here would be a treatise on amplifier design, and I am afraid there is no space for it.

5. Here, of course, is the basis of Mr. Braendle's accusation of advertising. His first statement was that reed loud-speakers "have not so seriously competed" with coil drives, either for power or quality. Now, in my reply I tried to keep off any "advertising" claims, and to speak as an engineer and musical student of reputation and experience. I repeat that the speaker in question does "seriously compete" with coil drives, and I believe that my firm is not afraid of direct comparison with coil-driven speakers on the market. As regards power-handling capacity, the matter is one of simple fact, and there is no doubt whatever as to my correctness. As regards quality, the matter must remain one of opinion, and all I claimed was that expert opinion was not all in favour of the coil drive; I might have said more. I maintain that my comment was justified, and I think that Mr. Braendle should express regret for his tone in this matter.

6. As to choke-feed output, with the comparatively low-impedance circuits now in use it is hardly practicable to avoid back coupling; for example, with a 150-ohm valve, or valves and 3,000-ohm loud-speaker, working at, say, 350 volts, the r.m.s. audio-frequency current is likely to be 15 mA, or so. This, passing through a 5-μF filter condenser on the mains unit, sets up 3 volts, of which 2 volts is likely to be passed back to earlier stages.

There is no doubt at all as to the advantage of getting rid of this altogether, even though its evil effect may be mitigated by condensers of 10-12 μF, and I think I was right in calling attention to the point. Mr Braendle is not correct in assuming that an audio-frequency transformer causes amplitude distortion if there is no d.c. component through it. The point (involving, of course, the fact that d.c. tends to constancy of permeability) has been raised before and disposed of. It is too complicated to go into here, but the whole subject is excellently treated by Kirke: "Microphone Amplifiers and Transformers," in *Experimental Wireless*, July and August, 1928.

P. K. Turner, M.I.E.E.,
Chief Radio Engineer, Graham Amplion, Ltd.

Slough, *February 8th*, 1929.

Lead Sheaths of Cables.

We have read with much interest the article in which Mr. C. J. Beaver attacks what has been regarded as the firmly-established fact that lead sheaths of cables may be permanently stretched in service. Although Mr. Beaver denies that he knows of any, there is a considerable amount of published evidence in support of this fact; and the statement made in our last paper was not "merely speculative," but based upon experience and a special test of our own which will be included in a paper to be read in March.

Let us examine the nature of his evidence against permanent expansion. If it be assumed, following Mr. Beaver, that his cable is initially full, the only ways in which room can be provided for compound expansion without permanent stretch of the lead are by the increased volume due to expansion of the lead sheath (i) as the temperature rises, (ii) under internal pressure. In this case (ii) is only about one-tenth of (i), so that change of lead thickness makes very little difference. They may be very simply calculated from the constants given in the articles: for a rise of 75 deg. F. (see fig. 4), coupled with an internal pressure producing a strain up to Mr. Beaver's figure for the elastic limit, the increase in volume of a six-foot sample of cable A is about 1.533 cubic inches; the

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volume of compound in such a sample (allowing for copper and paper space) is of the order of 191 cubic inches, from which it may be deduced that to avoid permanent stretch the compound must have a volume coefficient of expansion not exceeding 0.000112 per deg. F., which is less than one-third of the normal value for insulating oils. It may be that "diatrine" is such a compound, but Mr. Beaver must forgive us if we are sceptical on this point. The estimate errs in Mr. Beaver's favour, since paper and copper expansion are neglected and the lead sheath is assumed to reach the copper temperature. If this coefficient of expansion is exceeded, then the lead must be permanently stretched.

The only other explanation of Mr. Beaver's results which is possible is that there are air spaces in the cable initially. We appreciate that he attempted to ensure complete filling before commencing his experiment, but with a compound of so high a set point as "diatrine," which is extremely viscous to well above the working temperature (over 2,000 secs. Redwood at 180 deg. F.), it is difficult to see how any entrapped air can ever escape; indeed, on page 98 the author admits as much when he says: "It may be noted that even if the enclosures above referred to are appreciable *in toto*, the employment of an impregnating compound which is highly viscous under the maximum working temperature conditions will ensure that they can never aggregate as they would tend to do in a thin mobile medium."

Another point on which Mr. Beaver makes no comment is that in every case he obtains a vacuum on cooling. Why is this, if there is no change of internal volume?

His maximum pressure without distention is of the order of 35 lb./sq. in., which is less than has been reported by other competent investigators on long lengths of cable in service. The 1927-28 report of the Underground Systems Sub-Committee of the N.E.L.A. says: "High pressures of the order of 60 lb./sq. in. can be developed in ordinary cable with normal loading; these pressures are not uniform along different parts of the cable even under uniform exposure and equal conditions. High pressures cause stretching of the lead sheath." Similar results have been reported by many operating companies in the United States.

As regards the reference to Dr. Junius's paper, fig. 2 illustrates the behaviour of a very badly impregnated cable. Similar checks on impregnation have been carried out in the factory with which we are associated for many years (see British patent 275,721) and on a cable whose impregnation is really "well advanced" the change in capacity is under 2 per cent. for a change of pressure between vacuum and 100 lb./sq. in.

For the reasons given we are driven to the conclusion that the explanation of Mr. Beaver's results is that there is occluded air in the highly viscous dielectric of his experimental cable, which cannot be removed by the methods he employed.

T. N. Riley.
T. R. Scott.

London, N.W.9, *February 4th*, 1929.

Service Boxes.

Lead service boxes are not necessarily more watertight than c.i. boxes, as "Service" seems to think. A lot depends on the plumber jointer, and *cast*-lead boxes may be porous, which defect is not met with in boxes pressed out of sheet lead. In most localities it is necessary to use a c.i. protection shell, which considerably adds to the total cost.

Cast-iron service boxes, with suitable glands, can be made quite watertight, and that without the skilled (and costly) work of a plumber jointer. Wood bushes are not used in the most modern designs of c.i. boxes, and one make at least does away with the necessity for any drilling of lead or wood bushes with a gland consisting of a shuttle which is screwed down on to lead strip wrapped round the sheath. This, of course, does away with the need for stocks of bushes to fit every size cable in use, a fact which has been pointed out in some bright advertisements that have appeared recently.

If volume of advertising bears any relation to volume of sales, then I think "Service" is incorrect in inferring that lead boxes are used in larger numbers than c.i. boxes; but, on the question of advertising, probably "Service" is not altogether ignorant.

There is one thing to be said in favour of lead boxes made on the job. Their use helps to make one service connection keep both jointer and mate comfortably occupied for one whole day.

February 8th, 1929. **T. J. B.**

The letter over the signature "Service" on page 263 of this week's Review is evidently inspired, for the writer admits that he is in possession of facts concerning the purchases of supply undertakings generally, and so he must be apparently a manufacturer, or factor, of such apparatus. That being so, it is evident also that he is attempting to deceive, for from statistics I have read recently I find that he would have been nearer the true state of affairs if he had said "one finds that a few undertakings are still using lead service boxes," instead of making use of the insinuation which he does.

Acting on this evidence, I assume that his other implications are liable to be inaccurate. Let us see exactly what "Service" states:—

A.—"Cast-lead service boxes protected by c.i. shell appear to make a far more reliable job." Does "Service" appreciate the difference between sheet and cast lead?

B.—"Can it be said that a properly designed and properly filled c.i. service box is as reliable, in waterlogged ground, as a cast-lead box, plumbed on to the main and the service cable?" Surely "Service" knows that a plumbed joint is not necessarily watertight, whereas a c.i. box can be made so, and that cast-lead is porous, especially when dross gets into the castings?

C.—"What is the objection to them (cast-lead boxes)"? Over and above the objections already stated, there is the initial cost of the boxes and the cost of installation. All supply authorities do not employ plumber jointers.

Following on the method adopted by "Service," of the use of a nom-de-plume, I sign myself,

London, *February 9th*, 1929. **Deuce.**

Architects and Electrical Specifications.

In the preparation of plans for new buildings, whether intended for factory requirements or dwellings, the architectural profession very frequently has control of the electrical specification, in addition to the building one. Sometimes such electrical specifications are very well drawn up, and have evidently had an electrical man working in collaboration with the architectural draughtsman. On the other hand, there are so-called specifications which are useless for purposes of quotation, or anything else. Whether architects should issue these under their own names only, is a matter of some importance to the electrical profession in general, and to the contracting fraternity in particular; but, writing as one of the latter, the point I wish to protest against is the time allowed the contractor; he has to read and digest a specification, visit the prospective job, weigh up runs, quantities, and labour, and in spite of other pressing work, to have a tender prepared and sent in, amounting to hundreds of pounds, in the working space of 72 hours!

In nearly every case the architect has "sat on" the job for months; but the contractor is given *hours* for his part of the job! (The electrical contractor being, of course, an afterthought.)

Can anyone wonder why there are such wide discrepancies in prices given in tenders for various jobs?

Blind guess-work is evidently practised by many people tendering, if they are to have their tender delivered to time.

The articles which you publish from time to time on the economics of the contracting side of the electrical industry would prove valuable if the theories put forward in them could be put into practice—but blind rush seems to be the fate of the poor contractor, against the leisurely and dignified procedure of the architectural profession.

"Live and Let Live."

February 7th, 1929.

Side or Bottom Heating?

I have followed with interest the discussion which has been going on regarding the above subject in your journal, and am pleased that we have had the opinion of Mr. W. Ellerd-Styles; having read his paper on "Large Baking Ovens," I must admit he is well versed in heating problems, and I feel that the remarks of Mr. S. F. Bickell are open to the same criticism as he lays at the door of Mr. Ellerd-Styles.

Opinions are asked for, and I must say we have all a lot to learn as regards electric cooking and heating, both domestic and industrial, but by expressing candid opinions and views we are bound to achieve some little good. We cannot get away from the fact that nearly all domestic cooker manufacturers have constructed their cookers on the principles of the gas cooker, which forms a cold pocket at the bottom of the oven when the present system of side heating is being used, which is purely a system of direct radiation to the oven interior, or element guards. We must consider the best system of baffling our elements, and I see no reason why we could not construct an oven entirely with side heat which would give us satisfactory heat throughout the oven and assure us of even distribution all over the oven, including the bottom, even when using two or more trays of goods in the oven at the one time, because, as Mr. Bickell states, one cake in the oven is no test, but I say an ovenful sometimes is a catastrophe due to uneven heating. Having experimented with this system of baffling the elements, I know that it is very efficient and will not raise any difficulty regarding uneven heat throughout the oven, which complaint we are so much accustomed to at present. Regarding the use of only top and bottom heat in an oven, I feel it would not be very successful, especially when one is using two or more trays of goods in the oven at the one time, due to the fact that the centre of the oven would be cold and therefore necessitate the shifting of trays from time to time during firing and, in the case of the top tray, if the product to be cooked is scones and cakes, they would be gripped and so prevented from gaining the necessary bulk; also the opening and closing of the door to fulfil the changing operation would cause a considerable amount of heat losses, especially in such a small chamber as a cooker oven.

The present construction of cookers with side and bottom

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heating is fairly good, but on medium heat one is bound to experience uneven heating when the oven is fully loaded, with two or more trays of goods to be fired. By the method I have been experimenting with I found no uneven heat, even when the oven is fully loaded, so by introducing this system of baffling elements, we are assured of even heat throughout the oven at all times, and also assured steady circulation.

Lagging certainly is a vital point in all ovens, no matter whatever function they have to carry out, and enough care cannot be taken when designing these cookers to make sure of quick heating, good retention of heat, and no cold spots due to bad packing of slag wool or lagging; also, all ovens ought to be fitted with a thermometer and small vent on the door.

Now that there are so many different designs of cookers on the market, I feel that a good deal of useful information on this sore question might be obtained by calling for a report from the Electrical Association for Women, that is cooks and users of cookers, and I am sure their information would tend to clear up this matter for all time.

J. D. Taylor,
Graduate I.E.E.

Glasgow, C.2, *February 1st*, 1929.

Relaying Political Speeches.

The Old Country papers, just to hand, give some interesting details of the devices to be used in the coming political campaign, and tell that land lines will be utilised for relaying the speeches. Mr. Neville Chamberlain's speech in Liverpool on January 18th will be heard simultaneously by big audiences in distant towns; likewise the Premier will be heard in eight different towns. The Press speaks of this as an innovation.

Over twenty years ago I urged the adoption of this, and developed several ideas in loud-speakers. It is a strange coincidence that I spoke of the need for relaying the speeches of the late Mr. Joseph Chamberlain, in order that he might be heard in several cities simultaneously. Although I brought my ideas before several firms, no interest could be aroused as to the possibilities in this field.

I would like to pay tribute to the Electrical Review, always ready to help along new developments, which showed a very helpful interest, publishing the first account in the issue of June 5th, 1908.

N. D. Blagdon Phillips.

Vancouver, B.C., Canada.
January 26th, 1929.

I.E.E. Discussions.

I was glad to see your leader on Electrical Research in which you commented on the poor quality of the discussion at a recent I.E.E. meeting, and could have wished you had made the complaint a more general one. I have been to a number of the Institution meetings in London this winter and have been struck by the excellent quality of the papers and the poorness of the discussions which frequently followed.

In the first place, why cannot speakers get down to their remarks without so much hand-shaking and back-patting? What is the use of escaping from that Victorian convention of wasting the tail end of the evening in votes of thanks if we are only to have the same futilities dragged in at the beginning; far better have it left till the end when one can at least go out and escape it. Criticism (or confirmation) rather than commendation should be the aim.

In the second place, the discussions are usually opened by one or two speakers who are experts in the particular subject covered, but who do not therefore necessarily have anything very special to say. Those responsible for the conduct of these meetings (and the speakers or prospective speakers themselves) should realise that a man need not know as much as the author of the paper in order to contribute something useful to the discussion—what matters is that he should be keen and have a point to put. Even cranks may be useful, if they are limited to a few minutes each. Would it not be possible to reverse the present order and let the young enthusists speak first, rigidly rationed as to time, whilst the benevolent "big guns" wind up the discussion with longer time allowances? I am sure that at present many useful contributions (possibly by younger and less experienced speakers) fail to get delivered.

One final grouse: Why must *every* meeting which starts at 6 o'clock end at 7.30? Some of them deserve to, but others really merit a little longer. After all, if the discussion is worth having it is worth doing really well. Everyone can *read* the papers, and most people can make a summary—the discussion should fill a place which the printed work cannot, in putting the author and his critics face to face.

Member.

February 2nd, 1929.

P.S.—All this sounds perilously like a "grievance." Need I add then that I have no such thing, and that on the few occasions when I myself have had something to say I have been given every reasonable opportunity.

[Owing to pressure on our space, several letters have unavoidably had to be held over.—Eds. Elec. Rev.]

Parliamentary News.

(By Our Special Parliamentary Reporter.)

Electricity Undertakers and Bulk Supply.

On February 4th, Mr. Maitland asked the Minister of Transport whether he was aware that, in cases where authorised undertakers required additional supplies now before the bulk supply to be provided under the South-East England Electricity Scheme was available, it was the practice of the Electricity Commissioners, instead of granting sanction for the extension of existing plants, to require the undertakers to endeavour to obtain a bulk supply from the selected station to whom such undertakers would be assigned for bulk supplies when the scheme came into force; that the power companies owning the selected stations thereupon offered a supply conditional on the undertakers' entering into an agreement to cease generation themselves and to take from the power companies over a long period of years all the current the undertakers required in bulk at a price higher than the price at which the undertakers could produce in their own stations, and which would be more profitable to the power company than if the supply was made when the scheme came into operation; and whether he would take steps to see that the supply required in such circumstances during the intermediate period was given free from such conditions.

Colonel Ashley said he understood that it was the normal practice of the Electricity Commissioners, before deciding whether to grant or refuse consent to the extension of a non-selected generating station, to require the applicants to approach the Central Electricity Board or other appropriate undertakers to ascertain whether a bulk supply could be obtained in lieu of extending the non-selected station, and, if so, on what terms and conditions. He was not aware that the power companies, owning stations which had been determined to be selected stations under the Scheme, offered supplies on the conditions and with the results referred to in the question, but any specific instance of this character brought to their attention would be investigated by the Commissioners.

The Baird Television Co.

On February 5th Mr. Thurtle asked the President of the Board of Trade if he was aware that the Baird Television Development Co., Ltd., had not held any annual meeting or submitted any accounts and balance-sheet since the company was floated in 1927, a period of more than 18 months; and if he was proposing to take any action to enforce the law against that company.

Sir Philip Cunliffe-Lister said he understood from the chairman of the company that the meeting was deferred in view of negotiations with the General Post Office and British Broadcasting Corporation, which were in progress in the latter part of the year for the provision of facilities for an experimental broadcast of television; that arrangements had only just reached a stage at which progress could be reported to the shareholders; and that a general meeting was now being convened. In the circumstances, he did not think that any action on his part was required.

The Laying of Post Office Cables.

On February 5th Lord Apsley asked the Postmaster-General how many miles of telephone and telegraph lines were relaid underground in 1928 and at what cost; and whether he was making any arrangements with electricity supply companies with a view to securing their co-operation where new electric cables were being laid in the same district.

Sir W. Mitchell-Thomson said that ducts and cables containing approximately 600,000 miles of wire, were laid underground during 1928 at a cost of £4,280,000. About 40,000 miles of this represented diversion of overhead wire. Arrangements had been in operation for some time past for the exchange of information between the Post Office and other undertakers, including electricity supply companies, with regard to projected underground works, and every endeavour was made to secure co-ordination in this respect; but it was undesirable to lay telephone or telegraph lines in very close contiguity to power circuits.

A Departmental Matter.

On February 7th Viscount Sandon asked the Prime Minister whether, seeing that electricity was not a matter of transport, and that the merchant marine was, he would interchange those two sections of the Ministry of Transport and Board of Trade, respectively, especially in view of the fact that the latter department also had responsibility for gas.

Mr. Baldwin said he had noted the suggestion, but he did not think that it was practicable.

Cost of Wireless Licences.

On February 7th Colonel Howard-Bury asked the Chancellor of the Exchequer whether, seeing that the receipts of wireless licences amounted to £1,250,000, of which £824,000 was paid to the British Broadcasting Corporation and £254,000 to the Exchequer, he could see his way to reduce the wireless licence fee from 10s. to 7s. 6d.

Sir W. Mitchell-Thomson, who replied, said he could not. He shared the view expressed by the Crawford Committee

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that a fee of 10s., which was equivalent to 1d. for three days' programmes, was not unreasonable, and he did not propose to recommend a reduction.

Sanction to Companies' Reorganisation Schemes.

In reply to a question by Mr. Clynes on February 5th, the PRESIDENT OF THE BOARD OF TRADE said that steps would be taken to bring into force immediately Section 53 of the Companies Act of 1928. This provides that the simple procedure laid down in Section 120 of the 1908 Act for obtaining the sanction of the Court and the consent of the shareholders shall be available in all cases of reorganisation.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

2,022. "Electric switches." C. Hellyar and Anglo-Sphinx Engineering Co., Ltd. October 24th, 1927. (304,380.)
18,403. "Rectifiers for alternating current." Dubilier Condenser Co. (1925), Ltd. September 24th. 1926. (277,937.)
19,257. "Electric current rectifying apparatus." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. July 20th, 1927. (304,336.)
21,365. "Measurement of the transmission time of electrical oscillations." Dr. W. Kunze. August 13th, 1927. (Convention date not granted.) (283,538.)
24,337. "Construction of roofs of electric furnaces and the like." D. F. Campbell. September 15th, 1927. (304,162.)
24,408. "Electric starters for engines." Scintilla Akt. Ges. May 28th, 1927. (291,069.)
26,973. "Audible signalling devices." Sparks-Withington Co. July 15th, 1927. (293,644.)
27,006. "Manufacture of the dollys or operating levers of electric switches." J. A. Crabtree. October 12th, 1927. (304,175.)
27,019. "Means for converting mechanical, acoustic, or the like impulses into electrical impulses." E. W. Braendle and R. H. Billingsley. October 12th, 1927. (304,165.)
27,147. "Illuminated direction-indicators and signals for motor vehicles and the like." Powell & Hanmer, Ltd., and W. J. Daniel. October 13th, 1927. (304,177.)
27,416. "Arrangements for supplying current for the operation of thermionic valve systems." British Thomson-Houston Co., Ltd., A. P. Young, and J. Hutt. October 15th, 1927. (304,167.)
27,435. "Mounting arrangements for automatic switches and the like." Automatic Telephone Manufacturing Co., Ltd., F. Kessler, C. R. Woodland, and J. C. McCrindle. October 15th, 1927. (Addition to 291,151.) (304,169.)
27,490. "Flexible couplings for transmitting rotary motion, adapted for electric locomotive drives." English Electric Co., Ltd., and G. Zweigbergk. October 17th, 1927. (304,342.)
27,555. "Magnet systems for converting electric oscillations into acoustic ones, or *vice versa*." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 17th, 1927. (304,347.)
27,557. "Electrical devices such as wireless receiving sets." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 17th, 1927. (304,259.)
27,559. "Thermionic valve circuits." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 17th, 1927. (304,222.)
27,587. "Electric contact seam welding machines." W. Meacher. October 18th, 1927. (304,348.)
27,676. "Electrical induction voltage regulating systems." A. Browne. October 18th, 1927. (304,265.)
27,716. "Wireless aerials." A. J. Wilkins. October 19th, 1927. (304,351.)
27,758. "Automatic dial switches." Standard Telephones & Cables, Ltd., G. Hurford, and N. V Kipping. October 19th, 1927. (304,352.)
27,759. "Circuit interrupting mechanisms for telephone systems." Standard Telephones & Cables, Ltd., B. B. Grace, G. Newton, and C. P. Smith. October 19th, 1927. (304,353.)
27,760. "Electrodeposition of alloys." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). October 19th, 1927. (304,354.)
27,761. "Telephone and like repeater circuits." Standard Telephones and Cables, Ltd. October 19th, 1926. (279,455.)
27,774. "Protection of electric transformers." British Thomson-Houston Co., Ltd., and H. S. Petch. October 19th, 1927. (304,356.)
27,775. "Protective devices." British Thomson-Houston Co., Ltd., and H. S Petch October 19th, 1927. (304,357.)
27,814. "Balanced electric protective arrangements." A. Reyrolle & Co., Ltd., and H. C. Atkins. October 19th, 1927. (Cognate application, 9,463/28.) (304,359.)
27,927. "Kinema film with combined sound and picture record, and method of preparing the same." W. E. Beatty. October 20th, 1927. (304,366.)
27,930. "Method of balancing electric cables." Standard Telephones and Cables, Ltd., and J. Collard. October 20th, 1927. (304,367.)
27,935. "Electric oscillation generators." W. S. Smith and W. N. McLachlan. October 20th, 1927. (304,369.)
28,192. "Transmitting apparatus for wireless-telegraphy." J. K. Im Thurn, G. Shearing and C. Matthews. October 24th, 1927. (304,382.)
28,200. "Devices for generating electrical oscillations by means of piezo-electrical crystals." Radiofrequenz Ges. and H. Eberhard. October 26th, 1926. (279,845.)
28,248. "Apparatus for electrically transmitting to a distance the indications of a measuring instrument or the like." Deutsche Telephonwerke und Kabelindustrie Akt. Ges. October 23rd, 1926. (279,510.)
28,316. "High-tension electric circuit-controlling devices." A. F. Harmer and Drake & Gorham, Ltd. October 25th, 1927. (304,386.)
28,597. "System of illumination." General Electric Co., Ltd., and E. L. Randall. October 27th, 1927. (304,390.)
29,151. "Metal-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. November 1st, 1926. (279,910.)
29,354. "Laying of electric cables and apparatus therefor." Callender's Cable & Construction Co., Ltd., and L. G. Brazier. November 3rd, 1927. (304,399.)
30,103. "Method for obtaining a perfect high vacuum." Dr. S. Loewe. November 11th, 1926. (280,560.)
30,289. "Electrical signalling apparatus." Magneta Suisse Soc. Anon. November 27th, 1926. (281,265.)
30,615. "Synchronised electric telegraph systems." K. L. Wood and Eastern Telegraph Co., Ltd. November 15th, 1927. (304,417.)
31,547. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 23rd, 1927. (304,423.)
32,868. "Apparatus suitable for the reception of wireless-telephony." Graham Amplion, Ltd., and P. K. Turner. December 5th, 1927. (304,430.)
33,113. "High-frequency coils for electric induction furnaces." G. E. Taylor and Electric Furnace Co., Ltd. December 7th, 1927. (304,432.)
35,342. "Electric switches." General Electric Co., Ltd., H. C. Turner, and A. Sherwin. December 30th, 1927. (304,448.)

1928.

1,762. "Receiving apparatus employed in wireless-telegraphy and telephony." F. Casardi and R Sarti. January 19th, 1928. (304,469.)
1,785. "Electrical power systems for ship propulsion and other purposes." Metropolitan-Vickers Electrical Co., Ltd. January 19th, 1927. (283,902.)
2,000. "Telephone systems." Telephon-Apparat-Fabrik E. Zweitusch and Co., Ges. January 22nd, 1927. (283,973.)
2,189. "Electric fires or radiators." H. H. Berry. January 23rd, 1928. (304,474.)
2,791. "Electrically-heated ovens." Walker, Hunter & Co., Ltd., and J. Walker. January 28th, 1928. (304,483.)
3,098. "Electromagnetic apparatus for use in the reception or reproduction of sound." C. French. January 31st, 1928. (304,487.)
4,505. "Electric cables." E. S. Ali-Cohen. February 13th, 1928. (304,493.)
5,769. "Ionic valve with two anodes and two grids." Soc. des. Etablissements Industriels de E. C. et de A Grammont. April 16th, 1927. (288,965.)
7,385. "Electric vacuum tubes." British Thomson-Houston Co., Ltd. March 14th, 1927. (287,087.)
7,943. "Sound-reproducing horn." Electrical Improvements, Ltd., and L. C. Grant. March 15th, 1928. (304,511.)
8,730. "Method of, and apparatus for, switching reproducers from one device to another." Electrical Research Products, Inc. April 1st, 1927. (288,142.)
9,530. "Means for operating mercury switches." Soc. Anon. Hewittic and M. Demontvignier. May 16th, 1927. (Addition to 273,257. (290,597.)
9,696. "Short-circuit-proof safety fuse cartridge with an overload lag." Siemens-Schuckertwerke Akt. Ges April 9th, 1927. (288,289.)
10,348. "Electric circuit breakers." Metropolitan-Vickers Electrical Co., Ltd. April 6th, 1927. (288,326.)
12,525. "Radio-electric insulating supports." H. Guillou. May 12th, 1927. (290,281.)
13,417. "Electric furnaces for annealing metals." Siemens-Schuckertwerke Akt. Ges. June 15th, 1927. (292,139.)
13,942. "Mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. May 13th, 1927. (290,297.)
14,167. "Picture-projection and sound-reproduction apparatus." De Forest Phonofilms, Ltd. June 18th, 1927. (292,462.)
15,401. "Transformers." International General Electric Co., Inc. May 27th, 1927. (291,107.)
15,557. "Incandescent electric lamps for projection apparatus." Pathé Cinema, Anciens Etablissements Pathé Frères. June 1st, 1927. (291,401.)
15,790. "Telephone cables." Siemens & Halske Akt. Ges. March 3rd, 1928. (Addition to 291,030.) (304,551.)
16,926. "Automatic telephone system." Soc. Anon. de Téléphonic Privée. June 11th, 1927. (292,088.)
17,407. "Mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. June 20th, 1927. (Addition to 290,297.) (292,506.)
17,598. "Electric control device for machines or apparatus for the sorting, evaluating, or calculating of statistical cards or paper strips provided with perforated symbols." Siemens & Halske Akt. Ges. June 28th, 1927. (292,978.)
23,222 "Single-stage electrically-driven rotary compression or vacuum pumps for braking purposes on vehicles." C. Spirig and Swiss Locomotive and Machine Works. August 11th, 1928. (304,574.)
30,170. "Synchronising synchronous machines." Siemens-Schuckertwerke Akt. Ges. October 19th, 1927. (299,015.)
30,435. "Rectifying units for electric current." Siemens-Schuckertwerke Akt Ges. and G. Scharowsky. November 14th, 1927. (Divided application on 296,596.) (304,579.)
32,430. "Coating metallic or non-metallic bodies with osmium." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 31st, 1927. (Divided application on 304,396.) (304,580.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 6th :—

Birlec (lettering and design). No. 493,568. Class 8. Electro-magnetic switches, circuit breakers, meters, fitted switchboards, &c., for use in connection with electric furnaces No. 492,028. Class 18. Electric industrial furnaces.—Birmingham Electric Furnaces, 55, George Street, Parade, Birmingham.

Truphonium. No. 497,984. Class 8. Loud speakers.—Truphonic, Ltd., 121-123, Rosebery Avenue, E.C.1.

Lecoid. No. 496,015 Class 50. Compounds composed principally of bitumen, pitch, resin or wax for sealing electric cable boxes and for the like purposes.—Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.

Research in Italy.

The National Research Council held its inaugural meeting on February 2nd in the presence of Signor Mussolini and of its president, Senatore Marconi, says *The Times*. Modern scientific research, said Signor Mussolini, required an adequate organisation and vast means. It was the lack of these in the past that had led to the present decadence of research and to the paucity of research workers in Italy. To remedy this situation individual research workers needed to be assured that they could "live by science and for science."

The National Research Council, added Signor Mussolini, must keep in living contact with the industrialists, agriculturists, the business men, and the administrative authorities, and in particular with the different confederations of employers and workers, since scientific research ultimately resulted in improvement and increase of production.

The inadequacy of individual and unorganised research was also laid stress upon by Senatore Marconi, who referred to the need of co-ordination and discipline among research workers. It was important, he said, that a discovery made or piece of research work begun in Italy should mature and develop so far as possible in Italy. At the same time, means should be found for a rapid development and application in Italy of inventions made abroad.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALDERSHOT.—Garage, &c., for Gray & Holderness, Ltd., motor engineers.

ALFRETON (Derbyshire).—Re-erection of portion of Alfreton Hall, for R. C. A. Palmer-Morewood.

ATHERTON.—Housing scheme (50), Hag Lane; surveyor to U.D.C.

BIGGLESWADE.—Additional 116 houses, for the R.D.C.; surveyor.

BILLINGHAM (Stockton-on-Tees).—Houses (400), Station Road, for the Synthetic Ammonia and Nitrates, Ltd.

BIRKENHEAD.—Out-patients' department, Children's Hospital, Woodchurch Road; governors. Extensions, Emmanuel Missionary Training Home, Palm Grove; trustees.

BIRMINGHAM.—Factory (£20,000), Tyburn Road; W. H. Briscoe & Co., Ltd., Park Street. Treatment centre, General Hospital: governors. Library, Westley Road; city engineer. Viaduct over New Street station; city engineer. 2,000 houses, Hall Green estate; city engineer.

BOLTON.—Cinema, Churchgate; J. E. Hindle, of Southport, and J. A. Watson, of Preston. 30 houses, Whittle Grove; Leigh Bros., Ltd. Housing schemes, Crumpsall Street, Radcliffe Road, Castle Hill, and Smethurst Lane; borough engineer.

CHELMSFORD.—Additional 100 houses, for the T.C.; borough engineer.

CHISLET (Canterbury).—Church (£4,000), for the Wesleyan trustees; G. Browning, builder, Canterbury.

DEVONPORT.—Extensions, cinema, Princess Street; Hippodrome (Devonport), Ltd.

DONCASTER.—Additional 220 houses, Intake, for the T.C.; borough surveyor.

DUDLEY.—Extensions, Netherton Library; W. Lindley.

DUMBARTON.—Workshop, showrooms, &c., for Messrs. McLetchie & Son, motor hirers and agents; the manager.

DUMFRIES.—Town hall (£50,000); burgh surveyor.

EASTBOURNE.—Alterations and additions, Burlington Hotel, Grand Parade; P. D. Stoneham & Son, architects. Conservative hall, Trinity Place; F. G. Cooke, architect.

EDINBURGH.—Additions to cinema, Canning Street, for General Theatre Corporation, Ltd.; the manager.

FIFESHIRE.—Church at Methil Hill (£5,000); the U.F. minister, Methil Hill.

FLEETWOOD.—Central school (about £35,000); H. Stonestreet, district education clerk.

GLASGOW.—Cinema to accommodate 1,700 in Hyndland, for Scottish Cinema and Variety Theatres, Ltd.; Gardner & Glen, architects. Cinema, Cumberland Road; T. Ormiston. 102 houses, Braidfauld Street; housing director.

HEMEL HEMPSTEAD.—Secondary school, for Herts. Education Committee; Kieffer & Dawe, architects.

HITCHIN.—Additional 37 houses and flats, for the U.D.C.; surveyor.

HUDDERSFIELD.—Large extensions to works, Dalton, for British Dyestuffs Corporation.

HULL.—Houses (226), North Hull housing site, and 224 at Willerby Road; D. Darvey, Guildhall.

LEEDS.—Shops and offices, Guildford Street (£120,000); city architect.

LEICESTER.—Grammar school; J. Miller, architect, Glasgow. Wesleyan church; trustees.

LETCHWORTH.—Secondary school (£46,000); B. Parker, architect.

LONDON (East Ham, E.).—52 houses, Charlemont Road; E. Ling Cooper.

(Bermondsey, S.E.).—340 houses, Rotherhithe slum area; borough engineer.

LONDON—*continued.*

(Camberwell, S.E.).—Buildings, Camberwell New Road; London General Omnibus Co. Building, Basing Road; H.M. Office of Works.

(Catford, S.E.).—187 houses, Farm estate, Southend Village; A. J. Glock, Ltd. 60 houses, Winsford Road; Middletons (Builders), Ltd.

(Deptford, S.E.).—Highways depôt, Knott Street; borough engineer.

(Eltham, S.E.).—90 houses, Belmont estate; Eley & Allen.

(Greenwich, S.E.).—Administrative office extensions and women's receiving ward, for the Board of Guardians (£8,261); clerk.

(Plumstead, S.E.).—52 houses, Thornhill's estate; Wright and Renny.

(Walworth, S.E.).—Extension of Browning Congregational Settlement (£50,000); warden.

(Putney, S.W.).—College, West Hill; Sir Giles Gilbert Scott.

(Wandsworth, S.W.).—Factory, Merton Road; S. Clifford Tee & Gale.

MANCHESTER.—Patients' workshops, Baguley Sanatorium; J. & J. Parish, Ltd.

NORTHAMPTON.—Premises, for the Town and County Benefit Building Society (£20,969); Frank Allen, surveyor; F. H. Hawtin, builder.

ORSETT (Essex).—Housing scheme (94), for the R.D.C.; G. F. Andrassey, surveyor, Palmer's Avenue, Grays.

PAISLEY.—Cinema, for Paisley Picture Theatre Co., Ltd.; manager, High Street.

PLYMOUTH.—38 houses, Stoke Ideal estate; Ideal Estate Co., Ltd.

PUDSEY.—Housing scheme (124) (deposit £5); B. H. Noble, borough surveyor.

RADCLIFFE.—Winding shed, Irwell Bleach and Dyeworks, for Robinson & Co., Ltd.

RICCALL.—School (£6,175), for East Riding E.C.; director of education, Beverley.

ST. ALBANS.—Adaptation of mansion, Hill End Mental Hospital (£1,800); Herts. C.C.

ST. HELEN'S.—Electric lighting installation, heating, and hot-water supply, boys' secondary school, for the borough E.C.; secretary.

SHEFFIELD.—30 houses, Longley estate; J. Laver & Sons, Ltd. Church, Longley estate; Church of England authorities. Sewage works (£84,000); city engineer.

SILKSWORTH.—Remodelling elementary school; Durham County Education Committee.

SMETHWICK.—Clinic, Firs estate (£6,000); borough engineer.

SOLIHULL.—Extensions to grammar school; governors.

SOUTHAMPTON.—Hall of residence, University College (£18,566); A. Saunders, builder, 51, Belmont Road.

SPENBOROUGH.—Housing scheme (136), for the U.D.C.; A. Rothera, surveyor, Cleckheaton.

STOKE POGES.—School, for Bucks. E.C.; C. G. Watkins, secretary, Aylesbury.

STRETFORD.—33 houses, Northleigh Road; W. R. Rochell.

TENTERDEN (Kent).—Additional 48 houses, for the R.D.C.; surveyor.

TIVERTON.—61 houses, for R.D.C.; Mr. Bamsey, architect.

TONBRIDGE.—Extensions, Pembury Institution, for the Board of Guardians; Frank Harris, engineer, 48, Pembury Road (returnable deposit of £1 1s.).

TWICKENHAM.—Foundry, for the Aluminium Plant and Vessel Co., Ltd., Northfield House, Wandsworth Park, S.W.

WAKEFIELD.—Additions, Clayton Hospital, Wentworth Street; Massie & Holdsworth.

WALLINGTON.—Kitchen reconstruction, Belmont colony (£10,360); Metropolitan Asylums Board.

WITHAM (Essex).—Central premises, for the Co-operative Society; secretary, High Street.

WORKSOP.—Technical college (£17,000); Greenwoods (Mansfield), Ltd.

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The

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The Government and Trade.

IT is four and a half years since the Government then in power appointed what we have come to know as the Balfour Committee on Industry and Trade. It was set up under pressure from all directions—Parliamentary and otherwise—under the chairmanship of Sir Arthur Balfour, a man of eminence in Sheffield industry, and in our issue of February 6th, 1925, we described its task as one so immense that only men and women of exceptional courage would dare to undertake it.

Owing to the vast area that had to be covered, it became desirable to publish separate reports dealing with special sections of the investigations as completed; these alone formed very bulky and exhaustive publications and they received a certain amount of publicity, but we are afraid much that is in them has been forgotten, or just put aside for reference. Periodical agitations that have arisen, during the four and a half years that have elapsed, for further Government inquiries into trade and industrial matters, have given the impression that many people have forgotten the Committee's existence.

Having ventured to follow the investigations somewhat closely and having noted the laborious nature of the proceedings, we feel that the most hearty congratulations should now be tendered to Sir Arthur Balfour upon the completion of his great work, for it is expected that the final document will appear before the end of February. Quite recently there was a further revival of the agitation for more trade investigations to be made and for business men to be called in to assist the Government in formulating the policies which are to bring us back to industrial prosperity. When the Balfour conclusions are published, more light may be shed on the situation, but in the meantime we are little moved by these constantly reiterated suggestions for more and yet more business men to be called in to run the Empire.

There is good ground for the fear that when men already so busily successful with their own affairs, men well known and well advertised, are put upon more and yet more committees, they are unable to devote time to them. An imposing list of names may satisfy a popular clamour, but the committees that are to get things done must consist of men with time and energy as well as experience.

At a moment like the present when most of us are

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thinking of the British Industries Fair, organised largely by the Department of Overseas Trade (though full credit for the Birmingham end of the enterprise belongs to the Birmingham Chamber of Commerce), one may be permitted to wonder whether the Advisory Committee of that Department is so constituted as to render that great measure of practical export trade assistance which our national position and need command.

A development that is likely to bear fruit in the future will be the more frequent meeting of the Empire Economic Conference—for the importance of close co-operation between the Mother Country and the Dominions and Dependencies in the expansion of inter-Imperial trading relations seems to be unquestionable.

It is expected that the policy of the Government when it faces the country shortly will be to some extent based upon the recommendations put forward by the Balfour Committee as the outcome of the digestion of a vast accumulation of evidence prepared by or on behalf of different trades and all classes of interests—employers and employed alike. The report is therefore awaited with exceptional interest.

Spring Cleaning. It may seem almost absurd to write about spring-cleaning while the country is frost-bound, pipes are frozen, and thousands of households are resorting to a practice of earlier years and fetching their water supplies from street stand-pipes or borrowing from more fortunate neighbours. But whatever the weather to-day it may speedily change and warm days will bring the spring-cleaners about our ears with a rush, so we must be ready for them. That is why it was quite right and proper for the Electrical Development Association to hold a conference in London last Friday, to discuss, *inter alia*, how to organise for a successful spring-cleaning campaign. The time of the annual clean-up is not merely one for the *use* of vacuum cleaners, the renewal of electric lamps, and the washing or renewing of silk shades, it is a time when many households, large and small, make various other electrical changes of a far more substantial nature. It may be that for months past there has been a practice on the part of the housewife of leaving this, that, and the other change until the decorators come in in the spring. The electrical installation contractor is in demand for putting in new lighting and heating points, providing electric fires and cookers, vacuum cleaners and, perhaps, refrigerators, the very thought of which may make us shiver at the moment. The old fireplaces have been giving trouble and there is a desire to change over to electricity, at any rate in readiness for the warmer days when fires are only needed early in the morning or in the cool of the evening. When the carpets are up it is easier for the electrical men to do their work; if there *must* be an upheaval, says the housewife, let's have it for all purposes simultaneously. At such a moment we do well to stress the low rates for cooking and water heating *if we are charging low rates* to encourage this desirable class of load.

Twenty Years of Illuminating Engineering. The Illuminating Engineering Society celebrated its Twentieth Anniversary by a dinner at the Trocadero Restaurant on February 13th, when there was a large and representative attendance. The nature of the speeches, reported elsewhere in this issue, and the guests representing kindred associations and bodies, served to indicate how illuminating engineering has broadened since its inception in this country, just over 20 years ago, when a band of enthusiasts was called together by the late Mr. Leon Gaster, to whose prophetic vision is largely due the subsequent course of the Society in this country. We were glad to learn from the remarks of the president, Mr. C. C. Paterson, that it is proposed to associate Mr Gaster's name with a memorial fund, out of which a suitable award will be made each year for the best paper read before the Society.

Since the foundation of the Illuminating Engineering Society in England in 1908 (the first body of this kind to be established in Europe) similar societies have been established in Germany, Austria-Hungary, Holland, and Japan. Parallel with these developments the international movement in illuminating engineering has made steady progress. The International Commission on Illumination, with national committees in all the chief countries, is now firmly established. In England research in illuminating engineering is also undertaken by various other bodies, such as the Illumination Research Committee, working under the Department of Scientific and Industrial Research, whose secretary Mr. H. T. Tizard, C.B., proposed the main toast of the evening. There is now quite a series of committees at work under the British Engineering Standards Association. All these activities do not overlap, but dovetail into each other and the results are available for international discussion.

England, therefore, which may fairly claim to have been the pioneer country in illuminating engineering in Europe, seems to be in a specially favourable position to serve as the home of the next great international congress, which is to take place in 1931. We feel sure that not only the Illuminating Engineering Society, but also all the bodies with which it is linked, will make a generous response to the appeal of its president to join hands in giving visitors from abroad a warm welcome, and to repay in some measure the unbounded hospitality shown to the delegates who visited the International Illumination Congress held in the United States last year.

The "Underground" Railways. The improvement recorded in the reports of the four electric railway companies of the "Underground" group should be pleasing alike to shareholders and the public; to the shareholders because it means an increased dividend, and to the public because a paying system gives the most satisfactory service. It also encourages the companies themselves to extend and improve their lines, rolling stock and facilities. This, in turn, means more work for several industries, and more particularly the electrical industry. It is seen from the reports of the four companies that they intend to spend £1,045,000 during the current year. Of this, £576,000 comes under the head of "rolling stock," while £74,000 is shown against "power stations, &c.". While this money may represent payment for contracts already placed, and not entirely new work, it shows that the "Underground" group is doing its share in solving the unemployment problem.

Industrial Research. The annual report of H.M. Department of Scientific and Industrial Research for 1927-28, extracts from which will be found elsewhere in this issue, recalls the plea of the 19 Associations for the continuance of financial assistance for a period of ten years, the acceptance of which the Department was unable to recommend. Other means of securing more permanent support are being tried, but meanwhile State aid can be justified on quite different grounds from those on which grants were originally made.

Research associations would not cease if State aid were withdrawn, but it would be deplorable to permit their scale of operations to be even more restricted than they are at present. A subscription towards research is often regarded as a charitable gift, to be reluctantly made in a public spirit, and withheld without compunction when funds are small. British industry is no doubt learning to alter its outlook gradually, by force of example and competition; it is significant to note that the strongest support comes from those concerns which maintain research laboratories of their own, and if judicious State help can accelerate that education, it will be money well spent. The financial instability of many of the Associations is a source of anxiety to convinced leaders of industry.

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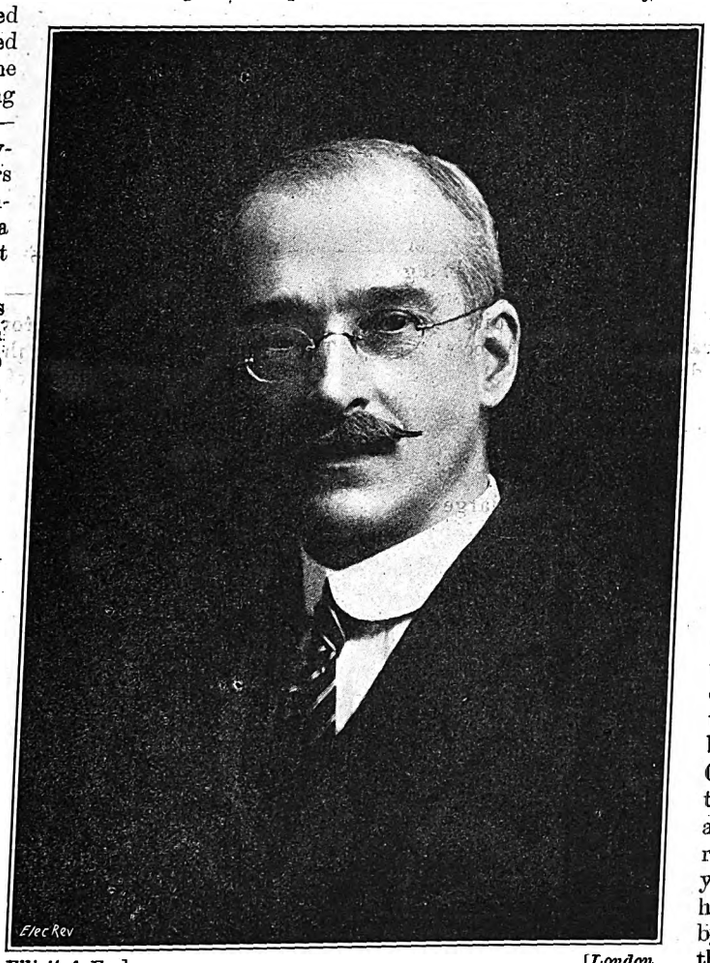
Arthur Hinton Allen.

Technical Editor of the "Electrical Review."

It is with a grief that cannot be put into words that we have to intimate to our readers that Arthur Hinton Allen, Member of the Institution of Electrical Engineers, Technical Editor of the Electrical Review, a director of the Electrical Review, Limited, a loved and faithful colleague, the friend and counsellor of so many, a man of pioneering spirit in scientific thought, research and practice, the advocate and champion of many an electrical movement, a straight and honourable gentleman who could give no quarter to a sham, has finished his course and passed quietly on. And the manner of his passing remains as an example—he knew that he was leaving and as the waters rose, his spirit was unquenched, for his was a confidence that did not flinch.

The home of the Allens at 114, East Dulwich Grove was visited by the influenza and pneumonia scourge with ruthless violence in the closing days of January. First one and then another was laid low, and on the afternoon of Sunday, February 3rd, with a mind full of anxiety for his loved ones, he remarked on the telephone, in what proved to be the last conversation with a colleague, that he "did not know what was going to happen this week." On the following day he developed influenza, three days later he developed pneumonia, and on the morning of February 13th he breathed his last. Mr. Allen was in his fifty-seventh year, having been born in August, 1872. He was the son of a clergyman of the Church of England. A student of exceptional promise, he was compelled by circumstances when but a boy, to leave the Grammar School earlier than either he or his master desired, and seek to carve out a career for himself. Only a few weeks before his death he smiled happily as he mentioned the period of struggle and privation through which he passed in the days of the early apprenticeship which he served with a Glasgow firm of electrical engineers. May we not find herein some explanation of that sympathy and help that he was so ready to afford to others who needed them? He worked by day and he studied assiduously by night. He was a First Pender Gold Medallist in Electrical Engineering at the Glasgow and West of Scotland Technical College. After the completion of his apprenticeship he was electrical assistant in 1889 and 1890 to the late Professor Andrew Jamieson at the College just named. From 1890 to 1894 he was in the service of Messrs. J. H. Holmes & Co., at Newcastle-on-Tyne.



Elliott & Fry] [*London.*

The Late Mr. A. H. Allen, M.I.E.E.

In the year 1894 he came south and took up a post which was to prove the deciding influence upon all his later life. He had been deprived of the coveted opportunity of continuing at college in his boyhood, but by the age of 22 he had so far made good in that connection as to be appointed under the late Professor Ayrton as a demonstrator and lecturer on electrical design at the Central Technical College in Exhibition Road. Here he worked hard for five years during which period he read papers before the British Association and elsewhere, little thinking that the Review in which those papers appeared, was for practically the remainder of his life to give him an opportunity of dealing with all the technical problems that would arise relating to electricity and the electrical profession. In 1899 he joined the editorial staff of the Electrical Review as technical sub-editor under the late Mr. T. E. Gatehouse, the editor-in-chief. From 1899 until Mr. Gatehouse passed away in 1921, Mr. Allen and the writer of the present notes worked in closest co-operation, one on the technical and the other on the commercial side of the paper. Some time before the death of Mr. Gatehouse they assumed the titles of Technical and Commercial Editors respectively, and in the year 1921 Mr. Allen and his colleague were invited by Mr. Henry Alabaster, the chairman, to become directors of the Electrical Review, Limited. And so with the loyal co-operation of a competent and increasingly efficient staff of assistants the Review has been produced.

Mr. Allen became an Associate of the Institution of Electrical Engineers in 1894, an Associate Member in 1899, and a Member in 1913. He was an active supporter of the informal meetings and was on the committee responsible for their arrangement. He took the deepest possible interest in all the new movements in the profession and industry; was for some years a member of the committee of the Electrical Trades Benevolent Institution; and rendered special service in connection with the development of the Overhead Lines Association. His delight when his plans succeeded, when his views were found to be justified, was good to see. He gave of his best ungrudgingly to the Electrical Review and to the electrical profession and industry, but there were few things which gave him greater happiness in the course

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of his editorial career than to meet, as he was constantly doing, the students who had been "through his hands" at Exhibition Road during those five years under Ayrton, and had found the way of success and acknowledged their indebtedness to him.

Mr. Allen was an active Mason and a member of Electric Lodge 2087 of which he was a Past Master, also Past Provincial Grand Superintendent of Works, Middlesex. He was further a member of the Telephone Chapter.

In character, we should describe Arthur Allen, as the result of a very long and very intimate relationship, as one of the most blameless, philosophical and painstaking of men. Always devoutly minded and deeply thoughtful concerning the things that really matter most, he, to our knowledge, had not a vestige of fear in regard to what lies beyond, rather did it appeal to him as a further field for personal investigation. Quiet-dispositioned as a rule, he was fearlessly critical when occasion justified; a patient investigator and strong in his denunciation of artifice and fraud. He made a host of friends in his quiet way, and he will therefore be sorely missed in the electrical world, while we his constant companions shall often look and long for him in vain. To his widow, his three daughters and his son, there has been a widespread outpouring of heartfelt sympathy in the loss that has befallen them.

We have to acknowledge with deep appreciation numerous sympathetic communications which have reached us from representatives of well-known electrical organisations and from private individuals connected with the profession, paying affectionate tribute to Mr. Allen's high qualities and untiring service.

The Funeral.

The funeral service was held at St. Barnabus Church, East Dulwich, on Monday morning last. The interment followed at New Cemetery, Forest Hill Road. The family mourners included Miss Constance Allen (daughter), Rev. H. J. Allen (brother), Mr. Frank Broadbent (brother-in-law), and Nurse England. Mrs. Allen and other members of the family were prevented by continued illness from being present.

Among others present either at the church or at the cemetery were:—

Representing the ELECTRICAL REVIEW:—Messrs. E. A. Gatehouse (Managing Director); Mr. Albert H. Bridge (Commercial Editor and Director); Mr. E. S. Middleton (Secretary and Director); Mr. H. Porter Cox, Mr. Arthur Cox and Mr. P. J. Haskell (representing the Advertisement Department); and Mr. W. H. Wicken (representing the Composing Department). Illness prevented the presence of Mr. Henry Alabaster (Chairman of the Company) and Mr. G. H. Alabaster (Managing Director), and Mr. J. E. Kingsbury.

Others present included:—Mr. W. A. Jones (General Secretary, Electrical Power Engineers' Association); Mr. A. Brammer (General Secretary, Association of Supervising Electrical Engineers); Messrs. R. W. Hughman (*Electrical Times*); Mr. E. J. Wilcock (secretary of the Electric Lodge); Mr. A. L. Johnson; Mr. B. G. Stewart; Mr. B. C. Holding (*Electrician*); Mr. T. C. Futers; Major T. Rich; and Mr. A. S. E. Ackermann.

Wood Pole Strength.

Some Aspects which emphasise the necessity of employing true pole-strength values based on actual practice.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

IN this country the usually accepted figures on which wood pole-strength is based, including those of the more recent tests,* were obtained under conditions which differed from actual general practice. The latter tests are less reliable and more incomplete than the Wade tests carried out more than 20 years ago, for they neither give the true strength of the pole nor the true strength of the pole foundation; but they do show how, in a really effective manner, to produce the partial strength of the pole and its foundations. The Wade figures, however, give us the true and actual full strength of the self-supported pole-timber, which basic condition is the real starting point we require to know. On top of this true value of timber fibre stress due to bending (which condition is not allowed in actual practice, because common sense tells us to support so as to convert, or cancel out, a large part of the pure bending stress) we may apply much more lateral pull, or bending stress, and still keep to the reasonably economical foundation, because the latter is only (or more generally) disturbed and weakened by the actual lateral pull on the pole itself, and not the total pull, which is converted and satisfied by good practice. Since regulations provide that foundation strength be the stronger of the two, the bending stress on the pole is the criterion.

All serious operating engineers are aware that to openly allow a correctional pure bending stress on poles is worse than a violation of good practice. In construction we seek to respectively balance transverse and longitudinal loads, and in maintenance we endeavour to free the poles themselves of as much bending stress as possible by good practice. Therefore, the very least that can be said is that it is worse than useless to show results of tests which do not produce the maximum possible strength of one or the other; the strength values given by the latest tests are towards the weakest of the various conditions in so far as required good practice is concerned. The best and safest construction and maintenance practice in overhead electric power lines exemplifies that for:—

(*a*) Ordinary pole: we so take care of the lateral pull (or bending stress) on the pole that the pole-foundation practically takes care of itself.

(*b*) "H" and "A" frames, also towers: we so take care of the tension that the compression and the foundation practically take care of themselves.

The most unsound and uneconomical practice is to allow an unrestricted lateral pull, or bending stress, on the pole itself. The smaller the ground area covered by the pole footing for a given depth and applied load and height of application, the greater the care required to diminish actual pole bending. Hence, the most unsound and uneconomical practice is to install and maintain a pole line so that it is subjected to an unrestricted and/or total lateral pull; or, put in another way, to so install and maintain it that the effective and safe strength of pole, or foundation, or both, is so low as to result in unsound and uneconomical conditions. There are three distinct conditions, namely:—

(1) The practice of improving the Wade figures, *i.e.*, provision for taking up the lateral pull, or bending stress, on the pole and reasonably surplus foundation strength to care for the actual bending stress allowed to come on the pole, *never* the total bending stress.

(2) Wade values: provision for obtaining the full unrestricted bending stress on the pole with ample foundation strength to meet it.

(3) Woodhouse (B.E.A.I.R.A.) values: provision not available for obtaining anywhere near full strength of pole due to bending stress, nor the true strength of

* "Overhead Electric Lines," by W. B. Woodhouse, I.E.E., see ELEC. REV. Nov. 16th, 1928.

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foundation; one stress is rapidly diminishing the other until about 1/5 the strength value of (2) is the approximate result.

At this, or any other, period of our rural electrical development it would be most disastrous to accept the latter figures as the strength on which cresoted red-fir poles must be based. For more than 20 years we have successfully based our figures along the lines of (2) method, which strength approximates to actual practice, but is very rarely due to a rigid foundation, as originally shown. It is due to, and is maintained in, ordinary every day universal practice by using stays, or struts, wherever such a lateral pull, or push, is at all likely to occur. In actual practice we openly consider it foolish to leave a corner, or terminal, pole unsupported, yet some of us readily talk of a lateral pull offering about the same stress occurring on a relatively straight run of line left unsupported. In reality, unsound and uneconomical conditions do not relate to the wood pole itself; they relate generally to the improper manner of construction and maintenance.

It is both unsound and uneconomical to construct and maintain any overhead electric power line with its poles unsupported where it is definitely known that a lateral pull thereon will weaken the foundation, pole, and line, or/and require very much stronger poles, or foundations, or both. Good practice tells us there is no necessity for such incomplete construction.

The real reason why wood pole failures are conspicuous by their great scarcity is because regulation loading conditions are heavy, the factor of safety high, wood pole lines are the most flexible of lines, the stronger poles assist the weaker poles, the stressed conductors and wires assist support, and stays, or struts, or both, take up the main stress, or surge, or sudden blow. If there is any failure at all, or any weakness or slackness, sagging or distortion, it should be in the stay or strut, but very rarely in the pole or foundation in good practice.

When testing we must either start with the pole, or with its foundation; there are no intermediate measures. That is to say, are we testing the truly effective bending strength of the pole, or the full foundation strength? If we test for one or the other, then the pole or the foundation, whichever is considered, must be the stronger of the two in order to meet the *full-strength* requirements of the pole, or the foundation, to be tested. How can we possibly expect to obtain the true strength of anything (say, a pole) when a vital part of the whole (such as its foundation) is weaker than the thing (the pole) to be tested, and *vice versa?* Moreover, why have such an "unsound and uneconomical" condition, which is not a real test in the first place, and exemplifies poor practice in the second place? If testing the real effective strength of a pole, the foundation *must* be strong enough to give at least the real effective strength of the pole: if it is not, then we are not testing for, or obtaining, the real strength of the pole.

If a foundation is weak against lateral pull, one of the best and cheapest ways of maintaining its strength, even when a much greater load is applied, is to stay or strut the pole against that load. Would we condemn a building as weak because the foundation failed? Better still, would we place a pole vertically and without strut against a building and expect it to give its full or maximum available strength against the lateral pressure of the wall? Can this be called any other than unsound and uneconomical practice? Would not a commonsense man say "put it up so as to get either the maximum possible effective strength of the pole, or the foundation, or both, provided it is sound and economical practice?"

First, we design according to regulation ice and wind loadings; then, we take the accepted 7,800 lb. per sq. in. factor for maximum fibre stress of timber used (red fir); finally, the 3.5 factor of safety. These provide us with more than ample strength for the pole. Then we have the pole foundation strength, which regulations again provide for without stating how it must be done. Added to all these we have two very valuable strength, or reinforcing, factors, namely, depth of pole and use of stay or strut. One of the most valuable factors of strength of foundation is *depth*. For a given depth the foundation area has a maximum strength value and, considering all things, favours the "H" frame, the "A" frame with the wide splay of poles, and the generally used rural pole sizes; the heavier the lateral pull on the pole, or frame, for a given ground area and depth, the weaker the foundation, or the greater the cost of artificial foundation for equivalent safety, &c. —always favouring the "H" or the "A" frame, compared with same type of footing with the smaller area, especially the heavier loaded single or compound pole. Although depth is so very important, we still accept almost unreservedly established practical experience without calculation or further consideration.

For a given tension, or lateral pull, the narrow base design calls for more massive construction, but for general rural lines the ordinary wood pole is satisfactory. What is urgently required is a modification of the bracing of frames, particularly the "H" frame: also a wider use of screw anchors for foundations. It is felt that the diagonal rigid bracing of the "H" frame tends to weaken the frame as a whole, due to point concentration. Much greater strength would be obtained by using cable in place of the rigid cross-braces on "H" frames, and still greater strength by discarding the whole middle *rigid* brace for a stay on each side of the frame.

The usual formulæ for bending moment due to wind on the pole is well known, as is also the bending moment due to wind on conductors; the sum of these two moments gives the total external moment on a self-supported wood pole. If we multiply the factor of safety by the total external moment, we arrive at the maximum internal moment from which the actual size of pole is derived. The diameter d of a wood pole at the groundline, in terms of maximum internal moment M, is given by—

$$d = \sqrt[3]{\frac{M}{k}} \text{ inches,}$$

where k = a constant for the fibre stress
= 63.8 for red fir.
$M = 0.008179\, f\, d^3$ (ft.-lb.)
$= 63.8\, d^3$, where $f = 7{,}800$ lb. per sq. in.

There is no practical necessity to swerve from this value of pole size while Regulation factor value remains at 7,800 for f and 3.5 for the factor of safety, so that we can accept the fundamental equation $Ph - 0.008179\, f\, d^3 = 0$, where P = lateral pull in lb. and h = height of application of load above the ground line in ft.

The Ontario Municipal Electrical Association.

The annual meeting of this Association was held in Toronto on January 23rd. Much consideration was devoted to the necessity of combating anti-public ownership propaganda by private corporations, and the alienation of immense water-power rights on the St. Lawrence. A resolution was unanimously adopted to the effect that funds should be at the disposal of the Hydro-Electric Power Commission of Ontario for the diffusion of information as to its operations and matters of interest to the hydro municipalities, and that legislation be asked for to enable it to appropriate the necessary funds for publicity purposes. Another resolution was to the effect that nothing should be done with the Beauharnois power proposal for the development of power on the St. Lawrence until the Courts had decided the question of power ownership as between the Dominion and the Provinces. The meeting expressed itself in favour of the preservation of the London (Ontario) home of the late Sir Adam Beck as a "hydro" museum, and the erection by the Dominion Government of a suitable memorial to Sir Adam at Baden (Ontario), his birthplace. The following officers were elected:—President, Mr. C. A. Maguire; vice-presidents, Messrs. Willoughby Ellis (Hamilton), August Lang (Kitchener), Fred Newman (Picton); secretary-treasurer, Mr. T. J. Hannigan.

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A Russian Power Station.

The first development to be completed under the Soviet Government electrification scheme was the 80,000-h.p. hydro-electric station on the River Volchov.

By C. J. WEBB, A.I.A.E.

IT has been known for some time past that the Soviet Government has been proceeding with a very comprehensive electrification scheme for which preliminary work was put in hand almost immediately after the Revolution. The first development of any magnitude was the hydro-electric undertaking on the Volchov river, where a large generating station has been built to provide electrical enegy to meet the increasing industrial requirements of St. Petersburg, or Leningrad as it is now known. The power station is designed for a total capacity of 80,000 h.p., and the scheme embraces a step-up transformer station, a double transmission line to Leningrad, and a primary step-down sub-station in that city, with six outgoing lines to the same number of secondary stations in which the voltage is further reduced for local distribution. It was also decided to combine the power station works with locks which make the Volchov River navigable as far as Lake Ilmen: 120 kV was adopted for the Volchov-Leningrad transmission voltage, the primary distribution pressure being 35 kV, and the secondary 6.6 kV. The greater part of the electrical equipment for this installation was supplied by the Swedish General Electric Co., Ltd. (Asea), which also contributed to the planning of the station.

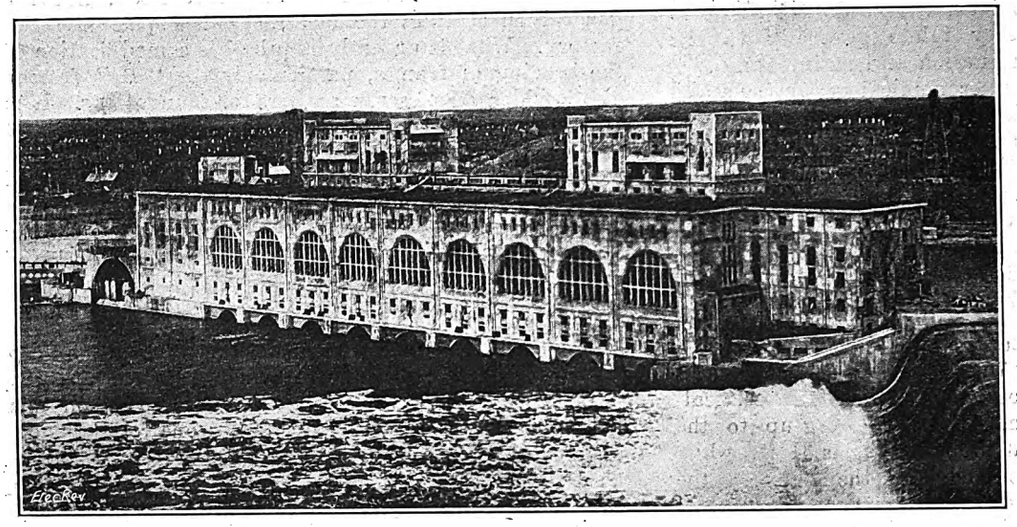

Fig. 1.—Volchov Hydro-electric Power Station.

The power station, fig. 1, is located on the eastern bank of the river, about 80 miles east of Leningrad. By means of a dam 688 ft. in length and 56 ft. high, the surface of the river has been raised approximately 34½ ft., and an artificial fall of this head produced. The dam is of solid construction, in sections with axial water-tight expansion joints, except for a small internal tunnel intended for inspection purposes and to provide a means of access between the eastern and western banks. Suitable provision has been made to protect the dam against the enormous stresses to which it is subjected by masses of ice when the break-up occurs. The design and shape of the weir are also such as to give a uniform flow of water. The power station and the dam are built up on caissons. The generator room, fig. 2, is 460 ft. long and 55 ft. wide, and houses eight large and two small generator sets. Each of the large ones is driven by a Francis vertical-type turbine, constructed by the Karlstads Mekaniska Verkstad, of Kristenham, Sweden, which, with a gross head of 34½ ft., gives an output of 10,000 h.p. at 75 r.p.m. For the operation of the control gates of the turbines each set is equipped with a Swedish (Nidquist & Holm) turbine regulator controlled by an oil-pressure governor belt-driven from the main shaft. The oil-pressure system is so arranged that the turbines can be served

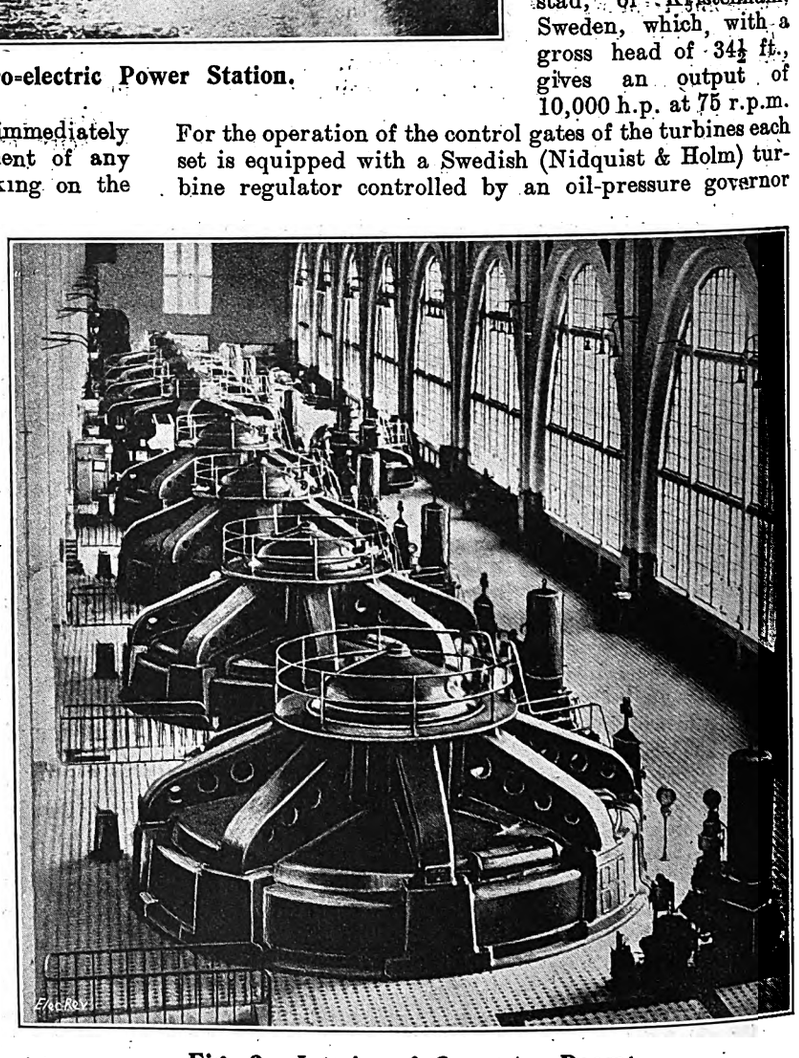

Fig. 2.—Interior of Generator Room.

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separately or in parallel. The turbines have their own guide bearings. The supporting bearing is mounted on the upper stator frame of the generator, which carries the whole of the rotating parts, both of the turbine and the generator. Four of the main generators were supplied by the Asea Co., to whom the writer is indebted for the accompanying illustrations and the main portion of the details, and four by the Elmaschtrust works of the Russian State Electrical Trust. The Asea machines will develop 8,750 kVA at 75 r.p.m., 50 periods, 11,000-V; they are totally enclosed and fitted with vertical shafts and flange couplings for connecting-up to the turbines. The diameter at the base ring is 31 ft., while the height from the bottom edge of the flange to the upper end of the supporting bearing cover is about 19½ ft. The stator frame is of cast-iron, the section at the back of the alloy-steel stampings being designed as a duct for the heated air which is led into a receiver duct under the power-station floor. Fan blades fixed to the rotor serve to force cooling air through the machine and to distribute it in a satisfactory manner. The excitation is supplied by separate motor-driven 100-kW, 240-V exciter units. The total weight of each generator is 300 tons.

On the down-stream side of the station is a corridor into which the intakes of all the turbine ventilators open, so that cooling air for the generators can be drawn either directly from outside the station or, during particularly cold weather, from the interior of the machine room. The ventilator fans, which are located on the floor immediately below the generators, are directly driven by 2,200-V induction motors served by duplicate supply cables. There are ten ventilators, one for each generator and two in reserve. The generators are earthed in groups of four through resistances which limit the earth current to 135 A. Conductors from the alternator terminals are taken to an adjacent cable-box room, from which cables have been laid up to the 11-kV oil-switch floor, which is served on both sides by two 6-ton lifts. There are two rooms on this floor, one for the actual switches and one for the operating equipment. Fig. 3 is a view of the operating gangway for the isolating links and oil switches. Provision has been made by means of large sumps for conducting the switch-oil away in the event of leakage or fire.

The oil-switches are designed for a short-circuit capacity of 450,000 kVA, and are of three sizes; 2,000 A for the transformers and bus-bar connectors, 600 A for the generators, and 350 A for the local supply transformers. From the oil-switch floor the conductors are taken directly to the 11-kV bus-bar floor. The bus-bar system is duplicated, one section being on each side of the wall. Each three-phase bus-bar group is carefully divided from the neighbouring groups by means of heavy reinforced-concrete barriers. The disconnecting links are operated by means of rods from the oil-switch floor below.

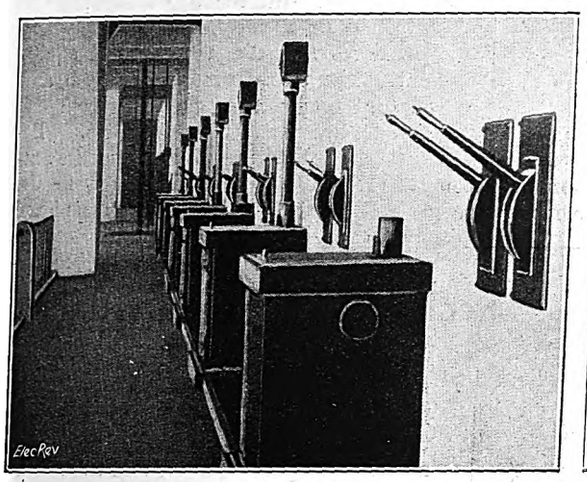

Fig. 3.—Operating Gangway for 11-kV Isolating Links and Switches.

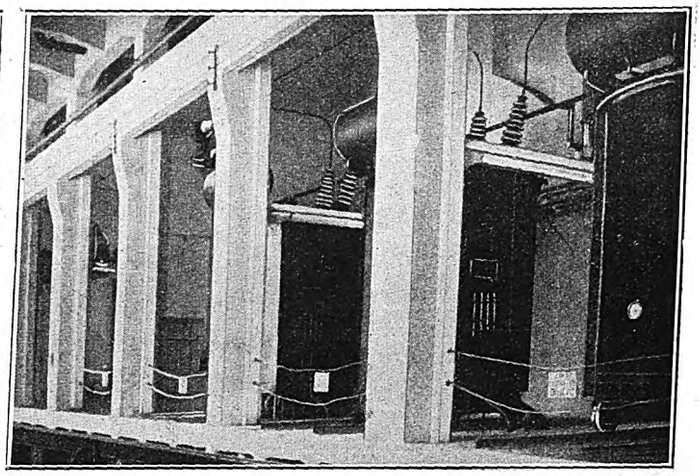

Fig. 4.—Main 11/120-kV Transformers.

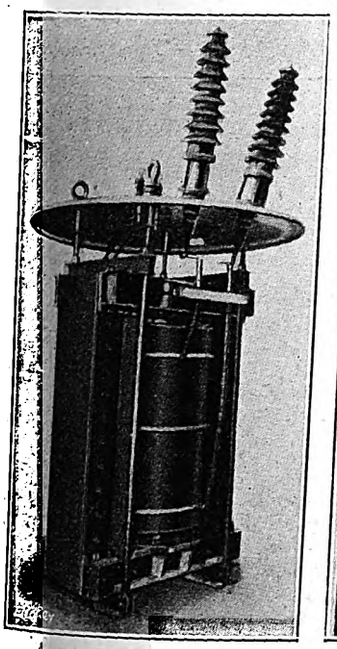

Fig. 5.—11,700-kVA Single-phase Transformer.

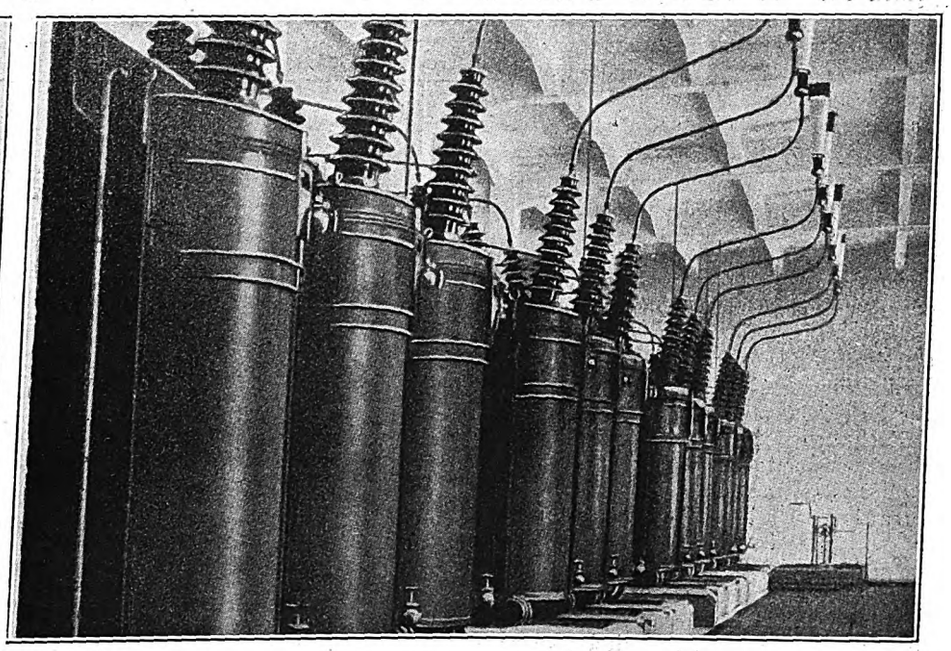

Fig. 6.—120-kV Oil Switches.

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The two identical sections of the bus-bar system are divided by rod-operated isolating switches, and owing to the long lengths of the bus-bars, expansion joints have been introduced. From the 11-kV bus-bars the supply is led through further isolating links and oil switches to the main step-up transformers.

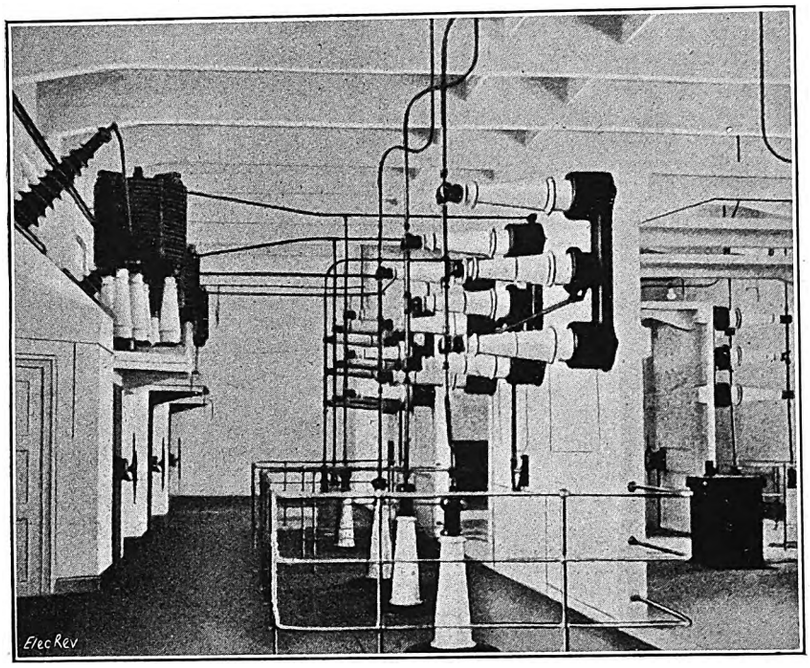

Fig. 7.—Reactances and Isolating Equipment.

The 11/120-kV transformers, fig. 4, are situated on the same level as the 11-kV switchgear. Each of the three transformer groups is loaded at 35,100 kVA, each group consisting of three 11,700-kVA single-phase transformers, fig. 5, oil insulated and water cooled. The groups are delta connected on the low-pressure side and star connected on the high-pressure side, with directly-earthed neutrals. An explosion relief valve on each transformer is designed to withstand an internal pressure of four atmospheres and a vacuum of 0.8 atmosphere; the cooling coils have been pressure tested to 20 atmospheres. The transformers are designed for a temperature rise of 55 deg. C. above the temperature of the incoming cooling water, which has a maximum temperature of 25 deg. C. At 10 per cent. overload the temperature rise of the windings does not exceed 60 deg. C., or in the oil 45 deg. C. Without exceeding these values, the transformers, starting cold, can be 50 per cent. overloaded for 20 minutes and 100 per cent. for 10 minutes.

Each transformer is provided with a thermo-element for distant and direct-reading thermometers, which latter is furnished with a contact device for giving a signal in the control room if the temperature of the oil exceeds a certain predetermined limit.

From the transformers conductors are led up to the 120-kV switchgear contained in two towers, one at the north and one at the south ends of the station. Each tower has two floors, the lower at a 100-ft. level containing the 120-kV oil switches, fig. 6. The h.p. conductors consist of 38-mm hard-drawn copper tubes, 2 mm thick. In the north tower there are four oil switches, of which two are intended for the two north transformer groups, one for the outgoing line from this tower, and one as a section switch for the other transformer group and connection between the north and south towers. The south tower contains three smaller oil switches, one transformer switch, one line switch, and a section switch. All these oil switches are designed for a breaking capacity of 25,000 A, and are furnished with explosion chambers and current transformers embodied in the leading-through insulators.

From the oil-switch room conductors are taken up to the isolator room above. The isolating links are of the standard 3-pole knife-switch type, and the operating gear is contained in a special gangway which also serves for the transformer equipment. The transformer, oil-switch and isolator rooms are divided from one another by fireproof partitions. Between the isolating switches and the outgoing lines are connected reactance coils, immediately in front of which are placed hand-wheel-operated single-pole switches by means of which the line can be effectively earthed, phase by phase. To special bushings in the wall of the tower is connected the transmission line, which crosses directly over the river in a 1,246-ft. span to the first transmission-line mast. Figs. 7 and 8 show, respectively, the isolating links, reactances and outgoing insulators, and the 120-kV operating gangway. Connection between the bus-bars in the north and south towers is made by means of an outdoor line. Fig. 9 shows the 120-kV bus-bars installed in one of the towers.

The motor-driven exciters for the main generators are supplied from two 1,250-kVA service generators erected in the centre of the machine room; these are directly coupled to 1,400-h.p. water turbines running at 150 r.p.m. Each of these generators running alone is able to supply field current for the whole station. For auxiliary power requirements there are two 1,250-kVA station transformers fed from the 11-kV bus-bars, reducing that pressure to 2.2 kV. To limit the short-circuit current in the auxiliary system, special reactance coils have been placed between the voltage regulating transformers and the auxiliary bus-bars, and in this way it is possible to run the generator exciters from the 11-kV system. This arrangement constitutes a very useful stand-by. The ideal of collecting all the control apparatus in one place has been realised at Volchov. The control board consists of a central horse-shoe bench-type portion with two 12-panel flanks of

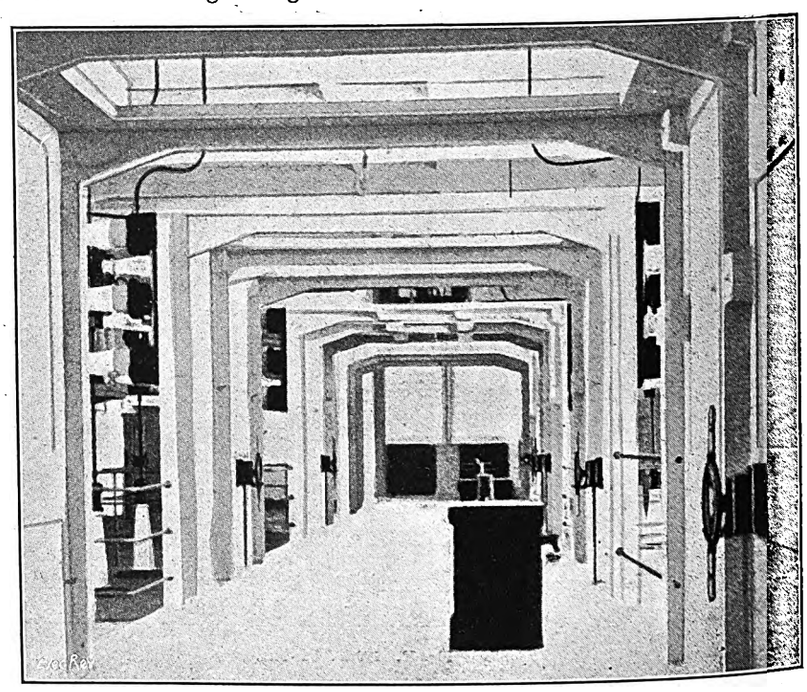

Fig. 8.—Operating Gangway for 120-kV Gear.

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the flat-type. The bench board carries the actual switch-operating equipment, and the flank boards carry the instruments, relays, and so on.

To provide direct telephone communication with the sub-station in Leningrad, the control room is equipped with high-pressure telephone apparatus which operates on the transmission line. Communication with the machine room is by means of ships' telegraphs. An indicator board placed at the south end of the machine room shows by means of a red figure against a blue background the machine to which the instruction given applies. The necessary d.c. control current for the station is supplied by a 220-V battery having a capacity of approximately 540 Ah.

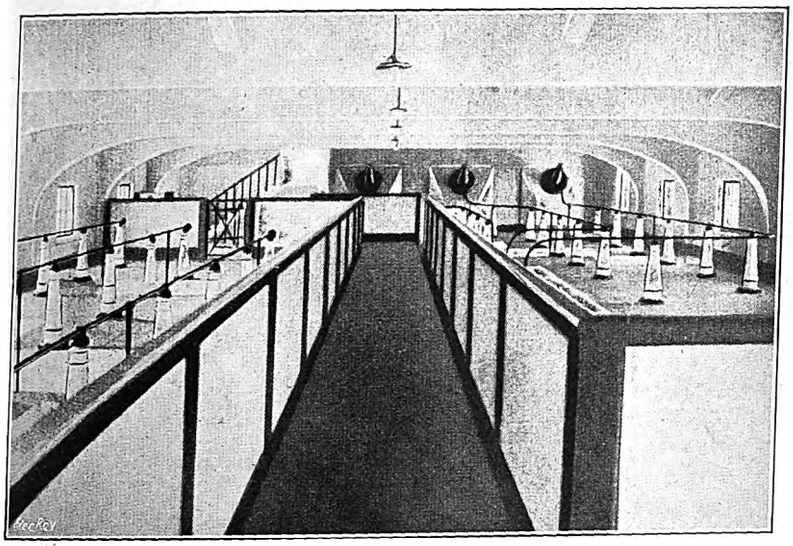

Fig. 9.—120-kV Bus-bars.

For lighting and local requirements within the station there are three small switchboards combined with step-down transformers supplied from the local 2.2-kV system. The switchboards are furnished with automatic lighting change-over switches which normally make connection with the a.c. supply, but which throw the lighting circuits on to the battery if there is any fault on the a.c. system. To enable high-pressure tests to be carried out, the station is provided with a testing transformer for pressures up to 350 kV. This is fed from a special motor generator, which, together with the transformer and necessary switchgear, is erected in a small room adjoining the transformer repair shop. By means of a 350-kV wall bushing the test voltage is led into the workshop, where arrangements are provided for carrying out pressure tests. For oil testing one of the Asea standard type portable oil-testing equipments, provided with a 50-kV testing transformer, oil-immersed spark gap, and switching equipment, is used, fig. 10.

For carrying out tests on the generators there is a special load resistance, fig. 11, at the north of the station, consisting of a large concrete water reservoir furnished with three electrodes which can be raised and lowered in the water by an electric hoist governed from the control board.

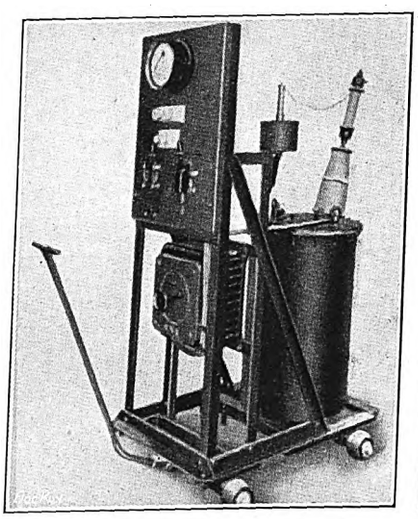

Fig. 10.—50-kV Oil-Testing Apparatus.

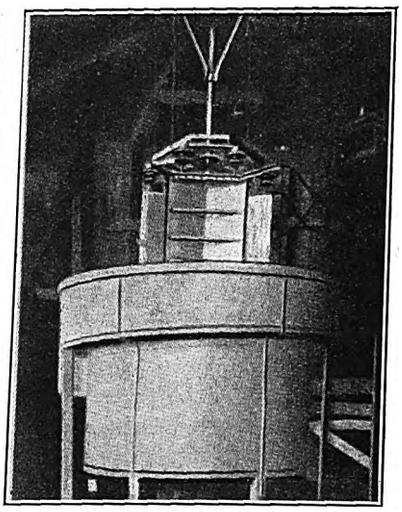

Fig. 11.—Load Testing Resistance.

The different relay combinations in the station are arranged in such a way that complete selectivity is obtained for all the switches from the generators through to the sub-station, and the same principle is adopted for the local distribution within the power station. The generator protection is provided by means of overload time-limit relays equipped for constant-time setting, high-sensitivity differential relays with constant-time relays having short-time setting and signalling relays.

The main transformers are protected by overload time-limit relays with constant-time setting, balanced differential relays combined with constant-time relays with short-time setting, double-contact instantaneous relays and signalling relays.

The line protection for the two parallel 120-kV outgoing transmission lines consists of special overload time-limit relays with locking arrangements, differentially-connected reverse-power relays, earthing relays assymmetrically connected with constant-time relays, and balanced earth-current relays differentially connected with the instantaneous relays.

The bus-bar protection acts either by breaking the earth or by dividing the sections of the system when the two groups of generators are operating in parallel. In the earthing circuit of each group of generators are placed over-load time-limit relays with constant-time setting and, accordingly, on the occurrence of an earth fault the earth of the corresponding group of generators is broken after a certain time. The earthing resistance is designed for a maximum earth current of about 135 A, so that the possibility is provided in the case of the section switch of directly isolating the bus-bar system in which the fault lies before the earthing release has had time to operate.

The local transformers are protected on the high-pressure side by overload time-limit relays with constant-time setting and double-contact instantaneous relays which release both the primary and secondary transformer oil switches. On the low-pressure side there are overload relays with inverse-time action which only release the low-pressure switches.

Synchronising can be carried out on the 11-kV system by means of the generator switches. The necessary pressure transformers for synchronisation are placed on opposite sides of each oil-switch, so that incorrect switching-in cannot take place. Each group of generators is furnished with a synchroscope which, by means of a five-pole change-over knife-switch operated from the front of the control panel, can also be used for synchronising by means of the section switches.

The Volchov power station has now been in full service for some time past, and every detail of the equipment has been found to be quite equal to the exceptionally heavy demands made upon it.

We understand that the Metropolitan-Vickers Electrical Co., Ltd., supplied a considerable amount of the equipment for the Volchov installation.

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Electricity Supply at Eastbourne.

Extensions at the generating station, and new offices and showrooms, were recently inaugurated by Sir Andrew Duncan, chairman of the Central Electricity Board.

IT is evident that municipal enterprise at Eastbourne is not limited solely to the attraction of holiday-makers, and that in matters electrical the town is progressive. As far back as the year 1882, East bourne Parade was illuminated by 22 Brush arc lamps, and soon after the interior illumination of several of the leading business houses in the town was introduced by running incandescent lamps in series with the arc lamps.

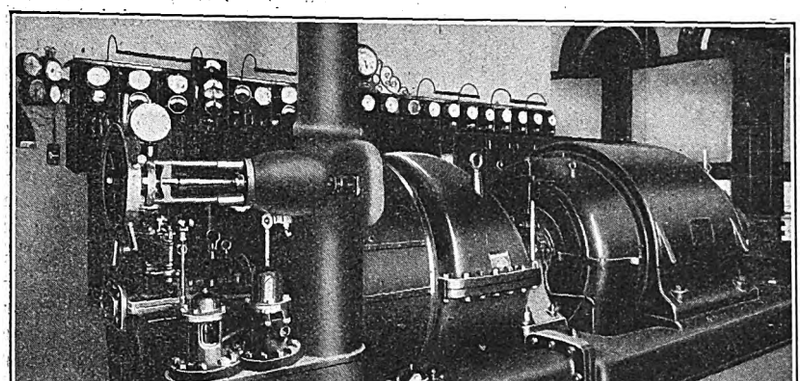

Fig. 1.—2,500-kVA Turbo-alternator.

In those days the generating station was situated on the site of the old Bedfordwell Waterworks, and the plant consisted of two 25-h.p. semi-portable Robey boilers and undertype engines driving 25-light Brush arc machines. The site, however, was found to be unsuitable and, accordingly, the Old Brewery in Junction Road was acquired in 1884, additional plant being put in from time to time until 1899.

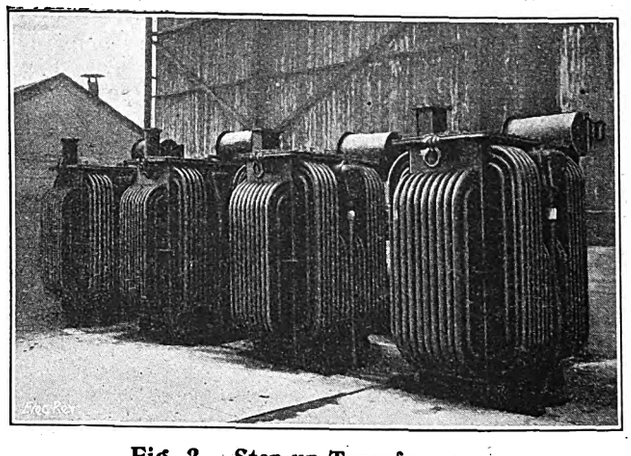

Fig. 2.—Step-up Transformers.

The limitations at the Old Brewery, however, soon made a second move necessary, and new works at the east end of the town were completed in 1902. Further extensions to the plant were made from time to time as the load grew. In 1923 an Allen-G.E.C. turbo-alternator of 2,500 kVA capacity, together with the necessary steam-raising plant, was erected, while in 1926 a duplicate turbine set was installed, with additional boiler plant. As the maximum load in 1927 was 6,962 kW, it was again found necessary to install further plant, and a repeat order was placed for a turbo-alternator, boiler, and auxiliary gear.

During the time in which the latter extensions were being carried out at the power station, new offices and showrooms were fitted up in Grove Road, and important extensions to the distributing system were made by the installation of an 11,000-V ring main, approximately eight miles long, practically encircling the town and feeding three of the outlying principal sub-stations at St. John's Road, Pashley Road and Eldon Road, with a tap taken into the central sub-station at Devonshire Place to act as a stand-by for the 11,000-V feeder laid direct from the power station to that point. All of these extensions were inaugurated by Sir Andrew Rae Duncan, chairman of the Central Electricity Board, on Wednesday last week.

The new turbo-alternator, fig. 1, consists of a high-pressure impulse-type turbine, supplied by Messrs W. H. Allen, Sons & Co., Ltd., driving a 2,500-kVA turbo-type alternator, supplied by the General Electric Co., Ltd. The working steam pressure at the turbine stop-valve is 250 lb. per sq. in., while the total steam temperature is 650° F.; the machine speed is 3,000 r.p.m. An Allen "Contraflow" condenser installed with the turbine is designed to maintain a vacuum of 28 in. (barometer 30 in.) at 25 per cent. overload, using 3,150 gallons of water per minute at 75° F. There are some interesting points about the construction of the alternator. The stator consists of a core built up of laminated steel punchings enclosed in a cast-iron yoke; the core is cooled by a large number of tubular ventilating ducts, which are served by two fans mounted one at each end of the rotor. The rotor was machined from the solid, the ultimate tensile

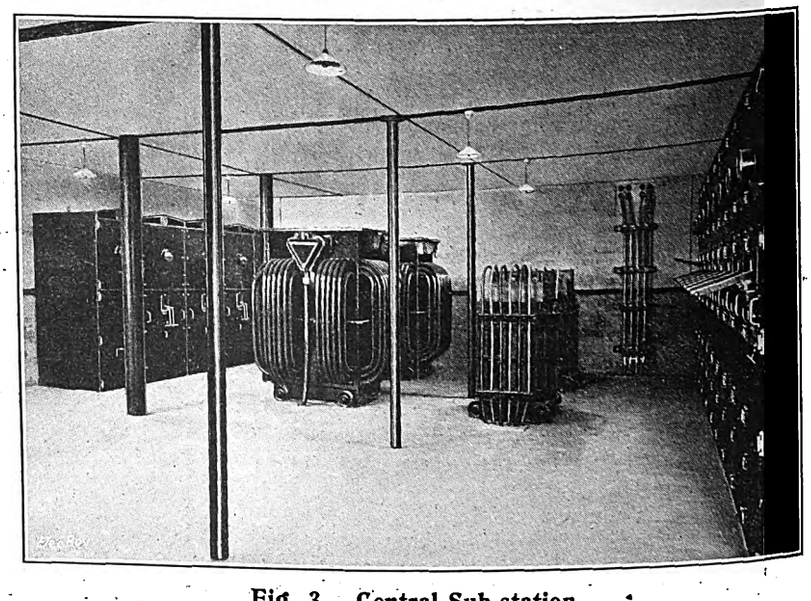

Fig. 3.—Central Sub-station.

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strength of the steel used being over 75,000 lb. per sq. in. The quantity of cooling air required by the alternator is 15,000 cu. ft. per min., and this is dealt with by an oil-film air filter situated outside the turbine room. The highest temperature recorded on the alternator on test was 116° F., or 23° F. below the maximum temperature rise allowed for in the specification. The exciter is of the over-hung type.

The extensions in the boiler house consist of a new Vickers 3-drum, bent-tube boiler, fig. 4, complete with super-heater, economiser, chain-grate stoker and forced- and induced-draught equipments. The boiler is of the triple-circuit type and has an evaporative capacity of 50,000 lb. per hour; the boiler steam conditions are 260 lb. per sq. in. and 250° F. The contractors for the boiler plant were the Vickers Boiler Co., Ltd.

On the distribution side there has been installed a considerable amount of transformer plant and switchgear, both at the power station and at the sub-stations mentioned. The 11,000-V equipment at the power station consists of nine 11,000-V truck-type cubicles and four 1,050-kVA transformers, fig. 2, while the equipment at St. John's Road, Pashley Road and Eldon Road consists, in each case, of five similar truck-type cubicles, together with the necessary 2,200-V steel-plate cubicle switchboard to control the two 500-kVA outdoor transformers. Fig 5 shows the St. John's Road "sub," with the outdoor transformers.

The central sub-station, fig. 3, is equipped with five truck-type cubicles controlling the e.h.p. supply, two 1,050-kVA oil-cooled indoor-type transformers, nine 2,200-V steel-plate cubicles controlling the h.p. feeders supplied from this sub-station, and also two 300-kVA air-cooled transformers, the low-pressure leads from which are taken to a slate-panel board controlling the distributors in the roads converging at this point. Owing to the necessity for having a sub-station in the centre of the town, and the difficulty of obtaining a convenient site, there was no alternative but to construct this sub-station underground. It is interesting to note that it is one of the largest underground sub-stations in the country, measuring 32 ft. by 37 ft. by 10 ft. 6 in.

The transformers at the power station step up the single-phase supply from 2,200 V to 11,000 V, and they are so designed that, at a future date, they can be connected to the 11,000-V three-phase supply from the Central Electricity Board, stepping down to a two-phase four-wire supply for the existing single-phase feeders. The transformers at the sub-stations can also be dealt with similarly. There are 55 main transformer sub-stations situated in various parts of the borough, and in these are installed air-cooled and oil-cooled transformers varying from 50 to 300 kW, supplying the lighting and power consumers at 200 V, single phase. The switchgear and transformers were supplied by the General Electric Co., Ltd.

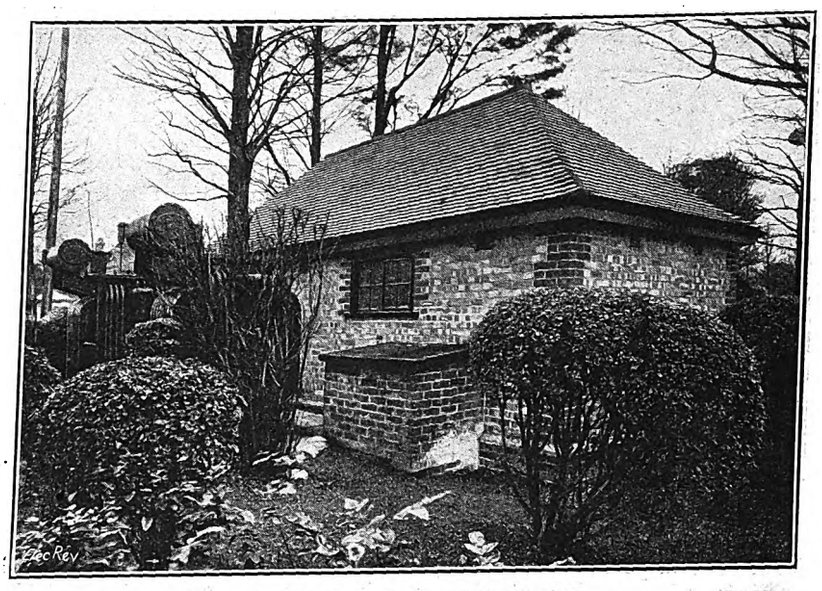

Fig. 5.—St. John's Road Sub-station.

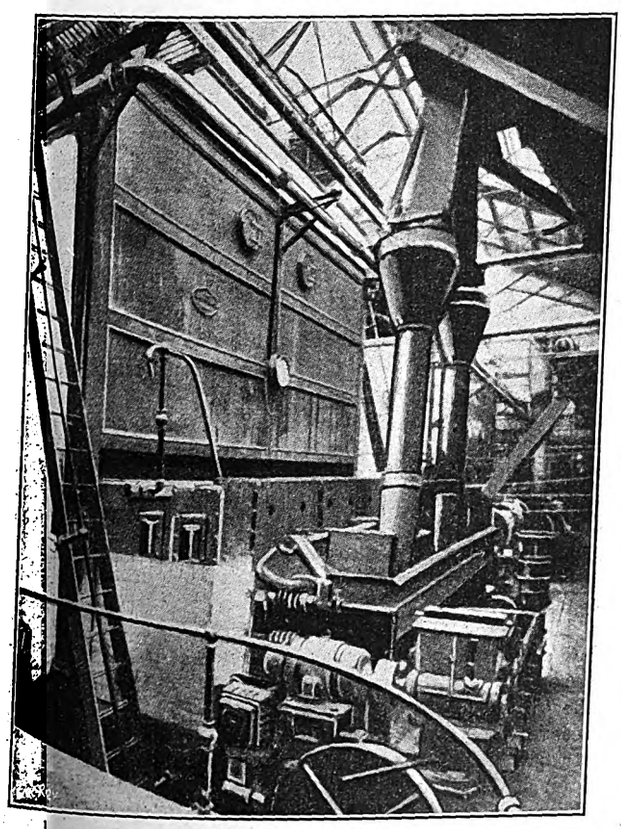

Fig. 4.—50,000-lb. Boiler Unit.

A large number of G.E.C. "Wembley" lanterns are used for street lighting in Eastbourne, notably in Devon shire Place, Memorial Square and Upperton Road, fig. 6, and in the vicinity of the railway station, while special decorative lighting units, employing colour sprayed lamps, are used along the Parade.

The provision of the new offices and showrooms has been made necessary by the continued demand for electricity supply in Eastbourne and district, and by the fact that it was considered advisable to have offices in the heart of the town, rather than at the power station. The showrooms have been suitably equipped to assist in educating the consumer in the resources of electrical service, and to familiarise him with the wide range of fittings, fixtures and appliances available. The premises

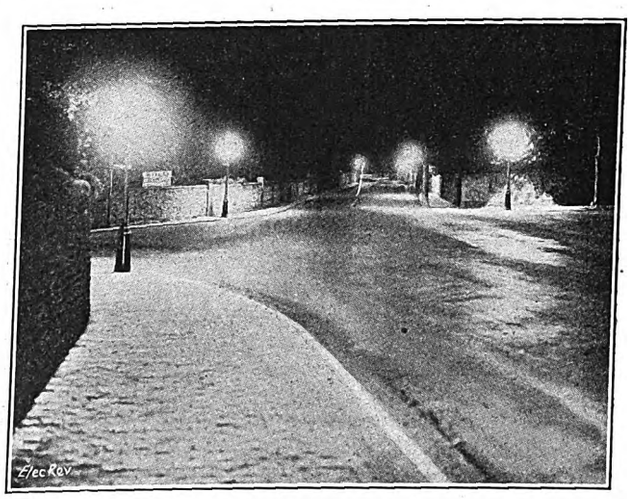

Fig. 6.—Electric Lighting at Upperton Road.

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occupy a frontage of 90 ft., and are approximately 53 ft. deep. A special feature in the showrooms will be made of a range of French glassware, while glass-fronted cabinets will show a range of domestic appliances, including a complete range of cookers, washers and wringers, cleaners, and so on. A portion of the basement has been set out as demonstration rooms, in the

Fig. 7.—View in New Showrooms.

form of a large kitchen, scullery and bathroom, containing modern equipment. The remaining portion of this floor has been allocated to a stores for cookers, meters, and so on.

Fig. 7 is a view taken in the showroom proper. The ground floor is occupied by the showrooms themselves, where there is displayed a complete range of everything electrical. The sales manager's office is positioned at the rear. On the first floor are accommodated the chief engineer's office and the general office, the latter consisting of a large room laid out for the sole purpose of promoting the maximum working efficiency. Leading off the general office are the offices of the consumers' engineer and chief clerk, and also typists' and waiting rooms. Access to these offices is by means of the grand staircase from the showroom. On the second floor are situated the mains department premises, including the mains engineer's office, the drawing office, and the meter department staff rooms. An internal telephone system connects all parts of the building, which is also connected to two exchange lines and to the Corporation's private exchange at the Town Hall.

Although Eastbourne is a purely residential and holiday resort, there are 775 electric motors in use, totalling over 3,600 h.p., and ranging in power from $\frac{1}{4}$ h.p. to 320 h.p., while the amount of energy sold for heating, cooking, and power represents 58 per cent. of the total kWh sold. The total number of meters connected to the system at the present time is over 17,000, including 4,400 prepayment meters.

An assisted wiring scheme was inaugurated in 1922, to apply to small residential property, under which the Corporation provides a lighting installation for from 4 to 6 points in each house, the supply being given through prepayment meters. The rent for this, and also that of the meter, is obtained by an additional charge of 2d. per kWh over the normal rate of 4d. The scheme, which commenced with one road as an experiment, has rapidly extended, and now covers 186 streets, in which over 3,350 consumers have been connected. Electric cookers are let on hire by the Department, at rates varying from 2s. 6d. per quarter upwards, according to the size of the cookers. Free wiring to the extent of 30 ft. is included in the hire charge. The following number of domestic appliances are now on hire to consumers: domestic cookers, 420; institutional equipments, 9; kettles, 300; water heaters, 61; and miscellaneous apparatus, 20.

Hire-purchase Selling.

A Consideration of Financing Arrangements Suitable for the Electrical Trade.

By "ECOS."

ONE of the problems facing the electrical trader, and for that matter any trader, at the present day is the advisability of adopting the hire-purchase method of doing business. There is a rapidly growing tendency for all classes to take advantage of hire-purchase facilities, and in America several important industries have been built up on this basis. The system as practised here is not exactly the same as in the United States, and an equal degree of popularity has yet to be achieved. It is very important that the electrical trader should give earnest attention to the matter. Certain firms have already adopted the practice, but it is felt that there are many who would appreciate more information.

At the outset it must be understood that the vital distinction between a cash sale and a sale under a hire-purchase agreement lies in the legal possession of the goods sold. In the case of a cash sale the ownership of the article almost invariably passes immediately to the purchaser. He does not necessarily take the article away with him, but in the eyes of the law it is his although he leaves it at the shop to be delivered later. In the case of an article sold under a hire-purchase agreement, however, although the hirer has the use of the article from the first payment, it is the legal property of the seller until the last payment has been made and the transaction completed. The hire-purchase system as carried on in this country is in effect the hiring of goods by an intending purchaser who can at any time terminate the agreement by returning the goods to the trader. This fact considerably limits the scope of the system, and only those goods that are of a durable nature are suitable for sale under the system. Thus the electrical trader must first decide whether or not the goods he has for sale are suitable and then he can then turn his attention to the best method of running the system.

Electrical wiring work would at first sight appear to be admirably suitable for sale under hire-purchase agreements. It must be appreciated, however, that in the event of the hirer going out of the agreement the recoverable value of the material would be small. This state of affairs could be met by fixing a comparatively high initial payment, but on the whole this method of doing business is not recommended for the contracting industry. Where an electricity supply authority sells wiring to its consumers, however, the situation is altered. In such a case it is not absolutely essential that the supplier should recover the material. In the event of the hirer terminating the agreement because of removal, for instance, the new tenant of the premises could in all probability be induced to take a supply. Moreover, the instalments can be easily collected with the accounts for the supply of electricity or through the

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prepayment meter, and of course the total sale of electrical energy would be expected to increase as a result of the system. When supply authorities also employ the system for appliances they are really carrying on the business of electrical retailers, and the remarks on the subject of retail trade are applicable to them.

It is to the electrical retailer that the hire-purchase system offers the brightest possibilities. Ovens, washers, fires, vacuum sweepers, kettles, percolators, lighting fittings, to name but a few lines, are all suitable for the purpose. Wireless sets and components can also be sold under the system, but care must be taken in such cases not to extend the payment period unduly, because of the risk of the particular type of set going out of fashion. The secret of successful hire-purchase business for the electrical retailer is to ensure as few returns as possible, and by careful credit investigation he can be reasonably certain whether the prospective customer is "safe." It is not good business deliberately to "oversell" a customer and induce him to purchase beyond his means. The wise trader will look in the direction of that class of person who, although he could afford to purchase the article outright prefers to pay for it out of income rather than to break into his savings or interfere with his investments.

From the manufacturer's point of view the hire-purchase system is useful for disposing of machinery and plant to customers who find it inconvenient to pay the whole cost at once. A further opportunity lies in the possibility of selling goods to retailers on the hire-purchase plan instead of granting credit in the usual way.

Having decided that his merchandise is suitable for sale under hire-purchase conditions, one of the most important matters upon which the dealer must make a decision is with regard to finance. Very few firms are in a position enabling them to finance hire-purchase business with their own resources, inasmuch as it means that a large amount of capital is always locked up. There are at present in existence several finance corporations who are willing to take over the burden of financing hire-purchase accounts, and provided a reputable firm is chosen, the dealer need have no compunction in putting himself in its hands. He need have no fear that his good-will may suffer as a result of the methods adopted by finance corporations; most of them are quite willing to adapt their arrangements to suit the individual needs of traders.

A manufacturer selling to customers who wish to avail themselves of hire-purchase facilities must first get into touch with a finance group. Upon being convinced as to his *bona fides* they will give him a supply of proposal forms and will either provide him with a supply of standard draft agreements, or alternatively will draft an agreement form suitable for his line of business. The proposal form may actually be printed on the back of the agreement, but in any case it is understood that the agreement is not complete until the finance corporation has considered the application of the manufacturer's customer and satisfied itself as to his reliability. Most finance groups prefer not to take part in transactions when an unduly long payment period is granted, nor do they see eye to eye with the proponents of the "No Deposit" scheme, and in the case of electrical machinery they would probably make a point that a minimum initial deposit of 20 per cent. be made and that the remainder be paid up within two years or preferably a year.

Let us assume then that a customer purchasing equipment to the value of £500 has agreed to pay an initial deposit of 20 per cent. and the balance, plus finance charges, spread over twelve months. After he has filled in a proposal form, and this has been approved by the finance corporation, the agreement is completed, the customer hands over his payment of 20 per cent., and the machinery is duly delivered and installed. The agreement, it must be appreciated, is strictly between the manufacturer and his customer, and before the finance corporation will advance the balance of the money it is necessary for the manufacturer to guarantee that his customer will complete the payment for the article and the financing. This usually means that the manufacturer has to sign a promissory note for the amount. Upon receiving this guarantee together with the agreement, the finance corporation will send the manufacturer a cheque for the balance of 80 per cent. so that he receives the full cash selling price of the equipment practically at once. The purchaser has of course to pay for the facility of spreading his payments over a period, and in this case the charge would work out at about 7½ per cent. for the year. This amount is added to the selling price and collected with the monthly instalments. Under the conditions we have assumed, the monthly payments would be worked out as follows:—

	£
Cash price of article	500
Less first payment	100
Balance outstanding	400
Finance charges (7½ per cent.)	30
Total amount due	430
Monthly instalment. £35 16s. 8d.	

If he prefers, the manufacturer is at liberty to collect the monthly instalments and forward them to the finance corporation. It is more usual, however, for the finance corporation to do the collecting, and after forwarding the documents the manufacturer generally takes no further active part in the transaction.

We have so far considered a scheme which has been developed for the needs of a manufacturer selling electrical machinery or electrical plant. A similar scheme could be adopted by a wholesaler selling, say, radio sets to retailers who prefer to pay for their stock more or less at the same rate as they themselves expect to sell the sets. In the case of the retailer selling direct to the public on hire-purchase terms, however, the unit transaction would be much smaller, and although the business could be financed on a similar plan, it would be better to adopt an alternative plan as outlined hereunder.

When a retailer sells, say, a vacuum cleaner on the hire-purchase system it is usually better not to allow the monthly collections under the agreement to be made by an agent of the finance company. By having a competent mechanic go round each month for the instalments he can ensure that the machine sold is not being ill used. Moreover, small minor repairs can be executed on the spot, and if there are any signs that the customer is not getting the best out of his machine the collector can give hints concerning the proper handling of the machine. By so doing the retailer can build up goodwill and new clients will doubtless be introduced by the original purchaser. In addition, the collector, towards the end of the period when the vacuum sweeper is nearly paid for, can very often induce the customer to purchase something else.

For financing such business it is usually necessary for the retailer to establish his *bona fides* with the finance corporation with which he intends to deal. Such a concern will not usually enter into business with a firm whose annual turnover does not amount to about £4,000 (cash and hire-purchase sales).

When the preliminaries have been settled, a supply of proposal and agreement forms will be provided. As customers enter into hire-purchase agreements by filling up the forms, the dealer himself makes out a promissory note on the finance corporation for the balance outstanding. He does not, however, send the agreements individually to the finance corporation, but retains the documents and sends them in monthly to the finance group for scrutiny, taking care, of course, to keep a list of the documents so sent. For small articles most finance companies are prepared to consider business on a basis of 10 per cent. deposit with the balance spread over six or twelve months. When the monthly batch of proposals and promissory notes is received the credit standing of the clients is investigated, and if everything is in order a cheque is sent to the dealer for an amount equal to about two-thirds of the credit balance outstanding. This advance is repaid by the dealer in regular monthly instalments spread over the period.

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For this service a charge of about 5 per cent. is made for balances outstanding over twelve months, but it is left to the dealer to pass on this charge and his own charges to the hirer as he may think fit. Thus the dealer, instead of receiving the gross profit on the transaction in a lump sum, takes it in monthly instalments spread over a year. The actual amount of financing done by the dealer can be lessened by demanding a higher initial deposit.

The foregoing remarks will perhaps show that hire-purchase business can be very simply and profitably undertaken by an electrical retailer or trader. It must not be thought, however, that the retailer or manufacturer has not to make any investigation into the credit standing of his customer. In the event of his customer failing to keep his agreement, the trader has to take in return (if he can get it) the now second-hand machine and to refund to the finance corporation the balance of the amount owing to it. This is obviously a strong point for a high initial deposit and an agreement sufficiently short that the value of the article as second-hand is always greater than the balance outstanding. Better still, however, the trader should convince himself beforehand of the reliability of his intending purchaser; in case of any doubt it is better to demand cash.

Organising for Increased Sales.

The Fifth E.D.A. Conference of the 1928-29 Session.

At the fifth conference of the Electrical Development Association at the Royal Society of Arts on February 15th, Mr. H. W. Roberts (General Electric Co., Ltd.) read a paper on "Organising for Increased Sales; Spring Cleaning Season, 1929." Mr. F. W. Purse, borough electrical engineer of West Ham, was in the chair.

In the early part of his paper, Mr. Roberts referred to the general question of increasing sales without reference to specific articles, and in this he briefly discussed the problems of creating a selling atmosphere, mastering selling points, and methods of approaching the customer. Passing on, he urged the importance of supply undertakings looking ahead and making due provision for possible requirements for years ahead. He said that the Central Electricity Board was definitely legislating for the future and not just meeting the demand as it came along. He recommended the E.D.A. Circles to devote one of their evenings to a survey of the retail shop representation in their areas and see whether this was really adequate to the public requirements. He considered that the industry was badly served in the matter of representation in the main thoroughfares in the towns of the country.

The necessity for standardisation and simplification of apparatus and fittings was also emphasised. It was frequently urged, he said, that the prices of standard apparatus were too high, but if there was a greater tendency to adopt B.E.S.A. standards, then the demand would be sufficiently large to enable price reductions to be made. After recommending monthly accounts for electricity supply, Mr. Roberts had some strong things to say regarding price-cutting in electrical apparatus. He said that good value for money, coupled with good service, was the basis of public goodwill.

In increasing sales, it was essential to have a definite aim; one should decide on the turnover it was desired to reach, then analyse it with a view to seeing how it could be achieved. The turnover and expected profit must bear a definite relation to the establishment charges to be incurred, and in the case of a retail shop the first consideration should be to select a standard line in constant demand, such as lamps, and make up one's mind that the business in that particular line must, for example, pay the rent of the shop. The advantage of lamp turnover was that it was quick, and quick turnover was the secret of profitable retail trading. Lamp selling, if studied carefully by the assistants, was an extremely good basis upon which to build up salesmanship in other lines of apparatus.

The next step was to prepare a definite campaign, making up one's mind as to the turnover to be reached in various classes of apparatus and then deciding as to how to get that business, *viz.*, by canvassing, advertising in the Press, or effective window displays. A well-planned campaign running over a period and carefully watched was better than "storm troop" tactics that lasted for a short time and then petered out. Having settled on the programme, say, three or six months ahead, it was essential to stick to it. When deciding upon the apparatus to be stocked, consideration must be given to the backing given by general publicity, to stocks available from the manufacturers, and, above all, to quality. One means of establishing a good connection among the public was to offer an annual maintenance contract at a small fee, as this definitely linked the householder up with a contractor or the supply authority, upon whom the householder soon began to lean for all his electrical requirements. There must be a good variety among the stock held, good window displays, and attractive layout of showrooms; as one of the chief selling points of electricity was its cleanliness, all shops, showrooms, &c., associated with the selling of electrical apparatus should be kept scrupulously clean and tidy.

Dealing specifically with the spring cleaning campaign for 1929, Mr. Roberts said that the plans of the E.D.A. perhaps dealt too prominently with the suction cleaner without referring to the numerous other possibilities of increasing business at that particular time of the year. If we could educate the public up to the all-electric idea, then there would be no need for spring cleaning; electrical apparatus would be in use all the year round and prevent the accumulation of dirt which it was now necessary to remove every spring. In the meantime, however, the spring cleaning season was an excellent one for propaganda for electrical apparatus. During the early winter the manufacturers were busy meeting the demand for their goods, and therefore it was appropriate that at the other period of the year efforts should be made towards creating a greater demand. There were still 75 per cent. of the houses of the country not yet wired for lighting, quite apart from the much bigger field of wiring them for heating and cooking.

A number of the more familiar selling points in respect of hot water, cooking, washing machines, fires, new wiring installations, kettles, suction cleaners, lighting fittings and fans were then outlined, and, incidentally, Mr. Roberts made another reference to spring cleaning from a different angle, *viz.*, the spring cleaning of the industry itself. At the end of the winter season it was highly desirable to overhaul stocks, shops and showrooms, and weed out unsaleable goods or refinish those that had become tarnished, thus preparing the way for next year's programme. Clearance sales at stated times of the year might be a good idea if general agreement could be arrived at by the trade on this point. They would serve not only as a spring cleaning of stocks, but also as a medium for intensive propaganda and advertising. Finally, Mr. Roberts spoke of the need for extra vigour in counteracting the opinion of the section of the public which still thought that electricity was dangerous. The whole trouble arose from a bad installation here and there, and enough had not been made of this fact, and pointing out the dangers of other methods of lighting, heating and power.

Discussion.

In the discussion which ensued, Mr. Bernard spoke strongly of the necessity for confidence on the part of those selling apparatus, if sales were to be increased. Standardisation was also important; if there were fewer types of plugs and sockets, for instance, they would be cheaper. Relative costs with similar services were a good selling point, and he instanced the charge of 4s. per dozen made by the gas companies for fireclay renewal elements, which he suggested was a very high price compared with the value to be obtained from a new element in an electric radiator, which cost very little more. As to rendering accounts monthly, the South Metropolitan Gas Co. did this, and, judging from the speech of Dr. Carpenter at the recent annual meeting of that company, it was very satisfactory.

Mr. Selley (St. Marylebone) suggested that the first thing to make a success of a selling campaign was to have a competitive price for electricity. Unless this price was right it would be impossible to sell apparatus. He did not agree with the idea of monthly accounts, as it would need a very large addition to the meter-reading and clerical staffs. If 100 meter readers and clerks were employed on this work on a quarterly basis, he calculated it would require 300 on a monthly basis. The difficulty with standardisation in domestic articles was that one housewife was not willing to have something because her neighbour had one. As regards looking ahead 10 or 15 years, he wondered what the position to-day would have been if the industry had ordered sufficient supplies of stoves, for instance, 10 years ago to last until the present time! Washing machines would never be sold in any quantity until the drying problem could be got over, and in a district like his own there was no place to dry clothes in the homes of the people. Whilst agreeing that the ratable value system of charging, plus a penny a unit, was a convenient system, again, he saw difficulty in applying it in a place like Central London; similarly, he failed to see how a tariff for universal adoption throughout the

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country would ever be arrived at. The reference in the paper to the danger of electricity was to be deprecated because there were very few bad installations after all. It was the business of the supply authority to see that apparatus was properly installed, and there were the Institution Wiring Rules. Hot-water apparatus would solve a lot of the troubles of the household, but it would never be sold with electricity at 2d. per kWh. The buyers of apparatus might look ahead a little and, say in April, give the manufacturers some indication of their requirements for the coming winter, so that the goods could be delivered during the summer months.

Mr. JOYCE (General Electric Co., Ltd.) remarked that lack of capital was preventing the selling industry increasing in the required manner, and with that must be coupled the lack of retail shops throughout the country. Some enterprising companies and municipalities had excellent showrooms, but in London itself there were very few first-class electrical showrooms. Contractors seemed too concerned in preparing tenders for public contracts to pay sufficient attention to the public needs. The manufacturers could send the contractors overprinted matter and endeavour to help them increase sales, but this was usually found subsequently under the counter and was never used. It was necessary to get the retailer to use the propaganda material with which he was supplied.

Mr. SHEARS (Hackney) advocated tackling the increased amount of wiring that was waiting to be done, as part of a spring campaign, because this provided a bigger field for selling accessories subsequently. He also wished that the lamp manufacturers would reduce their prices. To offer a maintenance contract to a consumer rather suggested lack of confidence in the installation.

Mr. B. HOLDING said that we had a great many shopkeepers, but they required converting into sellers of electrical apparatus. With regard to the problem of drying when using an electric washing machine, there was a machine which incorporated a centrifugal dryer.

Miss TICKELL (Leyton) remarked that one of the suction cleaner manufacturers had canvassed Leyton with his own staff, in the name of the supply authority, and had succeeded in selling 250 cleaners in five months.

Mr. PATMORE suggested that the lack of specialist staff was one of the causes of backwardness in sales development. Why should the manufacturer, as in the case of Leyton, have to provide the canvassers for apparatus from the sale of which the supply authority would reap the largest benefit? With regard to fires, he mentioned that the company supplying in his district had sent round a notice urging consumers to use their fires as little as possible between certain hours. This company took its supply in bulk and was afraid to increase its maximum demand under the new system, and he thought it time that direct representations were made to the Electricity Commissioners to revise the charges made by bulk suppliers.

The CHAIRMAN said it would be impossible to lay down hard and fast rules for every district, as the peculiar conditions of the locality must be taken into account when preparing any campaign. He reminded Mr. Selley that all steam laundries did their drying indoors, and therefore he might increase his load by fitting electrically-heated drying cupboards. There was undoubtedly to be a boom in electric wiring on the hire system, and in West Ham they had been inundated with applications. Another matter which he was considering was a maintenance department which had been shown to be successful by the gas companies.

Mr. ROBERTS briefly replied to the discussion, and said he did not suggest that orders for 10 or 15 years for apparatus should be placed with the manufacturers. They themselves would not care to have to buy their raw material all that time ahead. What he meant was that those responsible for showrooms and shops should look ahead and plan their arrangements so that in 10 or 15 years they would not find their accommodation, for instance, too small. He regarded the maintenance contract as indicating confidence in the installation, and that should increase the confidence of the public. He was afraid it would be a long time before lamps would be available at 1s. each, and he recalled that the prices in this country compared favourably with those prevailing on the Continent, but they were very different from those prevailing in America. The reason lamps were cheaper in America was that 95 per cent. of the consumers were on one voltage, and that made the number produced enormous, and so brought down the price. Incidentally, Mr. Roberts mentioned that there were thousands of current limiters in use in this country, but these had definitely become sales limiters because in those districts where they had these things it was impossible to sell the users an iron, and the sooner they were taken out the better for the supply authority, the manufacturer and the retailer.

Fuel Control in Power Stations.

Notes on Modern Developments for Effecting Economy in the Generation of Electricity.

By DR. ING. FRIEDRICH MUNZINGER, Berlin.

(*Extracts from a paper read in* LONDON *at the* 1928 CONFERENCE *of the* INSTITUTE OF FUEL.)

THE principal means of achieving cheaper electricity are: high boiler pressures and steam temperatures; application of more perfect working processes and machines; and a series of measures to lessen the price-raising influence of the peak loads of modern stations on the operating and capital costs. These three aims are partly contradictory to each other, so that they must be balanced, in order to improve the overall economy as far as possible.

At high live steam pressures, the high-pressure stage has to deal with a larger percentage of the entire available heat drop, so that its effect on the total efficiency is consequently higher than at lower live steam pressures. The great thermal progress made within recent years in the construction of high-pressure turbines is therefore not so marked, because the steam enters the low-pressure stage at a lower temperature, in consequence of the better efficiency of the high-pressure stage. Hence, the available heat drop in, and the thermo-dynamic efficiency of, the low-pressure stage are depreciated, and an improvement in efficiency of the high-pressure stage of 1 per cent. only increases the efficiency of the entire turbine by approximately 0.2 per cent.

The greatest heat economy would be obtained with an infinite number of extraction points, but, of course, the turbine can only be bled at a limited number of points. Only very moderate gains are obtained with more than three extraction stages. Consequently, two bleeding points are considered adequate, in order to avoid having a too-expensive and complicated plant. Besides the direct advantage, traceable to the entropy diagram, preheating of feed water by extraction has the additional advantage that it diminishes the volume of steam flowing through the low-pressure stage, which is extremely desirable, in view of the difficulty of obtaining the necessary cross-section for the very large volumes of steam at large outputs and high vacuum, and also in view of the necessarily large condensers.

The parallel operation of several pre-heating systems presents no difficulties, and the end temperatures of the feed water have always the most advantageous thermal values. Another favourable factor is that the preheat turbine—if based on the same output—deals with a greater quantity of steam. (In the Klingenberg plant, for instance, this ratio is 8.8 to 14.5.).

Despite the favourable American reports pertaining to reheaters heated by flue gas, the author does not believe this to be the final and best solution. According to the writer's personal view, reheating by live steam become more remunerative as the steam pressure increases. It renders the entire operation of the plant more simple and reliable; the long and large-diameter pipe lines for carrying the steam to and from the reheater can be dispensed with; the pressure losses in the reheater diminish; special auxiliary regulating devices for the turbines are not required; and, finally, the first cost of the plant is undoubtedly lower.

If one has a free hand in the selection of the reheating pressure it wholly suffices to effect reheating, within the investigated pressure range, merely with condensing steam, in order to attain moderate moisture of steam in the low-pressure stages.

Capacity and efficiency of chain grates have been greatly improved by making them stronger, by providing efficient drives, by tightly closing off the back end of the grate, and especially by equipping them with forced draught. About five years ago, pulverised-coal furnaces with central milling plants were introduced, and more lately individual mills have become increasingly popular. Pulverised-coal furnaces possess in Germany (and probably in other countries, too) outstanding advantages for electricity works and collieries, because the large quantities of Silesian small coal, for which there was practically no market, and the fine-grain Westphalian coal, which has a poor gas content, can be burnt at a good efficiency. Up to now it has been mainly the prime cost of pulverised-fuel firing which has restricted the wide adoption it deserves. On continuous service the efficiency of pulverised-coal firing is 2 to 4 per cent. higher than that of chain grates.

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With coals having poor combustible properties on grates, the difference is still more marked and of considerable financial consequence, because coals which, based on their calorific values, are decidedly cheaper than those suitable for chain grates can be burnt with assured success.

The adoption of individual mills is steadily increasing. In the writer's opinion these mills will, in many cases, be principally in demand in the future, particularly if the total operating costs are taken into consideration. Individual mills should be preferred in small- and medium-sized stations for cheap fuels having, sometimes, a considerable moisture content, and for short periods of operation. The boiler stand-by must, however, be greater than with central mills, and the efficiency is, particularly at rapidly fluctuating loads, about 1 to 2 per cent. lower. With central preparation, about 1 to 3 per cent. of the energy produced is lost by the pulverising process, according to the calorific value of the coal, the cooling water conditions, the steam pressure and the size of the power station.

In spite of the advantages associated with pulverised-fuel firing, the conditions to-day are not such, nor will they be probably for some time to come, that they are always superior to mechanical grates. Both mechanical grates and pulverised-fuel firing have their own definite spheres of application, in which they excel; besides, there may be cases in which opinions differ as to what class of firing should be given preference.

Even to-day, pulverised-fuel firing is frequently more suitable for boilers with steam outputs of more than 60 to 70 tons per hour. A single-ended boiler with a pulverised-fuel furnace can readily produce up to 200 tons of steam per hour; with a chain grate scarcely more than half as much. The longer the load period and the more expensive the fuel the smaller will the boiler output become at which pulverised-fuel firing is more economical. With low-volatile coal, the range of application of pulverised-fuel firing—under otherwise equal conditions—is greater than with highly gaseous coal, because the air can be pre-heated far more.

An essential advantage of pulverised-fuel firing is the fact that the air for combustion can be pre-heated almost as much as desired. This is of importance for attaining a high boiler efficiency with extraction turbines, since no, or only small, economisers are permissible with them. Cooling of the flue gases down to 250-280 deg. F. is nowadays easily accomplished, but it is only seldom of financial advantage.

The flue gases, in a great many cases, can be cooled to the same temperature with economisers and with air preheaters. The higher the live steam pressure, the higher is the temperature of the condensate preheated by bled steam which enters the economiser. To-day its temperature is frequently 285 to 350 deg. F., *viz.*, just as high as the temperature of the flue gases should be, in many cases, if the plant is to work really economically. However, in order to be able to cool the flue gases to these temperatures, in spite of the hot feed water, the economiser would have to be of unpractical size. In these cases air preheaters afford a good means of obtaining, at reasonable capital cost, the necessary waste gas temperature, and are therefore of marked importance with high steam pressures. As against economisers, they give, in many cases, for the same waste-gas temperature, a higher thermal efficiency and indirectly reduce the plant and fuel costs, in that they diminish the loss in the residue and unburnt gases.

The thermal superiority of steam of more than 700 lb. is frequently offset by the more expensive turbines, pipe lines and boilers. As long as no high-pressure boiler has been developed for 1,400 lb. at about the same price as an ordinary 500-lb. boiler, a general transition to materially higher pressures than 500 or 750 lb. cannot be anticipated.

In very many electricity works only 4 to 7 per cent. of the total current is generated at a load of more than 50 per cent. of the peak. Since the whole station has to be built for double the output to cover this small percentage of the maximum energy generated at any one time, the high cost of production at low load factor is not surprising. The capital expenditure for the additional machine output is so large that it far exceeds all the fuel saving attainable by technical improvements under the most favourable conditions. For real economy it is therefore far more important that the necessary peak-load machines be as cheap as possible than that peak loads be produced in the most thermally efficient manner.

The capital cost for the peak output may, among other things, be reduced, either by heavily overloading the boilers or furnaces for a few hours, even if the efficiency thereby depreciates, or by steam accumulators, which store up energy during light-load periods and supply it again at times of peak load.

Discussion in London.

Mr. W. M. SELVEY said that when trying to sell power he had found that the men to whom one appealed were trying to save money merely on the narrow running costs of their existing plant, turning a convenient blind eye to all sorts of extras which appeared in the annual balance sheets, but did not come before them week by week. It had been pointed out by Dr. Ferranti that when something new was introduced there was always a tremendous amount of development work behind it, and the selling price of the apparatus had to include the cost of the development. Thus, in making comparisons between a newly-developed system and an established system, the former was at a disadvantage. Therefore, if it were more enterprising in adopting new systems, the costs of the new apparatus would be reduced. He believed the cost of high-pressure boilers would be reduced considerably when the demand was increased, and when the development costs could be spread over a larger number of plants.

Mr. F. H. ROSERCRANTS said that during a trip to the Continent he had been amazed by the extent to which welded construction for boilers had been adopted, particularly in Germany. At present in this country welding on high-pressure piping and receivers was accepted, but not boiler drums with welded seams. It would be interesting to know what was the character of the opposition, if any, offered to this type of construction in the early stages of its development on the Continent. Referring to the application of cooling surfaces to furnace walls, he thought the next logical step would be the incorporation of the furnace cooling as an integral part of the boiler unit. He was much more impressed by the favourable opinion that Dr. Munzinger had expressed with regard to the accumulator and the Loffler boiler than he was with the equipment itself.

Mr. E. R. WILKINSON said that despite the favourable American reports on reheaters heated by flue gas, reheating by live steam had been adopted in the later American stations constructed for reheating. It was true that one could not get the same thermal efficiency by reheating with live steam, but that disadvantage was probably more than offset by the very considerably reduced capital charges on the live steam reheating equipment. He had recently made a very extensive investigation on the question of boiler pressures, and had come to the conclusion that a pressure of 1,400 lb. need not be considered at all—having regard to thermal efficiency alone, irrespective of capital charges—for the peak, so far as thermal efficiency was concerned, appeared to be about 1,200 lb. per sq. in.

Mr. CHARLES ERITH referred to the La Mont boiler, which had been in operation in Boston for over a year and was about to be introduced into Europe. It was not a flash boiler, but was constructed of small tubes, ⅝-in. in diameter, and had forced circulation. It differed from a flash boiler in that it had no water level, and in the fact that at least four times the amount of water that could be evaporated per tube was positively injected into one end of each individual tube. Therefore, the superheater was placed in the normal position, screened by the water tubes; the firing system was perfectly normal, and low cost was assured. Undoubtedly the cost of a La Mont boiler constructed for a pressure of, say, 1,600 lb. per sq. inch, could be reduced to that of a normal boiler. He also drew attention to the striking development of the multiple-retort type of stoker on the Continent, as well as in America. Doubtless Dr. Munzinger was aware of the adoption of multiple-retort stokers at the Spandau (Berlin) electricity works and at the Hamburg electricity works. These stokers, needing no arches, could be developed for a furnace of any dimensions. They also lent themselves extremely well to supplementary firing at peak loads by pulverised coal, the normal load being met by direct combustion of untreated coal on the stokers themselves.

Mr. W. H. PATCHELL was disappointed that Dr. Munzinger's paper did not contain results of the operation of the Klingenberg plant. Referring to preheating with auxiliary turbines, he asked how the water in the main turbines was got rid of, and whether there were signs of erosion as the result of the adoption of the non-bleeding policy in the main turbines. With regard to the grinding mills used in conjunction with pulverised-fuel plant, he asked how the mills at Klingenberg had stood up to the work, and what was the position with regard to drying. Again, he asked what steps had been taken to prevent or diminish the emission of dust from the chimneys—a matter which had constituted a very real difficulty elsewhere. One heard a good deal about what Loffler boilers were going to do, but one could not get operating data with regard to them; if Dr. Munzinger could say where such data was available he would be rendering valuable service. He believed that only one insurance company in this country would consider welded drums seriously, although it might be that if an engineer insisted upon using welded drums and told the insurance companies that they could take the business or leave it, they might re-consider the matter.

Mr. H. E. PARTRIDGE said his firm had made recently a welded drum, 54 ft. long and 4 ft. 6 in. in diameter, and had tested it to destruction; the back of the drum had broken before the weld.

Electricity Commissioners' Report.

The eighth annual report of the Electricity Commissioners covering the period from April 1st, 1927, to March 31st, 1928, has been issued (H.M. Stationery Office, price 3s. net). It indicates that during the year under review the energy generated (570 stations) totalled 9,927,850,630 kWh, and that the fuel consumed was as follows: coal, 9,034,323 tons; coke breeze, 149,721 tons; and fuel oil, 40,107 tons. The energy sold in 1927 by authorised undertakers amounted to 6,850,162,808 kWh (2,519,521,676 kWh by companies), an increase of 19.6 per cent. compared with the 1926 figure, and of 87.9 per cent. during the five years since 1922. Further reference to the report will be made in due course.

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Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Detection of Unlicensed Radio Sets.

On February 13th, Sir NICHOLAS GRATTAN-DOYLE asked the Postmaster-General if he would state what, for the year 1928, was the cost of the service organised by his department for the purpose of detecting radio apparatus operated without licences; what amount was recovered by fines; how many prosecutions were instituted; and whether the balance of expenditure was charged against the cost of the department or was deducted from the revenue from broadcasting licences.

Sir W. MITCHELL-THOMSON said it was not possible, without undue cost in accounting, to segregate the cost of the specific work of detecting radio apparatus operated without licences. 1,135 prosecutions were instituted in 1928, and convictions were obtained in all but seven cases. The total amount of fines recovered, including costs where granted, was £1,186. The difference between the cost of the prosecutions and the amounts recovered was borne out of the proportion of the licence revenue which was retained for management.

Departmental Control.

On February 13th, Lord SANDON asked the Prime Minister whether he could explain the reasons which prevented the exchange as between the Board of Trade and the Ministry of Transport of the responsibility for the mercantile marine and electricity.

Mr. BALDWIN said whether or no the suggestion was advisable as a practical measure was not a matter which could be dealt with by way of Parliamentary question and answer, but was one which would require lengthy and detailed examination. Even if in the result any change were found desirable, legislation would be required to give effect to it.

Beam Radio-telegraph Receipts.

On February 14th, Lord WOLMER, the Assistant Postmaster-General, informed Mr. Wellock that for the period from April 1st to December 31st last the gross receipts of the Post Office from the Imperial "beam" wireless services were estimated at about £358,000. The credit balance in respect of the same period (before charging depreciation or interest on capital) was estimated at about £152,000.

Electricity and the Cost of Living.

On February 13th, Sir H. BRITTAIN asked the Minister of Labour whether the item in the cost-of-living index relating to fuel and light included electricity, or was based only on gas, coal, oil and candles.

Sir A. STEEL-MAITLAND said that the cost-of-living index-number was designed to indicate the cost of maintaining unchanged the pre-war standard of living of working-class families. As electricity was much less important than gas as a means of light and heat in working-class dwellings before the war, it was not included in the fuel and light group of items used in the compilation of the cost-of-living index-number.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Scottish Electrical Contractors' Gathering.

The annual entertainment of the Edinburgh Branch of the Electrical Contractors' Association of Scotland was held in the North British Station Hotel, on February 8th, and took the form of a dinner, whist drive and dance. The party numbered about 200, and many sections of the electrical industry were represented. The Electrical Contractors' Association (England) was represented by the president, Mr. Walton, the secretary (Mr. Penwill), and Mr. Robson, of the Newcastle branch. Other guests were Mr. Parkin (British Electrical Development Association), Mr. New and Mr. McLagan (Accumulator Makers' Association), Councillor Couston and Mr. Seddon (Edinburgh Corporation Electricity Department), Mr. D. S. Munro (Institution of Electrical Engineers), and representatives of the other branches of the Association in Glasgow, Dundee and Aberdeen. Mr. A. J. Shand (chairman of the branch) presided at the dinner, and the toast of the guests was proposed by Mr. J. Foggo (president of the Association), and replied to by Councillor Couston and Mr. Walton. In the course of his remarks, Councillor Couston referred to the excellent co-operation which existed in Edinburgh between the supply undertaking and the trade, and said that this had resulted in the very satisfactory extension of the use of electricity in the area, the output having been doubled in the past four years. Mr. Walton, in his reply, urged that there should be the closest and most friendly co-operation between the Scottish and English Associations in the many problems in which they were mutually interested. Dancing was carried on until an early hour, a feature of the evening being the Scotch reels, which were much appreciated by the English visitors.

The Siamese Electrical Market.

In the course of a D.O.T. report upon economic conditions in Siam (Stationery Office, 1s. 6d. net), Mr. W. W. Coultas, Acting British Consul-General, Bangkok, says that the quantity of electrical goods, apparatus, and machinery imported during 1927-28, though showing a decline from the preceding year's figure, was still more than three times the quantity imported in 1925-26. Also, in spite of the decline in quantity, the value showed an increase, from 1,743,829 to 2,390 967 ticals (£1=11 ticals or baht). An appendix shows that in 1927-28 the imports came from the following sources:—Germany (668,808 ticals), Hong Kong (464,485 ticals), United Kingdom (295,907 ticals), United States (234,469 ticals), Japan (167,030 ticals), Penang (161,799 ticals), Belgium (100,409 ticals), and other countries (298,060 ticals). In 1925-26 the United Kingdom was the largest importer with 106,000 kg. The following year Belgium took the lead with 636,000 kg., supplying nearly 50 per cent. of the total. During 1927-28 German goods ousted Belgian in popularity. There is likely to be a growing demand for all types of electrical goods in Siam in proportion to the extension of the use of electrical power throughout the country. With improved communications this process should tend to become accelerated.

Rumanian Radio Exhibition.

The *Board of Trade Journal* states that the first International Exhibition of Radio Apparatus in Rumania is to be held in Bucharest from April 15th to June 1st this year. Apparatus sent for the exhibition will be admitted free of duty. It is considered, in view of the removal of most of the restrictions on the importation and use of radio apparatus, that British firms could participate in the exhibition with advantage. Rumania is said to offer an increasing market for radio appliances of all kinds. Information regarding the exhibition can be obtained from Le Comité d'Organisation, Exposition Internationale de Radio, 171, Strada Romana, Bucharest III.

Lord Birkenhead's New Post.

Sir Philip Dawson, M.P., announced last week that Lord Birkenhead had been appointed chairman of the Greater London and Counties Trust, Ltd. This Trust holds a controlling interest in the following electricity supply concerns:—The Bedfordshire, Cambridgeshire, and Huntingdonshire Electricity Co.; the Cookham and District Electricity Corporation, Ltd.; the East Anglian Electric Supply Co., Ltd.; Edmundsons' Electricity Corporation, Ltd.; the Oxford Electric Co., Ltd.; the Wessex Electricity Co.; and the Western Electricity Supply Co., Ltd. The Trust also has interests in other electricity supply companies. In a public statement, Sir Philip Dawson said that there was an understanding that, although the capital was mainly American, the directorate should remain British, and that all work should be placed with British firms.

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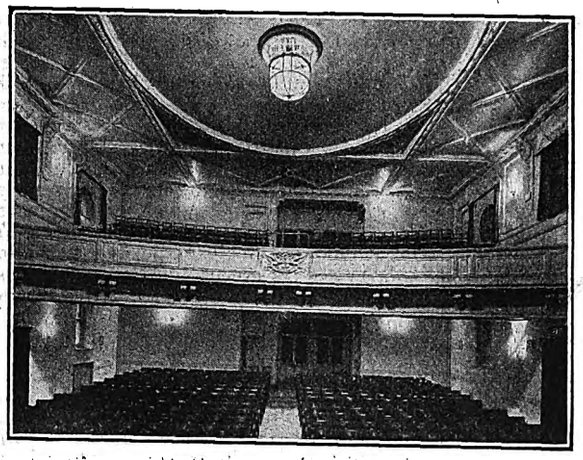
Czecho-Slovakian Electrical Imports.

According to the *Board of Trade Journal*, electrical machinery and tools valued at 265,000,000 crowns (£1,600,000) were imported into Czecho-Slovakia during 1928. This compares with 255,000,000 crowns (£1,550,000) in 1927.

Lighting at the Guildhall School of Music.

In the theatre of the Guildhall School of Music, London, a new lighting scheme has been carried out recently by the Public Health Department, Corporation of London, under the supervision of the city electrical engineer. Around the walls are installed a number of specially designed bracket



Lighting at the Guildhall School of Music.

fittings constructed of white rippled glass panels set in beautifully-finished metal work. These were designed by the GENERAL ELECTRIC CO., LTD. Ample illumination over the gallery and stalls is provided by a single auditorium unit of striking design. A photograph of the theatre, obtained with the aid of the new lighting, is reproduced herewith.

Bankruptcy Proceedings.

F. J. HUDSON, 63, Thurnscoe Road Bradford, electrical engineer.—Lack of capital and insufficient turnover due to bad trade, were the causes of failure put forward by the debtor at the first meeting of creditors held recently at the Official Receiver's Office, Bradford. The debtor returned a statement of affairs showing ranking liabilities of £453 and a deficiency of £442. The case remains in the hands of the Official Receiver as trustee of the estate.

H. H. D. RADCLIFFE and F. HADDLETON (City Electric Services), electrical engineers, 51, Islington Row, Birmingham.—First meeting held February 21st, at the Official Receiver's office, 191, Corporation Street, Birmingham. Public examination March 13th, at the Court House, Birmingham.

L. H. LAWRENCE (H. F. Lawrence), electrical engineer, 43, Canterbury Road, Margate.—First meeting, February 22nd, at Carey Street, W.C.; public examination, March 19th, at the Guildhall, Canterbury.

A. F. KINGDOM, electrical and mechanical engineer, Tavistock Street, Plymouth.—Trustee, Mr. A. N. F. Goodman, Official Receiver, 11, St. Aubyn Street, Devonport, released January 31st.

H. A. PRATT, electrical engineer, Essex House, Lee Road, Dovercourt.—Trustee, Mr. H. S. Gotelee, 9, Arcade Street, Ipswich, released February 4th.

J. F. & A. E. FAULKNER (J. F. & A. E. Faulkner), wireless dealers, &c., 20, Market Street, Penistone.—Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield, released February 6th.

J. A. HARTIGAN and G. J. D. HARTIGAN (London Fan and Motor Co.), electrical engineers, 81, Charlotte Street, Tottenham Court Road, W.1.—First and final dividend of 3s. 9½d. in the £, payable at Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C.1.

Company Liquidations.

T. L. KAY & CO., LTD., 6, Blake Street, York, wireless factors, &c.—A meeting of creditors was held on February 11th, at the Royal Station Hotel, York. Mr. D. S. Mackay, the Official Receiver, reported that a compulsory winding-up order had been made against the company, which was registered in June, 1926, and took over an existing business as from January 1st of that year. Last September a resolution for voluntary liquidation was passed, and a statement of affairs was then prepared which showed liabilities of £4,031, against net assets of £988. One creditor objected to the voluntary liquidation being continued, and filed a petition upon which the winding-up order was made. The Official Receiver said that the matter was somewhat involved, and certain items called for explanation. In December, 1927, the total assets were valued in the company's balance sheet at £9,100, whilst in the voluntary liquidation the assets were estimated at £1,294, and were subject to preferential claims of £305. Sir Robert Kay stated that the balance sheet for 1927 included a number of vehicles which should not have appeared in the balance sheet, as they did not belong to the company, and that the book debts included certain contra accounts. A resolution was passed appointing Mr. R. Crampton, York, as liquidator with a committee.

EPOCH ELECTRICAL SOCIETY, LTD.—Winding up voluntarily. Liquidator, Mr. C. Hughes, 24, Ironmonger Lane, E.C.

BOWER ELECTRIC, LTD.—A meeting of members is called for March 18th at 1-2, Bucklersbury, E.C.4, to hear an account of the winding-up from the liquidator, Mr. F. S. Salaman.

Reduction of Capital.

ARON ELECTRICITY METER, LTD. AND REDUCED.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £350,000 to £225,000, and will be heard in London on February 25th.

For Sale.

By order of the Greenwich Cable Works, Ltd., which have removed to Croydon, Messrs. H. Butcher, Hall & Co., in conjunction with Messrs. Blake & Dannatt, will sell by auction at the Mart, Queen Victoria Street, E.C., on March 19th, the freehold factory at Crooms Hill, Greenwich (floor space 26,000 sq. ft), also eight freehold residences. By order of the Receiver, the postponed sale of the lease, goodwill, trade names and stock of the Beko Lamp Co. will take place on February 27th. Mr. H. J. Shaw will conduct the sale at 13, High Holborn, W.C., and on February 28th, at the same place, Mr. Shaw will sell by auction trade and surplus stocks of wireless and electrical goods. Messrs. Leopold Farmer and Sons will sell by auction on March 6th, at the Auction Mart, 155, Queen Victoria Street, E.C., the freehold premises, with a floor area of 10,600 sq. ft. at 70-74, Windmill Road, Hampton Hill. By order of the Caldy Manor Estate, Ltd., owing to the electricity supply being taken over by the Hoylake and West Kirby U.D.C., Messrs. G. N. Dixon & Co. will sell by auction on February 26th on the premises at Caldy the generating station and plant, Caldy Village, near West Kirby. The Commanding Officer Royal Engineers, West Riding area, invites offers for surplus generating plant now lying at Hull. Plympton St. Mary Electricity Department has for disposal surplus generating plant, accumulators, meters, &c. Messrs. Fryer, Cooper & Co. will sell by auction on February 28th, at 3, Red Cross Street, E.C., a stock of electric wire, insulating sleeves, transformers, &c. Egham and Staines Electricity Co., Ltd., invite offers for one 500-b.h.p. English Electric Diesel engine, direct-coupled to one 2,200-V alternator. (See our advertisement pages to-day.)

Change of Address.

The only offices of the Eastbourne Corporation Electricity Department are now at Electric House, Grove Road, Eastbourne. (Telephone 3060.)

A "B.I." Novelty.

The accompanying picture shows a novel delivery combination recently designed by British Insulated Cables, Ltd., for express delivery of the company's smaller sizes of cables,

A Novel "B.I." Delivery Combination.

wires and accessories. The sidecar, as will be observed, is made and finished in the form of a "telescoped" cable, with a hinged door at the top.

Unemployment.

There was a further fall (24,580) in the number of registered unemployed during the week ended February 4th. The total at that date was 1,369,500, as compared with 1,394,080 on January 28th, and 1,162,150 on February 6th, 1928.

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Local Exhibitions.

EDINBURGH.—At the fourth annual Housing and Building Exhibition opened in the Waverley Market on February 14th, the Edinburgh Corporation Electricity Department has a tableau—"Electricity, the Dawn of a New Era." Electric cookers, heaters, and other labour-saving appliances are shown, while demonstrations of cooking by electricity are given.

MORECAMBE.—The Corporation Electricity Department has an extensive display of domestic electrical appliances on fourteen stands at a Trades Exhibition which is being held at the Winter Gardens, under the auspices of the Chamber of Trade, from February 20th to 27th inclusive. The equipment demonstrated at the stands includes washing machines, cookers, geysers, toasters, cleaners, irons, refrigerators, electric blankets, &c. Electrical films are being shown each day, and there are electric cooking demonstrations and lectures by Mrs. Helen Palmer; lectures on electric refrigeration by Mr. John A. M. Dunlop, B.Sc.; and on the use of electricity for the home and by the shopkeeper, by Mr. G. S. Francis (B.E.D.A.). Among local traders with stands are Mr. Edgar Backhouse (domestic electrical appliances, shades and wireless goods); and Mr. G. W. Dawson (electrical and wireless goods).

Recent Contracts.

Messrs. JOHN THOMPSON WATER TUBE BOILERS, LTD., London and Wolverhampton, have received by cable a contract from the State Electricity Commission of Victoria, Australia, for boiler-house equipment for the Yallourn power station, amounting to £233,288. The contract includes eight boilers, each having an overload capacity of 85,000 lb. of steam per hour, 275 lb. working pressure, complete with superheaters, to give a final temperature of 700 deg. F., air preheaters, forced and induced draught fans, steel casings, firebrick linings, and pipework. This is the third large contract which the company has received from the Commission, bringing the total number of "Thompson" boilers ordered up to twenty-four.

The ENGLISH ELECTRIC CO., LTD., has been awarded a contract by the London and North Eastern Railway for a Diesel-electric locomotive equipment, comprising a 1,000-h.p. high-speed "Beardmore" engine, driving a 675-kW "English Electric" generator and 10-kW auxiliary generator, with complete control equipment. This material will be mounted on one of the electric locomotives (used on the Shildon to Middlesbrough line), which is already equipped with motors, and will now be converted by the English Electric Co. for Diesel-electric working. The complete locomotive will weigh 90 tons and will have a draw-bar pull of 40,000 lb. It is proposed to use it for hauling a 1,000-ton train at 20 m.p.h.

Electrical Goods for Jugo-Slavia.

The Department of Overseas Trade has received from the Commercial Secretary at Belgrade a list of materials urgently required by the Jugo-Slav Ministry of Communications. The list includes the following:—For the River Shipping Board. Electric welding apparatus, 100-h.p. Diesel engine, with electric generator and switchboard, two electric motors, 25 and 20 h.p., various electric generators and other electrical materials. For the Construction Department: Telephone and telegraph materials. For the Machinery Department: Electric lighting sets for passenger coaches and coal-loading appliances. Tenders are to be submitted in Belgrade by March 10th, and may be for all the materials or for each separate group of materials. Further particulars are available at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

The Electrical Imports of Salvador.

In a recent report on conditions in El Salvador, Mr. D. J. Rogers, Acting British Consul at San Salvador, says that among the import items in which British shipments were especially low was electrical machinery and apparatus. Reference to an analysis of the import trade forming an appendix to the report reveals that during 1928 the imports from Great Britain of electrical machinery, apparatus and material during 1926 were 73,652 kg., but they fell to 1,359 kg. in 1927. The complete figures for this class are not given, so that comparison with other countries is impossible.

Railway Electricians' Wages.

The Industrial Court has decided that electricians employed in the generating stations and sub-stations and on the h.p. cable system of the Metropolitan Railway Co. shall be subject to the reduction of 2½ per cent. in wages agreed to by the whole of the railway employés. The men's unions put forward the view that the Metropolitan was more similar to the Underground Electric Railways than to the trunk systems, and the "Underground" had not put the reduction into operation. This view, however, was not accepted by the Court.

Palestine and Near East Exhibition.

The Department of Overseas Trade states that it is proposed to hold the fourth Palestine and Near East Exhibition and Fair in April next at Tel Aviv. It is understood that German, Italian, and Rumanian firms are taking considerable interest in the coming fair. As the period of the exhibition will coincide with the twentieth anniversary of the founding of Tel Aviv, it is expected that Palestinians from everywhere will visit the exhibition, which will be, therefore, an excellent advertising medium. The exhibition will include sections for imported industrial and agricultural machinery, builders' plant, electrical goods, wireless apparatus, a motor and motor-cycle show, and raw materials for local industries. Information can be obtained from the London representative, Mr. G. Bradlaw, c/o Palestine Electric Corporation, Ltd., 3, Bedford Square, W.C.1.

The F.B.I. and the Budget.

In accordance with its usual custom, the Federation of British Industries is placing its views before the Chancellor of the Exchequer to assist him in framing his Budget proposals. In a memorandum the Federation welcomes the Government's de-rating scheme as the first constructive and serious effort to restore prosperity to industry. It is considered that the present rate of income tax is abnormal and uneconomic, and a return to penny postage and to penny cheque stamps is urged. The Federation presses for an allowance in respect of disused machinery and plant as recommended by the Royal Commission on Income Tax. The abolition of the stamp duty on amalgamations is called for, and the Chancellor is asked to seek to procure relief from double taxation on foreign earnings. Several other matters are touched upon in the memorandum.

The Swiss Industries Fair.

The thirteenth annual Swiss Industries Fair will be held at Bâle from April 13th-23rd. More than a thousand exhibitors will be represented this year, covering every phase Swiss national crafts and industries. Railway concessions will be granted by the Swiss Federal Railways and German State Railways to those visiting the Fair from Great Britain.

Babcock & Wilcox in Poland.

The *Financial News* says that it is reported from Warsaw that an agreement has come about between Messrs. Babcock and Wilcox, Ltd., and the Krakau engineering works of L. Lieleniewski and Fitzner Gamper A.G., for the establishment of a company under Polish law under the joint control of the two firms. The new company would take in lease the engineering works of the Polish firm at Sosnovice, and transform it for the manufacture of boilers.

The Timber Market.

Our Timber Trade Correspondent states that imports of building timbers last month were heavy compared with those for January, 1928, and stocks, especially in the metropolitan area, are fairly large. Consumption, however, is also better, and as quite ten weeks have to elapse before the new season's goods arrive, stocks are not considered heavy. Choice hardwoods are in low supply, and the smaller arrivals of mahogany logs last month are likely to have the effect of stiffening spot prices for these descriptions. Teak is dear; future immediate shipments are difficult to obtain from shippers whose available supplies are meagre. American hardwoods have already stiffened in value. The growing consumption of plywood in the United Kingdom and on the Continent has had the effect of sending up prices.

New Catalogues and Lists.

ECO POWER, LTD., 15, Lincoln's Inn Fields, W.C.2.—The modern catalogue tends to become more and more a compilation of valuable technical data, and a high-class brochure just issued by a subsidiary of E. Green & Son, Ltd., describing the Foster economiser, its construction and operation, is in this sense quite modern. A concise and instructive discussion of features and functions is followed by a description of the construction; the calculation of fuel saving and the increase of boiler capacity by installing the economiser is briefly dealt with, and then follow instructive sections on induced draught, the corrosion of tubes, and the flow of fluids in smooth pipes, while curves show the weight of gases resulting from the complete combustion of coal and oil and the relation between water temperature rise and gas temperature drop in an economiser for different ratios of weight of gases to evaporation. Tables of properties of saturated and superheated steam are included, and the whole is copiously illustrated.

THE A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—February stock list of motors, fans, meters, appliances and accessories.

THE RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester.—A list of accessories and electrical repair equipment. Illustrated and priced.

KLAXON, LTD., 36, Blandford Street, W.1.—An illustrated and priced list of "Klaxon" horns for industrial purposes.

THE BRITISH ALUMINIUM CO., LTD., Adelaide House, King William Street, E.C.4.—A booklet entitled "The Lightest of the Common Metals," containing illustrations of the numerous applications of aluminium.

FURSE WHOLESALE, LTD., Traffic Street, Nottingham.—A net trade buyer's list of electrical supplies, apparatus and appliances—industrial, commercial, and domestic.

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The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for February, containing illustrated articles and notes on "Osram" lighting installations, "Geocophone" radio apparatus, and other phases of the company's activities.

The Electrical Equipment & Carbon Co., Ltd., 107-111, New Oxford Street, W.C.1.—February stock list of motors, dynamos, carbons, &c.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—A priced and illustrated folder dealing with a number of the company's enclosed lighting fittings, table standards, brackets, &c. Also Publication L451, dealing with the company's floodlighting equipment, in which many photographs of actual installations are reproduced.

Messrs. E. P. Allam & Co., Ltd., 107-109, Gray's Inn Road, W.C.1.—February stock list of motors for sale or hire.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—An illustrated pamphlet describing the "Automaticus" component cleaner.

Messrs. Campbell & Isherwood, Ltd., Bootle, Lancs.—An illustrated catalogue of the company's portable electric drills, including coal drills.

Social Events.

On February 9th a football team representing the Magicoal works of Messrs. Berry's Electric (1928), Ltd., met the Head Office eleven at Wembley. A very exciting game resulted in a win for the Works team by 7 goals to 6. Mr. Gavin J. Berry, a director of the company, and Mr. Raymond Berry were combatants in the struggle.

The third annual sports of the Indian Cable Co., Ltd., were held at the company's recreation grounds, Tatanagar, India, on January 26th. The sky being unusually overcast, made an ideal day for outdoor amusements, and the lack of sunshine was fully compensated by the gay effect made by the wonderful mixture of colours in the costumes of some 2,000 spectators. The programme, consisting of track, field, and humorous events, was shortened by running off the heats on the previous Saturday, and then took some four and a half hours to complete. S. R. Guha and Sabdar Hussain tied for the championship trophy presented by Mr. F. W. Leake, Calcutta director. Increasing interest is being shown in these meetings, which are due to the efforts of the company's Welfare Society. The prizes, comprising a long list of useful articles, were presented by Mrs. Watkins, the "Burra Memsahib."

The staff of Messrs. J. H. Tucker & Co., Ltd., held a dance on February 14th at the Marshal Foch Hotel, Birmingham. It was regretted that the principals of the company were unable to be in attendance due to indisposition and prior engagements.

Book Notices.

"'Mechanical World' Electrical Pocket Book, 1929." Pp. 401; fully illustrated. Manchester: Emmott & Co., Ltd. Price 1s. 6d. net.

"The Practical Electrician's Pocket Book, 1929." Pp. 5[illegible]0; fully illustrated. London: Odhams Press, Ltd. Price 2s. 6d.

"The Choice of Electric Motors and Control Gear." By A. Kershaw. Pp. 1[illegible]0; figs. 57. London: Technical Section, Association of Engineering and Shipbuilding Draughtsmen. Price 4s.

"Electrical Transmission and Distribution," Vol. III, Switchgear, Part I. Pp. viii+279; figs. 58; Vol. IV, Switchgear, Part II. Pp. viii+236; figs. 82. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. each net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. February, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"*Journal* of the American Institution of Electrical Engineers." Vol. XLVIII. No. 1, January, 1929. New York: The Institute. Price $1.

Trade Announcements.

Messrs. James Hendry, Ltd., Glasgow, have appointed Mr. T. S. Riley as their London representative in succession to the late Mr. Wynbloom. The London office is at 16, Union Court, Old Broad Street, E.C.2.

Messrs. Newtons of Taunton announce that they have added constant-potential battery-charging equipment to their standard manufactures.

Bull Motors, Ltd., has appointed Mr. W. F. Knight, Cecil Chambers, Strand, W.C.2, sole representative for London and the eastern and south-eastern counties.

Messrs. E. R. Morton, Ltd., 117, Charlotte Street, W., have been appointed sole London agents for "Lustrolux" radio valves. We have received some pamphlets giving details of these valves.

Mr. G. H. Coppin has removed to 151, High Holborn, W.C.1. His telephone number and telegraphic address are unchanged.

Messrs. Grierson, Ltd., have removed to 4, Bloomsbury Square, W.C. (Telephone: Museum 9113.)

New French Company.

A company has been formed in Paris (27, Rue Henri Faisans) with a capital of three million francs, and the title La Société des Forces Motrices de l'Ouzoum, to establish a hydro-electric station at Arthez-d'Asson, in the Lower Pyrenees.

A Canadian on Russia.

Colonel H. J. Mackie, an ex-member of the Canadian Federal House, left Liverpool on February 9th in the White Star liner *Regina* after a four months' visit to Moscow. Since 1921 Colonel Mackie has made sixteen visits to Russia, each over three months in duration, to investigate conditions in that country. Colonel Mackie said before sailing that the Russians much preferred British goods, particularly British machinery, and that there was a splendid opportunity for an increased volume of trade with the country, as the proposed British Trades Mission would discover for itself. Colonel Mackie expressed himself entirely satisfied with the security the Russian Government offered. "The flow of German capitalised industrialists into Russia is very large," he continued, "and they are making tremendous headway and are getting a great volume of trade, much of which Great Britain should have."—*Daily Telegraph.*

New Swiss Company.

A company has been formed at Emmenbrucke, near Lucerne, with the title La Société Salvis, Fabrique d'Appareils Electriques, to carry on the manufacture of electric cooking and heating stoves, &c.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price Feb. 19	Fortnight's inc or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	"	£52	...
a	Bisulphide of Carbon	"	...	...
a	Borax	"	£25	...
a	Copper Sulphate	"	£25 10s.	...
a	Potash, Chlorate	per lb.	8½d. to 4d.	...
a	" Perchlorate	"	5½d.	...
a	Shellac	per cwt.	£18 10s.	...
a	Sulphur, Commercial	"	£11	...
a	" Roll	"	£11	...
a	Soda, Chlorate	per lb.	8d.	...
a	" Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	8¼d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£95 to £100	...
b	" Wire	per lb.	1/1 to 1/9	...
b	" Sheet	"	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£208	...
	Grade II	" "	£141	...
	Grade III	" "	£76	...
c	Brass (rolled metal 2" to 12" basis)	per lb.	1[illegible]⅝d.	...
c	" Tubes (solid drawn)	"	1/0¾ to 1/1d.	¼d. inc.
c	" Wire, basis	"	10⅝d.	...
c	Copper Tubes (solid drawn) ...	"	1/3	⅜d. inc.
c	" Bars (best selected) ...	per ton.	£108	£4 inc.
c	" Sheet	"	£108	£4 inc.
c	" Rod	"	£108	£4 inc.
d	" (Electrolytic) Bars ...	"	£84 10s.	£5 15s. inc.
d	" " Sheets ...	"	£148 10s.	...
d	" " Wire Rods	"	£94 10s.	£5 15s. inc.
d	" " H.C. Wire	per lb.	11⅝d.	⅝d. inc.
f	Ebonite Rod	"	2/8 to 2/6	...
f	" Sheet	"	2/8 to 2/6	...
n	German Silver Wire	"	2/2	...
h	Gutta-percha, fine	"	nom.	...
h	India rubber, Para fine	"	1/1	¼d. inc.
l	Iron Pig (Cleveland No. 3.) ...	per ton.	67/-	2/- inc.
l	" Wire, galv. No. 8, P.O. qual.	"	£21	...
g	Lead, English pig	"	£24 10s.	15/- inc.
g	Mercury	per bot.	£22 2s. 6d. to £22 5s.	...
e	Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e	" " medium	"	4/- to 8/-	...
e	" " large ...	"	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings	"	1/8½	...
p	" " drawn bars & rods	"	1/8¾	¼d. inc.
p	" " rolled strip & sheet	"	1/8½	¼d. inc.
p	" " wire...	"	1/6½	¾d. inc.
o	Platinum	per oz.	£18 17s. 6d.	...
d	Silicium Bronze Wire	per lb.	1/1	1d. inc.
r	Steel, Magnet, in bars	"	7½d.	...
n	Tin, Block (English)	per ton.	£222 10s. to £223	£5 5s. dec.
n	" Wire, Nos. 1 to 16	per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter, dated February 16th, Messrs. James Forster and Co. stated that a feature of the lead market on Monday and Tuesday of last week was the continued buying of considerable quantities by the home trade against orders for manufactured material. The buying ceased on Wednesday, and this fact, coupled with realising by speculators, caused a setback, which, however, did not proceed far. With the prospect of smaller arrivals in the near future and of the maintenance of the present good demand, it will not be surprising to see prices advance further. The Board of Trade returns for January show: Imports, 28,090 tons; exports, 2,956 tons; leaving for home consumption, 25,134 tons.

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A Birmingham Handbook.

In connection with the British Industries Fair, the Birmingham Corporation has prepared a 304-page handbook for distribution to visitors. It has been compiled and edited by Mr. W. S. Body, chief clerk in the Town Clerk's office, and deals with many phases of the city's life and activities. The first section is historical, dealing with the growth of industry and famous Birmingham men; the remainder deals with the many social services administered by the Corporation—a remarkable account of municipal enterprise. The publication is well illustrated.

Swedish Anti-Exhibition Movement.

As a result of the many exhibitions held in Sweden last year and the still larger number proposed to be held this year, a reaction has occurred among manufacturing firms against local displays. At a recent meeting in Stockholm of representatives of about 50 manufacturers and merchants engaged in the electrical industry, an "anti-exhibition organisaton" was formed, it being considered that participation in the different small exhibitions did not pay. The movement has also secured the support of a big ball bearings firm and the largest shipyard.

Lighting and Power Notes.

Aldershot.—Change-Over.—The Town Council has applied for sanction to change over the system of electricity supply from d.c. to a.c. for the whole of the area under the control of the Council. The work to be carried out relates to the outlying portions of the borough.

Ashford (Kent).—New Plant.—The Urban District Council has decided to install additional generating plant at an approximate cost of £10,000.

Bacup.—Assisted Wiring Scheme.—The Council has approved a recommendation of the Electricity Committee for an assisted wiring scheme. Consumers will be required to pay an additional 1½d. per kWh up to 200 kWh for each £ of capital expenditure on wiring. If the wiring of a house costs £5, the additional 1½d. per kWh will be withdrawn after the occupier has consumed 1,000 kWh.

Barnoldswick.—Electricity Charges.—The Urban District Council's scheme for the distribution of electricity has been completed and the charges fixed are:—Lighting (ordinary): First 50 kWh, 6½d. per kWh; second 50 kWh, 6d.; over, 5½d. per kWh per quarter. Minimum charge: Summer 5s. per quarter, and winter 10s. per quarter. Heating and cooking: First 100 kWh per quarter, 1½d. per kWh; over, 1d. per kWh. Lighting through prepayment meters: Flat rate of 7d. per kWh. Power supplies: First 25 kWh per quarter, 5½d. per kWh; next 1,000 kWh, 1½d.; next 5,000 kWh, 1½d. All subject to 5 per cent. discount for prompt payment of accounts.

Bedwas and Machen.—Loan Sanctioned.—The Urban District Council has received sanction to a loan of £8,575 for the extension of the electricity undertaking.

Belgian Congo.—Hydro-Electric Development.—Good progress is being made with the construction of the dam and hydro-electric station which is being established by the Société Générale des Forces Hydro-Electriques du Katanga in the Belgian Congo. The water intake and half of the dam have already been completed and arrangements are well forward for the erection of a 120,000-V transmission line. It is anticipated that the plant will be completed early in 1930.

Berkhamsted.—Overhead Lines.—On February 4th Mr. Erskine inquired into the application of the Chesham Electric Light & Power Co. for permission to extend its overhead mains from Northchurch to Little Gaddesden. There were objections on the part of local residents against overhead lines crossing their grounds, and Mr. Swann, for the company, put forward alternative suggestions as to routes where overhead lines would be less objectionable. Mr. A. H. Randall, deputy clerk of the Rural District Council, said that his Council raised no objections provided the company placed cables underground at Little Gaddesden, so as to preserve the amenities of the village. Mr. Swann said that an underground cable at Little Gaddesden would cost £2,200, and overhead lines only £800. The inspector said that he would meet the objectors to see if some compromise could be agreed upon.

Blackburn.—Change-Over.—The Corporation has given notice of its intention to apply to the Electricity Commissioners for sanction to change over the system and pressure of electricity supply from d.c., 3-wire, 440 V to a.c., 3-phase, 50 cycles, 400 V and single-phase, 50 cycles, 230 V.

Bromley (Kent).—Bulk Supply Agreement.—The Town Council has entered into a new agreement for ten years with the West Kent Electric Co., Ltd., for a bulk supply of electricity. The coal clause is to be altered, and it is estimated that there will be an annual saving of from £1,700 to £2,000.

Canterbury.—Supply to Housing Estate.—The Corporation Lighting Committee has offered to supply electricity to houses on the North Holmes site at a flat rate of 9d. per week, on the Housing Committee guaranteeing the weekly payments, but has declined to sell fittings to the tenants, and suggested that the Housing Committee should provide free of cost one electric lamp for each point, renewals to be provided by the tenants.

Carlisle.—Electricity Extensions.—In connection with the Central Board's electricity scheme for North-West England and North Wales, the Corporation has approved the expenditure of £128,000 on extensions to the electricity works, which will include the installation of one 15,000-kW turbo-alternator.

Continental.—Czecho-Slovakia.—The Council of Ministers of Czecho-Slovakia has recently approved the construction of a river dam in the Dyje (Thaya) Valley, near Vranov, Province of Moravia, in connection with which a hydro-electric plant is to be erected to supply Southern Moravia with electricity. The total cost of the project is estimated at about £498,000, 80 per cent. of which will be advanced by the Province of Moravia, the balance being provided by the National Government and the concessionaire construction company.

Switzerland.—The Oberhasli Kraftwerke Gesellschaft is raising a 5 per cent. loan of £1,000,000, through a group of Swiss banks, in order to finance further constructional work at the Oberhasli hydro-electric station. One 30,000-h.p. turbo-generator is already undergoing its acceptance tests, while a second set of the same capacity is expected to be ready in April. When completed the plant will have a capacity of 120,000 h.p.

Daventry.—Overhead Lines.—The Rural District Council has decided to consent to the Northampton Electric Light and Power Co., Ltd., erecting an overhead line from Daventry to Woodford, with overhead distributing mains in the villages in the district.

Doncaster.—Reduction of Charge.—The Town Council has reduced the annual charge to the Bentley-with-Arksey Urban District Council for street lighting by electricity with 122 120-watt lamps from £6 10s. per lamp to £5 10s.

Dunoon.—Electricity Scheme.—At the last meeting of the Town Council it was stated that the Electricity Sub-Committee had considered schemes submitted by the National Electric Construction Co., Ltd., Messrs. Johnson & Phillips, Ltd., and the local gas manager. The scheme by Messrs. Johnson and Phillips, Ltd., who proposed to erect a Diesel-engine installation at a cost of £41,000, with facilities for pumping oil from the harbour to the plant, was adopted. The prices at which the company is prepared to supply electricity are 8d. per kWh for ordinary lighting, 4d. per kWh for street lighting, and 3d. per kWh for heating and power.

Glasgow.—Electricity Charges.—A consumers' deputation, representing over a dozen tenants' associations in Glasgow and district housing schemes, has been appointed to meet the Clyde Valley Electrical Power Co. regarding its new charges for electricity. It is stated that answers to a questionnaire disclosed quite a number of anomalies in the different charges in various districts and different charges for similar sized houses.

Grampians.—Electricity Scheme.—Good progress is being made with the work in connection with the Grampian electricity scheme at Bridge of Ericht, although operations will not be in full swing until spring is well advanced. The present operations centre chiefly in tunnelling a channel for the conveyance of water from Loch Ericht to the power station. The work of laying the cable between Arbroath and Kinloch Rannoch is being carried out, and is proceeding from both ends, so that it is expected that a supply of electricity from the Arbroath plant will be available for places *en route* in the course of next summer.

Grange-over-Sands.—Duplication of Line.—It was recently reported to the Urban District Council that Barrow-in-Furness Corporation has received sanction to the duplication of the transmission line to Grange and Meathop, and the Corporation has applied for power to borrow £5,000 for electricity extensions in the Grange area. Messrs. Johnson & Phillips, Ltd., are constructing the second transmission line.

Hastings.—Electricity Schemes.—The Central Electricity Board has informed the Town Council of its intention to run an overhead line from Stonestile Lane to the Broomgrove power station in connection with the South-East England scheme. The Board pointed out that it would cost £15,000 to put the mains underground. The Mayor stated at the last meeting of the Council on February 8th that there had been strong petitions from private residents against the proposal.

Electricity is to be supplied to the Battle Urban District Council for three pumping stations on an agreement for five years, the Council guaranteeing a minimum consumption of 40,000 kWh per annum at a charge of 1d. per kWh. The cable extensions will cost £1,160, and the line can be designed to form part of a scheme for supplying Crowhurst, Catsfield, and Ninfield. The mains are also to be extended at a cost of £1,045 to supply 28 houses at Bachelor's Bump, where eleven applications have been received.

Lincoln.—New Feeder Cable.—At a recent meeting of the City Council approval was given to a recommendation of the Electricity Committee that a new feeder cable be laid from St. Swithin's power station to St. Giles at an initial cost of £3,613.

Liverpool.—Contributions to Rates.—The Tramway and Electric Power and Lighting Committee has recommended the

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City Council to allocate £50,000 from the electricity account, and £75,000 from the tramway account towards the relief of the city rates. In the preceding year £150,000 was contributed by the two undertakings.

NEW BOILER PLANT.—The Committee has received the sanction of the Electricity Commissioners to the borrowing of £13,018 for the extension of the boiler house at Lister Drive power station.

London.—ISLINGTON.—The Borough Council Electricity Committee has voted £12,000 for the further replacement of h.p. and l.p. mains.

ST. PANCRAS.—The Borough Council Electricity and Public Lighting Committee has recommended the installation of additional condensing water plant at King's Road power station at a cost of £7,549, and the laying of two new feeder mains and the extension of one existing feeder main at a total cost of £6,300. The Finance Committee has recommended that application be made for sanction to loans for these purposes.

Sanction has been received to the borrowing of £24,159 for mains, meters, wiring and domestic apparatus.

SOUTHWARK.—The Borough Council has engaged Mr. Arthur Collins, at a fee of 200 guineas, to report upon the cost of taking a partial supply of electricity in bulk and the possibility of meeting the cost by an increased output.

Marlborough.—NEW PLANT.—At a meeting of the Town Council on February 6th, approval was given to a recommendation of the Electricity Committee that application be made for sanction to install a further 100-kW set at the College power station. The estimated cost of the scheme, with building, is £6,000.

Northern Ireland.—PORTRUSH (CO. ANTRIM).—The Urban District Council has approved a scheme submitted by the Lighting Committee for the installation of additional plant at the power station at an estimated cost of £4,000.

Paisley.—ELECTRICITY IN BULK.—The Town Council has remitted to the Electricity Committee convener and deputy convener a proposal to obtain a bulk supply of electricity.

Portsmouth.—NEW TRANSMISSION LINE.—The Corporation Electricity Committee is to provide an additional main transmission line to supply electrical energy to the district outside the Island of Portsea. The proposed relief main is to be taken by underground cable and overhead lines to the Corporation's existing sub-station at Emsworth; the section of the proposed line being 0.1 sq. in., and the voltage 33,000. This line will be capable of transmitting 5,000 kW, whereas the maximum load on the present system outside the Island of Portsea is only 2,000 kW. The estimated cost of the main, including both underground cables and overhead lines, is £28,000, and immediate steps are to be taken to secure the necessary consents.

Sittingbourne.—ELECTRICITY SCHEME.—Representatives of the Urban District Council and the Milton Regis Urban and Rural District Councils recently met representatives of the Kent Electric Power Co. relative to a supply of electricity for the district. Mr. J. C. Dalton, secretary of the company, explained the general outline of the scheme, and stated that the supply would be available next autumn. Sittingbourne would be the radiating centre, and it was agreed that the Councils should be supplied with a plan showing how the rural district would be served, after a canvass had been made to ascertain the probable demand to guide the company in fixing the charges.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Warrington Corporation to supply electricity in part of the rural district of Warrington; the Lancashire Electric Power Co., to supply electricity in the urban districts of Blackrod, Croston, and Withnell, the rural district of Chorley, and part of the rural district of Preston; and the Cleveland and Durham County Electric Power Co., to supply within parts of the rural districts of Stokesley, Middlesbrough, and Guisborough.

The Minister of Transport has confirmed a Special Order made by the Commissioners authorising the Leicestershire and Warwickshire Electric Power Co. to supply electricity in parts of the rural districts of Stratford-on-Avon and Warwick.

Tilbury.—LOANS.—The Urban District Council has applied for sanction to the following loans: Kiosk switchgear, £600; mains in the North Ward, £2,024; h.p. cable in the South Ward, £976; and for installations in a further 200 houses, £2,500.

Tonbridge.—LOAN.—The Urban District Council has applied for sanction to a loan of £12,715, being the estimated expenditure to March, 1930, in connection with the alteration in the system of supply of electricity.

United States.—ELECTRICAL DEVELOPMENT.—According to the *Electrical World*, approximately $1,500,000 will be expended by the Milwaukee Electric Railway and Light Company this year in expansion of the boiler capacity and auxiliary equipment at its Lakeside power plant. A boiler operating at a pressure of 1,390 lb. per sq. in., and costing $725,000 is the chief item in the programme. This boiler will be similar to the high-pressure boiler installed at Lakeside two years ago. It will generate 300,000 lb. of steam per hour at a temperature of 750 deg. Expanding first in special high-pressure turbines and then in machines of normal pressure, the steam from the new boiler will develop energy equivalent to 40,000 h.p. This boiler will serve to match the steam capacity with that of the electrical generating equipment, which was increased to about 235,000 kW last year by the addition of two turbo-generators, one of 60,000 kW and one of 7,700 kW rating.

Plans to add 100,000 kW of steam generating capacity, in the form of two units, to its station A plant in San Francisco are being made by the Pacific Gas & Electric Company. Preliminary plans call for two 50,000-kW compound units operating under approximately 1,400 lb. steam pressure. These will replace two small units totalling about 27,000 kVA in the present plant. Natural gas will be used as fuel, and with the size of the units and the high steam pressure involved it is expected that the plant will show unusually high economy. The first unit is to be in operation eighteen months after work is commenced.

Wedmore.—OVERHEAD LINES.—Col. F. Gordon Tucker, for the Ministry of Transport, recently held an inquiry into an application by the North Somerset Electric Supply Co., Ltd., for compulsory wayleaves for overhead lines between Wells and Highbridge. The approximate length of the line is 12 miles, with 299 poles. The company has secured wayleaves from 88 per cent. of the owners of land for the erection of 276 poles, but the remaining owners have failed to make any satisfactory arrangement. The chief objections raised were on the ground that an overhead line across the middle of a field would greatly reduce its selling value, and interfere with the amenities; also that the payment per pole erected was insufficient.

Wellington (Somerset).—ELECTRICITY SUPPLY.—The Urban District Council has received from the Electricity Commissioners a copy of a letter from the Wellington District Electricity Co., explaining that owing to the situation which has arisen under the Electricity Acts, it would be unwise for the company to construct a generating station at Wellington, that the town should be supplied with electricity in bulk from some other source, and that the company was arranging that supply with the Whitehall Securities Corporation. When the matter came before the Council it was suggested that the Council was quite able to get its own supply in bulk and distribute it, and there was no reason why it should continue to be bound by the Order. It was decided to communicate with the Commissioners to that effect.

Wigan.—LOAN.—The Town Council has applied for sanction to a loan of £30,000 for transformers, switchgear, mains, &c., in connection with the supply of electricity to Upholland, Standish, Shevington, and Wrightington.

Worcester.—ELECTRICITY SUPPLY.—The Town Council has decided to install two 500-kVA Scott-connected transformer sets, at a cost of £825, three 200-kVA transformers (£145 each), and one 100-kVA transformer (£115), and to expend £2,000, in addition to £4,600 already spent, on the work of changing over from d.c. to a.c.

Tramway and Railway Notes.

Bradford.—TRACK RENEWALS.—The Corporation Tramway Committee has decided to relay tramway track in various streets at a cost of £29,053.

Continental.—CZECHO-SLOVAKIA.—The Skoda Works Co. of Pilsen, has recently completed five electric goods locomotives for the Czecho-Slovakian State Railways. The engines are of 800 h.p., and are designed to be operated by d.c. at 1,500 V. and for a maximum speed of 37 m.p.h.

Increase of Charges.—The Minister of Transport has made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, authorising certain fare charges by the following tramway authorities:—To remain in force until December 31st, 1929: The Bristol Tramways and Carriage Co., Ltd. To remain in force until December 31st, 1931: The Corporations of Barrow-in-Furness, Burnley, Haslingden, Preston, and Kirkcaldy, the Urban District Councils of Pontypridd and Aberdare, and the Musselburgh and District Electric Light and Traction Co., the Yorkshire (West Riding) Electric Tramways Co., Ltd., and the Great Orme Tramways Co.

London.—DISTRICT RAILWAY "HOLD-UP."—Eastbound traffic on the District Railway was suspended for some hours, from 9 a.m. on February 12th, when a train from Hounslow, bound for East Ham was derailed outside Sloane Square station owing to a broken axle. A normal service was resumed at 12.30 p.m.

Rochdale.—ABANDONMENT OF TRAMWAY.—The Corporation Tramways Committee which has had under consideration the relaying of the tramway track in Wardle and Littleborough, the high cost of reconstruction and the improved methods of road transport since the negotiations with Littleborough were commenced, has decided to recommend the Council to abandon the track between the borough boundary at Wardle Lane and Summit terminus at Littleborough. The Committee also suggests that authority be granted to reopen negotiations with Littleborough to substitute a 'bus service on this portion of the route.

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Southern Railway.—"HOLD-UP" OF SERVICE.—A fire which broke out at Streatham Common station on the Southern Railway shortly after 6 a.m. on February 14th, delayed the service from Sutton and Coulsdon to Victoria. It was necessay to cut off the electricity supply to the conductor and overhead systems and consequently the local lines were blocked.

United States.—BOSTON.—The *Electric Railway Journal* reports that a project for extending the Boston Elevated Railway rapid transit lines in all directions is recommended by the Special Transit Commission, which has filed its report with the Massachusetts Legislature. The cost of construction of the proposed routes is estimated at $50,000,000. This sum does not include the cost of the necessary addition to rolling stock. The fundamental suggestions made in the report include the authorisation of the construction of an adequate rapid transit system for the metropolitan district, the purchase of the Chelsea division of the Eastern Massachusetts Railway and its lease to the Boston Elevated, and the co-ordination of the elevated lines with the railways running into Boston. There are now ten railroad lines entering the metropolitan district and extending in a fanlike formation to practically all sections of the metropolitan area. Some of these lines provide a substantial and satisfactory suburban service to the territory through which they pass, but upon many of them suburban service has been abandoned or curtailed because of competition with the elevated or because of the increase in the use of the automobile. If this programme is carried out as outlined, practically the entire metropolitan area within five miles of the State House will be suitably served with rapid transit facilities, and cars or 'buses from all sections of the metropolitan district can reach various rapid transit terminals or stations, with relatively short runs.

Telegraph and Telephone Notes.

Brazil.—RADIO STATIONS.—The two new short-wave radiotelegraph stations that will be opened early in March in the State of Matto Grosso, one at Corumba, the other at Cuyuba, will complete the programme for the radio circuit of the national telegraph system, five others having just been opened, four at Rio de Janeiro and one at Recifé (Pernambuco).—*Reuter's Trade Service* (Rio de Janeiro).

International Telephony.—FRANCE-POLAND.—Direct telephone communication was opened on February 15th between Paris and Warsaw. The line is over a thousand miles long. —*Reuter* (Paris).

ENGLAND-POLAND.—On February 15th a public service was inaugurated between London and Warsaw.

Russia.—TELEPHONY.—The Tass agency states that new high-frequency telephone apparata have been installed on the Moscow-Kharkov-Tiflis line, making it possible to carry on several conversations simultaneously.—*Reuter* (Moscow).

South Africa. — TELEGRAPH SERVICES. — Mr. Sampson, Minister of Posts, has made a statement to *Reuter's* correspondent with regard to his statement in Parliament on February 12th regarding the Imperial cable and wireless merger. Reports suggested that Mr. Sampson's statement confirmed fears that the Union might establish some sort of service to compete with the merger, but Mr. Sampson emphasised that nothing in his earlier pronouncement justified such an interpretation; indeed, there was now no reason, after certain adjustments had been made, why a Government licence should not be issued to the Wireless Telegraph Company of South Africa. How could the Government grant a licence and, at the same time, set up competition against the South African Company? The Government did not contemplate such competition, and it would not be appropriate for the Government to exercise any pressure for the formation of a merger in South Africa, but if a merger were negotiated on voluntary lines by the cable and wireless interests, the Government had no power to oppose it, provided the terms of the Government licence and the Act were adhered to. The Government would insist on the full responsibility of the party concerned in carrying out its contract, whether it were a wireless company, a merger, or any other body. The British Post Office had, in connection with the merger negotiations, reserved to itself the rights of telephony. He felt that the Union Government, in conjunction with the "beam" service, could possibly come to an arrangement on that matter and that terms also acceptable to the British Post Office could be arranged at the British end.

The Telephone Service.—BIRMINGHAM.—The annual report of the Advisory Committee (Mr. R. A. Weaver, M.I.E.E., superintending engineer, North Wales District) for 1928 shows that at the end of that year there were 81 exchanges in the district, two new ones were opened, and the equipment extended at 30 others. The growth of stations continued, and there were 68,333, representing an increase of 8.57 per cent. There was an increase of private branch exchanges during the year, the total number installed being 3,404, of which 46 were automatic. The number of telephones connected with private branch exchanges totalled 25,073. The demand for telephones at private residences continued: 1,737 were added during the year, making a total of 13,086. Call offices increased to 815, of which 447 were street kiosks. In the local exchanges 56,061,677 calls, including short-distance trunk calls, originated in the district, an increase of 3,764,480, while the long-distance calls controlled in the trunk exchange increased from 3,663,446 to 4,086,950. The number of telephone telegrams dealt with was 819,978, an increase of 32,845. The capital expenditure during the year on the extension of the underground cable system to meet local subscribers' development was approximately £108,000, and a total of 300 minor distribution schemes were carried out in addition. During the year 1,543 miles of overhead wires was erected; the total mileage of overhead wires at the end of the year showed a reduction of 13 miles on the total of 1927, owing to the substitution of underground wires; the total at the end of 1928 was 23,631 miles.

United States.—INTER-CITY COMMUNICATION.—The new Universal Wireless Communications Co., which was recently granted forty of the seventy available commercial short-wave radio channels by the Federal Radio Commission, over the Radio Corporation of America, the Postal Telegraph-Cable Co., and other applicants, is already facing the possibility of a Congressional investigation as to "where it got the pull" and who, if anyone, is behind it politically. The transaction is reported by the *T. & T. Age* to have caused much discussion at the Radio Conference at Ottawa, Canada, which is trying to settle the intermediate-wave band on the North American continent amicably with delegates from the United States. The Universal Wireless Communications Co. is said to be organised by financiers in Buffalo, N.Y., with a backing of about $25,000,000, and claims that it intends to establish radio service between 110 cities in forty-eight States; at least fifteen stations situated in fifteen of the cities must be ready for use by the public on December 31st, 1929, and two additional stations every month thereafter until December 31st, 1931, when the entire network must be complete; the equipment must be of a character and speed satisfactory to the Commission, and to co-operate with stations operating in connection with aviation and, when necessity demands, with stations operating on frequencies allotted for such special uses as fire, police, power, emergency, agricultural and other services.

Radio Notes.

Australia.—GOVERNMENT CONTROL.—*The Times* Canberra correspondent states that the Government is making arrangements to assume control of broadcasting throughout Australia on July 1st, and tenders are invited for the supply of large quantities of material, the closing date for delivery of tenders being March 12th. The Postal Department says that British firms can obtain telegraphed particulars in ample time.

Belgium.—RADIO INSTITUTE.—The Government is understood to be considering the erection of a radio institute for broadcasting programmes made up equally of French and Flemish items, with a smaller proportion of items in German for the inhabitants of the annexed areas. The means will, it is suggested, be raised by a tax of 50 francs on each receiving set, and also by a tax on all valves payable by the manufacturers. According to *World-Radio*, only about 36,000 sets are at present registered.

Canada.—NEW COMPANY.—Trans-Canada Communications, Ltd., with headquarters in Toronto, has been incorporated, with a capital of $1,000,000 (£200,000). Its charter includes everything pertaining to radio, including power to operate broadcasting stations, to manufacture or deal, and provide regular inter-city communication.

LICENCE INCREASES.—Receiving licences issued for the nine months ended December 31st last totalled 243,768. In all the provinces, a steady increase over the corresponding period in 1927 was maintained, says *World-Radio*. Ontario led with a total of 120,972, Quebec was second with 41,204, while Saskatchewan was third with a total of 22,033. Of the other provinces, official figures show the following order:—British Columbia, 19,152; Manitoba, 16,127; Alberta, 12,178; Nova Scotia, 6,348; New Brunswick, 5,221; Prince Edward Island, 451; North West Territories, 48; and Yukon, 34.

Russia.—WIRED-WIRELESS.—Since the beginning of this year the whole business of broadcasting in the U.S.S.R. has been placed in the hands of the Commissariat of Posts and Telegraphs. A radio university has been opened (in addition to the existing technical and agriculture courses), the lectures of which are given only by radio. On October 1st, 1928, there were 326,285 registered radio sets in the U.S.S.R., 1.5 times as many as in 1927. This year the Commissariat of Posts and Telegraphs has been considerably extending the "radiofication" of villages by the adoption of the system of broadcasting by wire. According to the estimates of the Commissariat, the wire system should increase the number of radio listeners at the end of this year by more than a million. The broadcasting stations are now experimenting with so-called radio-films. Radio theatres have been opened in Moscow and Leningrad. On August 1st, 1929, a new radio station is to be opened in Moscow with a power of 75 kilowatts; its construction will cost 1,800,000 roubles.—*Reuter* (Moscow).

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—March 12th. Posts and Telegraphs Department. Telephone relays. (B.X. 5078.)*
April 2nd. Jumper rings and terminal strips. (B.X. 5066.)
March 18th. State Electricity Commission of Victoria. Insulators and accessories. (B.X. 4997.)*
April 8th. 22,000-V transformers. (B.X. 5101.)*
April 8th. Galvanised steel transmission line towers. (A.X. 7401.)*
April 29th. Two or three steam turbo-generator sets with condensers for Yallourn Power Station extension. (B.X. 5062.)*

Bromley.—March 4th. Education Committee. Installation of electric lighting at the Raglan Road Council school. Specifications, &c., from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

Chadderton.—Electric lighting of subsidy houses. Particulars from Messrs. Calland & Kenyon, Hollinwood Avenue, adjoining Hollinwood station.

Edinburgh.—March 25th. Electricity Supply Department. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuseboards, electricity supply meters. (February 15th.)
Electricity Supply Department.—March 15th. One 1,500-kW motor convertor. (See this issue.)

Egypt.—CAIRO.—March 27th. Ministry of Interior. Supply and installation of an electric lighting system for the town of Fashu. (B.X. 5037.)*
March 6th. Underground and overhead transmission line from the Mit Chamr electric power station to the town of Kom el Nour. (B.X. 5074.)*

Erith.—March 4th. Electricity Department. H.p. and l.p. cables, joint boxes, &c. (February 1st.)

Fort William.—March 12th. North British Aluminium Co., Ltd. Material required for the electric power and lighting distribution system at the works near Fort William. (See this issue.)

Hastings.—February 25th. Corporation. Electrically-driven pumping plant for the Kent Street pumping station. Specification (£5) from the engineer, Mr. G. M. C. Taylor, of Messrs. John Taylor & Sons, Caxton House, Westminster, S.W.1.

India.—March 1st. India Stores Department. 200,000 insulators, 49 drums dry core telephone cable, 500 tons g.i. wire. (February 15th.)

Lancaster.—March 18th. Electricity Department. Two water-tube boilers (36,000 lb. per hour), with mechanical stokers, economisers, air heaters, steel chimney and fans. (See this issue.)

Leeds.—Electricity Department. March 9th. 2,000- and 6,600-V single-phase, and 3-phase (6,600-V) Scott-connected transformers for a period of two years; 11,000-V, 3-phase transformers. (February 15th.)

Linlithgow.—February 28th. District Committee. Erection of lamps and electric lighting fittings in the special lighting districts of Winchburgh and Kirkliston. Specifications from J. G. B. Henderson, district clerk.

Liverpool.—Water Committee. Electrically-driven pumping sets for the Aubrey Street pumping station. (See this issue.)

London. — CENTRAL ELECTRICITY BOARD. — March 2nd. 66,000-V and other transformers (London Area) in connection with the South-East England Electricity Scheme. (February 1st.) 33,000-V overhead line—Luton to Aylesbury—in connection with the South-East England Electricity Scheme. (February 8th.)
March 4th. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area); and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (January 18th.)
LONDON COUNTY COUNCIL.—February 26th. One 10-cwt. electric goods lift for the Hammersmith Building Trade School. (February 8th.)

Lourenco Marques.—March 19th. Port and Railways Board. 50-kVA Diesel-driven generating set and an electrically-driven water pumping set. (B.X. 5050.)*

Manchester.—March 6th. Electricity Committee. House wiring material for the assisted wiring and hired apparatus schemes. (See this issue.)

New Zealand.—DUNEDIN.—March 20th. Tramways Department. Tramway equipment. (A.X. 7441.)*
WELLINGTON.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Northern Ireland.—BELFAST.—February 26th. Tramways Committee. Stores (including electrical accessories, carbon brushes, armature and field coils, &c.) for 12 months. (February 8th.)

Oldham.—March 11th. Board of Guardians. Electric lamps and fittings. Forms of tender from Mr. F. W. Fletcher, clerk to the Guardians, Union Offices.

Rhyl.—February 26th. Electricity Department. 1,750 yd. 3-core e.h.p. cable, 1,100 yd. 4-core armoured cable, 1,750 yd. of telephone cable, e.h.p. switchgear, two 250-kVA static transformers, and l.p. switchgear.

Scarborough.—March 2nd. Electricity Department. E.h.p. and l.p. switchgear, transformers, transformer kiosks, e.h.p. cable. (See this issue.)

Sheffield.—March 14th. Electricity Supply Department. Buildings and civil engineering works and constructional steelwork, transformers, pipework and valves, e.h.p. switchgear, battery, shunting locomotives and accessories. (See this issue.)

South Africa.—CAPE TOWN.—March 15th. City Council. Metal-clad switchgear. (B.X. 5004.)*
March 21st. 300-amp. fuses. (B.X. 5080.)*
PRETORIA.—March 28th. Posts and Telegraphs Department. Telephone switchboard cords. (B.X. 5048.)*
JOHANNESBURG.—March 4th. Town Council. 6,600-V switchgear. (B.X. 5087.)*
March 21st. 65,500 porcelain insulators. (B.X. 5114.)*
March 21st. Weatherproof wire. (B.X. 5113.)*

Southend-on-Sea.—March 4th. Electricity Department. 1,200 d.c. house-service electricity meters. (See this issue.)

Stirling.—February 25th. Town Council. Electrical work in connection with the erection of 52 houses (deposit £1). Specification from Mr. A. H. Goudie, burgh engineer.

Uppermill (near Oldham).—February 28th. Electric lighting installation at Woods Lane branch premises of Uppermill Industrial Co-operative Society, Ltd. Particulars from branch.

Warrington.—March 11th. Electricity and Tramways Committee. Motors and transformers. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Ampthill.—Board of Guardians. Accepted:—
Installing electric heating apparatus in the board room and offices.—Bedfordshire Electrical Installation Co.

Carlisle.—Electricity Committee. Accepted:—
Boiler-house plant (£35,775).—Stirling Boiler Co., Ltd.
350-kW turbo-alternator (£3,061).—British Thomson-Houston Co., Ltd.

Fylde (Lancs.).—Board of Guardians. Accepted:—
Installation of electricity at Institution and Union offices (£2,239).—P. J. Frampton, Blackpool.

London. — FULHAM. — Electricity Committee. Recommended:—
Lowering the position of the river suction pipes used in connection with the electricity works (£1,600).—J. Cochrane & Sons, Ltd.
ST. PANCRAS.—Electricity and Public Lighting Committee. Recommended:—
Rotary water screen (£475).—Ledward & Beckett.
Additions to water-softening plant (£692).—Boby & Co.
Additions to the de-aerating plant (£895).—G. & J. Weir, Ltd.
Addition of a 7½-ton hoist to the existing travelling crane (£350).—H. Morris, Ltd.

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Sowerby.—Urban Council. Accepted:—
Installing power drive at the sewage works (£245).—Pollit and Wigzell, Ltd.

Southend-on-Sea.—Education Committee. Accepted:—
Installing electric light at the intermediate schools (£498).—Jackson & Co.

Southall.—Great Western Railway Co. Accepted:—
Supply of two electrically-driven pumps.—Tangyes, Ltd.

Stone (Staffs.).—Board of Guardians. Accepted:—
Installing electric light at the Institution.—Langley and Co.

Swindon.—Town Council. Accepted:—
Wiring installation at the new power station at Moredon (£2 019).—Griffin, Harding & Bryant.
Wiring and other work in connection with the fire alarm system (£924).—Carter & Co. (Nelson), Ltd.

Watford.—Board of Guardians. Accepted:—
Installing electric light at the casual, mental, and infirm wards (£568).—Ellis & Ward, Ltd.

Weymouth.—Radipole Lake Development Committee. Accepted:—
Materials for new vertical spindle motor (£158).—Worthington, Simpson, Ltd.

York.—Education Committee.
Installing electric light at the technical institute (£490).—Corporation Electricity Committee.

Forthcoming Events.

British Industries Fair, 1929.—Monday, February 18th, to Friday, March 1st. White City, London, W., and Castle Bromwich, Birmingham.

Birmingham Electric Club.—Friday, February 22nd. Grand Hotel. 7 p.m. "Electricity in Agriculture." Mr. G. E. Britton.

Physical Society.—Friday, February 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Electrical Trades Commercial Travellers' Association.—Friday, February 22nd. Connaught Rooms, Great Queen Street, W.C. 7 for 7.30 p.m. Annual dinner.

Institution of Mechanical Engineers.—Friday, February 22nd. Informal meeting. Institution, Storey's Gate, S.W. 7 p.m. "Electrical Precipitation." Mr. G. Baker.

Association of Mining Electrical Engineers (Lothians Branch).—Saturday, February 23rd. Philosophical Rooms, Edinburgh. Paper by Mr. G. A. McLennon.

(South Wales Branch).—Saturday, February 23rd. Cox's Café, Cardiff. 6 p.m. Annual dinner.

Association of Supervising Electrical Engineers.—Saturday, February 23rd. Hotel Cecil, London, W.C. Annual dinner.

Electrical Power Engineers' Association (London Local Group).—Tuesday, February 26th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Survey of Modern Steam Power Plant Practice." Mr. F. Nicholls.

"Daily Mail" Ideal Home Exhibition.—Tuesday, February 26th, to Saturday, March 23rd. Olympia, W.

Batti-Wallahs' Society.—Wednesday, February 27th. Hotel Cecil, London, W.C. 12.30 for 1 p.m. Luncheon. The principal guest, Lt.-Col. K. Edgcumbe, will give an address on "Prosperity."
Friday, March 1st. Hotel Cecil, London, W.C. 7 p.m. Annual dinner and dance.

Institution of Welding Engineers.—Wednesday, February 27th. Birmingham Chamber of Commerce. 7 p.m. "Welding and Cutting Practice with Low Pressure Plant." Mr. C. S. Milne.

Institution of Electrical Engineers.—Thursday, February 28th. Institution, London, W.C. 6 p.m. Faraday Lecture. "How Electricity Does Things." Mr. Ll. B. Atkinson.

(North-Eastern Centre).—Monday, February 25th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Electricity Supply to the Rural Districts of England." Mr. R. W. Gregory.

(North Midland Centre).—Tuesday, February 26th. Hotel Metropole, Leeds. 7 p.m. "The Modern Use of Pulverised Fuel in Power Stations." Mr. R. A. Chattock.

(South Midland Centre).—Wednesday, February 28th. Midland Institute, Birmingham. 7 p.m. Joint meeting with the Midland Centres of the Institutions of Civil and Mechanical Engineers. Cinematograph exhibition.

(East Midland Sub-Centre).—Tuesday, February 26th. The College, Loughborough. 6.45 p.m. "Motor Convertors." Mr. J. H. R. Nixon.

(North-Western Students' Section).—Tuesday, February 26th. Engineers' Club, Manchester. 7.15 p.m. "The Loading of Transformers on a Thermal Basis, with special reference to Temperature Indicators." Mr. T. A. Long.

Institution of Electrical Engineers—*continued.*

(London Students' Section).—Friday, February 22nd. I.E.E. Institution, London, W.C. 6.15 p.m. Joint meeting with the Institutions of Civil and Mechanical Engineers. "Standardisation." Mr. W. Ford.

(North-Eastern Students' Section).—Friday, February 22nd. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "The Progress of Electrical Installations on Ship Board." Mr. G. Waters.

(Meter and Instrument Section).—Friday, March 1st. Institution, London, W.C. 7 p.m. "The Rotor Bearings of Electricity Meters." Mr. W. Lawson.

Finsbury Technical College Old Students' Association.—Friday, March 1st. Trocadero Restaurant. 6.30 for 7 p.m. Annual dinner.

Junior Institution of Engineers.—Friday, March 1st. 39, Victoria Street, S.W. 7.30 p.m. "Notes on the Control of Electric Lifts." Mr. L. S. Atkinson.
Saturday, February 23rd. Portman Rooms. 7.15 p.m. Annual dance.

Royal Institution.—Saturday, March 2nd. 21, Albemarle Street, W.1. 3 p.m. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford, F.R.S.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

An electrical engraving machine suitable for marking a name or other device on kettles, irons, and other domestic apparatus.

VICTORY combined floor polisher and vacuum cleaner.

Notes.

Celebrations at Eastbourne.

As mentioned elsewhere in this issue, on February 13th Sir Andrew Rae Duncan, M.A., chairman of the Central Electricity Board, officially inaugurated the new offices and showrooms and the extensions at the power station of the Eastbourne Electricity Department. At a celebration luncheon at the Queen's Hotel after the opening ceremony, Sir Andrew referred to the public spirit which the Mayor of Eastbourne, Alderman H. J. Galliers, had shown in his dealings with the Central Board, and also thanked the Electricity Committee for its co-operation with the Board. Councillor Chatfield, the chairman of the Committee, had one standard by which to test the Board—would the Board's supply be cheaper or not? The Board accepted that standard; it had no disposition to take a narrower or autocratic view. There could be no great decrease in the price of domestic electricity without a large expansion in the distribution; Eastbourne knew that and was practising it, and the policy would undoubtedly reap a great reward. He congratulated Councillor Chatfield and his colleagues on their persistence in demanding from the Council the necessary grant to construct the new showrooms, which were a particularly fine example. Councillor Chatfield said that the position of the Eastbourne electricity undertaking was assured for seven years, at the end of which time, if the Central Board could supply cheaper, the generating station would close down. Opposition to the event would not be in the interests of the community or for the good of the electrical industry of the country. But the undertaking must not cease its efforts to make more widely known the uses to which electricity could be put. The undertaking was on the eve of extending into the country districts, with the consent of the Electricity Commissioners.

In reply to a toast to the visitors, Mr. Frank Hodges, member of the Central Electricity Board, said that Eastbourne was naturally concerned with the preservation of its amenities, and the Central Board would do nothing deliberately to destroy them. There must be a blend of amenity and economy.

The name of the engineer and manager of the undertaking, Mr. J. K. Brydges, M.I.E.E., was coupled with several of the toasts, and in a speech Mr. Brydges paid tribute to the work of his staff, particularly Mr. D. Roberts, the constructional engineer, who had had charge of the showroom work.

Water-Power in Tasmania.

In the article under the above heading in our issue of February 15th, the 7,050-kVA alternators at the Waddamana power station are referred to as having been supplied by the General Electric Co., Ltd. This is incorrect, as the machines were supplied by the General Electric Co. of America.

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Birmingham University Developments.

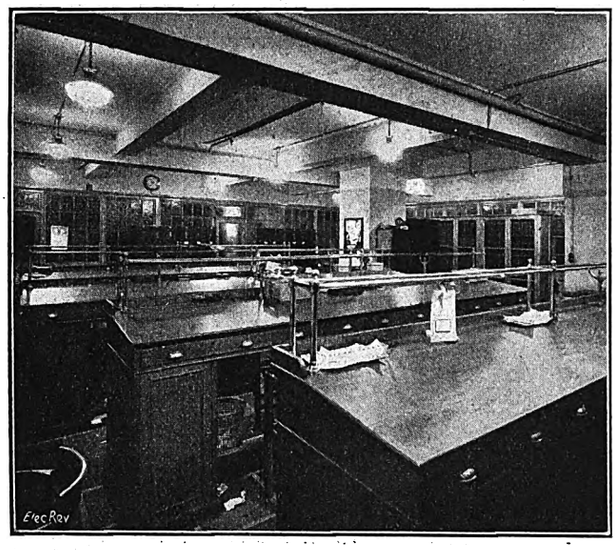
In our issue of February 8th, p. 246, reference is made to published contributions from the Department of Electrical Engineering, University of Birmingham, during the past year. The list should have included "The Domestic Storage of Energy," by Mr. L. G. A. Sims, M.Sc., which was published in the ELECTRICAL REVIEW on October 21st and 28th, and November 4th, 1927.

Appointments Vacant.

Test-room assistant (97s.) for the Battersea Borough Council Electricity Department. Meter superintendant (£480) for the Electrical Branch of the P.W.D. of the Government of Nigeria. Assistant sub-station attendant (79s.) for the Stoke Newington Borough Council Electricity Department. Statistical clerk (75s.) for the Southend-on-Sea Electricity Department. Draughtsman for the City of Carlisle Electricity Department. (See our advertisement pages to-day.)

Office Lighting Installation.

The accompanying illustration is a reproduction from a night photograph of the interior of one of the offices in the new *Daily Mirror* building, London, depicting "Lunax" lighting fittings and their effect. About 200 of these fittings were



Night view in "Daily Mirror" Offices.

supplied by Engineering & Lighting Equipment Co., Ltd., through the contractors for the job, Messrs. Rashleigh Phipps, Ltd. The fittings are mounted approximately 12 ft. 6 in. apart and 11 ft. from the floor. It is claimed that the glassware employed for the fittings has a transmission efficiency of over 85 per cent. It will be agreed that the lighting is excellent; an important feature is the absence of shadow or glare.

A High Vacua Gauge.

At a recent meeting of the Physical Society of London, the construction and calibration of a sensitive form of Pirani gauge for the measurement of high vacua were described by Mr. L. F. Stanley, A.R.C.S., B.Sc., research student, Royal College of Science. The gauge consists of a manometer and a compensator, the one identical with the other, placed in the opposite arms of a Callendar-Griffiths bridge; each consists, essentially, of a loop of 10 cm. of platinum wire, of 0.001 inch diameter, together with a compensating loop of 2 cm. of the same wire. The symmetry of the circuit makes errors due to thermo-electric effects very small. Investigations have been carried out to ascertain how the sensitivity of the instrument depended upon (1) the diameter of the gauge, (2) the temperature of the wire, (3) the temperature of the external walls, and (4) the nature of the material of the external walls. The gauge constructed follows variations of pressure with considerable rapidity, and its range of measurement is from 2×10^{-3} mm. to 4×10^{-6} mm. approximately.

Electricity Supply.

Mr. Archibald Page, chief engineer and manager of the Central Electricity Board, lectured on February 15th to the Students' Section of the Scottish Centre of the Institute of Civil Engineers at Glasgow on "The Generation and Distribution of Electricity in the British Isles." Mr. Page, after a historical introduction, referred in detail to the operations of the Central Electricity Board, and said that the main purpose of the Act of 1926 was the concentration of the generation of electricity for the country as a whole in a relatively small number of modern and efficient stations, so interconnected, constructed, and operated as to give the maximum of economy. The goal aimed at was increased consumption throughout the country by making electricity available in every direction at a steadily decreasing price. As the water power available in the British Isles was relatively small, the great bulk of the electricity would always be derived from coal, but there was no necessity for long-distance transmission in the sense that this term was understood in countries with large water-power resources, or extensive brown-coal deposits. While the 1926 Act would not create a new electrical heaven on earth, it would inaugurate an era of fresh activity in electricity supply, of increased prosperity in the industries which depended on electric power, and would go a long way towards ensuring the universal availability for supplies of energy throughout the country.

Electricity and Rural Preservation.

Criticisms of hydro-electric schemes now before Parliament are contained in a report which has been adopted by the Executive Committee of the Association for the Preservation of Rural Scotland. The combination of concrete dams and derelict river beds, and in some cases power stations, in place of the natural beauty of the lower end of lochs, will, the report states, destroy the attractiveness of the places altogether. It is said to be improbable that the Grampian and West Highland power schemes, with their heavy initial costs and distances from populous districts, can compete successfully with the steam-driven stations in the populous areas which they supply. If these schemes could show any benefit to the public in the way of cheaper electric power or increased employment, even to inhabitants of distant areas, some loss of amenity might be conceded as the price of industrial development; but, the report adds, it is a different matter to give to a private company legislative sanction to injure a large countryside in order that the company may make profits, while no other people derive any benefit at all, and the proposed exploiting of the river systems of the Highlands appears to come under this description.

E.P.E.A. Dinner.

Mr. R. A. D. MacAlister, A.M.I.E.E., presided at the annual dinner of the Scottish Division of the Electrical Power Engineers' Association, held recently in Edinburgh. Principal J. Cameron Smail, O.B.E., of the Heriot-Watt College, who proposed the toast of "The Electricity Supply Industry," said that at the present time one could not read a paper without hearing of new electrical developments—power stations, and so on—and people seemed to be prepared to invest millions quite calmly on new schemes. For the future, the industry had an extraordinary field at its own doors to do what it pleased with. It was free to an extraordinary degree from foreign competition. In London one could notice a drastic change due to the use of electric power; smoke had been eliminated from the centre of the city. The smoke question was very closely related to the supply of electricity, and the electricity supply people had it in their power to bring great benefits to the great cities.

Major Herbert Bell, O.B.E., chief engineer of Glasgow Corporation Electricity Department, who replied, said that it was interesting to note that the general price of electricity throughout the country was gradually coming down to a figure which it was believed would make it of use to all concerned.

Mr. F. A. FitzPayne, M.I.E.E., manager of the Edinburgh Transport Department, who proposed the toast of "The Association," said that the electrical industry required the highest training, the best brains, and fine skill. The reason for the formation of the Association—and that reason held good to-day—was that somebody was required to protect the industry and its professional interests. The Association had admirably and efficiently performed those functions. Its policy was continuity of service or supply and constitutional methods. Numerically and financially it was flourishing.

Mr. T. D. Martin, A.M.I.E.E., the president, replying, said that they were stronger to-day than they had ever been in the history of the Association. They had recently formed technical groups which worked in conjunction with the manufacturing engineer, and gave them a link with the industry as a whole.

H.P. Yarrow Boilers.

The Castner-Kellner Alkali Company, Runcorn, a subsidiary of Imperial Chemical Industries, Ltd., recently set to work two boilers at a working pressure of 600 lb. per sq. in. Probably amongst the largest of their capacity now in commercial operation in the country, each comprises a water-tube boiler with superheater, economiser, and air heater, designed specially to suit an existing boiler-house and flues which had been prepared for extensions with another type of boiler. The neat layout was made possible by the "elastic" design, which enables the overall dimensions to be varied within fairly wide limits. Yarrow & Co., Ltd., constructed all the plant with the exception of the Underfeed Stoker Company's latest "L" class stokers, each of a width of 17 ft. 6 in. and a length of 18 ft. 6 in., while the fans were supplied by Davidson & Co., Ltd. The single-flow design enables the gases to traverse large nests of tubes at the front, while the rear bank of tubes acts as a screen, absorbing only radiant heat; the combustion chamber is of very large capacity, and a feature is the large amount of heating surface exposed to the furnace. The Yarrow self-draining superheater has steeply inclined tubes, and its large integral steam drum is so placed between the nests of tubes that the steam temperature fluctuates only slightly with variations of load. As the gases leave the boiler they pass around the vertical tubes of the economiser, which is provided with movable deflectors to avoid lodgment of soot; they then flow through the tubes of an air heater constructed in two sections,

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the first gas pass being in a downward and the second in an upward direction; finally the gases are discharged into a common main flue which had been provided previously near to the roof of the building at the back of the boiler. The principal particulars of each of the two boilers supplied are as follows:—

Generating heating surface ...	10,500 sq. ft.
Superheater heating surface ...	3,250 sq. ft.
Economiser heating surface ...	5,500 sq. ft.
Air heater heating surface ...	12,000 sq. ft.
Grate area	324 sq. ft.
Normal evaporation	61,500 lb. per hour
Overload evaporation	75,000 lb. per hour
Pressure	600 lb. per sq. in.
Steam temperature	780 deg. F.
Feed temperature	225 deg. F.
Overall efficiency	86 per cent.

The above outputs are calculated on the basis of coal of a heating value of 10,000 B.th.u., both of the boilers being operated continually day and night over long periods.

A Substitute for Rubber.

Reuter's agency states that Mr. Thomas A. Edison has discovered a weed which yields a fluid from which a workable substitute for rubber can be extracted. He has not, however, been successful so far in designing a machine to separate the rubber substitute from the other components of the fluid.

"At Play" in the Engadine.

The popularity of Switzerland as a resort of people in search of recuperation and winter sports enthusiasts shows no signs of diminishing. Visitors from the British Isles have in recent winters included increasing numbers of electrical personalities: the accompanying illustrations, which were reproduced from photographs taken quite recently (for which we are indebted to Mr. W. F. T. Pinkney) depict, from left to right, Mr. C. R. Belling (Belling & Co.), and Mr. C. L. Arnold ("M.K." Electric, Ltd.), while Mr. J. A. Hirst (Brookhirst Switchgear, Ltd.), will be recognised laying a curling "stone."

Electrical Manufacturers "at play" in the Engadine.

E.D.A. Annual Dinner.

The annual dinner of the British Electrical Development Association, at which Sir John Gatti, M.A., J.P., the President of the Association, will occupy the chair, will be held at the Piccadilly Hotel on Thursday, March 14th, at 7 p.m. for 7.30 p.m. Ladies are especially invited; arrangements are being made to conclude with dancing from 10.15 p.m. onwards. Tickets can be obtained from the E.D.A., 15, Savoy Street, Strand, W.C.2, at 21s. each, including wines during dinner and dancing afterwards.

Marine Electrical Auxiliaries.

In a paper read recently before the Institute of Marine Engineers, Incorporated, by Mr. G. J. Scott, B.Sc., are some interesting notes on "The Design and Construction of Electrical Auxiliaries for Marine Service," including the following:—

Some of the advantages of direct-current electric motors over steam engines for driving ships' auxiliaries are: the direct-current electric motor has an extremely large overload capacity for short periods; the electric motor is always ready to run at full load, or even overload, at a few seconds' notice; an electric motor specially designed for ship work is extremely reliable, and mechanically very simple; electric drive for winch, windlass and steering gear is now as flexible, reliable and fool-proof as a steam drive, while the running and maintenance cost is enormously less. For motors and dynamos on board ship the very minimum amount of sheet iron in the form of covers should be used, as even when painted it is found that they corrode after a few years. Thick cast-iron commutator covers, with ventilation openings well below the centre line and pointing downwards, with similar inlet openings, have been found to be the best for engine-room motors. It is not considered that totally enclosed motors are necessary below deck, as long as ventilated motors are designed, except in special positions, where, for instance, chloride fumes may be present, as near refrigerating machinery.

Most of the control gear used below deck is in the form of starters for motors of various kinds, and these starters are mostly of the barrel type, the contactor type being only required for motors of larger horse-power, such as those driving refrigerating machinery, compressors, &c. Mica is the most reliable form of insulating material, and it should be hot-moulded on to iron bars, with all contacts and connections clamped on to the micanite, sufficient leakage path being always provided. It is very advisable to have all connections in the front of the starter. All contacts should be large, well spaced apart, and with renewable tips.

In specifying the maximum temperature rise of continuously-running electrical machinery on ships, the average temperature of the air surrounding the motor or dynamo should be taken into account, and it is now becoming usual, at least for ships which travel in tropical climates, to specify a maximum rise of temperature at full load of 63 deg. F. after six hours' run at full load.

In order to ensure the utmost reliability in contactor control gear fitted on board ship, it must be specially designed. It is essential that the control should be so arranged that a large range of speed is available, say, from 100 ft. per min. on the rope at full load to 450 ft. per min. on light hook, and that this change of speed should be given automatically by the winch, according to the load lifted, and also that the speed at any load should be under the control of the operator. For instance, although the winch may be designed to give automatically a high speed with no load on the rope, yet there are times when a very slow creeping speed is necessary with slack rope, as when hauling cargo from under hatches. The best way of doing this with contactor-controlled winches is to interlock the foot-brake with the controller, so that when the foot-brake is depressed the controller is automatically brought to the first step, whatever the position of the controller handle, thus putting the maximum resistance in the circuit. Further pressure on the foot-brake puts an artificial load on the motor, bringing the speed down to a creeping speed if required.

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Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review posted concerning their movements.

The Alderley Edge and Wilmslow Urban Councils, which have taken over the undertaking of the Alderley and Wilmslow Electric Supply, Ltd., have appointed Mr. HESKETH as manager.

The Stockport Town Council has appointed Mr. W. L. CHUBB, of Stoke-on-Trent, as mains superintendent. There were 63 applicants for the post.

Mr. RALPH LOMAX, borough electrical engineer at Stockport, has resigned, and at his request has been paid six months' salary in lieu of notice. The post is to be advertised, the commencing salary being £1,000 per annum.

Mr. M. J. PATTISON, chief electrical engineer of the Electro-Mechanical Brake Co., Ltd., has been appointed London manager in addition to his present duties.

Mr. W. F. KNIGHT, late London representative of the Electro-Mechanical Brake Co., Ltd., informs us that he has relinquished his connection with this company. He is retaining his other associations, and his address is still Cecil Chambers, Strand, W.C.2, but his telephone number is now "Temple Bar 4200."

Mr. ANDREW R. COOPER, assistant engineer at the Silverwood Colliery, near Rotherham, has been appointed electrical engineer at the Dorman Long Collieries, near Dover, Kent, and he has been presented by the Silverwood officials and staff with a Jacobean oak timepiece.

Mr. R. A. FEARNLEY, who last week was appointed general manager of the Southend-on-Sea electric tramways, has for the past three years been general manager of the Keighley Corporation tramways, during which period the whole of the tramways in that town have been replaced by railless services and motor-'buses. Mr. Fearnley is a son of Mr. A. R. Fearnley, general manager of the Sheffield Corporation tramways.

The St. Helens Town Council has increased the salary of the electrical engineer, Mr. R. LEE, from £800 to £850 per annum.

Mr. H. TOPLEY (of the United Alkali Co., Ltd., Widnes) has been appointed charge engineer at the Padiham power station of the Lancashire Electric Power Co.

Mr. H. GRIFFIN has resigned his position as charge engineer with the West Midlands Joint Electricity Authority at the Wolverhampton station to take up an appointment in a similar capacity with the London Power Co. at Deptford West station.

Obituary.—MR. T. H. BLAKESLEY.—The death occurred in London, on February 13th, at the age of 81 years, of Mr. Thomas Holmes Blakesley, M.Inst.C.E., who began his career as an engineer in the public service overseas, but in the early eighties of last century became interested in scientific research, especially in the measurement of alternating currents. He was appointed instructor in physics and mathematics at the Royal Naval College, Greenwich, where he followed up his studies of that subject and published work which received wide circulation at home and abroad. According to a lengthy account of his career appearing in *The Times* for February 15th, he regarded his chief work to have been the reform of the teaching of geometrical optics.

SIR J. A. HOSKER.—We regret to record the death, which occurred on February 13th, of influenza and pneumonia, of Sir James Atkinson Hosker. Sir James, who was 71 years of age, was a well-known medical man at Bournemouth, who took also a large part in the public affairs of the town. He was mayor in 1896. He was for many years keenly interested in electricity supply undertakings. He was not only chairman of the Bournemouth and Poole Electricity Supply Co., Ltd., but he was also a director of companies associated therewith, such as the County of London Electric Supply Co., Ltd., the Richmond Co., the Coatbridge and Airdrie Co., the Kent Electric Power Co., the South Metropolitan Electric Light and Power Co., and other concerns. He received his knighthood last year.

MR. F. B. PELL.—We regret to record the death, which occurred suddenly, of heart failure, on February 13th, of Mr. Frederick Bennett Pell, A.I.E.E. He became an Associate of the Institution in 1895.

DR. CHARLES PRELLER.—*The Times* reports the death, at the age of 84, of Dr. Charles Du Riche Preller, civil and electrical engineer and geologist. During his professional career Dr. Preller was engaged in electric railway and hydro-electric work in Italy and Switzerland, and the equipment of electric lighthouses on the coasts of France.

MR. C. W. SCHAEFER.—We regret to record that Mr. C. W. Schaefer, electrician-in-chief of the Eastern Associated Telegraph Companies, died suddenly at his residence on February 17th.

MR. W. A. FAIRGRIEVE.—We regret to state that Mr. William Augustine Fairgrieve, a partner in the firm of Fairgrieve Bros., electrical engineers, Eagle Works, Sunderland, died on Sunday last at the age of 47 years, leaving a widow, three daughters, and two sons.

Wills.—Mr. J. C. JOLLEY, late joint managing director of the Skefco Ball Bearing Co., Ltd., left £12,083 gross and £10,673 net.

The late Mr. S. P. W. V. LUKE, C.I.E., left £51,441 gross and £43,525 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

E. Jeffery, Ltd.—Private company. Registered February 13th. Capital, £1,000 in £1 shares. Objects: To acquire the business of manufacturing electrical engineers, &c., heretofore carried on at 22, Denmark Place, Charing Cross Road, W.C., as "Jeffery & Co." The permanent directors are: W. B. Jeffery, 8, Royal Circus, West Norwood, S.E.27; W. B. E. Jeffery, 5, Pyrmont Grove, West Norwood, S.E.27; E. S. Macfie, Marigolds, Stock, Essex. Secretary: Miss Q. A. J. Henniker.

Brecknell, Willis & Co., Ltd.—Private company. Registered February 13th. Capital, £20,000 in £1 shares (10,000 "A" voting ordinary and 10,000 "B" non-voting ordinary). Objects: To adopt an agreement with the Thrissell Engineering Co., Ltd., to carry on the business of traction engineers, formerly carried on at Jacob Street, Bristol, and that of mechanical and electrical engineers, founders in iron, brass, and other metals, tool makers, manufacturers of and dealers in electrical apparatus and equipment, &c. The directors are: A. M. Willis, "Ventnor," Charlton Park, Keynsham, Somerset, electrical engineer; A. H. Trotman, 148, Beaufort Road, St. George, Bristol, company secretary; V. Nowlan, 2, Evelyn Street, S.E.8, accountant. Secretary: A. H. Trotman. Registered office: 114, Jacob Street, Bristol.

Power Centre Co., Ltd.—Private company. Registered February 14th. Capital, £1,500 in £1 shares. Objects: To acquire the business of switchboard manufacturers and electrical and mechanical engineers now carried on at 15, Park Lane, Liverpool, as "The Power Centre Co." The directors are: S. E. Baile, "Hollin Hey," New Brighton; G. T. Heptonstall, 26, Prescot Street, Wallasey; W. G. E. W. Shaw, 21, Joliff Street, Liverpool; B. L. Myer, 51, Oxford Street, Liverpool. Registered office: 15, Park Lane, Liverpool.

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Tidal Energy, Ltd.—Registered as a private company February 14th. Capital, £10,000 in £1 shares. Objects: To carry on the harnessing, exploitation, and utilisation of power from tidal water, waves, and more generally all power supplied by the sea, or of all waterfalls and watercourses, with the object of creating hydraulic power, the transformation of hydraulic power into electric power, &c. The subscribers (each with one share) are: E. G. O'Reilly and A. F. Jeffs, 44-46, Leadenhall Street, E.C.3, solicitors' clerks. Solicitors: Maxwell, Batley and Co., 44-46, Leadenhall Street, E.C.3.

Snap Switches, Ltd.—Private company. Registered February 14th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of wireless equipment, electrical, mechanical and general engineers, manufacturers of insulating materials, aero instruments, &c. The directors are: W. H. Mills, 59, Hawkstone Road, Rotherhithe, S.E., electrical engineer; L. W. Farish, 46, Culverley Road, Catford, S.E., traveller; T. G. Farish, 46, Culverley Road, Catford, S.E., electrical designer. Secretary: W. H. Mills. Registered office: 17, Mason's Hill, Bromley, Kent.

Pye Radio, Ltd.—Registered as a public company February 12th. Capital: £180,000 in 150,000 8 per cent. cumulative participating preferred ordinary shares of £1 each and 600,000 deferred ordinary shares of 1s. each. Objects: To acquire the radio business of W. G. Pye & Co.; to adopt agreements (1) with C. O. Stanley, (2) with the Gresham Trust, Ltd., (3) with T. A. W. Robinson, and (4) with R. M. Ellis; and to carry on the business of manufacturers of and dealers in wireless transmitting and receiving sets, components, accessories and installations, gramophones, electrical apparatus, and apparatus used in connection with television, telegraphy or telephony, &c. The subscribers (each with one deferred ordinary share) are: W. J. Lovell, 199, Piccadilly, W.1, clerk; E. J. Hawes, 66, Beechmont Avenue, Hanwell, W.7, clerk; and five other clerks. Solicitors: Bartlett & Gluckstein, 199, Piccadilly, W.1.

North Electrical Co. (1929), Ltd.—Private company. Registered February 8th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with Sophia Miller, and to carry on the business of electricians, electrical and wireless contractors, factors, merchants and manufacturers, as carried on by the above at 63b, North Street, Leeds, as the North Electrical Co. The subscribers (each with one share) are: S. Kessler, 84, Harehills Avenue, Leeds, electrician; Mrs. A. B. Kessler, Harehills Avenue, Leeds. S. Kessler is the first permanent director and chairman. Secretary: S. Kessler. Registered office: 63b, North Street, Leeds.

Meech Electric Drives, Ltd.—Private company. Registered February 11th. Capital, £5,250 in 5,000 7 per cent. cumulative preference shares of £1 each and 5,000 ordinary shares of 1s. each. Objects: To carry on the business of electrical, mechanical and general engineers and contractors for and dealers in printing presses, and machinery, apparatus and accessories for the printing and paper-making trades, contractors for and dealers in electric motors, switchgear, control gear, and all appliances and apparatus for the generation, supply, use and control of electrical power, &c. The subscribers (each with one preference share) are:—J. Meech, 95, Mayow Road, Sydenham, S.E.26, engineer; A. C. Read, 154, Park Avenue, Barking, incorporated secretary. J. Meech is the first director and secretary.

Nigerian Electricity Supply Corporation, Ltd.—Public company. Registered February 11th. Nominal capital, £200,000 in £1 shares. Objects: To produce, generate and distribute electrical energy or power, and to carry on the business of electricians, electrical, hydraulic, mechanical or general engineers and contractors, manufacturers of and dealers in electrical apparatus, &c. The first directors are:—The Hon. L. Holland, 14, Buckingham Street, Adelphi, W.C.2 (chairman of Associated Tin Mines of Nigeria, Ltd.); H. G. Latilla, Marlands, Itchingfield, near Horsham (chairman of Nigerian Base Metals Corporation, Ltd.); Major E. S. Marks, O.B.E., 18, Thorney Court, Kensington, W.8 (managing director of Associated Tin Mines of Nigeria, Ltd.). The above directors are permanent. Registered office: Finsbury Pavement House, E.C.2.

Official Returns of Electrical Companies.

Bective Electrical Co., Ltd.—Capital, £6,000 in 116 preference shares of £50 each and 4,000 ordinary shares of 1s. each. Return dated December 28th, 1928. 106 preference and 4,000 ordinary shares taken up. £5,500 paid. Mortgages and charges, nil.

Reason Manufacturing Co., Ltd.—Mortgage on freehold land and premises in Lewes Road, Brighton, with fixtures, &c., dated January 31st, 1929, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

London Power Co., Ltd.—Supplemental trust deed dated February 4th, 1929, to secure £3,000,000 charged on the company's undertaking, property, assets and revenues, present and future, ranking *pari passu* with prior deeds. Trustees: Law Debenture Corporation, Ltd.

Tre-Coil Works, Ltd.—Debenture dated February 4th, 1929, to secure £400 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. Freudenberger, 79, Chatsworth Road, Brondesbury, N.W.

Foots Cray Electricity Supply Co., Ltd.—Satisfaction in full on January 1st, 1929, of debentures issued between October 15th, 1909, and December 22nd, 1913, securing £3,800 plus premium of 5 per cent.

Price's Electrical Supplies, Ltd.—Return dated December 14th, 1928. Capital, £3,000 in £1 shares. 1,210 shares taken up. £1,210 paid. Mortgages and charges, nil.

City Notes.

Metropolitan Railway Co.

The report for the year ended December 31st last shows gross receipts of £1,606,966, as compared with £1,558,474 in 1927. The expenditure rose from £1,079,076 to £1,116,424, and thus the net revenue advanced from £479,398 to £490,542. After crediting revenue from jointly-owned lines, &c., and deducting miscellaneous charges, the net revenue was £780,612, against £765,866. Debenture interest and preference dividends are paid and a final dividend of £2 5s. per cent. is recommended on the ordinary shares, making £3 10s. per cent. for the year (against £3 per cent. for 1927). The general reserve again receives £10,000, and a balance of £23,888 (against £26,464) is carried forward. The surplus Lands Stock dividend is raised from £3 12s. 6d. to £3 15s. per cent. The tendency of the past few years has continued; intensive road competition has caused a loss of short-distance traffic, while building developments in the more distant areas served have led to greater business in this direction. Notting Hill Gate station has been reconstructed and work is proceeding at Swiss Cottage. Great Portland Street and Euston Square will be the next to be dealt with. The older portion of the boiler plant at the Neasden power station is being replaced by six high-pressure boilers using pulverised fuel. It is hoped that Chiltern Court, the new building at Baker Street station, will be completed by the end of the year. After the ordinary meeting yesterday (Thursday) the proprietors were to be asked to approve the company's Bill now before Parliament. This provides for the widening of the lines between Wembley Park and Harrow, &c.

The "Underground" Group.

In our last issue we gave particulars of the dividends declared by the railway companies of this group; we now reproduce the substance of the companies' reports for the past year which were to be presented at the annual meetings yesterday (Thursday):—

London Electric Railway Co.—The total receipts rose by £128,571 to £2,302,744, and the expenditure by £98,611 to £1,284,831, the net revenue at £1,017,913 showing an advance of £29,960. Adding miscellaneous receipts and the balance brought forward (£158,101), there is a sum of £1,403,298. From this are deducted interest, rentals, &c., £50,000 for contingencies and renewals, and preference stock dividend, leaving £643,549 available. After the payment of dividends, £177,152 is carried forward. The total amount appropriated to reserve is £157,198. The year's capital expenditure was £853,144 net, the largest item being £707,345 for rolling stock. Reference is made in the report to the completion of the new Piccadilly Circus station, and it is stated that the continued displacement of old rolling stock by stock of the latest standard with air-operated doors has led to economies in working. Mention is also made (as in the other reports) of the Bill which is being promoted to secure co-ordinated operation of London transport and a Bill providing for further developments. The estimated capital expenditure during 1929 is £626,000, mainly on rolling stock.

Central London Railway Co.—The receipts for the year amounted to £573,472 (a decrease of £211); working expenses fell by £11,302 to £342,242; thus the net receipts increased by £13,717 to £231,230. To these are added miscellaneous receipts and £98,926 brought forward, making £406,260. After meeting interest, rentals, appropriation for contingencies and renewals and preference stock dividend, there is an available balance of £255,053. The dividends on the three classes of ordinary stock are paid, leaving £105,053 to be carried forward. The total amount carried to reserve was £40,000. The capital expenditure was small, and the account showed a credit of £113,747. The report states that the Wood Lane power station has been shut down, power now being derived from Lots Road.

Metropolitan District Railway Co.—The traffic receipts totalled £1,550,328 (an increase of £6,597); working expenses were reduced by £11,490 to £1,008,526; the net receipts were thus £18,017 higher at £541,802. After crediting miscellaneous receipts and the balance brought forward (£38,161) and deducting the usual appropriations, the balance available for dividend on the ordinary stock was £206,818, and after meeting that dividend £44,768 is carried forward. The total sum

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appropriated to reserve was £90,000. The expenditure upon capital account was £293,246, the new office building representing the bulk of this (£268,358). The capital expenditure during the current year is estimated at £399,000, the chief items being the new office building and rolling stock (£151,000). The report says that the new building is almost finished, and will be partly occupied by the staffs of the company and its associates early this year.

City and South London Railway Co.—The traffic receipts for the year amounted to £923,132 (a rise of £25,894), and the working expenses rose by £30,988 to £516,320, reducing the net receipts by £5,088 to £406,812. After adding miscellaneous receipts and the balance brought forward (£33,156) and making the usual provisions, the available balance was £110,179, and after meeting the dividend on the consolidated ordinary stock, £36,179 is carried forward. The capital expenditure during the year was £33,048.

Summary of Results.—We reproduce below a comparative statement of the four companies, which, with the London General Omnibus Co., participate in the Common Fund:—

	1928. £	Inc. or dec. £
Traffic receipts	5,349,676	+160,851
Expenditure	3,151,919	+106,871
Net receipts	2,197,757	+ 53,980
Miscellaneous receipts (net)	660,009	+ 16,241
Net income	2,857,766	+ 70,221
Interest, rentals, &c.	1,396,334	+ 28,638
Appropriation to reserve for contingencies and renewals	107,500	− 77,500*
Dividends on guaranteed and preference stocks	466,977	—
Balance	886,955	+119,083
Add Balance from last year's accounts	328,344	+ 86,154
Total amount available for dividends on ordinary stocks and shares ...	1,215,299	+205,237
Dividends on ordinary stocks and shares	852,147	+170,429
Rate per cent. per annum	5	+ 1
Balance carried forward to next year's accounts	363,152	+ 34,808

* Included in a total of £702,198 appropriated to reserves.

Traffic Figures.—The subjoined table shows that there was a general increase in the volume of traffic:—

	1928.	Inc.
Passengers carried—		
Ordinary	247,788,463	13,194,193
Workmen	62,465,869	4,593,683
Seasons	58,113,586	5,176,832
Total	368,367,918	22,964,708
No. of car-miles run	88,328,769	2,289,958

Hall Telephone Accessories (1928), Ltd.

The first ordinary general meeting of the company was held on February 11th, Major the Hon. O. M. Guest (chairman) presiding. In presenting the report (*vide* Elec. Rev., February 8th, p. 250), the chairman pointed out that the company's new type of coin-operated machine had been installed in G.P.O. telephone boxes; several thousands had been supplied and the company was engaged on a further large order spreading over the next 2½ years. The device had also been introduced into other parts of the Empire and foreign countries. The company was also supplying automatic stamp machines to the G.P.O. Several allied inventions were being manufactured by the company and new types would be introduced. The foreign demand for the company's products was growing steadily and they expected further progress this year. It was the opinion of the directors that the 1929 results would compare favourably with those of the past year. The chairman then referred to the proposed acquisition of the business of Thomas Watson and Sons, and said that the purchase price was a fair one and the business was very satisfactory. The issue of the necessary capital (£28,000) should not jeopardise the current dividend rate. The new capital would be offered to shareholders in the proportion of one new 10s. share at 11s. for each five held. In conclusion, he said that the company intended to issue a short report at the time of declaring interim dividends. The report and accounts were adopted and subsequently resolutions were passed to increase the company's capital to £178,000 by the creation of 70,000 10s. shares, of which 56,000 would be issued immediately.

Westminster Electric Supply Corporation, Ltd.

The directors' report for 1928 shows a net profit of £157,654, to which is added £35,551 brought forward, making £193,205. The preference dividend and the standard ordinary dividend (1s. 9.12d. per share) are paid, £28,608 is transferred to special reserve, and £29,022 is carried forward. The number of meters connected rose from 29,600 to 31,294, and the electrical energy sold from 54,622,781 to 59,854,409 kWh. The directors have appointed Mr. C. Parker general manager in addition to being secretary. Meeting: February 27th.

North Wales Power Co., Ltd.

An extraordinary meeting is to be held to-day (Friday) to consider the reduction of the company's capital. It is proposed to cancel 10s. of the 383,883 issued ordinary £1 shares, making them 10s. shares, thus reducing the capital from £1,000,000 to £808,058 10s. In a circular accompanying the notice of the meeting the directors state that the construction of the dams at Maentwrog proved more protracted and costly than was anticipated, resulting in a greatly increased capital outlay and loss of revenue, due to the fact that the company had to purchase energy. The directors have now arranged a contract with the Central Electricity Board whereby the whole of the output will be disposed of in due course. A provisional arrangement for the purchase of the hydro-electric undertaking of the Aluminium Corporation, Ltd., has also been made. Owing to the conditions of the Government's guarantee to the £2,000,000 debenture stock issued, no dividend has yet been paid on the preference shares since December 31st, 1924, and the arrears stand at £106,021. The directors consider it necessary, in order to be able to raise the additional capital which is required, to purchase or redeem the 8 per cent. "B" debentures; to cancel the arrears of dividend on the 8 per cent. preference shares; to reduce the ordinary capital; to subdivide the preference shares into two 10s. shares, and convert them into ordinary shares, and thereupon raise the capital to £1,000,000 in 10s. shares; to pay the Aluminium Corporation for its hydro-electric undertaking £350,000 in cash and surrender £150,000 of the Corporation's "C" debentures which the company holds; and to make a number of other arrangements, including an agreement providing for the underwriting of issues of 859,177 and 600,000 10s. ordinary shares before July 31st next.

Aluminium Corporation, Ltd.

This company has called a meeting for March 11th of the holders of its first debentures to obtain their sanction to the sale of the hydro-electric undertaking to the North Wales Power Co., Ltd., as mentioned above. It is pointed out that the sale of the undertaking will provide £350,000, which will be paid over to the trustees for the first debenture holders, and it is hoped that negotiations now in progress will provide a total of 94 per cent. of the amount of the debentures (£461,840). This is a greater amount than would be realised under a forced sale of the hydro-electric undertaking.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Truphonic Radio, Ltd.—425,000 shares of 2s. each, fully paid, Nos. 1 to 425,000. 225,000 shares of 2s. each, fully paid, Nos. 425,001 to 650,000.

North Metropolitan Electric Power Supply Co.—6,250 new ordinary shares of £1 each, fully paid, Nos. 1,593,510 to 1,599,759. 241 new ordinary shares of £1 each, fully paid, Nos. 1,599,760 to 1,600,000.

Hall Telephone Accessories (1928), Ltd.—56,000 new shares of 10s. each, issued at 11s. per share, fully-paid, Nos. 280,001 to 336,000.

Official Notice re Companies.

The names of the under-mentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

City of London Radio Corporation, Ltd.
International Phone-Alarms, Ltd.
Southern Lighting and Ignition Co., Ltd.

Ever-Ready Trust and Finance Co., Ltd.

Speaking at the statutory meeting on February 14th, the chairman (Mr. M. Goodfellow) said that the company had acquired a large holding in the Ever-Ready Co. (Great Britain), Ltd., and had assisted that company in purchasing an interest in Lissen, Ltd. In his opinion the company had already laid the foundations of a prosperous year, and, he hoped, a prosperous future.

Clarke, Chapman & Co., Ltd.

The net profit for the past year rose from £53,681 to £82,519. To this is added £7,022 brought forward, making £89,841, and after meeting depreciation, preference dividends, &c., it is proposed to pay a final dividend of 7 per cent. on the ordinary shares, making 10 per cent. for the year, against 7 per cent. for 1927. The reserve receives £10,000 (against *nil*), and £16,548 is carried forward.

Uxbridge and District Electric Supply Co., Ltd.

The accounts for the year ended December 31st last record a net profit of £41,141, to which is added £1,878 brought forward, making £43,019. After meeting debenture interest and redemption, and setting aside £16,000 for depreciation, the directors recommend a dividend of 8 per cent., free of tax, on the ordinary shares, leaving £1,936 to be carried forward.

Crossley Bros., Ltd.

The net profit for the past year was £56,813, as compared with £51,882 for 1927. To this is added £96,724 brought forward, making £153,537. It is proposed to pay the balance of the 7 per cent. preference dividend, leaving £125,300 to be carried forward.

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New Issue.

Pye Radio, Ltd.—This company, whose registration is noted in our "New Companies" section to-day, made an issue of 150,000 8 per cent. cumulative participating preferred ordinary shares of £1 each and 150,000 deferred ordinary shares of 1s. each on Tuesday last. The company has acquired the radio business of W. G. Pye & Co., Cambridge. The directors are Sir Thomas A. Polson, K.B.E. (chairman), Mr. L. G. Hawkins (L. G. Hawkins & Co., Ltd.), Mr. T. A. W. Robinson, and Mr. R. M. Ellis, the last two being managing directors. The registered office is at Radio Works, Cambridge.

Mersey Railway Co.

The report for the year ended December 31st, 1928, records gross receipts of £227,780 (against £231,996 in 1927) and net revenue of £83,116 (£83,278). To the latter amount is added £2,961 brought forward, making £86,077. After meeting debenture interest, transferring £2,000 to reserve, and paying the dividend on the 3 per cent. perpetual preference stock, it is proposed to pay a dividend of ½ per cent. on the consolidated ordinary stock and to carry forward £2,487. Meeting: February 22nd.

Charing Cross Electricity Supply Co., Ltd.

The directors recommend a final dividend on the ordinary shares of the West End Undertakings of the company at the rate of 10 1/16d. per share, less tax. This makes up the standard dividend for the year under the London Electricity (No. 2) Act, 1925.

Pennsylvania Water and Power Co.

The gross earnings for the past year were $4,388,087, against $3,525,343; the net earnings rose from $2,252,525 to $2,853,060. The dividend was $2½ per share, equivalent to 10 per cent. on the old $100 shares, which were divided into four last year. The dividend for 1927 was 9 per cent.

Simms Motor Units, Ltd.

At an extraordinary meeting on February 15th, a resolution was passed increasing the company's capital to £350,000 by the creation of 100,000 preference shares of £1 each. These are to be offered, by way of rights ,to the ordinary shareholders.

London Electric Supply Corporation, Ltd.

A final dividend of 5 per cent. (1s. per share), making 9 per cent. for 1928, has been declared on the ordinary shares.

J. G. White & Co., Ltd.

It is announced that J. G. White & Co., Inc., of New York, has acquired over 95 per cent. of the company's share capital and with it the control of the company.

Swiss Company.

The *A.G. für Elektrische und Industrielle Unternehmungen im Orient*, Zurich, reports a profit of 921,000 fr. for 1928. A dividend of 10 per cent. is being paid as in the previous year.

Mather & Platt, Ltd.

The directors recommend a final dividend of 5 per cent. and a bonus of 5 per cent., making 15 per cent. for the past year, as for 1927.

Montreal Light and Power Co.

The gross revenue for 1928 rose from $20,314,902 to $21,235,991, and the surplus, after providing for dividends, from $2,977,672 to $3,511,812.

German Loan in New York.

Last week a New York firm offered for subscription $15,000,000 of 6½ per cent. debentures of the Berlin City Electric Co., at 93½ per cent.

Norwich Electric Tramways Co.

A dividend at the rate of 5 per cent. per annum has been declared in respect of the past half year.

Brown Bros., Ltd.

A final ordinary dividend of 7½ per cent. is recommended, again making 10 per cent. for the year.

Chiswick Electricity Supply Corporation, Ltd.

The final dividend on the ordinary shares is 8½ per cent., maintaining the total for the year at 16 per cent. £16,000 is placed to depreciation reserve and £2,653 is carried forward.

Quebec Power Co.

A dividend of $0.5 per share has been declared on the common shares for the quarter ending March 31st.

Consolidated Gas, Electric Light and Power of Baltimore.

A dividend of $0.75 per share has been declared on the common shares in respect of the quarter ending March 31st.

Swedish Companies.

The accounts of the *Svenska Ackumulator A.B.*, for 1928, after provision for depreciation, show net profits of 526,000 kr. as compared with 259,000 kr. in the previous year. The ordinary shares are to receive a dividend of 12 per cent., against 9 per cent. in 1927.

Allmänna Svenska Elektriska Aktiebolaget.—The board reports a net profit of Kr. 4,650,000 for the past financial year, compared with Kr. 4,550,000 for the previous year, and proposes again to pay a dividend of 6 per cent., absorbing Kr. 4,500,000.—*Reuter's Trade Service* (Stockholm).

German Companies.

The *Isaria Meter Works Co.*, Munich, reports a loss of 272,000 marks for 1927-28, increasing the deficit to 307,000 marks. It is stated that the undertaking has now been acquired by the Siemens and Halske Company.

The *Poege Electricity Co.*, Chemnitz, reports a loss of 897,000 marks for 1927-28, of which 500,000 marks was lost through the Saxony metal workers' strike, as compared with net profits of 292,000 marks in the previous year. It is proposed to meet the loss by appropriations from the reserves.

Stocks and Shares.

Monday Evening.

The influence of America remains strong in the markets of the London Stock Exchange, and rumour plays a considerable part in bringing about price fluctuations due to talk of control being transferred from this side to the American side of the Atlantic, in the case of companies now domiciled over here. One of the latest developments is that reported by the Utilities Power and Light Corporation, which has announced the acquisition, through the Greater London and Counties Trust, of the entire capital stocks of seven British electricity supply concerns, and substantial interests in others. The company best known in the Stock Exchange of the group is Edmundson's Electricity Corporation, but there is also a market in shares of the Oxford Electric Company, another of the septette. Lord Birkenhead announces that he has accepted the chairmanship of the Greater London and Counties Trust, and has emphasised that the British companies will remain under British control. The effect upon the shares in the Stock Exchange has been to arouse a quickened interest in the market as a whole, without affecting these two to any particular extent. Edmundson's 7 per cent. preference are 25s., and Oxford ordinary 27s. 6d.

Electricity Supply.

County of London Electric have been a good market, and the list throughout shows a firm tone, though there is no special alteration in the nominal prices. Charing Cross are better at 26s. 6d. The Bankside Investment Trust issued £700,000 5 per cent. debenture stock at 97½, which was readily taken, and the openin~ price of ½ premium attracted attention. The interest on the stock, and the annual contributions to the sinking fund, are guaranteed by the City of London Electric Lighting Company, up to and in respect of the year 1971. Out of the five directors, four are also directors of the City of London Electric Lighting Company.

Newcastle-on-Tyne ordinary have gone back to 26s. 3d. Atlas debenture strengthened to 99½; the price of the shares remains about 27s. 6d., and the 7 per cent. preference are 23s. 9d.

Dollar Stocks.

International Telephone and Telegraph shares have gone back to 210, and American Telephone and Telegraph fell several points to 215. Dollar stocks are dull as a whole. Shawinigan weakened to 91½. Mexican Light and Power common has shed 8 points, falling to 90, and the preferred shares are easier at 77½. Brazilian Tractions at 70 are unaltered, but the company's preference shares at 230 are $5 down. The condition of affairs in New York is dominated for the time being by money; and the stringency, caused mainly by gambling throughout the United States, is reflected in the fears that continue to exercise our markets in regard to the possibility of a further rise in the Bank of England minimum. Some of the falls which have taken place during the last fortnight have been substantial, although when matched against the previous rises, it may well be said that the reaction does not amount to a great deal.

London Power Debenture.

Inquiry from one of the jobbers who dealt in the new London Power 5 per cent. debenture stock as to how the issue had gone elicited a telephonic (and laconic) "47 per cent." Unfortunately, the inquirer took this to mean 47 per cent. to the underwriters, whereas it referred to the amount allotted to the public, and a wrong impression was conveyed. The issue went so well that the public received only 47 per cent. of

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their applications, and the shareholders of the constituent companies obtained 70 per cent. of what they asked for. The correction was already typewritten when the London Power Company sent a very courteous letter drawing attention to a mistake for which every regret must be expressed. Fully-paid scrip can be bought at 99, or possibly cheaper. The issue price was 99½. As already observed, the rise to 5½ per cent. in the Bank Rate no doubt affected the price of a stock which makes a perfectly safe investment.

Home Railway Stocks.

The market for Home Railway stocks is heavy. Only the London and North-Eastern announcement remains to complete the tale of the dividends for 1928. The figures are due on the Friday in this week. Mild disappointment is the predominant note in connection with the dividends so far declared. Only the London, Midland and Scottish exceeded anticipation. Holders of the shares, and the income debenture stock of the Underground Electric Railways of London are far from satisfied with their company's announcement. The shares are a few pence down, and the incomes lost a further 3 points on top of their decline of 5 a week ago. The present price is 121. Districts and Metropolitans are both 10s. down, and the yield on the latter is by no means unattractive, considering the prospects which lie ahead of the company. Neither Central Londons nor any others of the Underground group have derived benefit from the increased dividends set out on p. 297 of last week's ELECTRICAL REVIEW. There has been a slight weakening of prices in the list of prior-charge stocks—a natural corollary to the advance in the Bank Rate and the fear that another increase may be necessary unless monetary conditions become easier in the United States.

Cable and Wireless.

On the swing of the pendulum, Eastern cable securities are lower for choice. The nominal falls are 2½ points in Eastern Telegraph ordinary stock and 10s. each in Eastern Extension and Western Telegraph shares. Globes remain unchanged at 26½. For the dullness there is no need to seek a further reason than impatience at the delay in announcement of the Communication Company's proposals, added to the rise in the cost of money. Great Northern Telegraphs keep around 33: other cable issues have not changed. Marconis rose above 4, but went back to 78s. 9d. The preference strengthened to £5. Marconi Marines rose ⅛ to 3¾ on hopeful expectations in respect of the dividend declaration. Canadian Marconis have fallen to 29s. 9d. Of the telephone shares, Orientals put on the fraction to 3 1/16. Automatics are still dull at 41s. 3d.

Manufacturing Companies' Shares.

In the list of manufacturing companies, General Electric ordinary recovered to 3¼ before reverting to 3⅛, though the fluctuations in the price during the past week have been mild as compared with the meteoric movements earlier in the month. Telegraph Constructions are better at 25¼. Chadburn's Ship Telegraph preference are lower at 7s. 6d. English Electrics went back to 9s. 6d., Henley's, Callender's and British Insulated held their previous rises, Enfield ordinary remained at 5⅜. Telephone Manufacturing dropped to 5s., Babcock & Wilcox are a little easier at 3 9/16. Vickers are dull at 11s. 10½. Associated Electrical Industrials drooped to 34s., having been up to 35s. 3d. Sudden revival in the rubber share market followed a strengthening of the price of raw rubber to 1s. a lb. and a little over. The difficulty of obtaining any reasonable quantity of supply, however, militated against the activity which otherwise would have characterised the rubber share market by reason of the improvement in the price of the produce.

Cum and Ex Dividend.

Dividend payments are now making their appearance with their accustomed liberality, and in this connection it may be of service to mention the Stock Exchange practice in regard to the quotation of prices ex dividend. Investors are frequently puzzled to understand when prices are cum dividend and when ex dividend. The rule is that, in the case of a final dividend for the year, the price of shares remains cum dividend up to the Stock Exchange account-day following the meeting of proprietors at which the dividend is confirmed. For example, if a company holds its meeting to-day (Monday) and confirms a final dividend proposed by the directors, the price of the shares will be quoted ex dividend on February 21st, being the Stock Exchange pay-day which follows the meeting. Up to February 21st people who buy the shares are entitled to receive the dividend, and those who sell the shares will hand it over to the purchasers. The actual date of payment of the dividend has no bearing upon the ex dividend quotation, though it frequently happens that a shareholder receiving a dividend on a Monday, will think that he has the right to keep the money if he sells the shares, say, on the next day.

The rule just set out is an easy one to remember, and experience has shown that it works advantageously from the point of view of buyer and seller alike. When a price is quoted ex dividend, the net amount of the dividend, so far as possible, is taken off the price, and a share which is quoted 25s. cum 1s. dividend, will be marked 24s. 3d. when it goes ex dividend

Share List of Electrical Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Feb. 18, 1929.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14†	15	72/-	−2s.3d.	... ..
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/6	+6d.	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅝	8⅝	27/-	—	5 8 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	52/-	—	2 17 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—	3 18 8
Kensington Ordinary	1	8	8	27/-	—	5 8 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/-	+6d.	5 8 8
Metropolitan	1	8	9	46/3	—	3 18 1
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/6	—	4 5 3
Mid. Elec. Power	1	—	15	2 1/16	—	... ..
Newcastle-on-Tyne Ordinary ...	1	5	6	26/3	−9d.	4 11 5
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	28/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	—	4 14 2
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	40/9	—	... ..
Westminster Ordinary	1	8⅝	8⅝	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	—	6 1 3
Yorkshire Elec.	1	8	8	36/6	—	4 7 8

†4% of which was tax free.

HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	"	8	8	65	−½	5 7 8
do. District	"	8½	4	80½	—	6 4 3
Underground Electric	£1	1½	5	25/6	−6d.	5 9 10
do. do. Income ...	Bonds	6	6	121	−3	4 19 2
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	109	—	5 16 6
do. Def.	"	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	10	2 1/16	—	4 16 10
Eastern Extension	10	10	10	9 ½	−½	*3 15 6
Eastern Tel. Ord.	Stock	10	10	267½	−2½	*3 15 0
Globe Tel. and T. Ord.	10	10	10	26½	—	*3 15 6
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	20	38	—	... ..
Indo-European	25	10	10	54½	—	*4 11 0
Marconi	10/-	5	*10	3 15/16	—	... ..
Marconi-Marine	1	8¾	12½	8¾	+⅛	3 6 10
Oriental Telephone Ord.	1	12	12	3 1/16	+ 1/16	... ...
Western Telegraph	10	10	10	26½	−½	3 15 6

*Interim.

HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8¾	—	7 6 8
do. do. 2nd. Pref. ...	5			3⅝	—	8 5 6
do. do. 5% Deb. ...	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	"	—	—	825	—	... ..
do. do. Pref. Ord.	"	8	8	118	+2	6 5 0
Brazil Traction	100	6	7	70xr	—	2 17 2
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	96½	+1	5 8 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12 6	−6d.	... ..
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	84	—	5 19 1
Mexican Light Common	100	Nil	Nil	90	−8	... ..
do. 7% Pref.	100	Nil	7	78½	—	8 18 4
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ..
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	18	15	3 9/16	−9d.	*4 4 4
British Aluminium Ord.	1	10	10	47/6	—	*4 4 2
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅞	—	3 1 6
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4 1/16	—	3 9 1
do 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ..
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	25.9	—	5 16 6
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	23/-	—	5 16 6
Enfield Cable Ord.	1	20	20	7⅝	—	3 14 6
English Electric	1	Nil	Nil	8 9	—	... ..
do. do. Pref	1	8	Nil	9 6	−6d.	... ..
Gen. Elec. Pref.	1	6½	6½	21/6	—	5 6 1
do. Ord.	1	7½	10	8½	—	3 4 0
Henley	1	25	25	6½	—	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	12/6	—	... ..
Johnson & Phillips	1	12½	10	2 1/16	—	4 17 1
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	25¼	+¼	*4 15 3

*Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during January.

THE Board of Trade returns of foreign trade during the first month of the New Year show a considerable improvement in the export position as a whole. The total value of exported goods of United Kingdom production was £66,879,607, an increase of £7,136,874 as compared with the exports during January, 1928. The figure was the highest since November, 1927. It will be seen from our table that electrical goods and machinery contributed to this improvement. The total value of exports of this class was £1,614,301, a figure which was only exceeded once during last year. It represented a rise of £178,863 as compared with December last, and one of £67,660 over the January, 1928, figure. The advance upon the December total was mainly due to electrical machinery which showed an aggregate rise of £150,665. The two non-submarine cable items showed satisfactory progress and unenumerated goods were up by £40,087. Against these have to be placed substantial decreases in exports of submarine cable and telegraph and telephone apparatus; batteries and accumulators also declined. In the comparison with January, 1928, although machinery again contributed to the increase, the greatest advance was made by unenumerated electrical goods and apparatus. Insulated wires and cables also rose considerably, while glow lamps showed a good proportional increase. All three telegraph and telephone items fell in value, the aggregate being £106,182, and batteries and accumulators reached a lower level. In the face of the large decrease referred to the rise of £67,660 in the total may be considered satisfactory.

Although the value of imports declined from the December level it was still very high, higher than in January, 1928. The decrease as compared with December was mainly due to smaller imports of batteries and accumulators; the other decreases were small and more than offset by the increases, of which the rise of £9,714 in telegraph and telephone apparatus was the most prominent. The increase in comparison with the corresponding month of last year was fairly general; the large rise of £60,681 in imports of telegraph and telephone apparatus was almost cancelled out by a decline of £58,371 in the value of imports of glow lamps. The only noteworthy change, apart from these, was a rise of £13,861 in insulated wires and cables.

As compared with December re-exported goods fell in value by £2,335, on account of smaller shipments of batteries and accumulators and unenumerated goods; the only important rise occurred in the case of telegraph and telephone apparatus. In the comparison with January, 1928, the only variation exceeding £1,000 was a decrease in the case of insulated wires and cables.

We give below particulars of the destinations of our exported electrical machinery. Assuming "other countries" to be non-Empire markets, the exports were divided approximately equally between foreign countries and the Empire, *i.e.*, £341,776 and £321,663, respectively.

Destination.	Jan., 1928.	Jan., 1929.	Inc. or dec.
	£	£	£
European countries	124,259	108,820	−15,439
Japan	11,704	97,158	+85,454
South America ...	101,593	39,186	−62,407
South Africa ...	37,743	41,522	+ 3,779
British India ...	94,235	135,095	+40,860
Australia	80,144	92,230	+12,086
New Zealand ...	41,265	23,503	−17,762
Canada	20,476	29,313	+ 8,838
Other countries ...	89,662	96,612	+ 6,950
Totals	£601,080	£663,439	+£62,359

The weight of electrical machinery exported rose from 3,837 tons in January, 1928, to 4,147 tons in January, 1929; thus the value per ton rose only from £157 to £159, indicating on the face of things something like stability of prices.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Jan., 1929.	Inc. or dec. as compared with Dec., 1928.	Inc. or dec. as compared with Jan., 1928.	Electrical imports for Jan., 1929.	Inc. or dec. as compared with Dec., 1928.	Inc. or dec. as compared with Jan., 1928.	Electrical re-exports for Jan., 1929.	Inc. or dec. as compared with Dec., 1928.	Inc. or dec. as compared with Jan., 1928
Electrical goods and apparatus (unenumerated)	£256,854	+ £40,087	+ £94,498	£130,277	− £8,871	+ £1,300	£4,917	− £2,341	− £827
Insulated wires and cables ...	273,305	+ 51,856	+ 28,792	76,451	+ 1,786	+ 13,861	481	+ 98	− 1,303
Glow lamps	53,362	+ 5,980	+ 10,335	22,327	− 368	− 58,371	546	− 844	− 517
Arc lamps and parts ...	1,826	− 307	+ 3[illegible]1	4,132	+ 1,614	+ 3,540	20	+ 10	+ 12
Batteries and accumulators ...	68,068	− 17.836	− 19,674	55,509	− 24,739	+ 6,960	375	− 1.440	+ 60
Meters and instruments ...	30.819	+ 8,719	− 769	21 539	− 2,693	− 5,632	1,110	+ 505	+ 224
Carbons	895	+ 484	− 1,957	13,171	+ 3,308	+ 2,278	83	− 248	+ 32
Switchboards (not telegraph or telephone)	11,722	+ 6,005	− 43	219	+ 65	+ 219	—	− 18	—
Electrical Machinery—									
Electrical machinery (unenumerated)	351,011	+ 41,600	+ 17.962	156,654	+ 6,281	+ 8,558	8,966	+ 369	+ 411
Railway and tramway motors	25,628	+ 8,642	− 16.492	—	—	—	—	—	—
Other motors and generators...	286,800	+ 100,423	+ 60,889	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	67,142	+ 10,551	− 34,027	3,781	− 2,917	− 8,053	5	− 3	− 174
Submarine telegraph and telephone cable	12,216	− 38,921	− 31,464	—	− 5,950	—	—	—	—
Telegraph and telephone instruments and apparatus ...	174,653	− 38,420	− 40,691	114,035	+ 9,714	+ 60,681	3,475	+ 1,577	− 528
Totals	£1,614,301	+ £178,863	+ £67,660	£598,095	− £22,770	+ £25,341	£19,978	− £2,335	− £2,610

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The British Industries Fair.—II.

Functions and Exhibits in London and Birmingham.

ON Monday last the two sections of the British Industries Fair, at London and Birmingham, opened for a period ending March 1st. There was a preliminary Press view on Friday last week which enabled visitors to observe the great increase in space and facilities at Castle Bromwich, although, as is usual on such occasions, packing cases were much in evidence. The demolition of some of the dividing walls of the huge building has made a great deal of difference, for the visitor is not aware that he has reached the Electrical Section until he sees some familiar names on the stands. Previously the section was in Building C, and was separated by a wall from the rest of the show. This year the stands in the section appear to be arranged in a better style; those companies displaying domestic and lighting appliances have particularly bright stands. Even the heavier equipment seems to have been set out to better advantage.

At the Press Luncheon, Mr. R. C. Rodgers (president of the Fair Council), who presided, made reference to the pundits who were continually exhorting the British employer and workman to "take their coats off." The speaker pointed out that the display proved that coats were already off and both manufacturers and their men were ready and willing to carry out all the work they were given. Mr. G. N. Guest (chairman of the Council) said that great as the past progress of the Fair had been, they were preparing for even greater developments. Already quotations were being obtained for next year's extensions. The space in the present Fair had all been booked by the end of June last, which was unprecedented. The organisers intended to give exhibitors an opportunity of booking space for five years ahead. Another bay running the whole length of the building would soon be added, and he anticipated that in five years' time the Fair would be twice its present size.

On Monday this week there was a luncheon at Birmingham in connection with the opening of the Section at which the Lord Mayor of Birmingham presided. Mr. L. S. Amery, Dominions Secretary, in wishing the Fair success, said that if every employed person in this country would spend a penny a day on British goods, 100,000 more persons would be employed.

On this page we reproduce the first pictures of stands in the Electrical Section, those of Metro-Vick Supplies, Ltd., and George Ellison.

The Mansion House Banquet.

At this banquet on Monday last, at which the President of the Board of Trade took the chair, the Prince of Wales made an excellent speech which was broadcast from the London and other stations. His Royal Highness spoke from experience of the misery and want resulting from continued unemployment, and asked everybody to do his share in creating employment, even though it was only in a small way. It was the purpose of the British Industries Fair to help to restore the normal flow of our export trade, and the success of the Fair was apparent from the fact that exhibitors booked space year after year. The Fair gave them an opportunity of selling their goods, and, moreover, of showing that, given the necessary equipment and methods, the British workman could hold his own with anybody in the world. Proof of that could be found in the rapid growth of some of the newer industries, such as artificial silk and the electrical and wireless trades. It was certain, however, that markets could not be found or a demand created if our salesmanship was not up-to-date. In the course of his travels he had sometimes found that British communities abroad, while desirous of buying British goods, were unable to do so because of their unsuitability. He learned that a representative committee was now studying this important subject, and although he did wish to anticipate its report, he was sure that it would advise personality, knowledge of the goods, knowledge of the condition and the language of the country where the goods were to be sold, and then tact and good manners.

The Prime Minister also spoke at length and made special reference to the participation of the Dominions in this year's Fair. International trade, inculcating a knowledge and understanding of foreign countries, was a means of ensuring peace. He hoped that this year's Fair would pass all records. Among the other speakers were the Brazilian Ambassador and the High Commissioner for New Zealand.

Metro-Vick Supplies, Ltd.

George Ellison.

Two of the Electrical Stands at Birmingham.

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Some of the Exhibits.

A Further Instalment of Illustrated Notes.

Kelvin, Bottomley & Baird, Ltd.

Among the exhibits of this company is the "Fugitometer," a robust and practical apparatus for testing the fastness of dyed and coloured materials to the influence of light under definitely controlled atmospheric conditions. Samples for test are placed in closed swatch boxes arranged symmetrically around a special form of carbon arc lamp of intense actinic power. A humidifying chamber and fan motor built into the apparatus, circulate a constant current of humidified air through the swatch boxes, and the latter are arranged for hinging down so that samples may be inspected during a test without disturbing the humid air circulation. The "K.B.B." fluorescence cabinets shown provide a new and rapid means of analysis of materials by ultra-violet radiation. The light source is a mercury-vapour quartz lamp, the emission from which is filtered through a special glass screen so that invisible ultra-violet rays fall only upon the samples under test. By means of the characteristic fluorescences excited in the samples, defects and adulterations of all kinds are rendered visible to the eye. The method is applied to a vast number of industrial uses. Shadowless operating lamps are shown; in these shadowless illumination is produced by scientifically designed reflecting surfaces, no lenses being employed. The models include a large suspension type for an operating theatre, a wall bracket type, a floor stand type, and a floor stand pattern operated by accumulators as an emergency light. Other exhibits are quartz mercury vapour lamps, the "Econometer" C.O.2 tester, a smoke warning indicator, and the "Pneumercator" distant boiler water gauge.

Hailwood & Ackroyd, Ltd.

This company exhibits illuminating glassware and fittings suitable for lighting the home, offices, hotels, restaurants, theatres, kinemas, workshops, streets, &c. Clear and coloured glassware and the company's new ply glass are the materials shown. Another section is devoted to "Hailuxo" heat-resisting glass, made up in a variety of different ways. This is suitable for any purpose where it will be required to withstand extreme heat or cold. In addition to the glassware, there are exhibited various kinds of metal stampings, pressings and machine parts in brass, aluminium, copper, iron, &c.

T.V.E., Ltd.

This company is exhibiting patent triplex bladed propellor fans, including exhaust fans, slow-speed silent fans, domestic fans (desk and bracket), and an ornamental table fan. A new appliance shown is an automatic tea-making machine. This device (fig. 14) combines an ordinary electric kettle and an ordinary teapot in such a manner that the teapot is placed on a platform above the kettle, in which position it receives the residue of heat while the water is being boiled. By means

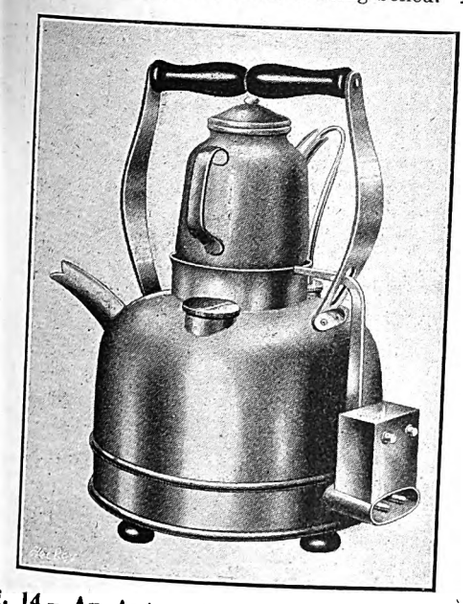

Fig. 14.—An Automatic Tea-making Machine.

of a simple contrivance the spout of the kettle is closed in the act of putting the pot in position, while the spout of the pot is so arranged that it coincides with a small pipe, leading from the body of the kettle, through which the water is transferred immediately after reaching boiling point. Upon the teapot being filled with water, the added weight automatically switches off the current by gravity. When the teapot is not in position the kettle may be used in all respects as an ordinary electric kettle. Axial flow blowers, designed to run at higher speeds than the usual type of centrifugal blowers, form another exhibit. These are designed primarily for ventilation work. They can be inserted directly in the duct and the motors are totally protected within the rotor itself, securing great economy of space.

Charles Joyner & Co.

This firm is introducing a new range of "Angelus" cookers, embodying a number of improvements, the chief of which is a new boiling plate, which is claimed to possess unusual efficiency and durability. This ring is of grey iron alloy, braced to prevent distortion. The walls of the bracing vanes transmit radiant heat from the coil to the surface of the plate and the element coil is carried in insulators of a special refractory material, no cement being used. The coil is easily and quickly replaced. One of the new models shown is the "Perfection"

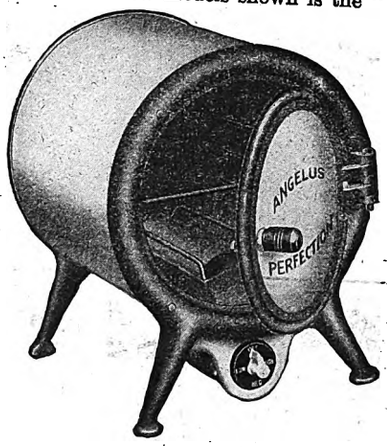

Fig. 15.—The "Angelus Perfection" Cooker.

cooker illustrated in fig. 15. The body is of sheet steel with cast end and door frames and the cylindrical construction is said to facilitate the circulation of the heated air. The oven has a total loading of 700 W controlled by a three-heat switch. The diameter is 12 in. and the length 13 in. The company also displays an "Empire" cooker designed specially to meet the requirements of overseas markets. Immersion heaters form another interesting section of the exhibit; the company has carried out a good deal of research work in this direction. It is stated that the demand for "Angelus" heating and cooking apparatus has necessitated the building of a large factory for its production.

The Gutta Percha Co.

The exhibits of this company (a branch of the Telegraph Construction and Maintenance Co., Ltd.) are divided, broadly, into two classes, namely, magnetic alloys and electrical resistance alloys. Within the first group are the patented alloys, "Mumetal" and "Rhometal." These exhibit remarkably high magnetic permeabilities in very feeble magnetic fields. Another magnetic alloy exhibited is "Radiometal." This has been primarily developed for use in the cores of audio-frequency transformers. It is characterised by high incremental permeability, and its use enables designers to produce transformers which will give a uniform amplification over the whole musical scale. The second group comprises "Pyromic" nickel-chromium resistance alloys. "Pyromic No. 1" is characterised by its great strength at very high temperatures, and its long life at temperatures of the order of 1,100 deg. C. "Pyromic No. 2" is a binary alloy consisting of 80 per cent. nickel and 20 per cent. chromium. The whole of these alloys are prepared in high-frequency induction furnaces. The T.C. & M. Company is a pioneer in this method of melting, and claims to have installed the first plant of this type in Europe. The stand also bears a number of instruments illustrating the uses of the different alloys, *e.g.*, an electric radiator employing "Pyromic" ribbon, and the alloys in the form of stampings, strips, sheets, and castings.

Spauldings, Ltd.

Both in London and Birmingham Messrs. Spauldings are displaying manufactured parts in fibre and "Bakelite." They are the actual manufacturers of both these materials, and supply large quantities of finished parts to the electrical, engineering, and mechanical trades. During the past year they have installed an up-to-date plant for the production of "Bakelite" mouldings of all kinds and in all colours. Messrs. Spauldings have their own tool room, in which they manufacture their moulds.

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Allen-Liversidge, Ltd.

In addition to a display of oxy-acetylene gear, this company is showing electric welding equipment. This includes the "Alda" electric arc welder and three "Pontelec" resistance welding machines, one for spot welding, one for butt, and one for seam. The "Alda" motor-generator set for arc welding is illustrated in fig. 16, and is seen to be a very compact equipment. The welding machines are operated to demonstrate the high speed at which welds can be made. With a spot welder of suitable design, it is possible to weld

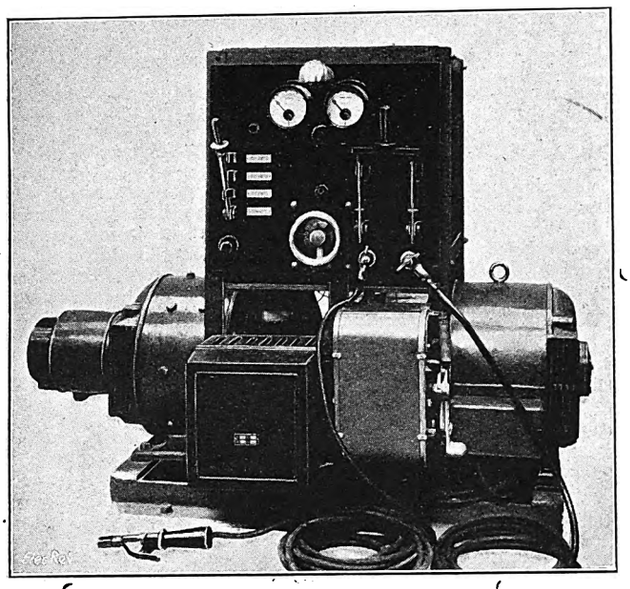

Fig. 16.—The "Alda" Arc-welding Set.

together two sheets of 20 s.w.g. mild steel in half a second at a cost of 1/1,000 of a 1d. where the cost of energy is 1d. per kWh. Another exhibit is the "Pontelec" electric resistance rivet heater. The cleanliness and speed with which rivets can be heated in this machine, and the abolition of burned and wasted rivets which a feature of other methods of heating have contributed to a large extent to the growing popularity of these machines.

Foster Instrument Co.

The main electrical interest in this exhibit is in relation to the measurement and automatic control of temperature. The control actually demonstrated is that applied to electrical fur-

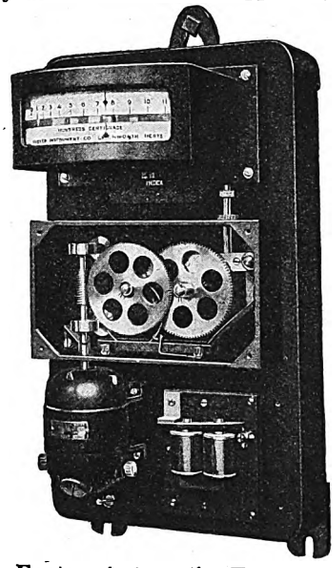

Fig. 17.—Foster Automatic Temperature-control Equipment.

naces. The measuring part of the apparatus is virtually an ordinary indicating electrical pyrometer of the thermo-couple type, the position of the pointer of the indicator determining the consequent operation of the control. This is achieved by periodic depression of the indicator pointer; the moving system in the indicator is able to withstand this constantly-repeated depression without damage owing to its patent "Resilia" spring mounting. The gearbox mechanism, operating the depression is only permissive in its action, the force actually liberated in the indicator is a limited force due to gravity; thus misadjustment cannot result in the liberation of destructively large forces in the indicator. On the periodic depression of the pointer, if the temperature is exactly at the desired figure, nothing happens, but if it is below, the depression closes the primary circuit of a sealed mercury contact relay which in turn switches on the current to the furnace if small or, alternatively, energises the contactor of a large switch if the furnace is large. This position persists until, on some subsequent depression, the pointer is above the desired figure, the depression then resulting in the closing of another relay circuit which cuts off the current from the furnace. Fig. 17 illustrates the indicator and depression mechanism. The control in operation results in a very rapid "see-saw" of temperature about the desired mean, the amplitude being quite small. There is, working with the demonstration set, a high-speed strip recorder which analyses this temperature oscillation. At the same time another recording pyrometer is connected to a thermo-couple stem in a piece of metal in the furnace, to show that the material under treatment in the furnace is not affected by the small oscillations of the control.

Davidson & Co., Ltd.

A very complete range of "Sirocco" fans appears on this stand. Included in this are fans for ventilation, dust removal, and for supplying high-pressure blasts to cupolas, furnaces, and forge fires. Those concerned with corrosive gases will be specially interested in the fan lined with ebonite, which protects the internal metal surfaces from the action of such gases and consequently greatly increases the life of the fan. A most practical and efficient method of grit collection is exemplified by the Davidson patent flue dust collector, of which a working model is to be seen in operation. Over 100 power stations have installed these collectors. A similar collector for dealing with industrial dust can also be seen at work. A very fascinating exhibit is the "Sirocco" aerostat, by which rotating balls are maintained in position in the air.

British Electrical Development Association.

This stand is a general information bureau and office for the South Midland Area. There is a display of literature, posters, &c. The area officer is Mr. H. W. Leamon, 57, Guildhall Buildings, Navigation Street, Birmingham.

Gent & Co., Ltd.

On this stand there are displayed improved mining bells and relays, suitable for working in parallel on bare-wire signalling, and passed by the Home Office, improved tapper keys mining pushes, heavy-duty power pushes, and telephones, all incombustible and flame-proof. Among the indicators and alarms for indicating and recording step by step the rise and fall of liquid level are the new "Tangent" high and low liquid level alarm with diversion relay suitable for a.c. or d.c. circuits, and new models of float switches. Another section is devoted to a.c. and d.c. motor sirens in sizes ranging from 0.1 to 4 h.p., suitable for sound signals, fire alarms, &c.,

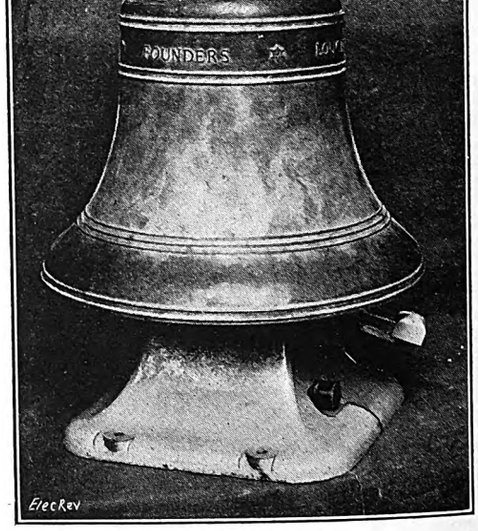

Fig. 18.—A "Tangent" Electric Motor Bell.

for use at mines and in other industries, also for coding signals. We illustrate in fig. 18 a new electric motor bell operated by a 0.1-h.p. motor, suitable for fixing in the open and for use at landing stages, ferries, fire stations, &c. There is also an interesting display of "Pul-syn-etic" electric clocks, clocks in "Bakelite," cast-iron, watertight and wood cases, process-timing clocks, together with "start and cease" sound signals, all controlled by a master transmitter, on the stand. A "waiting-train" turret clock is shown; this is capable of driving four 5-ft. dials. A motor-driven striking apparatus, controlled by a time transmitter through an hourly contact maker, is in operation, counting the hours on a ¾-cwt. bell. The remainder of the stand is devoted to telephones, staff locaters, radio apparatus, idle machine and output recording apparatus, &c.

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Clear Hooters, Ltd.

Several types of electric horns are displayed on this stand, as well as examples of push-buttons for use with them. A special deep-toned model is shown.

Holden & Hunt.

This firm is again showing a representative range of electric resistance welding machines, including spot, butt, wire and chain welders, as well as allied devices. All the machines are being shown in operation. A novelty is a 4-kW bench rivet heater which has been adapted for heating soldering irons (fig. 19). The ordinary commercial soldering iron is used, but is fitted with a stud made from a special alloy, which acts as a heating element. The soldering iron is gripped in the jaws of the rivet heater by this stud, and the heat generated in the stud is absorbed by the copper bit, which rapidly reaches soldering temperature. Under working conditions a normal 1½-lb. iron heats up in 30/60 seconds, giving a minimum of seven minutes soldering and using one kWh for 25 heats. The principal advantages are that the soldering iron rarely requires re-tinning, the copper bit has a long life, the cost of operation is lower than any other method of heating, and the iron is ready for use at a minute's notice. The machine can also be used for heating small rivets.

A large size (25-kW) double-headed rivet heater is shown, The machine is capable of heating 220 ¾-in. by 3-in. rivets per hour. In addition to the "No. 3" and "No. 4" universal spot welders which were shown last year, Messrs. Holden and Hunt are showing a small size of spot welder. This is the "No. 2" size, which is rated at 8 kW, and is capable of welding iron and mild steel up to ⅛ in. added thickness on repetition work or 3/16 in. added thickness occasionally. In these welders the frames are of heavy cast-iron, completely enclosing the high voltage parts, and the levers are of high tensile cast electric steel. During the process of welding all exposed parts can be handled with impunity. An automatic trip switch having a wide range of adjustment is fitted. The heating speed is controlled by means of a four-way regulator, whilst the water-cooled electrodes can be fitted quickly and easily with renewable tips of varying shapes to meet different requirements. The machines are controlled entirely by a foot pedal so that the operators' hands are free to handle the job. The provision of means for fitting special jigs and stakes, and the arrangement of the pedal enabling it to be adjusted forward, backward, or swung in a complete half circle, together with a rise and fall adjustment, make the machines extremely adaptable for handling the most awkwardly shaped articles. A well-designed example of hand-operated butt welding machine is also being shown. This welder is intended primarily for heavy jobbing work, and is capable of welding up to one square inch section. It is rated at 30 kW, and is water-cooled throughout; the "upsetting" pressure is applied by means of a powerful eccentric cam designed to give the pressure in a direct line with the required "upset," and to prevent any twisting or unbalancing force from acting on

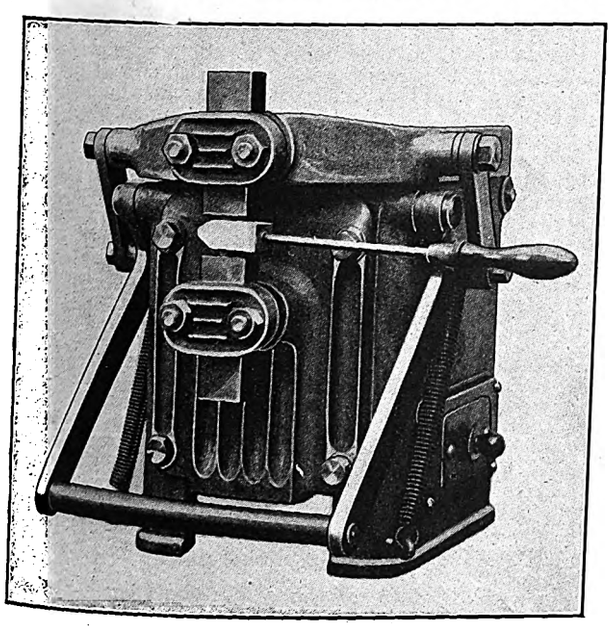

Fig. 19.—An Electric Soldering-iron Heater.

the slide. The switch is foot operated and the heating speed controlled by means of a three-way regulator. The application of butt welding to light engineering work such as joining lengths of wire together, welding nickel pins to steel shanks for sparking plugs, &c., is well illustrated by the "No. 2" size wire welder. The machine, which is rated at 4 kW, is capable of welding iron and steel (mild or high carbon) up to 5/16-in. diameter, brass and similar alloys up to 3/16-in. diameter, and copper up to ⅛-in. diameter. An interesting bench wire welder is also on view. The machine has an aluminium body, and weighs only 30 lb. The electrical capacity is ¼ kW, and it will weld up to ⅛-in. diameter steel, 1/16-in. diameter brass, and 1/32-in. diameter copper.

Bertram Thomas.

This firm concentrates attention upon its "Tiltrack" equipment for stores and similar places. In a factory where the rapid issue of parts is of great importance it is necessary to facilitate the storekeeper's work in every possible way. The

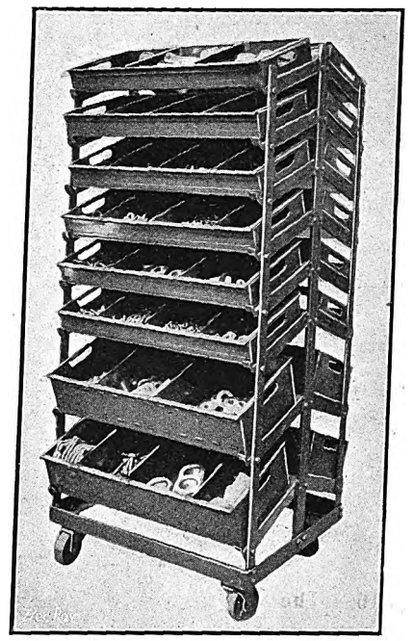

Fig. 20.—"Tiltrack" Storage Trays.

"Tiltrack" storage racks and bins are designed to this end. The system embraces vertical steel standards suitably spaced and braced together by tie bars, and upon rails or arms attached to these standards are stacked steel trays. The arms are slanted downwards to the front, so that the trays are tilted to expose their contents to view. New sections can be added as required without disturbing the existing fittings; and the sections can be re-arranged or regrouped with a minimum of trouble and interference. The trays are of a standard length; certain sizes are listed and stocked, but others can be supplied. By means of removable sliding partitions each tray can be sub-divided into compartments. "Tiltracks" are also made up in truck form mounted on castor wheels, and are useful in the dismantling and assembling of machines, and for erection purposes generally. An example of the equipment is illustrated in fig. 20.

Ransomes, Sims & Jefferies, Ltd.

The exhibits of this company comprise a squirrel-cage induction motor, 415 V, 1½ kW, at 1,420 r.p.m.; a wound rotor induction motor, 220 V, 3-phase, 50 cycles, 15 h.p., 960 r.p.m.; a drip-proof shunt-wound d.c. motor, 460 V, 4 b.h.p., at 1,100 r.p.m.; and a protected type d.c. shunt-wound motor, 230 V, 1½ b.h.p., at 1,200 r.p.m. There is also a selection of lawn mowers, including a 14-in. electric lawn mower which can be supplied for either a.c. or d.c.

Richard Johnson & Nephew, Ltd.

This exhibit consists of products in the form of bars, strips, and wire, in copper, bronze, cadmium-copper, aluminium, and iron and steel. The bars and strips are in the sizes and dimensions usually taken by manufacturers of electrical products and machinery: wire from 0.5 to 0.0124 in. diameter. Amongst non-ferrous exhibits is "Caduro" cadmium copper; the company claims that it was the first in this country to popularise this alloy in the form of wire for power and transmission purposes. "Caduro" trolley wire is said to give approximately three times the life of hard-drawn copper with comparatively little reduction in the conductivity. The zinc coating of the "Crapo" galvanised wire shown is perfectly adhesive under all stresses or mechanical blows. There is a varied selection of sections of all kinds, both in non-ferrous metals and steel. Galvanised steel wires for many purposes form another section.

Omega Lampworks, Ltd.

A full range of "Omega" lamps, all of the pipless type, manufactured under the company's own patented process, are on view on this stand. Details of manufacture are shown by a case containing all parts used in the lamps, and there is an exhibit showing the evolution of the lamp from the raw material to the finished product.

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Berry's Electric (1928), Ltd.

This year some new models of "Magicoal" fires are shown in a distinctive "bungalow," incorporating an improved flame effect which realistically reproduces the fascinating effect of certain gases in combustion which are so often met with in natural bituminous coal. In particular the new flame effect will be introduced into the "Newberry" fires, and the new models of the register of hob type. The latter range of models is a new series designed more particularly for newly-erected houses in which the fireplaces have not actually been completed. The fires are arranged to fit into the side of a wall

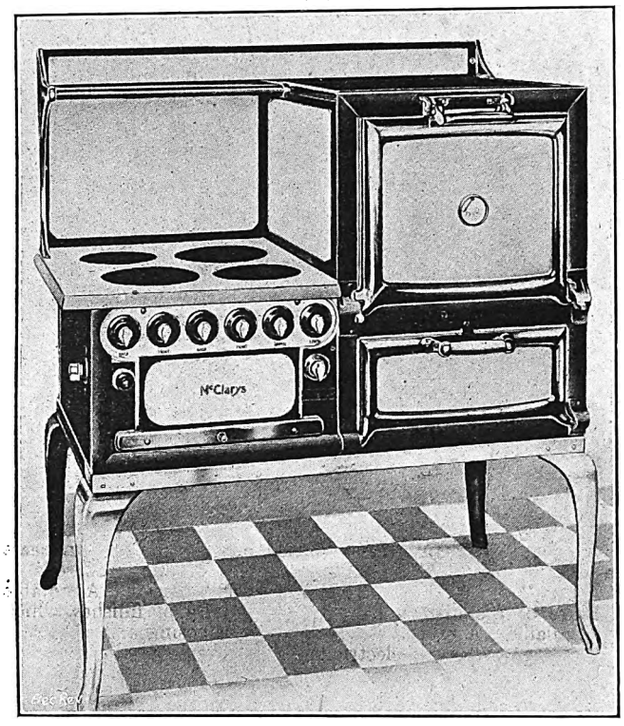

Fig. 21.—A "Berry-McClary" Cooker.

without any special preparation being needed. In addition to the "Magicoal" fires, the company also exhibits new designs of "Berry-McClary" cookers, the chief feature this year is the absence of most nickel-plated parts, which have been superseded by either white or black vitreous enamel. One of these is illustrated in fig. 21. In other sections the company shows signs, day and night type, and ironclad "foolproof" switchgear.

Electrical Power Engineers' Association.

This stand has been appointed more particularly as a rendezvous for members of the Association and their friends. An opportunity is taken to call attention to the activities of the Association, particularly to the characteristics and work of the Technical Group Scheme which the E.P.E.A. has recently instituted. Special facilities are given to certain firms for the display of machinery and apparatus likely to be of interest to members and to electrical engineers generally. An opportunity for the personal examination of the latest technical books connected with electrical engineering is offered at the stand.

Sturtevant Engineering Co., Ltd.

This exhibit comprises a range of the company's vacuum cleaners from a large stationary plant down to the household type. It includes a "No. 10" horizontal-type multi-stage turbo-exhauster, direct coupled to a 10-h.p. electric motor, mounted on a cast-iron base; a "No. 6" portable turbine vacuum cleaner, driven by belt from a 4-h.p. motor, complete with dust separator, the whole mounted on a four-wheeled, rubber-tired, turntable truck, being specially designed for workshop and industrial vacuum cleaning; a "No. 5a" portable turbine vacuum cleaner, driven by a 2-h.p. electric motor, the whole mounted on a four-wheeled truck; a "No. 5" portable turbine cleaner, driven by a ½/¾-h.p. direct connected universal motor for cleaning business and industrial premises; a "No. 4" portable turbine electric vacuum cleaner driven by ⅜/½-h.p. universal motor, for small business premises, kinemas, theatres, hotels, &c.; and a "Croydon" vacuum cleaner of the household type. In addition to the vacuum cleaning equipment, the company exhibits its pneumatic dispatch tube equipment; a plant has been installed and is working throughout the period of the exhibition. These tubes are used for dispatching cash in stores, also for sending messages, papers, and small articles from one place to another. Upwards of 100 British warships have been fitted up with the tubes for the transmission of messages, and they are extensively used by the large railway companies in this country. The latest patented equipment for economising power is shown.

Birmingham Electricity Supply Department.

As usual, the Department has taken a large space in which it demonstrates many applications of electricity. It has a small soap-manufacturing plant, consisting of an electrically-driven mill, plodder, stamper, &c. The electric welding plant shown comprises a butt-welding machine of 50-kVA capacity; a spot welder of 10-kVA capacity; and a 10-kW rivet heater. All this apparatus is of the latest design and embodies a number of improvements. There is also a range of electric furnaces of 23-kW, 11.9-kW, 7.9-kW, and 4-kW capacity for hardening, tempering, enamelling, &c. Other sections are devoted to small electrically-driven portable tools; ultra-violet-ray medical apparatus; and industrial lighting fittings and heating units. In addition, the British Electrical Development Association has taken space for an inquiry bureau covering the electrical industry generally.

W. Canning & Co., Ltd.

The principal exhibit of this company is that dealing with the deposition of chromium, which is now receiving a great deal of attention. The chromium equipment manufactured by the company has been considerably improved and brought up to date since the last Fair, and is being successfully used by a large number of manufacturers. The "Canning" system of warm nickel plating is another feature of interest; the equipment is claimed to give an improved deposit of nickel in a considerably shorter time. There are also examples of large low-voltage electro-plating generators, the manufacture of which is one of the specialities of the company. Other exhibits are automatic polishing lathes; a new design of self-contained electric polishing lathe; a cabinet for lacquer spraying and a full range of lacquers; and a display of electro-plating barrels.

Commutator Grinding Block Co.

The nature of this company's display is evident from its title. Four standard grades of block are shown, adapted to the amount and class of grinding called for. The extra coarse grade is for use where a large amount of cutting has to be done, such as the removal of large flat spots or high ridges. The fine grade is for finishing purposes. The blocks are made to any required shape or size, and several convenient forms of handle can be supplied.

Thor Lamps & Supplies, Ltd.

Many types of colliery lamps are exhibited. The pillarless type shown has, in place of the protecting pillars, a fall-over handle, which carries a sliding reflector. The lamp can be fixed in such a position that the handle is quite clear of the wellglass; consequently the all-round light given is entirely without obstruction. The lamps are shown fitted with various forms of wellglass, including dioptric glass, tinted glass, and a form of "Holophane" glass. The official's type of lamp, which is a bull's-eye lamp giving a powerful beam of light, is particularly useful for the examination of roofs and other places underground. Two types of emergency lamps are shown, namely, the torch and the bull's eye. Both types give a very powerful beam of light and are of small weight. Shaft and roadway lamps of three types are on view, one with adjustable light and two with fixed lights. The cells fitted in all these lamps described above are of the non-spillable variety, filled with "Sollyte" special jelly electrolyte, and they can be supplied with cases of flexible vulcanite, or of celluloid. The company also exhibits a charging stand of the usual type with special features, including a patent resistance cut-out, circuit breakers, in place of fuses, and unbreakable trays. The "Thor" magnet opener, which includes the provision of an automatic switch-on, is shown, and there is a complete range of lamp-room accessories.

Cape Asbestos Co., Ltd.

Among the materials shown by the company are "Pluto" blue asbestos and "Caposite" white mattresses for boilers, turbines, flanges and valves; "Bluejacket" sectional and rope coverings for steam pipes and blocks for boilers; "Capyt," "Plutite" and "Rhodite" jointings; millboard sheets, tubes and joints; blue and white yarns, plaited yarn and proofed packings and tapes; blue and white cloths for mattresses, theatre curtains, filtering and electrolytic work; blue and white fibres; "Amosite" crudes and fibres; and "Amosite" asbestos cloth.

Ringsdorff Carbons (England), Ltd.

A wide variety of carbons for electrical purposes appears on this stand. It includes carbon brushes for stationary motors and generators, &c.; rings for steam turbines; rods for electric welding; plates and rods for electrolytic work; circuit breaker contacts; carbon disks for telephone equipment, &c., all of which are made at the company's Hendon works. There is also an interesting working model of various designs of brush holders, which demonstrates how one design permits the whole surface of the brush to be continuously in contact with the surface of the commutator, while other designs allow the brush to be in contact only at its edges. Another exhibit is an illuminated box sign showing the correct method of measuring brush pressure.

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Chesterton, Jones & Co., Ltd.

This company displays a comprehensive range of electric heating and cooking appliances, electric light fittings and accessories. The "David" electric iron is shown in a variety of weights and finishes, including nickel and vitreous enamel in several colours. The "Davidson" range of "Direct Ray" bowl fires includes a special "model de luxe" with chromium-plated bowl and oxidised silver fittings. There is also a dainty model suitable for the nursery, with a white enamel base and ornamented with figures. A range of "Davidson" reflector and bar-type fires is shown, the models varying from highly-finished designs in keeping with various forms of decoration, to robust heaters suitable for the workshop. Another novelty is a whistling kettle provided with a flat top surface so that a teapot, feeding bottle, or other utensil can be conveniently warmed while the kettle is being boiled. Other apparatus shown includes plate warmers, table kettles, and a bath water heater of the storage type. The last is thermostatically controlled. The standard "Davidson" element used in the tank is particularly robust, and can be easily removed without the tank being emptied. These water-heaters are finished in high grade white enamel. Tubular heaters for window and general warming and a variety of electric light fittings are also displayed.

Tangyes, Ltd.

The largest of this company's exhibits is a 144-b.h.p. heavy fuel oil engine, fixed and running. There are also a 19-b.h.p. fuel oil engine, driving a dynamo for lighting purposes; a 6-b.h.p. engine, driving a vertical triple-ram pump; four "Tan-Gyro" centrifugal pumps of various sizes; several other types of pumps; a horizontal duplex boiler feeder; and a collection of pulley blocks, lifting jacks, &c.

Pritchett & Gold & E.P.S. Co., Ltd.

The exhibit of this company consists of batteries for central stations, house lighting, yachts, automatic telephone exchanges, train lighting, &c. The chief feature is the closed top cells, which were introduced at last year's Fair. These cells are noted for the ease with which the lid may be removed to allow for internal inspection. There is no sealing to be cut away, as the cells are sealed by means of a rubber flange fitted to a wooden lid. These cells can be sent out fully charged complete with acid, and are therefore available for immediate use. A staff of engineers is in attendance to advise on any question relating to batteries.

Electrical Power Engineering Co. (Birmingham), Ltd.

In addition to its standard range of d.c. motors from ⅛ h.p. to 100 h.p., this company shows its epicyclic-geared motor and motor-driven air compressor, polishing and buffing motors, dynamos, &c. A special feature this year is a new range of fractional horse-power interchangeable a.c. and d.c. motors specially designed to meet the demand for this size of motor for driving domestic machinery. The "Warwick" plant is again exhibited, and this year a special model cut completely in half is on view.

Record Electrical Co., Ltd.

A complete range of instruments is exhibited, comprising ammeters, voltmeters, insulation testers, cut-in and cut-out switches for accumulators, and automatic circuit breakers for power circuits. Amongst the instruments worthy of note are the change-coil ammeter, which can be used for testing various loads over a wide range without the use of current transformers or such weighty accessories; and the patent "Cir-scale" pattern instruments for a.c. and d.c. circuits which are well known for the long scale employed. The circuit breakers made by this company have been completely re-designed and many new features have been incorporated.

Birkbys, Ltd.

This company is exhibiting in both the London and Birmingham sections. The principal exhibit is "Elo," a synthetic resin product comprising mouldings, moulding powders, insulating varnish and resin, and in one form or another used largely for electrical work, mechanical engineering, scientifical instrument manufacturing, &c. "Elo" will not soften in heat, it retains its shape and form under all normal and many abnormal conditions, is unaffected by damp, and can be moulded to very fine limits of accuracy. Metal inserts can, when required, be firmly moulded into position during the process of making. The material has a dielectric strength of from 30,000 to 40,000 V a.c. for ⅛ in. thickness. In addition to samples of "Elo" products for electrical work, the company has a large collection of fancy goods in this material

Bakelite, Ltd.

This company has two stands, one in the electrical section and the other in the hardware section. On the former the company exibits a range of "Bakelite" products of particular interest to electrical engineers, including moulding materials, and examples of mouldings produced, sheet, silent gear material, and impregnating varnish for insulation purposes. On the other stand "Bakelite" lacquers, cements and varnishes are on view. "Bakelite" transparent material is also shown.

Boulton & Paul, Ltd.

Among this company's exhibits is an "Electolite" automatic lighting set. This will supply energy for thirty 20-W lamps; at the same time, the engine has 1½ h.p. to spare for driving auxiliary machinery. The engine is provided with automatic lubrication. If lubricating oil runs short the engine will stop automatically and cannot be started until the oil is replenished. A domestic double-acting electric pump which is shown is particularly suitable for country-house requirements, and can be driven from an electric lighting plant. The flood system of lubrication enables the set to be run for long periods without attention. The company also shows a vertical single-cylinder oil engine suitable for driving a generator, water elevators and other plant.

Turner Brothers Asbestos Co., Ltd.

This exhibit is devoted entirely to asbestos products of interest to the electrical and electro-chemical industries. Foremost among these are the well-known "Sindanyo" boards in two forms: the insulating grade, designated "Ebony Sindanyo," and the arc-welding grade, known as "Natural Sindanyo." The former is a non-hygroscopic electrical insulating board, possessing great mechanical strength and many other important properties. An interesting portion of this exhibit is a range of "Ebony Sindanyo" switchboards carrying typical gear, lent by six leading electrical manufacturers, all of whom are extensive users of the material. "Natural Sindanyo" is particularly adapted for arc shields, safety barriers, &c., and possesses exceptionally good mechanical and machining properties. On two large tables at the front of the stand the two grades are shown in a great variety of shapes, illustrating the facility with which these materials may be manipulated. Other products shown include asbestos fibres, tapes, cloths, braided tubings, millboard and paper.

Carron Company.

The stand of this old-established but up-to-date firm bears a display of fires, including examples of the "Carréflex," "Stella," "Cathedral" and "Carcole" series. A notable feature of the display is the wide variety of finishes which is available. A special item is a very imposing and attractive dog grate adapted to electricity. Of its cookers, the company shows its "No. 310F" and "No. 311" types, and also a new pattern just placed on the market which is designed to meet every culinary requirement of the housewife. The company's larger electric cooking apparatus is represented by a handsome double-oven range with hotplate and independent grill, typical of the class of appliances which the company is constantly supplying to hotels, public institutions, ships, &c. A selection of irons also appears.

Davey, Paxman & Co., Ltd.

Two vertical crude-oil engines are exhibited, the smaller being a 50-57 b.h.p. twin-cylinder type, and the larger of 160-184 b.h.p., with 4 cylinders. Both engines are built on the Paxman principle of unit cylinders and ventilated crank cases. The injection of the fuel is on the Blackstone patent "Spring Injection" system, and the design of both engines embodies the Paxman eccentric operated exhaust valve gear. Fig. 22 illustrates the general arrangement of the larger engine. Both engines are shown running under their own power on ordinary

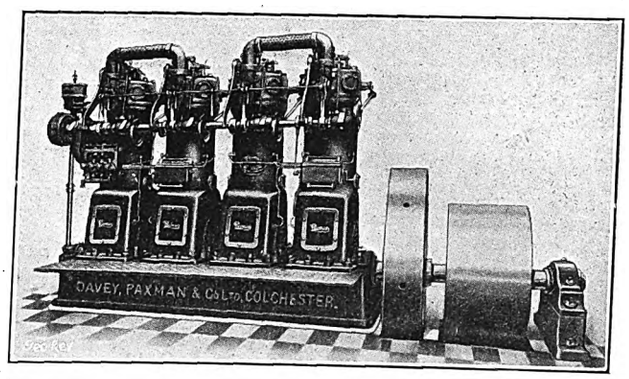

Fig. 22.—A "Davey-Paxman" 160/184-h.p. Engine.

fuel. Separate parts of the engine are exhibited, including a sectional head completely fitted up with valves, and a camshaft, which can be operated by hand to demonstrate its working. Two sizes of the Paxman all-steel sectional boiler are also exhibited. This type of boiler is made of mild steel plates and is built up on the multiple unit system. Each section is self-contained, there being no water joints between them. The front and back sections are water cased, and the gases actually pass three times along the length of the boiler, which has a double return flue, thereby effecting a very considerable economy in fuel. There are no tubes—only straight flat surfaces which can easily be swept right through from the doors at each end. The boilers are made in three patterns.

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British Hanovia Quartz Lamp Co., Ltd.

"Hanovia" quartz lamps are being shown on the stand of the Birmingham Electric Supply Department. These are very efficient sources of ultra-violet light with small energy consumption. The following are shown: The "Alpine Sun" lamp for use in medical consulting rooms, hospitals, &c. The strength of this 550-W lamp is such that a three minutes' exposure at three feet distance, is sufficient to tan the human skin. The "Homesun" lamp can be carried by a doctor on visiting rounds, or installed in the patient's home for private use. Its ultra-violet intensity is about one-third that of the "Alpine Sun" lamp; it takes 220 watts. Dark ultra-violet rays (when all visible light is filtered out) constitute an exceedingly delicate means of chemical analysis. Most substances, when examined in these rays, show a fluorescence which is characteristic for each particular specimen. Thus a counterfeit banknote, however well forged, would always give a different fluorescence from a real note owing to the different composition of its paper. The "Hanovia" analytic quartz lamp is designed for such tests, and has been adopted by chemists and workers in practically every branch of science and industry.

J. H. Holmes & Co., Ltd.

The principal exhibit upon this stand is a d.c. motor of a construction which enables it to be easily adapted, without any essential change in the framework, for use as an enclosed-ventilated, a pipe-ventilated, or a drip-proof machine. The company is also showing a 14-h.p., 770-r.p.m., 440-V, totally-enclosed, squirrel-cage motor. This type of motor is particularly suitable for service in situations requiring complete enclosure of the windings and working parts together with efficient ventilation. Cooling is effected by means of an external fan which draws air over the outside of the machine proper, and

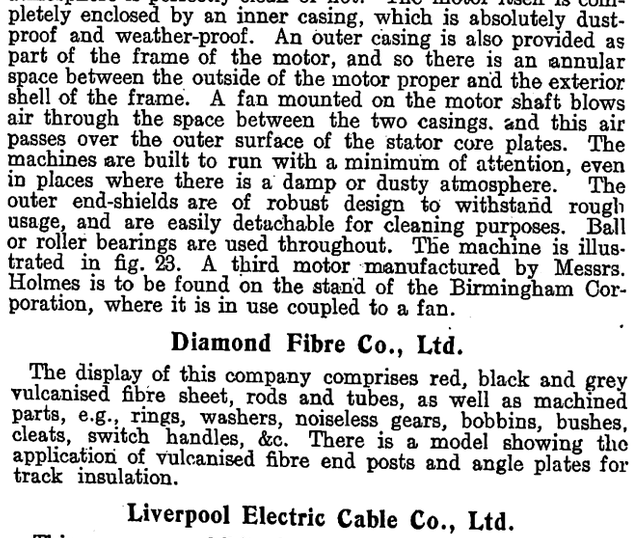

Fig. 23.—A "Holmes" Totally-enclosed Fan-ventilated Motor.

not into it; it is therefore immaterial whether the surrounding atmosphere is perfectly clean or not. The motor itself is completely enclosed by an inner casing, which is absolutely dust-proof and weather-proof. An outer casing is also provided as part of the frame of the motor, and so there is an annular space between the outside of the motor proper and the exterior shell of the frame. A fan mounted on the motor shaft blows air through the space between the two casings, and this air passes over the outer surface of the stator core plates. The machines are built to run with a minimum of attention, even in places where there is a damp or dusty atmosphere. The outer end-shields are of robust design to withstand rough usage, and are easily detachable for cleaning purposes. Ball or roller bearings are used throughout. The machine is illustrated in fig. 23. A third motor manufactured by Messrs. Holmes is to be found on the stand of the Birmingham Corporation, where it is in use coupled to a fan.

Diamond Fibre Co., Ltd.

The display of this company comprises red, black and grey vulcanised fibre sheet, rods and tubes, as well as machined parts, e.g., rings, washers, noiseless gears, bobbins, bushes, cleats, switch handles, &c. There is a model showing the application of vulcanised fibre end posts and angle plates for track insulation.

Liverpool Electric Cable Co., Ltd.

This company exhibits in connection with its associated company, the London Electric Wire Co. & Smiths, Ltd. The "Liverpool Cables" exhibit is divided into three main sections:—Paper-insulated mains cables, of which a full range of samples of various types for the transmission of electric power up to and including 11,000 volts working pressure is exhibited; representative types of pure and vulcanised india-rubber insulated wires, cables, and flexibles; and "Lecite" v.i.r. cables, and the "Lecite" wiring system.

London Electric Wire Co. & Smiths, Ltd.

A comprehensive exhibit of insulated wires is shown by this company. In addition to the usual types of covering such as cotton, silk, &c., there are examples of wires covered with "Lewbestos," which is capable of withstanding high temperatures. The special types of wires include aerial cables and resistance wires. The company also exhibits its "Lewcos" radio products, including centre-tapped coils and other coils of many types; "Glazite" coloured connecting wire, "Lewcoflex," wave traps, h.f. chokes and potentiometers.

Revo Electric Co., Ltd.

A complete range of domestic cookers, from the small "Breakfast" cooker to the large "Maxima" (suitable for families of up to 10 persons), is shown by this company. All embody the latest features in design, including all vitreous enamel interior, exterior panels, hob, switch indication plate, oven door and hot cupboard door panels, &c. An entirely new and effective door catch is a special feature, together with an adequate porcelain enamelled drain plate below the hob. The "Colonial" cooker, of special interest to the overseas buyer, has been designed specifically to compete with American cookers in Empire markets. Fitted with top and bottom heat to the oven, which has a drop door, it breaks away from the conventional design of English cookers. Grilling is effected by the use of the top oven element. All sheet metal portions are porcelain enamelled, as is the cooker hob. Totally enclosed, high efficiency boiling plates are fitted. The fires shown all incorporate the "Emitter" fire-bar. Two- and three-pint kettles, in copper and nickel finish, are exhibited, and the automatic switch device, introduced some 18 months ago, is a particular feature of the display. This switch cuts off the current when the kettle boils dry, and may be reset by the simple operation of a bush button. There is also a range of "Revo" irons, in a new finish.

Water heaters in white cellulose and nickel finishes are on view. Controlled in the usual manner by a mercury-break thermostat, their special feature is the facility provided for cleaning. The water inlet, outlet, element, thermostat, and drain plug are formed into a unit, which, by the removal of six screws, can be removed completely from the heavy gauge copper water chamber. The heaters are made in four sizes, *i.e.*, 1¾, 6½, 11 and 22 gal. Examples of standard and "De Luxe" wash boilers, as supplied to numerous supply authorities, are shown. Tubular immersion heaters are employed, giving a high degree of efficiency.

The hotel and restaurant apparatus exhibited includes a "Café" oven, a large griller, and a fish fryer. All sheet metal portions are vitreous enamelled, as also are the cast hobs. In the case of the griller all the cast portions are also porcelain enamelled. A double-oven range, suitable for small hotels and boarding houses, is an exhibit of interest, being the latest addition to the "Revo" range of cooking appliances. In addition to the foregoing there is a comprehensive range of lanterns, &c., together with bulkhead lights, garage handlamps, and industrial reflectors; examples of ceiling, wall, exhaust and desk fans; ironclad switch- and fuse-gear for domestic and industrial applications; and the newest designs of "Revo" cone and cabinet loud speakers.

Gregson Manufacturing Co., Ltd.

This company is a specialist in the manufacture of wood electric light fittings, and it shows a complete range of hall lanterns, lounge, dining and drawing room pendants, electroliers and candelabras, table and floor standards, wall brackets and wall candle fittings, desk and reading lamps. These fittings are made principally in oak, mahogany and walnut, to match any form of decoration or furnishing scheme. The company also manufactures silk and parchment lamp shades for use in conjunction with its table and floor standards, and some new and unique designs are shown for the first time. The exhibit includes several examples of wood fittings, suitable for public buildings, churches, kinemas, cafés, &c., and in view of the change that is taking place in the design of modern lighting fittings, the latest examples of the company's craftsmanship will be appreciated alike by lighting engineers who look for efficiency and by artists who desire effect with utility.

Reavell & Co., Ltd.

Many examples of compressors are displayed on this stand. Among them is a vertical two-stage double-acting machine, with an intercooler, designed for pressures up to 120 lb. per sq. in. Five one- and two-cylinder vertical single-acting models are also shown covering a range of pressures up to 100 lb. per sq. in. They are all fitted with automatic lubrication; the two smallest are air cooled, and the others are water jacketed. Three examples of rolling drum type rotary compressors shown include one in operation, driven by an electric motor and supplying air to a "Reavell-Askania" regulator. The latter provides a means of obtaining very fine control of the flow and temperature of gases, and is employed principally in gasworks, coke-oven plants, &c. One of the rolling drum compressors is shown in section, enabling the operation of the machine to be studied. Among the other exhibits is a garage compressor, an electrically-driven set for tire inflation and other garage purposes. There is also a "sub-station" set, on similar lines, designed for cleaning electrical machinery. Pneumatic tools are also displayed.

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Electricity Measurement.

Notes on recent developments in supply meters, with particular reference to those designed for special purposes.

By J. L. CARR, B.Sc., A.M.I.E.E.

(*Abstract of a paper read before the* METER SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper describes some of the detailed improvements which have been made in ordinary supply meters, and some of the methods which have been adopted for meeting special conditions. Practically all types of meters depend, for permanency of calibration, upon the performance of so-called permanent magnets, and a more complete understanding of the principles underlying the design of these should result in improvement all round. As the result of extended researches, there are now availabie much better magnetic alloys than formerly; with one or two exceptions, however, it would appear that little attempt has been made to utilise the exceptional qualities of cobalt steel, presumably on the score of cost. In a number of cases, electro-plating or calorising of magnets has been resorted to, in order to eliminate any trouble due to the scaling of paint or enamel after prolonged exposure to service conditions. Where recourse is had to magnetic shields, it has been shown by Melsom and Eastland* that the characteristics of the material employed are of importance, and that it should be as soft and highly permeable as possible. Wrought-iron and good-quality transformer iron give the best results. From records relating to large polyphase meters extending over a number of years, it appears that bearing troubles account for about 35 per cent. of the cases of faulty registration. For maintenance of low-load accuracy, unless a high torque is adopted, with increased loss, it is necessary to reduce the friction to a small amount and, more essential still, to ensure as far as possible that it remains constant in magnitude. Recently, the adoption by one manufacturer in this country of a bottom bearing consisting of a hardened steel ball between cupped jewels, with a view to providing greater reliability, has been indicated.

No considerable advance appears to have been made in the design of the commutator meter, and the only types examined in recent years display the same shortcomings as earlier models, in respect of poor low-load characteristics, lack of insulation, and so on. One of the leading Continental manufacturers maintains that the addition of a friction compensator is undesirable on account of increase in price, decrease in reliability, and addition to the cost of maintenance.

The position of the mercury-motor ampere-hour meter for use on small d.c. services has been consolidated, and it is interesting to note that in the case of the two principal British meters of this type the form has altered little during the past 20 years. Whereas in one of these meters continued use is made of an enamelled armature, in the other an amalgamated rotor has been definitely adopted, as is also the case in other types of mercury-motor meters recently introduced. Shunting also enables the size of rotor to be standardised for a range of capacities in the larger sizes, and this permits of reduced gaps in the magnetic circuits compared with those previously used. An attempt has been made in the newer meters to obtain increased torque by arranging that the magnetic flux crosses the armature twice. In one make this is achieved by providing two driving magnets, whereas in another type the same result is obtained by using a shallow bell armature pivoted about the centre of a short bar magnet of cobalt steel, an annular iron ring providing the magnetic return and the wall of the mercury chamber.

As regards mercury-motor meters, two types recently introduced in this country utilise amalgamated amatures. In one of American origin low-load compensation is obtained by means of a thermo-couple heated by a coil in series with the pressure circuit; in the other, the insulation of the shunt circuit is materially better than that in earlier models, and the power taken by the shunt magnet has been reduced by improved design, with consequent reduced heating. This is of importance in a meter of this type, on account of the comparatively high temperature coefficient. The effects of stray fields upon these meters are very much less than in the non-astatic rotating dynamometer form.

In no branch of metering work is greater competition evinced than in the single-phase metering field, and this is probably responsible for the present state of relative perfection. The torque developed in an induction meter depends, firstly, upon the intensity of the magnetic field, and, secondly, upon the value of the eddy currents produced in the rotor; with regard to the latter point, the use of thin aluminium disks is standard, and although variations in thickness affect these currents, the aim is generally to make the rotor as light as is consistent with rigidity. For a given shunt current, considerable increase in the flux is attained by reducing the magnetic reluctance of the element, and this is usually arrived at by reducing the gaps in the circuit and by better magnetic connection between the shunt and series magnets. By improving the magnetic conditions it has been possible in several makes of meters to reduce the consumption of energy in the shunt circuit from between 1 and 1.5 watts to approximately 0.5 watts, whilst at the same time slightly improving the torque. It has been shown that still further reduction in consumption, whilst retaining the same torque, is possible by practically eliminating all friction of the upper bearing, the armature in this case being dished so as to throw the centre of gravity below the bottom pivot, a non-magnetic spindle being provided.† During recent years there has been a movement to popularise a meter capable of carrying an overload of 100 per cent. continuously without impaired accuracy, and tests carried out on such a meter have given results above one-tenth of full load very similar to those obtained from a standard type of double the rating. It would appear that the overload meter has gained popularity in the United States and Canada, because of the rapidity with which the load increases in residential areas. All properly-designed electrical apparatus possesses a reasonable overload capacity sufficient to enable it to deal with abnormal circumstances of a temporary character. The practice of permanently running a meter above its rating is not, in the author's opinion, to be recommended, and trouble will sooner or later be experienced through other meters of the same rating, but not designed for the purpose, being over-run.

With the development of distribution for all purposes from alternating-current sub-stations on the 3-phase, 4-wire system, the use of 4-wire meters has increased, and the employment of the 3-wire meter is principally confined to high-pressure supplies. Two distinct types of meter are commonly utilised for this purpose, *viz.*, the two-element type with three current transformers, in which a system of superimposed secondary currents is employed, and the three-element type. The latter type, in the experience of the author, is much more difficult of calibration and is more prone to interaction effects.

In the polyphase meter developed by Mr. E. Fawssett, an attempt has been made to overcome or compensate the several variables in the commercial meter, so as to provide an appliance capable of a high degree of accuracy under all ordinary operating conditions, with a view to avoiding troublesome corrections in such cases as turbo-alternator efficiency trials.

The windings of this meter are arranged for a high torque, and the effects of temperature upon the power-factor adjustment are minimised by the employment of a quadrature loop of manganin. Two brake magnets are provided, one being mounted upon a bracket formed of a short, stiff bi-metallic loop of invar and brass, of such dimensions that accurate compensation is given for variations of temperature. The rotor is mounted upon a hollow spindle carried upon a spring-seated sapphire cup jewel; and the braking magnets, of ample proportions, are screened from the electromagnetic system. The result is that a remarkably flat curve is obtained, and a variation in pressure of 20 per cent. either way produces practically no effect upon the registration curve. It is further claimed that the effect of a 25 per cent. variation in frequency is negligible, and that the temperature coefficient is less than 0.025 per cent. per degree C.

The universal adoption of the principle of making the consumer pay higher charges as his power factor falls has been responsible for the development of a number of new instruments; various methods have been utilised and suggested, the principal arrangements being described in the paper. It is generally acknowledged that, as the capacity of plant installed. of cables, and of other apparatus is governed by the load taken expressed as kilovolt-amperes, a charge based upon the kVA demand would be equitable; and, further, a true kVA-hour meter provided with a demand-indicator attachment would enable the correct maximum demand to be ascertained without difficulty. Many and varied have been the attempts to produce such an instrument. It was early indicated in the classic paper of Ratcliff and Moore on "Electricity Meters,"† that, by suitably compensating the shunt element of an induction meter, a means for determining the consumption in kVA-hours over a limited range of power factor could be provided, and this has been extensively adopted in recent years. The

* "The Behaviour of Direct-Current Watt-hour Meters," *Journal I.E.E.*, 1912, vol. 49, p. 465.

† M. R. Fichter: *Revue Générale de l'Electricité*, 1924, vol. 15, p. 62.

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method consists of arranging that the shunt flux lags by more than 90 deg. behind the shunt pressure in the case of lagging power factors, so that the maximum registration of the meter is obtained with a load of power factor cos ϕ, where ϕ is the angle by which the difference in phase of the flux and pressure exceeds 90 deg. Within limits, this over-compensation may be obtained by the use of abnormally thick quadrature loops upon the shunt pole.

Recently there has been developed an electro-magnetic type of kVA meter which is, in effect, an induction ammeter with the control spring removed, so that the armature rotates continuously under load, the motion being transmitted from the vertical spindle to a demand indicator train. In the 3-phase instrument three elements react upon the spindle, the motion of which is transmitted through a suitable train to a spring-controlled wheel which is reset at regular intervals by the operation of a time switch. This wheel transmits its forward motion to a pointer which moves over a scale graduated in kVA. The registration under steady conditions of load is therefore the arithmetic sum of the kVA demand on each phase. Since the scale is non-linear, the registration under variable load will apparently depend upon the load characteristics. Because of this non-linear scale, an integrating dial is not provided.

The meter is so arranged that at normal voltage the registration is in kVA; by means of a shunt-controlled electro-magnetic device the torque is increased or decreased as the pressure varies, so as to provide compensation over a limited range of voltage fluctuation.

It is the considered opinion of the author that the employment of any type of metering apparatus which involves the use of arbitrary quantities is to be deprecated, and that only those instruments which measure with reasonable accuracy some definite and recognised quantity are to be recommended for use. Any gear which does not come within this category is extremely liable to arouse suspicion and distrust on the part of consumers, and it would probably prove a somewhat difficult matter to explain fully their use in the event of litigation being resorted to. In this connection it may be stated that a meter which registers continuously in kWh at times of no load is incorrectly arranged, and cannot, in the author's opinion, be justified. It may be further remarked that any apparatus which depends for its correct functioning upon, for example, the power factor of the consumer being kept within small limits, is to be regarded as unsuitable for extended use, and, in justification of this contention, the case of a kVA-hour meter which actually recorded less than the energy meter connected in series with it may be cited.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Small Generating Set.

The "Homelite" power plant, fig. 1, is a small electric generating unit, lately produced by GAR WOOD MOTOR BOATS, LTD., 12, Regent Street, Pall Mall, S.W.1, comprising a single-cylinder two-stroke 1½-h.p. engine and a 600-W. dynamo.

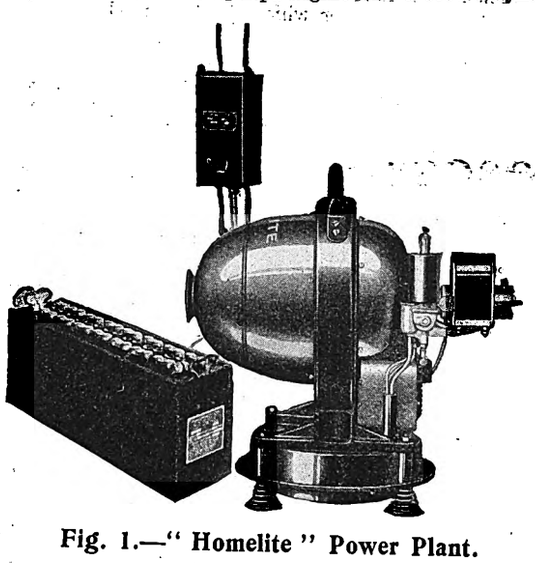

Fig. 1.—"Homelite" Power Plant.

It is of unique design and construction, it is claimed, and has only six moving parts. The engine is air-cooled, having a fan incorporated in the flywheel, which also serves for the dynamo. The set is made in two types, for 32 or 100 volts, for supplying directly or with batteries. The outfit weighs only 110 lb., and, it is claimed, is absolutely self-contained, silent, vibrationless, simple to operate, and very efficient. The "Homelite" is also suitable for use in garages and workshops for supplying small portable electric tools—drills, saws, and so on. The dimensions of the set are 21 in. long, 21 in. high, and 14 in. wide.

New Vacuum Fuses.

Among various new devices recently perfected in the research laboratory of the GENERAL ELECTRIC CO. of America are two new types of vacuum fuses. The first is a d.c. fuse rated at 10 A, 15,000 volts, which will rupture a current of 45 A at that voltage. It consists of a highly-evacuated glass tube containing a tungsten filament which is burned out by excessive current. As soon as the burn-out occurs the circuit is opened. The second fuse is of the vacuum type for the protection of instrument transformers, and has a rating of ½ A at 13,200 volts. The current on short circuit is limited by a series resistance to 110 A, which current can easily be ruptured by the fuse. Like the d.c. fuse, this device is entirely enclosed, so that there is no danger of a discharge being communicated to surrounding apparatus. It opens without a surge at the zero point of the current wave, and can be depended upon equally, it is claimed, in the case of an overload which barely exceeds the capacity of the fuse, and in the case of a short circuit, during which the current reaches the maximum which is fixed by the series resistance.

A New Welding Machine.

A mobile electric welding machine, fig. 2, which is under construction by ALLOY WELDING PROCESSES, LTD., 14-16, Church Street, Islington, N.1, for the Bengal and Nagpur Railway, will embody, it is claimed, some new features. It is to be fitted with the A.W.P. latest B.P. type dynamos, which are self-stabilising, drooping-characteristic machines giving the arc voltage at their terminals. The special features of the generator are that no separate series resistances, reactors, or transformers are required, and that separate excitation is unnecessary. A substantial steel cover with wide removable inspection doors at the sides, protecting doors to the switchboard, a recessed control panel and flush-mounted switchgear are points of the scheme to afford the maximum possible protection under adverse weather conditions. Such refinements as laminated springs, wide steel wheels, roller bearings and swivelling forecarriage are other features that will be appreciated by those who have to handle such equipment outside

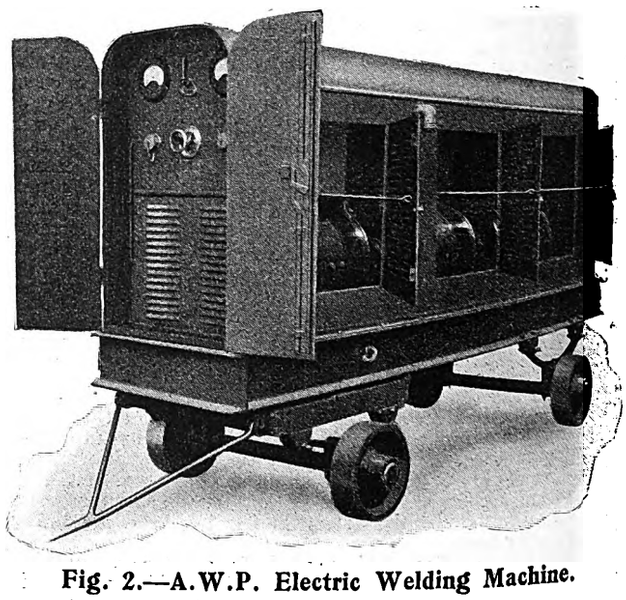

Fig. 2.—A.W.P. Electric Welding Machine.

the workshop. The dynamo, which had to be liberally rated and specially insulated, has been through a severe series of trials successfully.

New Lighting Fittings.

The "Efesca" reading lamp, fig. 3, a recent production of Messrs. FALK, STADELMANN & CO., LTD., 83 to 93, Farringdon Road, E.C.1, is designed, it is claimed, so that the ordinary

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gasfilled lamp is used in the correct, the best, and the safest position for light diffusion and length of life. The fitting has a carefully proportioned green cased opal parabolic reflector. Three adjustments are provided, securing, it is claimed, maximum flexibility, so that at whatever angle the rays may be projected they are screened from direct contact with the eye.

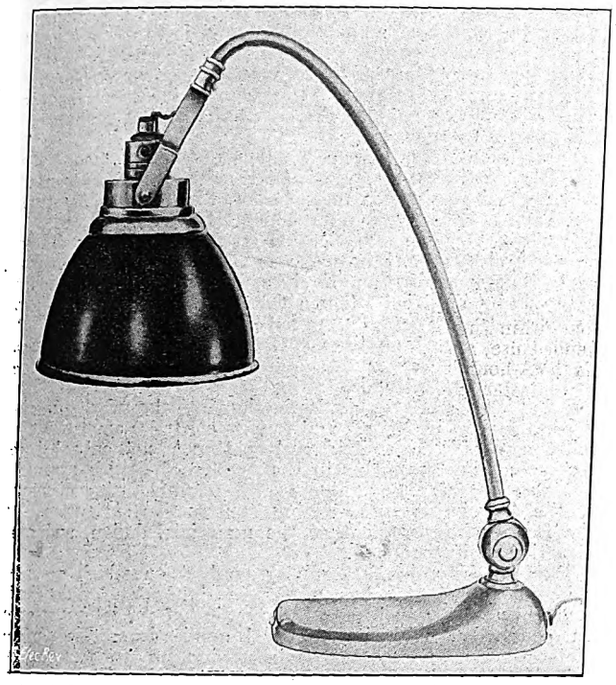
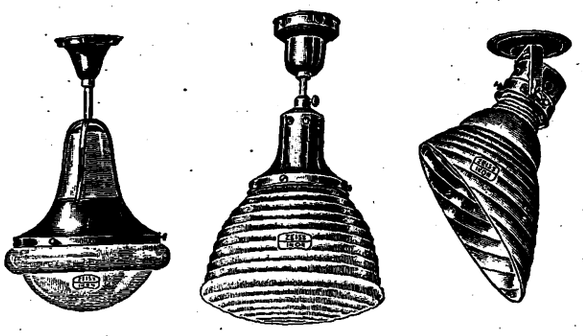


Fig. 3.—"Efesca" Reading Lamp.

Illuminating engineers will probably be interested in the Zeiss reflector fittings which are being marketed in the British Isles by Messrs. Carl Zeiss (London), Ltd., Winsley House, Wells Street, Oxford Street, W.1. There is a large and comprehensive range of these fittings, but the feature common to all is the specially designed silvered-glass reflector. There are two main types of reflectors used, namely, the parabolic and the bell type. The former is designed to give a concentration of light in one direction, and the latter a more widely spread illumination. Three typical examples of the Zeiss reflector fittings are illustrated. The first, fig. 4, model G.41, is of the parabolic type and is provided with a frosted glass cup at the top which gives sufficient illumination on the ceiling. This fitting has a frosted bowl underneath, and is suitable for interior illumination of showrooms and offices. Fig. 5 shows the bell-type reflector applied to a fitting suitable for indoor lighting, and fig. 6 depicts a modification of the bell reflector applied to the illumination of shop windows. In the last mentioned fitting frosted bulbs are used, and the light is projected in the required direction without being wasted by being allowed to illuminate the pavement outside the shop. With a 75-W lamp the intensity in the principal direction of the beam would be, it is claimed, over 2,000 c.p. Flood-light projectors embodying both kinds of reflector are available for lamps of 300 to 1,000 W, and these lamps give a correspondingly high efficiency combined with an even illumination of the hoardings or buildings for which they are used.



Figs. 4, 5 and 6.—Selected Zeiss Reflector Fittings.

Industrial Research.

Extracts from the Report of the Department of Scientific and Industrial Research for 1927-28.

The thirteenth annual report* of the Government Department of Scientific and Industrial Research for the period August 1st, 1927, to July 31st, 1928, indicates that the total net expenditure from the Vote was £438,817, and that from the Imperial Trust was £67,593, or £6,858 less than during the preceding year. The radio organisation spent £15,372. For 1928-29 the estimate amounts to £446,220.

Grants.—The grant to the Royal Institution for the general assistance of the work carried out by Sir William Bragg and his collaborators on the X-ray examination of materials was continued; all this work has a value quite apart from its scientific interest, and the use of X-rays for the attack of industrial problems of more direct interest is rapidly spreading. At the Cavendish Laboratory, Cambridge, Dr. Kapitza and his collaborators continued their investigations on magnetic phenomena, and published important papers on the electrical properties of various forms of bismuth crystals in strong magnetic fields. It may well be that our meagre comprehension of magnetic phenomena is attributable largely to the lack of any method of producing magnetic fields strong enough to affect the properties of most materials by more than an insignificant amount. This difficulty was removed by Dr. Kapitza, who developed apparatus capable of producing under accurately controlled conditions magnetic fields ten times as intense as those which had been produced hitherto by the strongest electromagnets. A general exploration of the effects of such fields on the electrical resistance of a large number of elements revealed unexpected results, and the extension of the experiments will certainly yield information of fundamental importance. It was considered to be in the national interest that these experiments should continue unhampered by lack of funds, and a grant not exceeding £2,500 a year will be made to the Cavendish Laboratory for a period of five years.

During the year the 19 Research Associations receiving grant aid from the Department submitted a memorial praying for the continuance of financial assistance for a period of 10 years, on the basis of annual grants equivalent to the annual subscriptions of members of the Associations; in effect, they desired a reversion to the policy adopted when they were first set up under the ægis of the Department, but it was unable to recommend the acceptance of the proposals.

Some of the Associations gave much thought to the practicability of substituting for voluntary contributions some equitable form of levy on the industries they serve. The Electrical Research Association had under consideration other methods for securing more general and more permanent financial support from the industries it serves, but the early fruition of such schemes cannot be hoped for and State aid during the intervening period can be justified on grounds which are quite distinct from the general grounds on which grants were originally given, and based on experience rather than on hope.

Under the scheme of grants to individual research workers and students-in-training, 380 applications were considered, and 185 awards made on the recommendation of the Advisory Council, at a cost of £22,500.

Patents.—During the year 18 applications for British patents were made, together with foreign and Colonial counterparts in suitable cases. Eleven British and foreign patents were abandoned, or allowed to lapse. The new applications relate to methods of treating coal, including low-temperature carbonisation, to improvements in radio-telegraph direction-finding apparatus, etc., and licences were granted in connection with colouring aluminium and its protection from corrosion.

Metal Alloys.—The use of new alloys has facilitated advances in engineering in many directions; it has made possible the improvement of the efficiency of power generating plant; and alloys are used largely for such purposes as electrical heating. There is no reason to believe that the industrial successes so far obtained, striking as they are, indicate anything more than the opening up of a fresh field of industrial development. There is little knowledge of those ultimate properties of alloys and metals on which strength at high temperatures depends, and much work has already been carried out at the National Physical Laboratory in the hope of throwing light on this fundamental question; these investigations are of such wide importance that they should be continued, and it was recommended that if any co-operative scheme was put forward by industry with the object of making

* Cmd. 3258, H.M. Stationery Office, 4s. net.

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comprehensive search for new and improved alloys, the Department should contribute half the cost.

Work Done.—Regarding the summary review of the work carried out by the various research organisations of the Department, an account of the activities of the National Physical Laboratory was contained in the latter's annual report.* Similarly the reports of the Fuel Research Board and of the Director of Fuel Research have been published; public interest in low-temperature carbonisation tends to obscure the other activities of the F.R. Board, which aims at ascertaining in detail the main characteristics of all the important coal seams, so as to indicate the most suitable means of utilising them, and special attention was being devoted to the use of poor-quality coals.

A report on the thermal and electrical conductivities of some aluminium alloys and bronzes was published. The Radio Research Board was very active, and published a number of papers. Investigations of illumination in industry continued, with good results.

Electrodeposition.—Investigations were continued under the supervision of a committee of the Department containing representatives of industrial interests, and very satisfactory progress was made at Woolwich with the investigation into the causes and prevention of pitting in electrodeposited metal. The arrangements for co-operation between the Research Department, Woolwich, and the British Non-Ferrous Metals Research Association were successfully put into force, and reports upon hardness of electrodeposited nickel and common defects in nickel deposits have been published. The work undertaken at the Royal Aircraft Establishment upon the deposition of zinc on aluminium as a protection against corrosion was continued throughout the year, and experiments were also made with steel, brass, and copper as basic materials. The investigations at Sheffield mainly dealt with the production of nickel deposits with less internal stress than is usually present; the effect of alternating current superposed on direct current was studied in detail and also the influence of deposits under various conditions of stress on the fatigue strength of steel test pieces.

B.E.A.I.R.A.—The work of the British Electrical and Allied Industries Research Association covered a wide range of problems of importance both to the manufacturer and the user of electrical plant. A number of programmes had to be curtailed, or suspended, for lack of the necessary funds. To reduce the national expenditure on insulation failures, estimated at £1,000,000 per annum, efforts were made to put the basis of purchase of insulating materials on at least as sure a footing as that of metals, and to obtain an all-round improvement in quality. Most of the work of classification and definition of materials, properties, and uses was completed, a large body of data built up, new methods of study developed, and marked improvements in many British products already made, the results obtained being used by members to great advantage in the development and selection of new and improved insulating materials. Further advances were made in methods of measurement, and in the preparation of purchasing specifications which had been adopted by the British Engineering Standards Association as the basis of standard specifications. Considerable attention was paid to the study of the fundamental nature of dielectrics, important theoretical studies were undertaken, and hypotheses successfully verified by experiment.

A standard insulating oils specification was revised, better products being available as a result of the work done. The Association's researches were of material assistance in the development and introduction of new methods of purifying insulating oils. The annual value of benefits derived by the industry was estimated to exceed £100,000.

Tables were published for the safe loading of all British standard cables for power and lighting, a simplified method of calculating the heating of cables laid in groups was developed, and good progress made in the study of the heating of cables grouped in ducts and exposed on racks, whilst attention was also given to the heating of cables buried at considerable depths, to effects of thermal capacity of the soil, and to the methods of measuring thermal resistivity *in situ*. Tests were carried out on overhead conductors, poles, pole and tower foundations, wind pressures on conductors, poles and towers, to provide data for the safe construction of the overhead lines in order to comply with the regulations of the Electricity Commissioners. The work done on stresses on pole foundations showed promise of providing a reliable scientific basis for design.

An extensive research into the characteristics of oil switches and circuit breakers led to important additions to knowledge covering the many factors causing variation in performance. Tests made on individual commercial designs of circuit breakers under control conditions proved of value to manufacturers, pointing the way to material improvements and showing unexpected results in the comparison of different models. New methods of circuit breaking are under development, and several important patents have been secured. A series of tests carried out on fusible cut-outs provided data for the revision of the British Standard Specification and for improved designs.

The Association co-operated with the Institution of Mechanical Engineers in researches on the properties of turbine nozzles, and it was calculated that the work already represented a gain in efficiency of the order of 3 per cent., showing a saving of about £6,000 per annum in the running of a 100,000-kVA super power station. Important information was obtained on the properties of steam at high temperatures, and on the laws of heat transference in steam condensers.

Instruments.—Among the results of the work done by the British Scientific Instrument Research Association the following may be mentioned: zinc sulphides giving various colours for use in luminous paints, and a zinc silicate sensitive to slow moving electrons for use in cathode-ray oscillographs, were produced, superior to those hitherto available, and the use of the zinc silicate enabled the sensitivity of the oscillograph to be markedly increased.

The distribution of the permanent magnetism among the materials forming the elements of a galvanometer suspended system was investigated; methods of treating such systems were applied industrially with beneficial results.

As a result of the investigation on the causes of a diffuse focus in X-ray tubes, a process was successfully applied industrially in the production of sharp-focus tubes. The quality of the X-rays emitted when a tube is excited by generators giving different types of "wave-form" was investigated. A generator designed on lines suggested by this research was installed in the Cancer Research Department of one of the leading London hospitals.

A prolonged analytical investigation into the relative merits of certain types of British and foreign electrical ammeters and voltmeters of the switchboard pattern† not only led to reassuring conclusions as to the quality of British products, but was also of direct value to the manufacturing members of the Association in providing constructive suggestions for the further improvement of the materials, design, and construction of instruments.

Rubber.—Ebonite is a rubber product on which accurate scientific information has, until recently, been very deficient, and the need for such data is becoming of special importance in connection with its electrical applications. Its surface deterioration on exposure to light, and its low temperature of plastic yield were investigated in conjunction with the British Electrical and Allied Industries Research Association and the Radio Research Board of the Department, and work was in progress on the relation between the composition of ebonite and its behaviour at high frequencies. The co-operation of the Ceylon Rubber Research Committee was enlisted with a view to determining the influence of the methods used in the preparation of raw rubber on the properties of the final product.

*ELEC. REV., April 13th, 1928, p. 662.

† ELEC. REV., January 4th, 1929, p. 41.

Illuminating Engineering Society.

Twentieth Anniversary Dinner.

THE twentieth anniversary dinner of the Illuminating Engineering Society, which was founded in London in 1909, was served at the Trocadero Restaurant on February 13th. Mr. Clifford C. Paterson, O.B.E., M.I.E.E., president, occupied the chair, and the company numbered some 175 members and guests, and their ladies.

Mr. H. T. TIZARD, C.B., F.R.S. (secretary, Department of Scientific and Industrial Research) following the loyal toast, proposed the continued success of the Society, expressing his admiration of what it had already done and his belief in what it was capable of doing in the future. It had helped his Department materially and through it illumination research had been started. The Society was now 20 years old, and very great development had taken place in means of illumination, but the net result of it all was that if one examined the efficiency of any modern lamp it would be found that only about 3 per cent. of the energy which went into it came out in the form of light. How feeble! Apart from striving for better efficiency, the duty of all illuminating engineers was to make the best use of what they had; but they were still a long way from that. Relatively, street lighting was bad from the traffic point of view, and how often did school illumination receive adequate consideration? Normally, the remedy for the very prevalent juvenile ailment of progressive short sight was to stop educating children so afflicted (*sic*); but in the case of a school he instanced, in which very great care had been exercised to provide correct and adequate illumination, that complaint had been definitely arrested. Modern school lighting was a scandal, but the Society was making people think about the subject, and the net result would be of much value to the nation.

Mr. C. C. PATERSON, O.B.E., M.I.E.E. (president), in responding, hinted that some of the previous speaker's suggestions would develop. They were met to celebrate the 20th birthday of their Society, which stood for good lighting and all that that implied; and they were more firmly established than ever on their understandings. Industry must have its own research organisations if it was to stand on its feet and

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avoid catastrophy. In 1931 the Society would have a duty to perform: an International Illumination Congress was to be held in England that year, and another might not be held in this country for another 30 years. Therefore, it must be a good function. A fine impression had been created by the British delegation at the recent American Congress, and great things were expected of the British Congress in September, 1931. They must not forget those who had fought and laboured to give them what they had to-day: no one would forget the late Mr. Leon Gaster, and it was his privilege to announce the formation of a memorial fund, the interest on which would be devoted to the award of Gaster premiums for the best discussions contributed to the Society's proceedings.

Mr. D. R. Wilson, C.B.E., M.A. (past president) toasted the guests, observing that some of them had perhaps advanced too far on the physical side of the subject and not sufficiently on the psychological and physiological sides. However, a medical committee now had under consideration research work which had been done on both sides, and a report was to be published shortly (relative to the visual rather than the optical aspect) which would show results second to none in the world. This country was fortunate in possessing a Home Office Inspectorate Department, which was very much alive to the importance of correct light for the comfort of factory operatives. Miss R. E. Squire, O.B.E., was well known as an inspector of factories, and her late analyses of inspectors' reports was of great value and should have been made more use of than it had. He welcomed all the other ladies present, who were with them for the first time, and hoped some of them at least would eventually become members of the Society, because he realised that they, being domestic users of electric light, were by far the most important members of the population.

Mr. J. Terrace, M.Inst.C.E. (president, Institution of Gas Engineers), in replying on behalf of the guests, protested against the insinuation that gas, as an illuminant, was dead; the lighting load was still the backbone of the gas industry.

Prof. Dr. J. Teichmuller, a guest, expressed his sincere and earnest wish for better appreciation of light on the part of all nationalities. He hoped all concerned would work together and that illumination engineers, architects, and artists, would co-operate to secure better use of light.

After dinner members and guests enjoyed dancing, voting the evening's entertainment most successfully enjoyable, notwithstanding the morning's fire, which taxed the resources of the restaurant's staff.

Electrical Wholesalers' Federation.

Annual Dinner.

The annual dinner of the Electrical Wholesalers' Federation was held at the Savoy Hotel, London, on February 14th, when Mr. Theodore Stretton, president of the Federation, took the chair.

After the loyal toast, the Rt. Hon. Sir Hamar Greenwood, Bart., M.P., proposed "Co-operation in Industry." He said there had been a good deal of talk about the inflow of capital into this country from abroad; people who criticised forgot that much of the money came from British capital invested abroad. He believed in the flow of money to the fullest extent. The time had gone by, he thought, when peace could be made certain by dynasties or parliaments, and the ideal of the future was that industry should be so combined throughout the world as to govern the dynasties to the extent that it would be possible to prevent war coming about as the result of a moment of ill temper. The electrical industry had its future assured, and nothing was so promising for the future of this country as the progress made in all branches of the electrical industry. Co-operation in industry meant continuity of employment, higher wages and fair profits. It was essential for the wholesalers to co-operate; they were an indispensable part of the industry.

Sir Philip A. M. Nash, in reply, said that British industry did not present a very inspiring picture to-day. Fiscal, political, and national conditions were not favourable, but that did not mean that they should discourage co-operation in industry. Co-operation in industry was as old as the hills, but each generation had its own particular problem. That of this generation was co-operation between Labour and Capital. He was pleased to see that important industrial organisations had decided not to turn down the findings of the Mond-Turner Conference. There was more need for co-operation in the electrical industry than in any other industry, and the future of the electrical trade depended on co-operation between all the branches. The electrical people had still to do many things, and one was the propulsion of ships. This was a sea-faring nation, but it lagged behind electrically in that connection. His company was setting up a department for dealing with the marine question. A healthy condition existed between the electrical and the other industries which supplied the raw materials. As a manufacturer he was prepared to pay for the services rendered by wholesalers, but both manufacturers and wholesalers should remember that they had a common object, namely, to lower the cost to the consumer; co-operation was needed on that point. The greatest problem in industry to-day was to get co-operation in the workshop—right through from the management to the operatives. To get the confidence of the workers was the main point, and that did not mean the holding of large meetings, and so on. By open discussions over the past eleven years his company had been able to remove the four big difficulties of the workman, namely, distrust and suspicion; lack of knowledge of the economics of the undertaking; fear of unemployment; and dissatisfaction with his wages; but for the success of any such schemes, the management must be sympathetic towards it.

Mr. J. Y. Fletcher, chairman of the Electrical Trades Benevolent Institution, in toasting "The Electrical Wholesalers' Federation," claimed to think along the same lines as the previous speakers. He believed the days of individual negotiation were past. It was necessary to have strong associations for the progress of industry. The policy of his company (the General Electric Co., Ltd.), was to support the Wholesalers' Federation. In order to get co-operation the wholesalers and manufacturers would have to realise that the wholesalers should purchase material before they sold it, and that they should sell it under the manufacturers' brand. The manufacturer who gave up profits to the wholesaler must expect, and was entitled to, transactions less in number and greater in volume.

In reply, the President said that during his term of office he had, with the wholehearted support of his council, used every endeavour to get into closer touch with every other kindred association. Perhaps their endeavours to co-operate with the contractors had not been quite as successful as they could have wished, and he appealed to them to get together at once. Both parties had exactly the same objects in view. Both desired that there should be a definite line of demarcation between the wholesaler and the retailer, and only by complete agreement on that point could there be proper control in the sale and installation of manufacturers' products. Why should it not be possible to have in the electrical industry an association embracing all sections of the industry. That would be true co-operation, and for the good of all. The Federation was out to give service to the manufacturer in the distribution of his goods to the retailer. It would not have within its doors anyone who was not a genuine wholesaler. Because of that it should be able to claim and obtain the assistance and co-operation of the manufacturers.

"The Guests" was proposed by Mr. A. Albrecht, and Mr. A. Nichols Moore, president, Incorporated Municipal Electrical Association, and Mr. Ll. B. Atkinson, director, Cable Makers' Association, replied.

Mr. G. P. Dennis proposed "Our President," to which Mr. Stretton responded suitably.

Correspondence.

Correspondents should forward their communications* as early as possible. *No letter can be published unless we have the writer's name and address in our possession.

Electric Motor-car Startors.

The article on electric motor car "startors" especially caught my eye, but instead of an article full of real information, such as one would expect from a recognised source like the National Physical Laboratory, it boils itself down to a meagre pittance of data about starting time, coulombs, &c., savouring of the usual pocket textbook. Cars called Nos. 1, 2, and 3, are alluded to; why not furnish their names, their ages, or something about them more than the misleading Treasury rating of h.p. mentioned, otherwise a comparison seems useless.

I should have thought that it was common knowledge that a constantly-meshed chain-driven starter, of the Morris type, is always silent in operation, but has difficulty at times in swinging the engine due to the large starting torque required, whereas the Bendix loose-pinion drive has all in its favour, gearing, accessibility, &c., excepting noise and wear on the flywheel toothed ring, where it always stops at the same spots.

Why was it not possible to test an extremely cold engine? I have had plenty of cold engines recently, without looking far for them either; also, is it necessary in these enlightened days to be informed that a hot engine takes less power to turn than when cold?

As an old motorist of 20 years' daily experience of all types of cars, from one to eight cylinders, when I got to the part of the article that describes cold engines starting in 0.39 to 0.75 of a second, it struck me as most humorous. Do the authors really think that a battery charges up in actual practice so easily and that there is little or no danger of its becoming discharged? If so, they cannot have had experience of car-battery charging stations.

I tremble to think what is happening to one of my cars, a 1928 Essex "Six," fitted with a six-volt battery. Is it discharging at from 360 to 540 amps.? If so, what on earth must the battery say to starting a half-frozen engine for the last

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few weeks, and churning out probably over 540 amps. for far more than 0.39 of a second. I finished with starting handles long ago.

I suggest the old saying "An ounce of practice, &c.," would well apply, and let us have some really practical tests, not with little engines only, but with big ones as well, say engines with the same bore and stroke, same setting and make of carburettor, same compression ratio, and last, but not least, same lubricating oil. Then, perhaps, we should learn why American cars, with their big engines, can get away with it, using only tiny batteries, and start cold or hot with that certainty that is one of the reasons why three of the last five cars I have purchased have been American. When I see a British car with no starting handle fitted (it's not put there for fun, oh, no! or to free the oil on a dirty morning; there is more in it than that) I hope that we are getting level with foreign cars on this important item, namely, electric motor-car "startors" (why not starters?)

In conclusion, does the Delco Company, or our battery makers here, know anything about the subject? I wonder! I fancy they do, but perhaps they won't say!

N. E. Brevig,
Managing Director,
VICTORIA ELECTRIC PLANT CO., LTD.

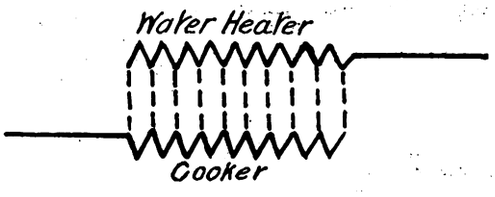
Westminster, S.W.1, *February 11th*, 1929.

[The answer to our correspondent's query (why not starters?) will be found in the "British Standard Glossary of Terms used in Electrical Engineering."—EDS. ELEC. REV.]

The Regulation of Cookers.

If electric cooking is to successfully compete with gas cooking, it is essential to improve the regulation. As a user who has studied this problem, I state emphatically that 3-heat regulation is not sufficient or satisfactory.

If thermostats cannot be fitted, I suggest that a cooker should either be combined with a water-storage heater, or a separate water-storage heater fixed close to the cooker, so that the heating elements of the cooker could be used on the potentiometer principle in conjunction with the elements of the water heater as shown in the accompanying sketch.



Obviously, much finer regulation would be possible without waste. The arrangement, of course, necessitates the use of a water heater, but electric cooking is not economical without a water heater. If a lower rate is given for water heating, a change-over switch could be used so that the higher rate would operate only whilst cooking.

I should like to see some criticism of the suggestion.

Regulator.

February 12th, 1929.

Catalogues.

The writer would like to bring to the notice of firms issuing catalogues that it is remarkable how many are received with the supplier's name richly emblazoned on the cover, but with no indication of a name on the binding, with the result that as soon as placed on a bookshelf the name is not discernible and the catalogue can only be identified by taking it completely out of the file or row.

When the catalogue is too thin to carry the name on the binding, then I suggest it be printed on the front, close to and parallel with the binding, so that on being drawn from the bookshelf only a short distance the name can be seen.

I am quite sure, in fact I have experienced it myself, that this fault of issuers and compilers of catalogues has on many occasions caused inquiries and business to be placed in directions where they would not have gone if catalogues with easily discernible names had been issued in place of those mentioned above.

Buyer.

Streatham, S.W., *February 16th*, 1929.

Engineers and the Future.

I feel that your leading article on "Engineers and the Future" calls for some comment. I fail to see why the fact that prophetic promises of greater engineering prosperity in the future should in any way give encouragement to engineers, and others, who view the conditions of remuneration for appointments in the electrical industry, demanding a fully-qualified technical man, with dissatisfaction.

From a study of the correspondence on whether it pays to acquire knowledge and various kindred articles which have appeared, from time to time, in the ELECTRICAL REVIEW, together with my own particular knowledge of this subject, I submit that this question, in so far as it concerns the qualified technical engineer of to-day, relates purely and simply to the conditions that exist at the present moment, and is to a very large extent independent of the prosperity of the industry.

In plain language, the technical man considers that he is not given his due, the remuneration offered as a general rule not being in proportion to the quality, quantity, and importance of the work done.

The prosperity prophesied for the future will, we all hope, be borne out in actual fact, but surely there is no reason to suppose that prosperity is going to be the monopoly of the electrical industry? Any future prosperity, as is generally anticipated, will most certainly be shared by the country as a whole. That implies that the general standard will be raised. The position of the technical engineer, therefore, while undoubtedly being better, will, however, relatively, be the same as at the present moment. I wish to point out that the main issue under consideration is the technical engineer's relative position.

You stress, quite rightly, the importance of the traveller in the scheme of things. I wish to stress the equal importance of the technical engineer.

C. A. W.

London, *February 9th*, 1929.

Side or Bottom Heat?

In filling my position as demonstrator to an electricity supply undertaking, I have been allowed to test all types of cookers and have come to realise that a thermometer is the biggest factor when an electric oven is concerned. It does not matter then whether you have top and bottom heat, or side and bottom heating, as the heat is controlled entirely by the switch. This is a good point when convincing the public that electricity is ideal for cooking and is a great help in teaching the consumer the economy of same in use in the home.

A Lady Demonstrator.

February 12th, 1929.

Reverting to the correspondence on the subject of "Side *v.* Bottom" heat for cookers, I offer my experience of a cooker so equipped. There are two 750-watt (approximately) elements which are controlled by one switch, so that both may be full on, the two may be used in series, or the top element alone.

After two months' use it has been found that when cooking a joint the top is burnt, the centre is insufficiently cooked, and the time required to cook it is excessive, being nearly three hours. The same remarks apply to the roasting of poultry, added to which is the difficulty of making poultry "stay put" so that the sides can be browned.

It would appear that both side and top and bottom heat are required, the sides, top and bottom each having three-heat control, needing three three-heat switches in all. Designers should aim at producing a cooker which will equal the performance of a gas cooker, *i.e.*, it should be as quick, joints and poultry should under no circumstances require turning over to brown, and there should be adequate control, which at present seems to be lacking in the case of many cookers.

No doubt a cooker built for these conditions would be expensive, but until any cooker can compete with a gas cooker, it must at least be capable of the same performance; as a large number of potential converts are at present used to gas cookers.

If our designers would only realise this fact there would be much more satisfaction, as the writer knows several people who have reverted to gas for the reasons stated, and I have done so myself, reluctantly, for the present.

H. Willoughby.

Nottingham, *February 9th*, 1929.

Service Boxes.

In reply to your correspondent "Service," I would say, after long experience of lead plumbed tee joints and various types of c.i. boxes, using wood or lead bushes, and after spending many days and nights locating faults on l.p. mains, that pressed-lead plumbed tee joints are much more reliable than c.i. boxes in any kind of ground, but especially in waterlogged ground.

I prefer a pressed-lead shell, or a shell made by the jointer from sheet lead, to a cast-lead shell, which is liable to be porous. Objection is sometimes raised to the lead shell joint on the score of expense; a plumber jointer is required for the work. In my opinion a plumber-jointer is necessary for lead-sheathed cable work, and the extra expense of lead service boxes is recovered many times over by the absence of faults.

Safety First.

February 13th, 1929.

Replying to the points raised by "Service" on service boxes, I really think he overlooked Riley in a recent issue of the ELECTRICAL REVIEW.

Cast-iron joint boxes are perfectly safe if properly filled with compound. The success of the compound-filling depends on the facilities provided for the filling. I seldom get any trouble, and the cast-iron compound-filled box is cheaper and quicker

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to install than the lead box. I do not like the idea of cast-lead boxes in any case.

If I were making a change, I should prefer pressed-lead boxes properly protected; but I do not intend to change at present, as good plumber-jointers are scarce.

L. Robbins.

Electricity Works, Pinner, *February 11th*, 1929.

Legal.

Tilling-Stevens Motors, Ltd., v. Kent County Council and the Minister of Transport.

IN the House of Lords, on February 14th, the Lord Chancellor, and Lords Sumner, Buckmaster, Blanesburgh and Warrington allowed an appeal by the plaintiffs in this action from a decision of the Court of Appeal reversing a judgment by Mr. Justice Clauson.

The plaintiffs claimed that their petrol-electric vehicles were subject to the lower rate of licence duty allowed to electrically-propelled vehicles, and claimed for the return of the difference between this and the duty paid on the higher scale. The defendants denied that the vehicles were electrically-propelled, but Mr. Justice Clauson upheld the defendants' contention and gave them judgment. The Court of Appeal took the opposite view. In giving judgment, the Lord Chancellor said that the appeal raised a narrow point of construction of the meaning of the language of the Finance Act, 1926. After due consideration he was of the opinion that a vehicle did not cease to be an electrically-propelled vehicle by reason of the fact that the electricity which drove the wheels was generated by a petrol engine.

British Thomson-Houston Co., Ltd., v. City Incandescent Light Co.

IN the Chancery Division, before Mr. Justice Eve, on February 15th, MR. TREVOR WATSON moved for an injunction to restrain the City Incandescent Light Co. from infringing plaintiffs' letters patent relating to gasfilled lamps.

His LORDSHIP granted an injunction for a week, and gave leave to serve notice of motion for February 22nd.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

22,146. "System of telegraphy or radio-telegraphy in combination with a typewriting machine adapted to ensure secrecy of messages." M. Compare. August 23rd, 1927. (Convention date not granted.) (276,376.)

25,166. "Apparatus for synchronising a moving-picture film, with sound-recording and reproducing machines, musical instruments, and the like." H. A. Johnson. September 23rd, 1927. (Cognate application, 20,343/28.) (304,705.)

25,348. "Apparatus for reproducing or recording sound-waves" C. H. Krager, W. E. Clifon, and Cliftophone Records, Ltd. September 26th, 1927. (304,805.)

27,291. "Means for closing a local circuit by variations in an applied electrical current.' J Neale. October 14th, 1927. (304,618.)

27,672. "Device for regulating the degree of transmission in thermionic valve circuits." Siemens & Halske Akt. Ges. October 19th, 1926. (279,452.)

27,906. "Electrical switches, plugs, sockets, or the like." Marcel-Sesame, Ltd., and F. Kerka ' October 20th, 1927. (304,621.)

27,936. "Thermionic valve negative resistance devices and the like." W. S. Smith and N. W. McLachlan. October 20th, 1927. (304,631.)

27,937. "Variable coupling devices for electric inductance coils." W. S. Smith and N. W. McLachlan. October 20th, 1927. (304,622.)

27,938. "Manufacture of liquid or solid products by gaseous reaction under the influence of silent electrical discharge." A. Carpmael (I. G. Farbenindustrie Akt Ges.). October 20th, 1927. (304,623.)

28,129. "Driving mechanism for films." Electrical Research Products, Inc. May 21st, 1927. (290,962.)

28,152. "Driving of alternating-current generators." F. Punga. October 22nd, 1927. (304,629.)

28,227. "Electric remote-control apparatus." J. Lyons & Co., Ltd., A. Goddard, G. Douglass, Igranic Electric Co., Ltd., and S. R. Wright. October 24th, 1927. (Cognate application, 18,428/28.) (304,707.)

28,317. "Light signals for railways and the like." J. Woodforde and Westinghouse Brake & Saxby Signal Co., Ltd. October 25th, 1927. (304,708.)

28,381. "Telephonic sound-reproducing instruments." Graham Amplion, Ltd., W. J. Rickets, and N. T. Carne. October 25th, 1927. (304,709.)

28,383. "Audio-frequency thermionic amplifiers for use in submarine and the like cable systems." W. S. Smith and N. W. McLachlan. October 25th, 1927. (Cognate applications, 33,347/27, 34,736/27, 1,115/28, and 4,949/28.) (304,710.)

28,460. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin, L. Polinkowsky, and W. Hatton). October 26th, 1927. (304,813.)

28,494. "Electrical indicating instruments." Weston Electrical Instrument Corporation. September 6th, 1927. (296,719.)

28,518. "Electric time switches." P. Krout. October 26th, 1927. (304,816.)

28,522. "Electric display systems." P. H. Waller. October 26th, 1927. (304,818.)

28,524. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. O. Passmore, and R. Taylor. October 26th, 1927. (304,820.)

28,526. "Loud-speakers." S. G. S Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 26th, 1927. (304,821.)

28,579. "Combined ringhanger and belt-hook for electric flash-lights." H. G. C. Fairweather (Winchester Repeating Arms Co.). October 27th, 1927. (304,824.)

28,678. "Electric artificial rainmaking and weather-regulating apparatus." K. Wallach. October 27th, 1927. (304,831.)

28,727. "Electric protective systems." A. Reyrolle & Co., Ltd., and H. Leben. October 28th, 1927. (304,832.)

28,768. "Thermionic cathodes for vacuum electric-tube devices." Westinghouse Electric and Manufacturing Co. October 28th, 1926. (279,890.)

28,778. "Step-by-tep switches, particularly for use in telephone systems." Associated Telephone & Telegraph Co. October 28th, 1926. (279,891.)

28,960. "Telephone hand sets." Standard Telephones & Cables, Ltd., and L. C. Pocock. October 31st, 1927. (304,843.)

28,961. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. E P. G. Wright, and D. H. Wain. October 31st, 1927. (Addition to 276,706.) (304,844.)

29,020. "Electrically-driven pumps." C. W. Van Ranst. October 29th, 1926. (279,904.)

29,047. "Synchronous telegraph systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). October 31st, 1927. (304,850.)

29,535. "Induction-type electric meters, relays, and the like." British Thomson-Houston Co., Ltd. November 29th, 1926. (281,250.)

29,759. "Devices for converting mechanical vibrations into electrical impulses, and *vice versa*, particularly applicable to sound-reproducing apparatus." D. W. Sayer and Electramonic Co., Ltd. November 7th, 1927. (304,858.)

31,176. "Electrical switches, particularly for high-tension systems." Electric Control, Ltd., and G. H. Dean. November 21st, 1927. (304,870.)

32,255. "Electric switches for adjusting ratios of transformers." British Thomson-Houston Co., Ltd. November 30th, 1926. (281,669.)

33,685. "Electric incandescent lamps and holders thereof." E. R. Grote. December 13th, 1927. (304,882.)

34,263. "Diaphragms for use in connection with gramophone sound-boxes and loud-speaking telephone receivers, and for like purposes." T. H. Tuite. December 17th, 1927. (304,888.)

34,676. "Inductances." J. H. Reyner. December 22nd, 1927. (Cognate application, 851/28.) (304,891.)

1928.

1,125. "Sound-amplifiers for use with wireless apparatus, gramophones, and the like devices." H. C. Hansen.—January 12th, 1928. (304,906.)

1,939. "High-tension electric cables." Soc. Italiana Pirelli and L. Emanueli. January 20th, 1928. (Cognate application, 20,873/28.) (304,912.)

3,751. "Electric liquid heaters." Santon, Ltd., and H. C. Sanders. April 26th, 1928. (304,928.)

4,087. "Subaqueous depth and distance measuring and signalling by sound waves." L. Mellersh-Jackson (Signal Ges.). February 9th, 1928. (304,930.)

4,612. "Electrical turning gear for starting internal-combustion engines." F. H. Royce. February 14th, 1928. (304,933.)

7,606. "Diaphragms, more particularly for loud-speakers and the like." Siemens & Halske Akt. Ges. March 12th, 1927. (287,065.)

7,959. "Device for replacing electric lamps on stationary fittings at any height without the use of a ladder." R. Ladrier. March 15th, 1928. (304,946.)

8,257. "Electrical signalling means." Electroflo Meters Co., Ltd. (Republic Flow Meters Co.). March 19th, 1928. (304,947.)

8,696. "Amplification of electric currents." W. Harrison and T. Wood. March 22nd, 1928. (Addition to 291,184.) (304,949.)

9,006. "Electric discharge tubes." E. Schrack and Dr. R. Eitenreich (trading as Radiowerk E. Schrack). March 24th, 1928. (304,951.)

10,235. "Electric current distributing and reversing devices for ringing swinging bells." A. Piton. April 4th, 1927. (288,218.)

10,753. "Glowlamp filaments." Soc. Française des Lampes à Incandescence Luxor. April 11th, 1927. (288,557.)

14,641. "Vacuum cleaners." International General Electric Co., Inc. June 6th, 1927. (291,729.)

15,332. "Electric resistances." Electrical Apparatus Co., Ltd., and R. H. Barbour. May 24th, 1928. 304,978.)

16,331. "Electrical distant observation system with automatic control means." B. Kellermann. June 5th, 1928. (304,982.)

19,051. "Time-controlled mechanisms for actuating valves and electric switches." P. Mourey. June 30th, 1927. (293,051.)

20,078. "Apparatus for extinguishing back ignitions in mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. July 21st, 1927. (294,244.)

20,973. "Electrical control of planers and like machine tools." Keller Mechanical Engineering Corporation. July 19th, 1927. (294,182.)

22,175. "Vacuum cleaners." Soc. Anon. pour l'Equipement Electriques des Véhicules. January 6th. 1927. (Divided application on 283,173.) (294,961.)

23,362. "Optical sound recording and reproducing apparatus." Electrical Research Products. Inc. May 21st, 1927. (Divided application on 290,962.) (295,603.)

23,652. "Wireless signalling." Marconi's Wireless Telegraph Co., Ltd. August 17th, 1927. (295,693.)

28,771. "Scanning mechanism for the transmission or reception of picture telegrams." Siemens & Halske Akt. Ges. July 20th, 1926. (Divided application on 274,870.) (298,245.)

28,772. "Arrangement for the compensation of inequalities in exposure in scanning mechanism for picture telegraphy." Siemens & Halske Akt. Ges. July 20th, 1926. (Divided application on 274,870.) (298,246.)

33,327. "Sparking plugs." Siemens & Halske Akt. Ges. December 23rd, 1927. (302,893.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 13th :—

Sun (design only), No. 493,881, and Electro Lux (lettering and design), No. 493,883. Class 6. Machinery of all kinds and parts thereof.—Electrolux, Ltd., 153-155, Regent Street, W.1.

Cinetrope. No. 495,282. Class 8. Loud speakers, radio-telephonic receiving sets in combination with gramophones, &c. Filmavox. No. 497,881. Class 8. Combined kinematographic and sound reproducing apparatus.—M.P.A. Wireless, Ltd., 62, Conduit Street, W.1.

Attentor. No. 496,591. Class 8. Devices regulated by a thermostat for producing a flicker in electric lamps.—G. A. and E. S. Seddon, 11, King Street West, Manchester.

Kent's. No. 491,708. Class 8. Instrument for indicating the efficiency of turbo-generators, apparatus for recording meter readings at a distance by means of electricity, &c.—George Kent, Ltd., 199-201, High Holborn, W.C.1.

Juneeco. No 497,764. Class 8. Radio-telephonic apparatus and parts thereof.—A. T. Smee, trading as the Junction Engineering Co., 149a, Junction Road, Highgate, N.19.

Trialmo. No. 498,075. Class 8. Apparatus for use in radio-telegraphy and telephony.—H. Scott, 21a, Barbican, E.C 1.

Marog, No. 496,372, and Flust, No. 496,373. Class 50. Compositions made of cellulose and synthetic resins and articles made from such compositions, including electrical insulators and electrical insulating boxes, &c.—H. P. Bayon, King's Farm, Shelford, Cambridge.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHFORD (KENT).—Housing scheme (22), for the R.D.C.; Mr. Wilde, surveyor, 30, Albemarle Road, Willesborough.

AUSTERFIELD.—Re-instatement after fire; Yorkshire Amalgamated Products Brick and Gravel Works (£2,500).

BARNSLEY.—Premises, Queen Street; F. W. Woolworth and Co.

BEXHILL.—Houses, St. John's Road and Plemont Gardens; J. E. Maynard, Collington Avenue. Houses, Cooden Drive, and shops and garages, Cooden Sea Road; Tubb and Messer, Sea Road.

BIGGAR.—Extensions, High Secondary School (£17,000), for Lanarkshire E.C.; clerk.

BILLINGHAM.—Shops and houses, Haverton Hill, for the U.D.C.; Kitching & Archibald, architects, 21, Albert Road, Middlesbrough.

BLACKBURN.—Warehouse, Knuzden Brook Mill; manager.

BOLTON.—Elementary school, Whitecroft Road; Education Committee.

BOURNE (LINCS.).—Thirty-two dwellings, on the Hereward Estate, for the U.D.C.; Mr. W. S. Green, surveyor. (Returnable deposit £2 2s.).

BRADFORD.—Elementary school, Ravenscliffe Road; city architect.

BRAINTREE.—Housing scheme (42), for the R.D.C.; E. L. Wheeler, surveyor, St. Peter's Close, Bocking.

BRISTOL.—Housing schemes (404), for the T.C.; L. S. McKenzie, city engineer. (Returnable deposit of £1.) Fifty-four houses, Whitehall Estate; E. A. W. Poole and Son. Forty houses, Horfield Estate; E. Walters & Son. Forty-six houses, Sea Mills Park Estate; city engineer.

BROMLEY (KENT).—Additional 100 houses, for the R.D.C.; surveyor.

BURNLEY.—Rebuilding St. Matthew's Church; incumbent.

BURTON-ON-TRENT.—Aerodrome, Forest Road; Corporation and Director of Civil Aviation.

CAMBRIDGE.—County Hall, for Cambs. C.C.; county architect.

CANTERBURY.—134 houses, St. Martin's Hill No. 2 site, for City Council; city surveyor. Wesleyan Church Hall; trustees.

CARLISLE.—Mental institution, Dovenby Hall; Corporation and Cumberland and Westmoreland County Councils.

CHESTERFIELD.—Works extension, Derby Road; Hall and Wilson. Extensions, Gilbert Heathcote School, Newbold Moor; Education Committee.

CHICHESTER.—Tuberculosis dispensary and school clinic, for West Sussex E.C.; county architect, Chichester.

DARLINGTON.—Houses (62); J. E. Chilton, architect, Houndgate.

DEAL.—Wesleyan Church Hall; trustees.

DEWSBURY.—Additional 37 houses, Pilgrim Farm Estate, for the T.C.; borough surveyor.

DOUGLAS (I.O.M.).—Stores, Battery Pier; Manx Petroleum, Ltd. Extensions, High School for Girls, for the E.C.; T. R. Lewin, clerk (returnable deposit of £10 10s.).

DOVER.—Wesleyan Church Hall; trustees.

DUMFRIES.—Housing scheme (36), for the T.C.; burgh surveyor.

ECCLES (LANCS.).—Electricity offices and showroom (£5,000 to £6,000), for the T.C.; John Knight, architect.

EDINBURGH.—Sheriff Court; town clerk. Monkey house (radiant electric heating) at Zoological Park, Corstorphine, to cost £2,600; F. C. Mears, architect.

ELLAND. Housing scheme (45), for the U.D.C.; T. Exley-Fisher, surveyor (returnable deposit of £1 1s.).

FALKIRK.—Additional buildings for new infirmary (£100,000); W. J. Gibson, architect.

FAVERSHAM.—Housing scheme (52), for the R.D.C.; surveyor.

FIFESHIRE.—Extensions at West Fife Infectious Disease Joint Hospital; town clerk, Dunfermline.

GILLINGHAM (KENT).—Additional 112 houses for the T.C.; borough surveyor. Block of shops, Gillingham and Napier Roads, for A. H. Horne; F. T. Mattocks, architect.

GLASGOW.—Alterations, Sauchiehall Lane, for Watt Bros. (Glasgow), Ltd.; Keppie & Henderson, architects.

HARPENDEN (HERTS.).—Church, for the Wesleyan trustees; Alan Brace, architect.

HODDESDON.—Block of shops and flats for A. S. Bostock.

HULL.—Annexe for Royal Infirmary (£40,000); governors. Housing scheme, Derrington Farm Estate; city architect.

IRISH FREE STATE (CAHIR, CO. TIPPERARY).—Technical school for the Convent of Mercy; V. Kelly, architect, 4, Grafton Street, Dublin.

LEAMINGTON.—Extension of Warneford Hospital; W. T. Nicholls, Ltd., builders, Gloucester.

LEEDS.—Elementary school, Wykebeck Avenue, Osmondthorpe (£17,000); Education Committee. Houses, shops and business premises, Stonegate Road and Green Road; F. Holmes. Flats, Hawksworth, York and Selby Road, and Middleton Housing Estates; W. T. Lancashire, city engineer.

LEEK.—Additional 350 houses, Haregate Estate, for the U.D.C.; surveyor.

LEYLAND.—Proposed fire station and depôt buildings; surveyor to U.D.C.

LONDON (HACKNEY, E.).—Thirty-five flats, Powell Road; borough engineer.

(UPTON PARK, E.).—Telephone exchange, Green Street, for H.M. Office of Works, King Charles Street, S.W.

(E.C.).—New buildings, Mansion House Street; National Provincial Bank.

(ISLINGTON, N.).—Forty flats, Anevell Road; R. Mansell, Croydon.

(CLAPHAM, S.W.).—Block of flats, Larkhall Estate, Albion Road; C. Miskin & Son, Ltd.

(HAMMERSMITH, S.W.).—Freemasons' hospital (£250,000), Ravenscourt Park, for the Freemasons' Hospital and Nursing Home; secretary.

(SOUTHFIELD, S.W.).—New Whitelands College, off West Hill Road; James Reekie & Son.

(STREATHAM, S.W.).—Cinema, High Road and Pendennis Road; Streatham Properties, Ltd.

(WANDSWORTH, S.W.).—Extensions, Flour Stores, Merton Road; J. R. Austin.

MALVERN.—Café, shops, saleroom, &c., Morningside, Graham Road, for W. H. Mayo.

MANCHESTER.—Elementary school, New Moston (£18,000); Education Committee.

MERTHYR.—Silk factory, Cyfarthfa site; Cyfarthfa Estates, Ltd.

MIDDLESBROUGH.—Conversion of Acklam Hall into secondary school (£10,000), for the Borough E.C.; director of education.

NAIRN.—Harbour improvement scheme; Henderson & Nicol, civil engineers, 21, Bridge Street, Aberdeen.

OLLERTON.—Police station (£6,250); Notts. Standing Joint Committee.

PETERHEAD.—Harbour improvement scheme (£100,000); Harbour Board.

RADCLIFFE.—Senior and junior schools (£50,000); secretary to the Education Committee.

ROCHDALE.—Housing scheme (135), Rathbone Street and Dicken Green Estates; S. H. Morgan, borough surveyor.

RUGBY.—Auction Mart, Henry Street, for Tait, Sons, and Pallant; J. H. & R. B. Liddington, architects, 23, Regent Street.

SANDWICH.—Additional 50 houses, for the T.C.; borough surveyor.

SNODLAND (MAIDSTONE).—Central school for Kent E.C.; W. H. Robinson, architect, Sessions House, Maidstone (returnable deposit of £2 2s.).

STALYBRIDGE.—Oil depôt, railway goods yard; Anglo-American Oil Co., Ltd.

STOURBRIDGE.—Extensions, Guest Hospital (£20,185); John Dallow & Sons, builders, Blackheath, Birmingham.

SUTTON (SURREY).—Houses (50), for F. J. Farrell.

TEIGNMOUTH.—Concert pavilion on the Den; F. W. Knight, surveyor.

WALSALL.—Reconstruction, old borough offices; borough engineer.

WARRINGTON.—200 houses, Reynolds Street area; borough engineer.

WATFORD.—Housing scheme (150 to 200), for the T.C.; borough surveyor.

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The

Electrical Review

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The Commissioners' Report.

THE annual reports of the Electricity Commissioners are presumably intended to be indicative of the progress achieved in co-ordinating and extending the electricity supply resources of Great Britain. The eighth of the series, extracts from which will be found elsewhere in this issue, covers the year ended March, 1928, thus conforming to practice in Government publications; belated issue is obviously better than none at all, while developments during the intervening eleven months are hinted at in various footnotes, though some of the statistics relate to 1927. It must be admitted though that the year under review was one of exceptional pressure upon the time of the Commissioners and their staff. In addition to the more urgent matters arising from the Electricity (Supply) Act, 1926, and their administrative duties, they devoted considerable attention to what they describe as the "problem of facilitating and expediting the supply of electricity in rural areas." Those circumstances rendered it necessary for them to defer consideration of a number of matters which were not immediately pressing and, we are told, contributed to the delay in issuing the Report.

During the eight years that have elapsed since the reorganisation of the country's electrical facilities was commenced it has become increasingly evident that the centralisation of generation will require to be supplemented by improved and co-ordinated distribution, and the persistent growth of the demand of the rural population for better amenities impelled the Commissioners to emphasise that the practical possibilities must be affected by a variety of factors; while they concede that developments in other countries afford a general indication of the potentialities, they point out that rural electrification in Britain must conform to British conditions. Quite so, but what are our conditions? Do they include such factors as rules and regulations sympathetically framed to stimulate economic distribution, which is essential if the sparsely populated countryside is to be adequately provided with electrical facilities? The Report demonstrates at length the fact that the areas which remain to be developed consist mainly of the more thinly inhabited country portions, amounting to 45 per cent. of the whole area, but supporting only 5 per cent. of the total population, with

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the low average density of 56 persons per square mile; yet we seem to have heard of more than one part of Europe whose equally rarefied population is in full enjoyment of electrical amenities. Yes, Continental practice seems to have been economic and adequate, if not exactly elaborate, and we shall do well indeed to cultivate the faculty of discerning merit in the accomplishments of others.

It is satisfactory to learn that the sale of electricity by authorised undertakers in 1927 increased by 19.6 per cent., compared with the 1926 figure, and by a total of about 88 per cent. during the five years since 1922. With the estimated population at the end of 1927 as a basis, the average consumption per head of population is calculated as 155 kWh; but, as has frequently been pointed out before, public supply stations represent but a portion of the total production resources of the country, for privately-owned generating plant, which has been installed on a widespread scale, does not come within the scope of the statistical returns which the Electricity Commissioners are empowered to obtain. However, some indication of the extent of the generating plant installed for industrial purposes is afforded by the preliminary reports on the third Census of Production issued by the Board of Trade; but they were issued in 1927 and relate to 1924, while they do not embody particulars of the production of electricity by the generating plant of industrial organisations, and, moreover, they do not include plant employed wholly, or mainly, for transport services. Nevertheless, the private output must represent a substantial contribution to the annual consumption, for it is apparent that the generating resources of trade and industry added some 65 per cent. in 1924 to the resources of the authorised undertakings.

It is comforting to recall the rapid recovery, as regards output and operating results, of the supply industry from the deplorable effects of the prolonged coal miners' dispute. The energy generated nearly reached 10,000 million kWh, an increase of over 18 per cent. on the 1926-27 figure, and it should be noted that the greater output was obtained with an increase of only 5.4 per cent. in the quantity of solid fuel consumed. Incidentally, it is of interest to record that the return to more normal conditions was accompanied by a diminution of the use of fuel oil.

The Report and its numerous appendices are much too lengthy to be abstracted otherwise than very briefly: it reviews the then overhead-lines wayleaves position and, *inter alia*, contains copious notes on the subject of Special Orders, the Commissioners having modified somewhat their Statutory Rules of 1920 with the object of simplifying their procedure and reducing the expense to applicants.

"Service" and Co-operation.

Throughout the speeches at the recent annual dinner of the Electrical Wholesalers' Federation, Ltd., the keynote was co-operation in industry, different speakers dealing with different phases of the subject, while Sir Philip Nash, K.C.M.G., chairman of the Metropolitan-Vickers Electrical Co., Ltd., struck a particularly welcome note—that of "co-operation in the workshop." He strongly advocated a policy which has been practised by his company for the past eleven years, of close and real co-operation between the management and workers.

Any scheme which has for its object such co-operation can only be successful when there is genuine sympathy on the part of the management—one that will help the operative to understand the difficulties of the inner working of the concern by which he is employed.

There is one field in the electrical world, the distribution side of the supply industry, where co-operation between the management and the workers should prove particularly fruitful. The prevailing idea in the supply undertakings to-day is service, and there is an army of men employed whose "product" is service. These men undoubtedly come into closer contact with the consumer than the management, and they actually appear to the consumer as "the supply authority." They have a unique opportunity of gaining for the undertaking the confidence of the consumer—an asset of inestimable value—and, in their conversations with the consumer during the progress of their job, can do very much indeed in the way of propaganda and business-getting.

The idea is not untried, and where it has been put into operation in a few cases in the electricity supply industry, and to a much greater extent in another important public service, it has proved conspicuously successful: but without the backing of the management—a backing which can only be born of the closest co-operation between the two parties in question, compatible, of course, with adequate discipline of the worker and prestige of the undertaking—the advantages of such a liaison as that referred to cannot be obtained.

Co-operation "in Bulk."

We are afraid that we have no great reserves of enthusiasm to expend upon proposals that are occasionally advanced for bringing all the organisations connected with the electrical trade under one umbrella, or into one associated whole. It is something when a single association representative of a particular section finds it possible for all its brethren to dwell together in harmony; it is better when two or three such can link up for the purpose of gaining special ends; but to expect sweeping movements to bring all together, save for the adoption of a simple general principle or a pious aspiration, is to look for something more than human. The idea has been so often advanced in different days and has been developed to some extent in differing forms, with little ultimate good result, that, though times are not what they were, we cannot find in our knowledge of the past promise of any greater success being secured in what everybody must admit are in many ways more difficult days. The reconciling of conflicting interests is an end greatly to be desired and one well worth working for, but let us secure peace and agreement within the separate sections before we hope too much for a peaceful consolidation of many sections in each of which common agreement makes much tarrying.

At the Fair.

It is very difficult to generalise regarding an exhibition of the size and variety of the British Industries Fair; all that can be drawn in the way of conclusions must necessarily be based upon prominent features observed here and there.

It may be said, however, that the electrical industry has put up a good show this year and surpassed the efforts of preceding years, a result for which the committee of the Electrical Section deserves a great deal of credit. If there is any criticism to offer it is that there is too much for the visitor to "take in" properly. The products of the electrical industry are so many and varied that complete classification is impossible, and many really good things may be missed in a multiplicity of apparatus and appliances. In this respect the gas industry appears to be more fortunate; manufacturers do not produce so many different lines, and some sort of co-ordination is possible.

Among the features which show the ability and willingness of our electrical manufacturers to fulfil one of the first requirements of salesmanship—the study of the customer's needs—is the "Colonial" or "Empire" type of electric cooker, which is shown for the first time by three or four companies. These cookers, which are admittedly designed to meet American competition, possess all the advantages of their Transatlantic prototypes without being cheap imitations, and to quote the hackneyed phrase should "meet a long-felt want" in the Dominion markets.

We shall be able to say more regarding the results of the Fair in a later issue; so far the reports have been to the effect that business has been fairly good.

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A Himalayan Hydro-electric Scheme.

The electricity works of the Mussoorie City Board has a water-power capacity of 3,000 kW, and provision is made for 6,000-V transmission.

By G. O. McLEAN, M.Eng.

It has been estimated that India has available in water-power more than 5 million horse-power, of which only about half is developed at present. Large schemes, which have been described in the technical Press, are those of the Tata Power Companies in the Bombay Presidency; the Cauvery and Mettur power schemes in Mysore State; and the Sutlej hydro-electric scheme (under construction) in the Punjab. In the North-East are the great Himalayas, with their perpetual snow, in which all the Ganges' tributaries have their source. One would expect to find several hydro-electric stations there, and most of the towns do have their own stations; but as the load is only lighting, and none of the hill-stations have more than 20,000 inhabitants, the power schemes are necessarily small. One of the largest is owned by the Mussoorie City Board, and the writer had an opportunity of visiting it recently, through the kindness of Mr. Bell, the city electrical engineer.

Fig. 1.—General View of Mussoorie.

Mussoorie is one of the many hill-stations of the United Provinces, 6,500 ft. above sea-level, and one of the most popular health resorts of the wives and children of the European population from April to October, when the heat on the plains is intense. The railway runs to within 14 miles of Mussoorie, to Dehra-Dun, the headquarters of the Indian Government's Forestry Department and Trigonometrical Survey. This town also receives its supply from the Mussoorie Board's station at Galogi.

Fig. 1, a general view of Mussoorie, gives an idea of the topography of the land over which the h.p. lines have to be taken. The power station, fig. 2, is situated at the foot of the range of mountains on which Mussoorie is built, and is about 6 miles from the latter and 8 miles from Dehra-Dun. The source of power is the Kiarkuli Nadi, a tributary of the River Jumna, itself a tributary of the great Ganges.

At a point 1,000 ft. above the station level and about 2 miles distant, the river is dammed and diverted through strainers into the intake reservoir or forebay (fig. 3) which holds about 29,000 cu. ft. From the further end of the reservoir, where are more screens and sluice valves, start the penstocks and two 24-in. diameter pipes. These follow the course of the river-bed, more or less, crossing and re-crossing it only once. As the fall is fairly gradual and there are no sudden changes of load, there is no fear of water hammer, and consequently no need for a surge tower, the intake reservoir or forebay taking its place. This reservoir is overflowing all the year round, more or less, dependent on the demand on the station.

The scheme was started in 1909, the civil engineering work being done departmentally; Messrs. Bruce Peebles & Co., Ltd., put in the first set of 150 kW capacity. The present station contains two 500-kW 3-phase Siemens alternators, generating at 6,000 volts and driven by Pelton wheels (J. Gordon), needle-governed; and two 1,000-kW, 3-phase alternators (Metropolitan-Vickers) driven by Pelton wheels, with needle and deflector governing. The Metro.-Vick sets generate at 400 volts, and there are two banks of transformers stepping up to the bus-bar pressure of 6,000 volts.

The switchboard is also by Metropolitan-Vickers, there being 4 machine panels and 4 feeder panels; all switches are hand-operated. Transmission is by 3-wire, 3-phase, at 6,000 volts, overhead lines, there being 2 feeders to Mussoorie, and 2 to Dehra-Dun.

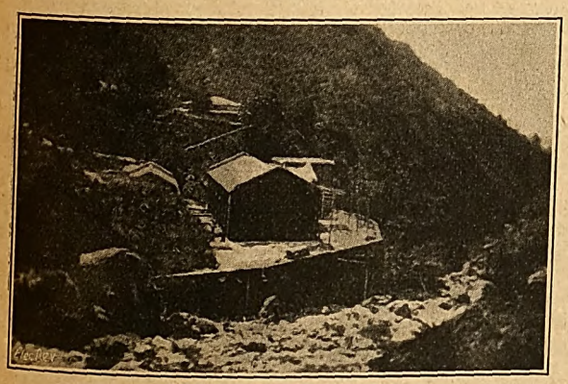

Fig. 2.—Mussoorie Power Station.

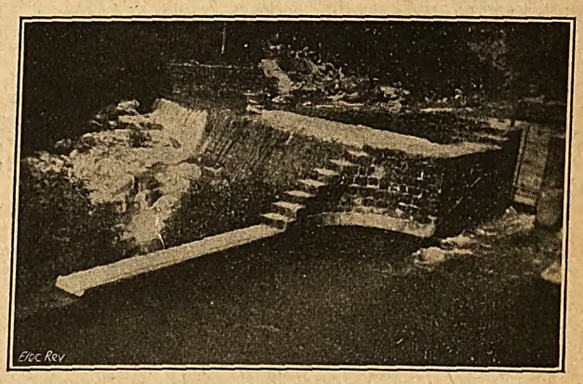

Fig. 3.—Dam and Intake Reservoir.

The station lighting, workshop motors and local distribution is at 440 volts, 3-phase, 4-wire. The town supply and house service at Mussoorie is also at 440 volts, 3-phase, 4-wire, there being about twelve small sub-stations scattered about the city. Up to the present, the maximum demand on the station has not exceeded 700 kW, but it is growing.

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Our Overseas Electrical Markets.

Economic Conditions in Australia, New Zealand, South Africa and India.

In the following article is given a survey of commercial conditions in the principal overseas markets for British electrical material, accompanied by charts showing the trend of imports into each country of such goods in recent months, based on the latest official returns available. It has always been the policy of this journal to direct attention in every possible way to export trade, on which the prosperity of this country so greatly depends. By examining the statistics of the electrical trade throughout the world, which are dealt with systematically nearly every week in these columns, manufacturers and exporters can gauge what business is available overseas and what foreign competition has to be met, and can lay their plans accordingly.

Australia.

Business in Australia has improved since the labour troubles in connection with shipping ended. Although unemployment, notably in the building and manufacturing trades, is still above the average, it is lessening as the season advances. Christmas trade was rather above the normal in the principal centres. Banking returns show increased deposits and diminished advances.

If expectations are realised—and there is every confidence that they will be fulfilled—the wheat crop will be considerably better than last season, while the wool crop will be either as high as, or higher than, the unusually large crop of the past three seasons. During the financial year ended June last, in spite of the fact that both the wheat and wool yield were less than in the preceding twelve months, the adverse trade balance was

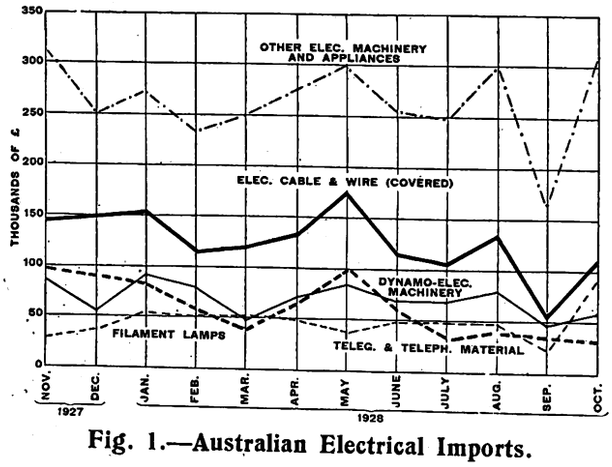

Fig. 1.—Australian Electrical Imports.

considerably reduced, and there is cause to hope that the foreign trade situation will soon show a gradual but steady improvement leading to a satisfactory revival of import trade.

A measure of trust in the ultimate recovery of trade and industry is the fairly wide endorsement of the views expressed by the Tariff Board and the British Economic Mission. The Tariff Board has pointed out that "Productivity should be the basis of all wages, for on it depends the general welfare of the community. There should therefore be co-operation between all parties to bring about this result. Employers should meet competition by the installation of up-to-date machinery and the adoption of the most modern methods, and employés should co-operate with the employers to secure the maximum output under these improved methods." If the conjoint efforts of employers and employés fail to arrive at a satisfactory solution, it would seem to be worthy of consideration whether the Government of the day should not then, after full and exhaustive inquiry, fix the general maximum limit of the rate of tariff assistance which it is considered economically sound to grant to any industry.

The British Economic Mission recommended that, if protection be persisted with, industries should be compelled to justify such special treatment. It is felt that support for a policy of moderate protection will be forthcoming from the new Minister of Customs (Mr. Gullett) whose sympathies are known to be with the agricultural interests.

Following a successful year's operation, as a result of which a small surplus was shown, the Victorian Electricity Commissioners are taking steps to increase the capacity of the plant at Yallourn. Their aim is to have three additional 25,000-kW sets in operation in 1931. The high-voltage transmission line between Melbourne and Yallourn will be duplicated. Now that hydro-electric power is available in north-eastern Victoria, an increased demand may be expected for many different kinds of small electrical apparatus and fittings. An interesting side light on the spread of the use of electricity in New South Wales is afforded by the official statistics of manufacturing industries. The extension of the network is said to have stimulated the sale of power-consuming appliances to all sorts of small workshops.

New Zealand.

A further advance has been made during the past quarter in the recovery in New Zealand business. With

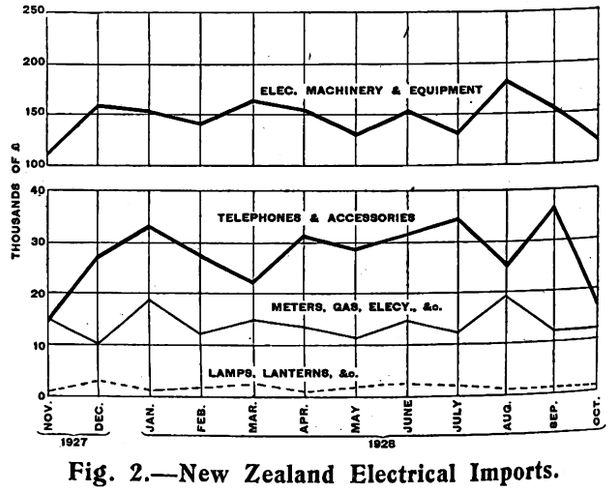

Fig. 2.—New Zealand Electrical Imports.

a few unimportant exceptions the products of the Dominion are expected to return very good yields. The banking situation has been strengthened substantially as a result of the caution exercised early in 1928. The increased wool clip has been partly offset by the lower level of prices realised. Building continues active practically throughout the Dominion.

The foreign trade returns for the twelve months show a favourable trade balance of £11,300,000 compared with one of £3,700,000 only in 1927. Exports were nearly £8,000,000 up, and imports £100,000 higher

Loans are being offered on easier terms than for some time past by both the Government and the banks, and it is anticipated that expenditure on development schemes and constructional work will be on an increasing scale during the current year; in fact, the opinion is widely held that 1929 will be one of the most prosperous in the history of the Dominion. It is disappointing to find that Great Britain's share of the total

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trade decreased slightly last year. It still stands, however, at about 47 per cent. At the same time it must not be overlooked that there are signs of a new tendency in the direction of the Dominion's exports which is of some significance. Larger shipments, notably of meat, are going to the United States.

It was recently reported by the British (United Kingdom) Manufacturers' Association of New Zealand that heavy business in electrical goods had been almost entirely confined to Government purchases, practically all of British manufacture. This remark applies also largely to transformers and switchgear. In cables and wires British makers, by lowering prices, have recovered lost ground. Within the past twelve months the New Zealand Government has purchased from British manufacturers machinery and general equipment, chiefly for the New Zealand Railway Department, of a value of approximately £650,000. Four railway workshops are being established, one in each of the chief cities of the Dominion.

Electricity is now available to 1,240,000 persons in the Dominion, whereas ten years ago the number was but 467,000. During the decade the amount of capital invested in hydro-electric enterprises advanced from £1,500,000 to £19,000,000. This great extension of the advantages of cheap power was one of the outstanding points observed during the recent tour of the northern province by sixty leading business men. They found vastly improved conditions in the country districts where electricity was available.

South Africa.

Crop prospects in South Africa showed a marked improvement with the opening of the New Year, owing to the welcome rains in November and December which relieved some prevalent anxiety due to the drought in certain districts last autumn. In some sections, however, rain is still needed. The results of Christmas trading proved very satisfactory, and the general purchasing power of the population augurs well for the trend of import trade in the immediate future.

Railway revenue and Customs receipts remain well up to normal and encourage a continuance of the policy of public works development which the Government has been pursuing for some time. Meanwhile most manufacturing enterprises are well employed. The building trades are still active and all engineering shops are busy.

The resumption of the wool sales in January was

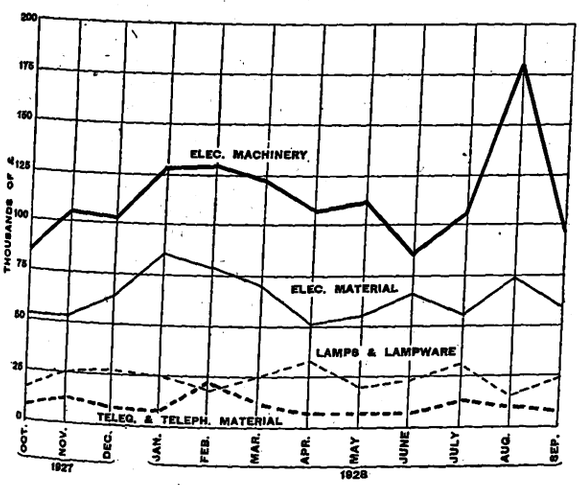

Fig. 3.—South African Electrical Imports.

characterised by well-maintained prices. The favourable tendency is of great significance to the Union to which a rise of a penny a pound in the price of grease wool may mean a gain of £1,000,000 in a year. Gold production for the eleven months was £40,348,500 in value, compared with £39,416,500 in the same period of 1927, while the coal output in the Transvaal, Orange River Colony, and Natal also showed an increase on the previous year.

Finally, foreign trade for the twelve months is expected to show an increase of between £3,000,000 and £4,000,000 in both imports and exports.

India.

India's foreign trade has shown an improving tendency during recent months. Both imports and exports have increased in value compared with the

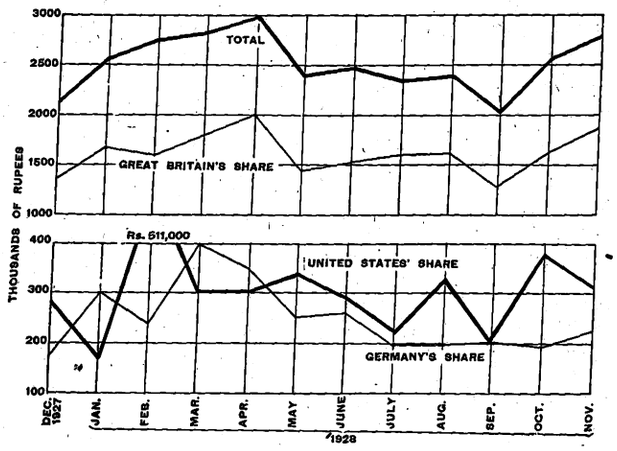

Fig. 4.—Indian Electrical Apparatus Imports.

previous year, and the favourable balance of trade has shown a further advance.

In most districts the weather has been favourable to crops, the condition of which is consequently good excepting the cotton in the Punjab. There is still cause for anxiety in the labour situation, further disputes being feared. This uncertainty will, it is thought, prejudicially affect the demand for engineering material in the near future, but on the other hand, there is considerable activity in prospect on the part of the Government in the direction of public works.

In an interesting survey of the effect of electric power on Indian industrial development which appeared recently in *Capital*, it was pointed out that the most promising field in India for the electrical engineer was

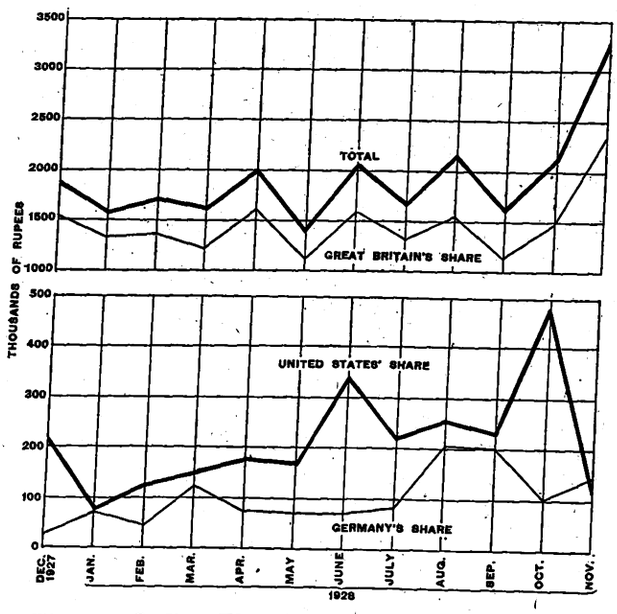

Fig. 5.—Indian Electrical Machinery Imports.

Madras. Despite the abundant water power resources in that Presidency the annual consumption of electricity per head of population was very considerably below 100 kWh which might be considered normal for such an area. Electric lighting and power plant with steam or internal combustion prime movers was being gradually established, but what was needed was distribution on a large scale at attractive rates. There were indications that the authorities were seriously taking

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up the question of exploiting the hydro-electric resources of the area on the lines of the programme drawn up by the recently formed Hydro-Electric Department. There is every likelihood that the Pykara project, which will be capable ultimately of yielding over 100,000 h.p., will be sanctioned in the near future. In that event energy should be available in 1931. Meanwhile, work has been started on a station for supplying power to the Pykara construction works as soon as necessary, to Ootacamund, Coonoor and other towns, and to the neighbouring tea estates. The Pykara project is intended to supply the Nilgiris, Coimbatore, Tiruppur and eventually Calicut, Cochin and Madras. It will also be extended to Trichinopoly and Madura. Careful consideration will be given to the needs of the agricultural districts, a special rate being proposed with a view to attracting a demand for uses other than pumping and lighting.

In the Punjab attention has been concentrated on the Mandi scheme, in the first stage of which 36,000 kW will be generated, the second stage providing for an increase to 70,600 kW, and the third to a total of 118,600 kW. The first stage would take about four years to complete and would enable about twenty towns in the Punjab to be supplied with electricity, the demand for which is already sufficient to justify the work. Specifications for the pipe line, generating plant and transmission line have been prepared, and the question of tenders will shortly be dealt with in London. In Bengal, while most of the larger towns are already electrified, a number of smaller projects are under consideration.

The Off-peak Heating Load.

Some further notes and figures showing its possibilities to the supply engineer, with particular reference to progress in Switzerland.

By L. G. A. SIMS, M.Sc. (Eng.).

In a contribution on this subject some months ago, the present writer described the advanced stage of development in Switzerland, and the wide and increasing use of apparatus devised to allow the storage and subsequent use of electrical energy in the form of heat.* It was shown, for instance, that by applying the principle to the heating of water, and to a less degree to the heating of buildings, the load factor of one Swiss town was increased between the years 1915 and 1924 from 56 per cent. to 74 per cent., and it was stated that the increased revenue and the wonderful characteristics of a load which can be fitted easily by the supply authority into the off-peak hours were so great that Swiss authorities, without exception, were giving every possible encouragement to its growth.

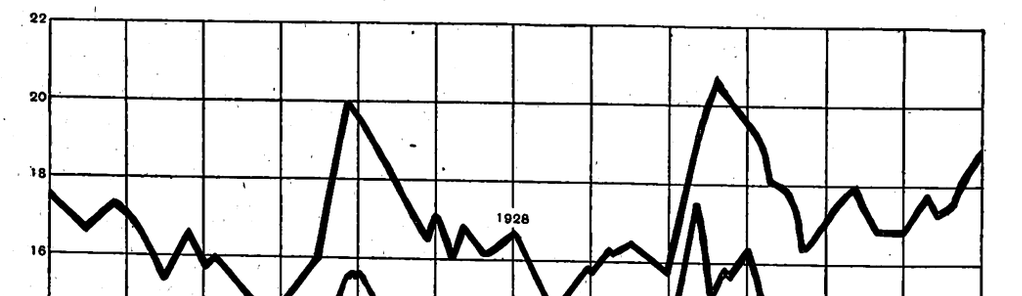

Fig. 1.—Load Curves, Basle, Switzerland.

It is, therefore, surprising to find that, despite the acknowledged benefits to both supply authority and consumer which a heat-storage system can confer, there is still in this country extraordinarily little progress to show. We may take as an example the domestic water-heating load. This is the ideal case of an off-peak load, for, since hot water is a necessity in every household, all the year round, the demand upon the station is steady, whilst water itself is naturally an excellent storage medium. Electrical water heating can be made really attractive to consumers with energy costing ⅜d. to ½d. per unit, the energy being taken at these cheap rates only during off-peak hours. Machines and cables which would otherwise be almost idle are thereby kept on load, the supply authority securing a considerable additional revenue. *There are at present in this country about three supply authorities which offer an attractive tariff for this type of load.* Does this mean that the others have no need of an off-peak load, that plant and distribution system are earning as much as possible, or that there is some fundamental objection to a revenue-earning storage system using cheap electricity?

* "The Domestic Storage of Energy," Electrical Review, October 21st and 28th, and November 4th, 1927.

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As a case in point, the writer recently installed an electric hot-water storage system with a loading of $1\frac{1}{4}$ kW, and applied to the supply authority concerned for the terms of any special tariff it might be willing to allow for this load, if run only during off-peak hours. The probable consumption would have been some 2,000 units per annum, which was surely worth encouraging, particularly in the city concerned, where the load factor is bad, but no better tariff was offered than the ordinary domestic rate on which one runs any ordinary day-time load, though the supply authority admitted the great advantage to it of the type of load proposed. This is the present state of affairs in one of our largest cities, and the result in the writer's case is that he may have to curtail the use of the electric system instead of using it freely as he would prefer, whilst other householders, having no interest in a system which does not show a reasonable running cost, will continue to pay their money to the coke and gas sellers.

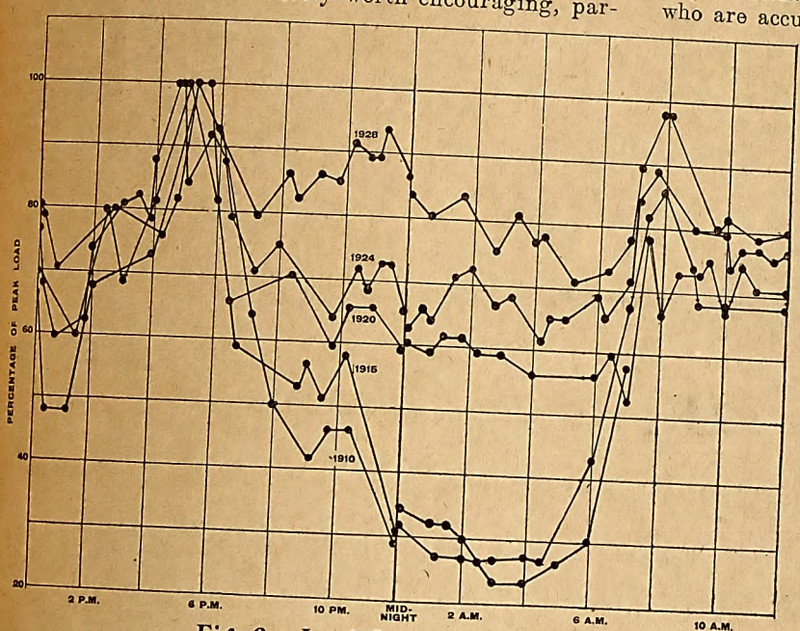

Fig. 2.—Load Curves, Replotted.

If this heat-storage method of improving load factor has been an unqualified success abroad, and if it can be shown to be economically sound to the supply authority here, then surely the time for hesitation and half-hearted experiment has passed. This is the opinion held strongly by certain electrical engineers in this country who have seen at first hand the advantages to all concerned of the scheme when in operation. In order to bring home more strongly and more exactly the nature of the advantages which may accrue to the supply authority, and to assist a judgment to be made upon the possibilities here, statements and figures published in the yearly reports of the Basle (Switzerland) electricity works, kindly supplied by the chief electrical engineer of that undertaking, have been translated and analysed.† It is hoped that the publication in English of some of the more important of these will quicken interest in the subject, and assist in the early introduction of cheap tariffs here.

In Fig. 1 are shown the actual load curves for Basle from 1910 to 1928, taken at corresponding times in the winter of each year shown. That there is a progressive improvement in the load curves will be evident to those who are accustomed to curves of this type, but a more striking demonstration of this is given by a slight re-arrangement of the curves. By expressing the maximum load reached in each case as 100 per cent., the peak values for each year are made to coincide, and the minima can then be more readily compared. If the curves be then replotted, so as to bring the night and early-morning hours—which are, of course, the off-peak hours—together, we get the curves shown in fig. 2. Here, surely, is material for thought and emulation, for the improvement in the shape of the curves so revealed is astonishing. Off-peak heating was commenced in Basle in 1915. Particular interest will therefore be taken in a comparison of the curves for 1910 and 1915 with those for 1920 and later. It is seen that the effect produced by the introduction of heat storage is placed beyond doubt by these curves. It is clear, moreover, that although the system has been working in Basle for more than 12 years, the improvement is still continuing. This is indeed the case as new off-peak heating installations are still being laid down every day. In fig. 3 are given three load curves covering six months of the present year, in order that the seasonal variation in the load curve may be seen.

Furthermore, it is extremely interesting to notice from the Basle electricity works reports how the total heating energy supplied by the undertaking is divided.

TABLE I.—Consumers of Energy for Heating.

	1923.	1924.	Percentage increase.	1924.	1925.	Percentage increase.	1925.	1926.	Percentage increase.	1926.	1927.	Percentage increase.
DAY CONSUMERS.	65	79	21.5	79	85	7.6	85	112	31.8	112	133	18.8
NIGHT CONSUMERS.												
(a) Large users with metered load	1,401	1,720	22.8	1,720	2,120	23.2	2,120	2,682	26.5	2,682	3,588	35.1
(b) Fixed charge (small) consumers	896	1,235	37.8	1,235	1,670	35.2	1,670	2,143	28.3	2,143	2,830	32.0
Total night consumers ...	2,297	2,955	28.7	2,955	3,790	28.3	3,790	4,825	27.3	4,825	6,418	33.0

There are, of course, two main classes of consumer: first, those who, for one reason or another, still take heating energy during the day, paying the day tariff, and, secondly, those who take it at a special cheap rate, chiefly during the night. The latter are mainly the owners of heat-storage systems, and are themselves divided into two classes:—

(a) Those whose energy is metered, that is, users of large boilers and of ovens working on heat accumulation, and

(b) Fixed-tariff consumers, that is, mainly domestic consumers having small water boilers.

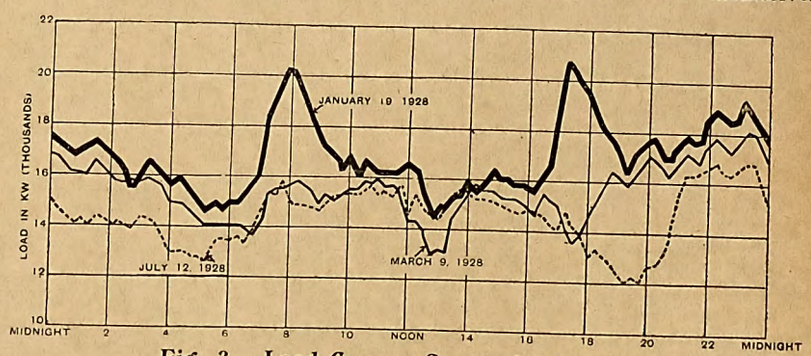

Fig. 3.—Load Curves, Seasonal Variations.

† Jahresberichte des Electrizitätswerks Basle, 1924-1927.

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Table I on the previous page shows the numbers of these consumers from 1924 to 1927.

It is seen that, taking all consumers of heating energy as 100 per cent., there is approximately a 30 per cent. annual increase in the number of consumers of energy at the cheap rate, and that this annual increase is itself tending to increase. As pointed out above, this is despite the fact that the Basle undertaking has exploited this type of load since 1915. At the same time there is a healthy annual increase in the number of day consumers, though the latter represent rather less than one quarter of those consuming energy at night. Unfortunately, it is not possible from the yearly reports actually to see the kilowatt demand of each type of consumer, but from the extraordinary improvement in the overall load curve of the town (as shown in figs. 1 and 2), it is certain that the night energy consumption greatly predominates. It is, therefore, of more than passing interest to know that the revenue secured from the sale of energy for heating was last year more than one million Swiss francs, the figure in English currency being approximately £40,000.

(To be concluded.)

High-pressure Cables.

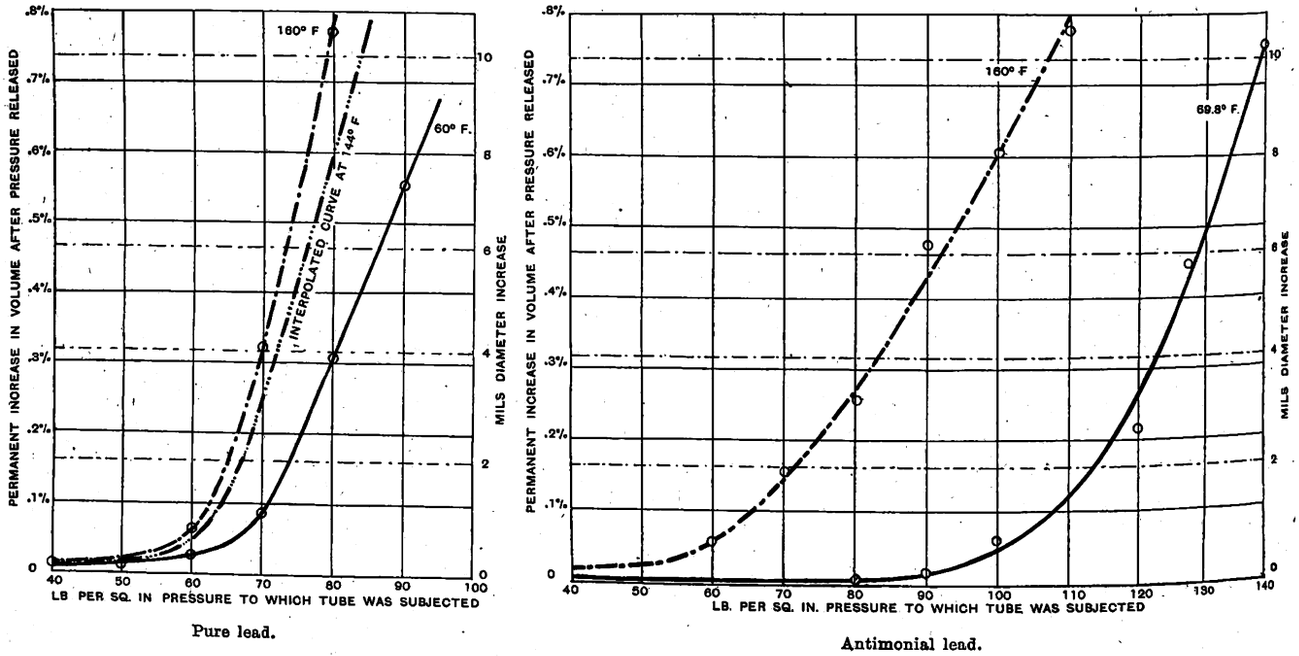
A reply to the suggestion that the alleged creation of voids in normal cables as a result of permanent distension of the lead sheaths lacks foundation.

By H. GURNEY WOOD.

In his recent article on the physical behaviour of lead sheaths in relation to failures of high-voltage cables,* Mr. C. J. Beaver, M.I.E.E., makes a number of points which must not be allowed to pass without comment.

The contention that the expansion of the impregnating compound sets up pressure inside the lead sheath is admitted, but it is argued that such pressure is not sufficient to cause permanent distortion of the lead. In this connection reference may be made to tests carried out by the Research Department of the Detroit Edison Co., when pressure was recorded as high as 85 lb. per square inch, with a corresponding vacuum of 15 inches.†

The pressure caused by the expansion of the compound will be limited by the ductility of the lead and by the air, or space, content in the cable. If the latter can be ascertained, it will be possible to predict what will happen in any given cable, provided the temperature distribution and the mechanical properties of the lead are known. Figs. 1 and 2 show the critical points in the cases of pure and hardened lead at two different temperatures, the permanent expansion being expressed as a percentage increase in volume and also as an increase of diameter. From these curves it will be appreciated that, though slight permanent increases in volume are indicated, there is no serious deformation at ordinary temperatures of the lead until 60 lb. per sq. in. is reached in the case of soft lead, or 90 lb. per sq. in. in the case of hardened lead, antimonial lead being used. When, however, the cable is run on overload it will be realised that the advantage of hardened lead is very much less, being almost entirely lost at the temperature of 160 deg. F. The readings below a pressure of 40 lb. per sq. in. were rather irregular, probably due to the lead sheathing not being truly circular in section. Pressure was left on the tubes tested in every case for six hours before being released.



Pure lead. Antimonial lead.

Figs. 1 and 2.—Permanent Expansion of Lead Tube by Internal Air Pressure.

The relationship between the temperature and permanent increase in volume of a cable sample sealed at each end and heated to a uniform temperature is shown in fig. 3, and by comparison with the fig. 1 curve the probable internal pressures which produced the permanent expansion can be computed. If, for instance, the volumetric expansion of the lead was 0.05 per cent. at 115 deg. F., then the pressure in the closed

* Elec. Rev., January 18th, 1929, p. 96, *et sec.*

† *Nature*, March 3rd, 1928, p. 338.

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sample must have been about 63 lb. per square inch. (absolute, 78 lb.). To check these results, lengths of cable were laid out on the bottom of a large concrete pit; the ends were properly sealed to prevent loss of compound and to enable loading currents to be applied, and tests were made to measure the power factor at high voltage. Pressure and vacuum gauges were inserted in the length of cable, so that the actual pressure inside the lead casing of the cable could be registered. Two typical curves are reproduced as figs. 4 and 5, with different current loadings: it will be noted that in both cases the pressure rises to a maximum, and then falls, which is typical of a large number of current runs on different cables.

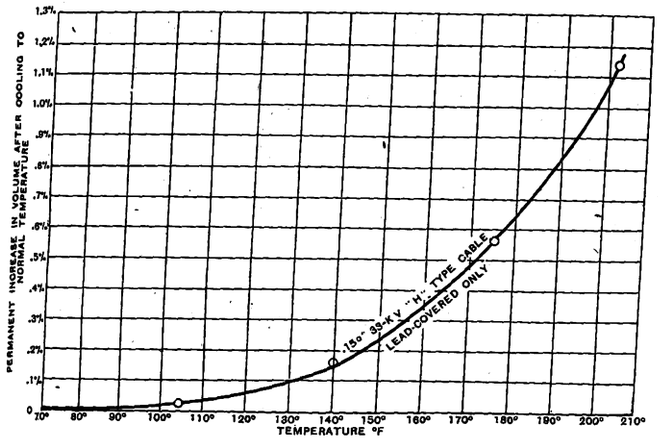

Fig. 3.—Permanent Expansion of Cable Sample by Heating for six hours to Temperature Shown and Cooling to Normal Temperature.

The probable explanation is that the lead is slowly expanding under the internal pressure, as might be expected from the other curves shown. In the case of the first run at 290 amperes, the temperature of the conductors at the conclusion of the run was 162 deg. F., and that of the lead sheathing was 127 deg. F., which would result in an average compound temperature of about 144 deg. F. Reading on fig. 3 curve, the permanent expansion would be 0.16 per cent., which (from fig. 1 curve) would require an internal pressure of, say, 67 lb. per square inch. The pressure actually measured was 69 lb. per sq. in., and had been as high as 74 lb., the agreement between the results being very close. As has previously been stated, the pressure generated by the expansion of the compound is largely affected by the cushioning effect of the air space inside the cable. The larger the air space, the lower the pressure to which the cable will be subjected under a given temperature; whereas the more completely all air spaces are removed, the higher will be the pressure with an increase in the extension of the lead, and on cooling a higher vacuum.

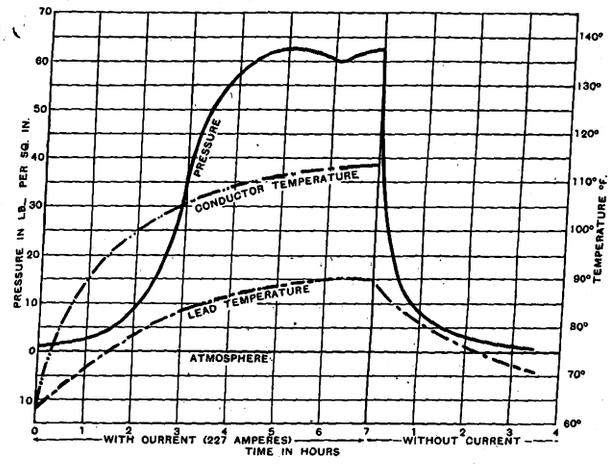

Fig. 4.—Test on 115 Yards of 0.15 sq. in. 33-kV Armoured "H"-type Cable.

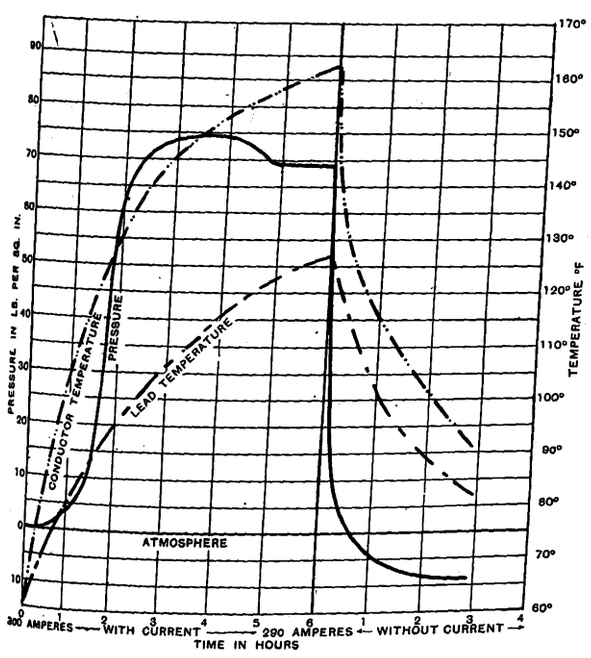

Fig. 5.—Test on 115 yards of 0.15 sq. in. 33-kV Armoured "H"-type Cable.

If the co-efficients of expansion given in Mr. Beaver's article are used as a basis of calculation, it will be found that the increase in volume of the dielectric in the prior-impregnated cable, due to a rise of 80 deg. F. throughout the whole cable, is greater than the increase of space inside the sheath due to the co-efficients of expansion of the lead by 0.021 cu. in. per inch length. This, by simple calculation, would indicate an air space figure of 0.064 cu. in., with the pressure recorded of 24 lb. (absolute). Applying the same constants to the vacuum-impregnated cable, the expansion to be provided for without stretching the lead is 0.0218 cu. in., which would indicate an air space of 0.0334 cu. in. at a pressure of 43 lb. (absolute).

The approximate space, or air content, in a cable may be directly measured by keeping a sample of the cable immersed in hot oil and collecting the air, or gas, which is driven off. The amount collected will not be the total quantity, but the method is a very satisfactory check on the impregnating process and the slackness, or otherwise, of the lead casing.

It is interesting to note that a cable made to the same dimensions as the vacuum-impregnated one mentioned by Mr. Beaver showed, by the method suggested for directly measuring the air space, a figure of 0.0328 cu. in. per inch. It would therefore appear that provided the air, or space, content is known and the correct figures for the co-efficients of expansion are used, it is possible to calculate what pressures are likely to be set up, and from the diagrams given to know if they are, or are not, likely to cause permanent expansion of the lead sheath.

The conclusions expressed in Mr. C. J. Beaver's article are seriously challenged by the curves reproduced herewith, as a pressure of 69 lb. per sq. in. is well above the critical point of ordinary lead in fig. 1, and that pressure was obtained with a conductor temperature of 113 deg. F.

The success and very general adoption of "H"-type cables is very good evidence that failures in the past have been due to the formation of voids, which, in a belted cable, are under electric stress; whereas, if they occur in an "H"-type cable, they are outside the field and therefore innocuous, and it is very well known that cable breakdowns are more likely to occur after the peak of the load has been passed, rather than when the temperature of the conductor is at its maximum.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Improved Watertight Switch.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has just brought out an improved design of the "Magnet" watertight quick-make and-break switch, fig. 1. Enclosed in a clean cast-iron case, this switch is operated by a solid brass pointer-type side handle. A boss on the inside of the operating lever enters a machined hole in the side of the casting and keys with a spindle connected to an inside

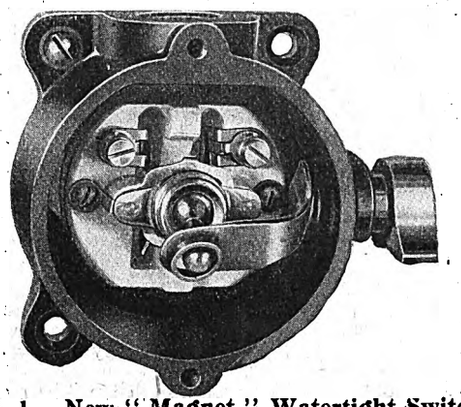
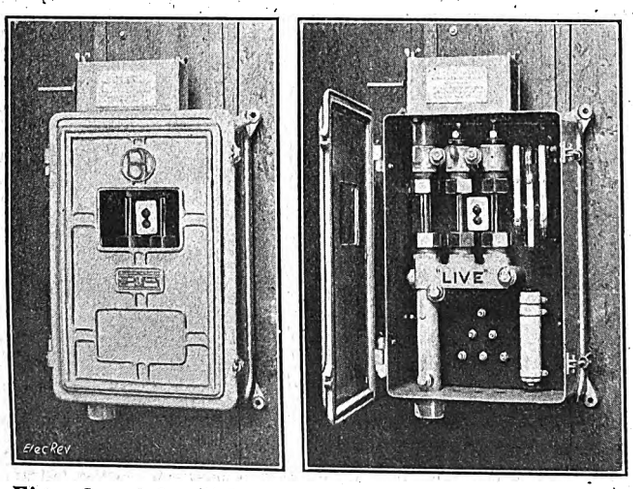


Fig. 1.—New "Magnet" Watertight Switch.

arm; these components are drawn together by a substantial screw through the gland, which is packed with tallowed hemp, thereby forming a well-lubricated watertight gland. The domed lid is fixed by two roundhead brass screws, and a good-quality rubber gasket is provided between the lid and box. Two fixing lugs are provided with countersunk holes, and a third lug is included, into which is fixed a large-sized brass round-headed screw with a washer for an earth connection. The convenient position of the conduit hole renders unnecessary any set or bend in the conduit.

Pump Control Equipment.

The "Pneutrol" control apparatus, figs. 2 and 3, is an ingenious device which has been introduced by Brookhirst Switchgear, Ltd., Northgate Works, Chester, to provide a sound engineering alternative to float switches or similar gear for use with automatic control panels for the the starting and stopping of electrically-driven pumps. The "Pneutrol" device can be mounted in a convenient position



Figs. 2 and 3.—"Pneutrol" Pump Control Equipment, "Closed" and "Open."

away from the tank, and the only part in contact with the liquid to be pumped is a small vertical compression tube which is connected to the control equipment by means of a plain ½-in. copper pipe. Variation in level of the liquid causes a variation of pressure in the pipe, and this imparts movement to two columns of mercury within the "Pneutrol" equipment. The operating circuit of the control panel is made or broken, according to the level of the mercury in the control apparatus, at points independently adjustable in each column.

The principal advantages claimed for the new control equipment are: there are no external moving parts in contact with the liquid; and cumbersome float gear is avoided; it is not necessary to place the device in proximity to the tank, where the atmospheric conditions may be unsuitable, and it can be situated in a convenient position under cover; as the make and break contacts are enclosed in glass tubes they are unaffected by external conditions; the starting and stopping limits are not affected by rolling or surging of the liquid in the tank or sump; for marine installations, the "Pneutrol" control has the further advantage that it acts definitely and with reliability under any conditions of weather experienced by a ship at sea.

A New Searchlight.

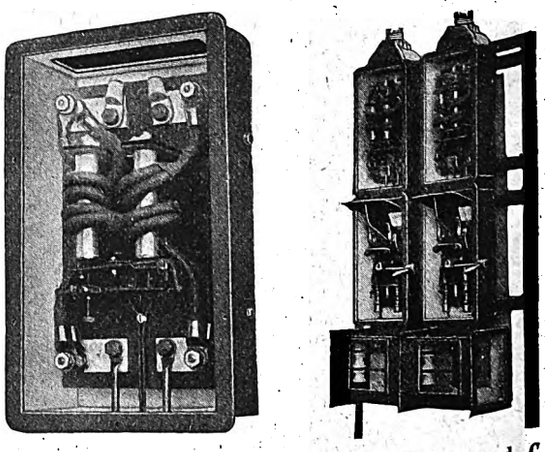
Fig. 4 shows a searchlight which has been produced by the London Electric Firm, Brighton Road, South Croydon, for the Royal National Lifeboat Association, forming part of the equipment of the recently-launched new super motor lifeboat delivered to Cromer. It is made in very light non-corrodible metal, but perhaps the most important feature is that it is entirely watertight. There is an inlet gland for the cable and another gland for the spindle of the lamp focus gear; the

Fig. 4.—A L.E.F. Lifeboat Searchlight.

latter can be operated without removing the hand from the handle, so that the searchlight may even be worked under the water. It is made for low-voltage lamps taking up to 60 W, the gasfilled variety being usually employed.

D.C. Leakage Relays.

To afford a ready means of complying with Regulation 94 F of the Wiring Rules of the Institution of Electrical Engineers, which requires that "in installations in which the normal working current in any circuit or circuits connected to the



Figs. 5 and 6.—"Statter" D.C. Relay and C.B. Combination.

main distribution board exceeds 100 A, there shall be provided, in addition to a fuse or circuit breaker with overload trip, an automatic device whereby the installation or faulty circuit, as the case may be, shall be disconnected in the event of a leakage to earth," Messrs. J. G. Statter & Co., Queen Anne's Chambers, Westminster, S.W.1, have introduced a range of d.c. relays. These are enclosed in c.i. cases with machined flanges, each being provided with inlets and outlets convenient for passing the full current of the circuit to be protected

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by it. The relays are wound for various current ranges, but all ranges are calibrated at from 50 to 100 A; in other words, they may be set to trip out at any current leak of from 50 to 100 A. Fig. 5 shows the standard relay with its cover removed. In operation the relay closes a pair of contacts, thereby energising a pressure trip coil on the circuit breaker. The contacts are not intended to break the circuit of the pressure trip coil; an auxiliary switch should be fitted in the breaker for this purpose. Alternatively the relay may be connected on the dead side, so that when the main circuit breaker opens the pressure trip coil is dead. Fig. 6 shows an equipment consisting of 2 d.p. circuit breakers and two relays, protecting two circuits against overload or leakage. The position of the bus-bar chamber and bars below the units is optional. Frequently the bus-bars are at the top, then the d.p. circuit breakers and the relays and outlets are at the bottom.

The relays are supplied in five sizes for carrying normal currents of 100, 200, 400, 600 and 800 A, respectively. The size of the smallest relay is 24 in. by 14 in. by 8 in., and of the largest relay 28 in. by 20 in. by 9 in.

The Brisbane Bulimba Station.

Particulars of the New Electricity Works of the City Electric Light Co., Ltd.

By JOHN S. JUST, M.I.E.E.

(*Abstract of a Paper read before the* Brisbane Division *of the* Institution of Engineers, Australia.)

The following are some notes in connection with the generating station of the City Electric Light Co., Ltd., at Bulimba, Brisbane, which I have had the honour of designing, constructing, and operating. The City Electric Light Co., Ltd., was exceedingly fortunate in finding a site within a radius of six miles of the General Post Office, Brisbane,

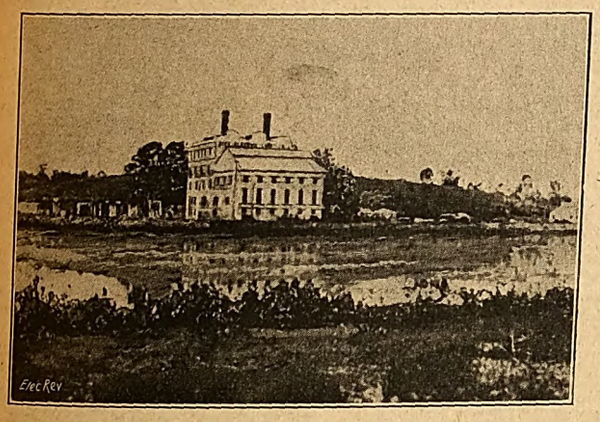

Fig. 1.—The Bulimba Generating Station.

which, from points of view of railway facilities, circulating water and transmission-line routes, is essentially able to economically support a station of well over 500,000 kW output capacity.

The layout of the Bulimba station, figs. 1 and 2, is such that the boiler room is at right angles to the engine room. The turbine room and boiler room extensions are towards the inlet water canal, with room for an additional switchgear bay between the canal and the boundary road. Coal is brought to the rear of the building and dropped by gravity into a 30-ton receiving hopper, and thence elevated by bucket conveyors to the overhead bunkers.

The boiler room has been arranged for four boiler units, three to have an evaporation of between 100,000 and 125,000 lb. of feed water at 90 deg. F. to steam at 300 lb. per sq. in., 750 deg. F., and a fourth with a maximum evaporation of 150,000 lb. per hour. The boilers are erected on steel framework carried from the ash pit floor; three are by Messrs. Babcock & Wilcox, Ltd., and one by Messrs. John Thompson Water Tube Boilers, Ltd.

Provision is made for two evaporations, each capable of dealing with the total water required under normal conditions by the boiler plant. Owing to the high-temperature steam conditions very large area condensers are installed, and as a condensing medium the feed water is used, so that the output of the evaporation is largely governed by the loading on the boiler at a given time. If extra treated water is required the evaporation may be worked to the total output by passing the treated water into the working condenser in the engine room. In addition to the evaporators chemical treatment plant, together with a filter bed, is provided. The ash-removal method adopted is through a water seal by drag chains.

Two drag-chain conveyors are provided, and the ashes are taken to various dumps by a light 2-ft. gauge tramway.

A 60-ton 4-motion electric travelling crane spans the engine room, in which is installed a Fraser & Chalmers turbine of 12,500 kW economic rating, 3,000 r.p.m., eight-stage impulse, single flow, from which steam is bled for feed heating, coupled to a 5,600-volt, three-phase alternator of 15,000-kW capacity, manufactured by the General Electric Co., Ltd.

The condenser, which is fixed immediately below the turbine, is of the Allen two-pass, "Contraflo" type, containing 20,700 square feet of cooling surface, and capable of condensing 148,000 lb. of steam at 28-in. vacuum when supplied with 1,040,000 gallons per hour of cooling water at 80 deg. F. A Parsons turbine represents a departure in that it is a pure reaction set, which thus increases its overall length to 42 feet. It has similar output and other details to the General Electric turbine, and is coupled to a Parsons alternator. Owing to the low-temperature rise of the alternators they are usually rated for continuous service at 20,000 kVA.

A third set, of 15,000 kW, to be installed will be moved from William Street; it was manufactured by the Metropolitan-Vickers Electrical Co., Ltd.

Generally the switchgear is designed to couple the alternators directly to the bus-bars, through transformers, and thence to the feeders. The system is laid out for a rupturing capacity of 500,000 kVA. There are ten 5-kV to 33-kV step-up transformers—33 kV, 400 A—and o.c. breakers, lightning arrestors, disconnecting links and choke coils controlling four 33-kV overhead feeders and two 33-kV underground feeders.

All the switchgear is of the outdoor type, and, where necessary, is supported on framework. The electrical auxiliary units in the power house can be fed either from the corresponding machines themselves, making self-contained units, from common busbars, or from any of the turbines.

There are at present two aerial lines, each of three conductors of 19/12 stranded copper, erected on a single line of poles. A new double-circuit line of similar size is under construction; this line will cross the Brisbane River at New Farm by means of flexible steel lines approximately 250 feet

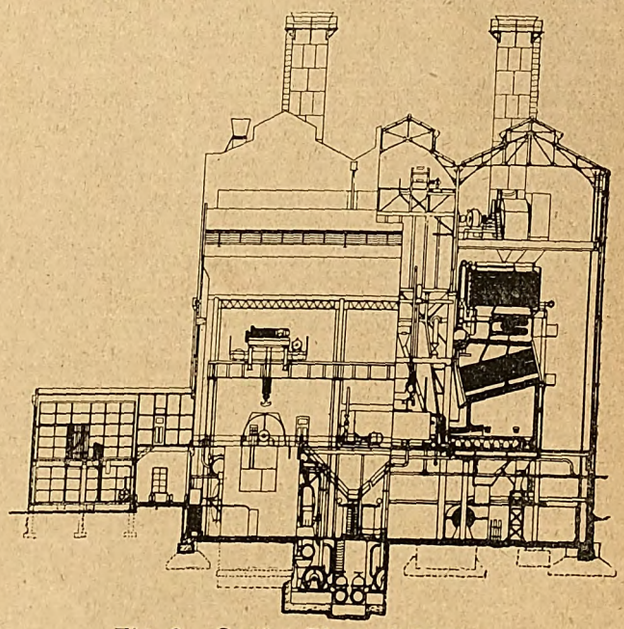

Fig. 2.—Section Through Station.

high. The aerial conductors are mounted on ironbark poles and wooden crossarms, and are spaced 36 inches apart.

The step-down sub-stations are similar to the step-up ones, and house 5,000-kVA, 33—5 kV transformers, controlled by 33-kV, 3,000-A, oil circuit breakers and disconnecting links.

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The Electricity Commissioners' Work.

Brief Extracts from their Eighth Annual Report, for 1927-28.

THE eighth annual Report of the Electricity Commissioners,* covering the period April 1st, 1927, to March 31st, 1928, contains prefatory observations on the regional schemes adopted by the Central Electricity Board, and a brief review of some aspects of rural supplies of electricity and the overhead-line wayleave situation.

Undertakers and Areas.

Inclusive of the C.E. Board and allowing for two companies with undertakings in England and also in Scotland, the number of separate undertakers was 642, a net addition of 19, consisting of 376 local authorities, 261 companies and persons, four Joint Boards, and two J.E.A.'s.

The authorised distribution areas embraced over 92 per cent. of the cities and boroughs, 86 per cent. of the urban districts and 58 per cent. of the parishes in the rural districts in England and Wales; and about 68 per cent of the cities and burghs and 29 per cent. of the civil parishes (exclusive of burghs) in Scotland. The authorised distribution areas in Great Britain covered about 89 per cent. of the urban areas containing upwards of 97 per cent. of the urban population; and nearly 42 per cent. of the rural areas containing upwards of 67 per cent. of the rural population. It is clear that the majority of the areas possessing the higher average densities of population, and thus presenting the better prospects of development on a remunerative basis, have already become occupied. The unoccupied areas in which no supply of electricity has yet been authorised, consist mainly of the more sparsely populated rural portions of the country, amounting to 45 per cent. of the total area, but containing only 5 per cent. of the total population, with the low average density of 56 persons per square mile. The rural areas for which powers have been granted since 1920 account for upwards of 82 per cent. of the area, and about 69 per cent. of the population of the rural distribution areas existing at March 31st, 1928. The figures also reveal the increasing sparseness of the rural areas for which supply powers have been sought in recent years, the average density of population in the rural areas of supply authorised prior to 1920 being of the order of 332 persons per square mile, as compared with 156 persons per square mile in the case of the rural areas of supply authorised subsequently.

Generation and Consumption.

The energy generated by the total of 570 stations amounted to 9,927,850,630 kWh, the fuel consumed being 9,034,323 tons of coal, 149,721 tons of coke breeze, and 40,107 tons of fuel oil. The 486 authorised undertakers' stations generated 8,551,425,279 kWh. Thus the output increased by nearly 18.7 per cent., for an increase of only 5.4 per cent. in the amount of coal and coke consumed, and accompanied by a falling off in the use of oil fuel, *i.e.*, 40,107 tons, as compared with 145,911 tons in 1926-27. It should be noted that the production of electricity at the stations included within the scope of the returns has practically doubled since 1920-21; also that there has been an all round increase of the order of 54 per cent. in the amount produced per ton of coal and coke consumed, compared with technical practice in 1920-21.

The number of stations remained the same as in the previous year, the closing down of 23 during the year being offset by the coming into operation of the same number of other stations, which included the new stations of the Corporations of Carlisle and Colchester, the Ferrybridge station of the Yorkshire Electric Power Co., and the hydro-electric stations of the Lanarkshire Hydro-Electric Power Co. at Bonnington and Stonebyres. Of the 570 stations, 251 (44 per cent.) generated less than 1,000,000 kWh each during the year, while 400 stations (70.2 per cent.) generated less than 10,000,000 kWh each. The remaining 170 with individual outputs of 10,000,000, or over, were collectively responsible for as much as 93.6 per cent. of the total generated.

The energy sold in 1927 increased by 1,126,509,285 kWh to a total of 6,850,162,808 kWh. Companies sold 2,519,521,676 kWh, an increase of 492,673,291 kWh, while the local authorities' increase was 639,835,994 kWh.

There was an increase of about 19.6 per cent. in the sale of electricity by authorised undertakers, as compared with 1926, and a total increase of about 88 per cent. during the five years since 1922. On the basis of the estimated total population of Great Britain at the end of 1927, namely, 44.18 million, the sale of electricity from public sources of supply in that year thus represented an average consumption of 155 kWh per head of population, but large additional supplies used in manufacturing and trading operations are derived from privately-owned plant, which has been installed on a widespread scale and does not come within the scope of the statistical returns. A valuable indication of the extent of the plant installed in factories and other works is contained in an appendix to the present report, which shows that the industrial generating plant installed in 1924 amounted to about 2,564,000 kW, as compared with 3,943,000 kW in the case of authorised and non-statutory electricity undertakings supplying mainly for sale to the public. The generating resources of trade and industry in that year thus represented an addition of about 65 per cent. to the resources of electricity supply undertakings.

Electricity Districts.

As in previous years, action taken relative to Electricity Districts was mainly confined to matters arising from the various district orders already in force, but the Commissioners proceeded with the formulation of a scheme for the North-West Midlands Electricity District, and the establishment of a Joint Authority is based in respect of technical development upon the transfer to the Joint Authority, when established, of the generating stations of the Corporations of Stoke-on-Trent and Stafford, and upon the construction by the Joint Authority of a secondary transmission system in the district which would supplement the main transmission system of the regional scheme for central England.

New Generating Stations.

The aggregate capacity of the generating plant for new stations and that for extending existing stations sanctioned by the Commissioners during 1927-28, amounted to 668,357 kW; while the amount of plant sanctioned for new generating stations was greater than in the previous year, the amount sanctioned for the extension of existing stations was smaller by about 118,000 kW. Of the generating plant sanctioned during eight years, approximately 57.9 per cent. was for local authority undertakers; about 34.5 per cent. for company undertakers; and about 7.6 per cent. for stations owned by railway and tramway authorities and non-statutory undertakings; in a number of instances the installation of the new plant involved the displacement of other equipment of an obsolete type. During the year ending March 31st, 1928, the Commissioners issued fifteen consents (nine to authorised undertakers and six to non-statutory undertakings) in respect of the establishment of new generating stations, representing the initial installation of plant of a total rated capacity of 246,642 kW. The three principal consents authorised the erection of new stations with initial capacities of 50,000 kW, or over, by the London Power Co. (Battersea), Leeds Corporation (Kirkstall), and the Lancashire Electric Power Co. (Kearsley). Applications from the London and Home Counties J.E.A. (Chiswick, since abandoned), West Midlands J.E.A. (Ironbridge, now being constructed), and the North Wales Power Co., Ltd. (Maentwrog, hydro-electric, now in operation) were under consideration and the ten following stations were being built: County of London E.S. Co., Ltd. (Barking, second half), North Metropolitan Power Station Co., Ltd., (Brimsdown, in operation), Oldham Corporation (Chadderton), Yorkshire Electric Power Co. (Ferrybridge), Birmingham Corporation (Hams Hall), Lancashire Electric Power Co. (Kearsley), Leeds Corporation (Kirkstall), Lochaber Power Co. (hydro-electric), Coventry Corporation (Longford, now in operation), Bristol Corporation (Portishead). The Commissioners prescribed the type of current, frequency, and pressure to be used at the three new private generating stations established by the Consett Iron Co., Ltd. (Derwenthaugh), Hollis Bros. and Co., Ltd. (Hull), and the Royal Leamington Spa Corporation (Warwick sewage works).

Extension of Stations.

During the year consents to the extension of existing generating stations were given by the Commissioners to sixty-one authorised undertakers, and in eleven further cases to railway and tramway authorities and non-statutory undertakings, representing, in aggregate, a plant capacity of 421,715 kW: the division of the total was as follows:—Local authority undertakers, 237,480 kW; company undertakers, 143,811 kW; railway and tramway authorities, 40,000 kW; and non-statutory undertakings, 424 kW. Consents authorising the installation of 10,000 kW, or more, were issued to sixteen authorised undertakers and two railway authorities, accounting for 323,000 kW, or approximately 76 per cent. of the above-mentioned aggregate. In six instances sanctions were given to the installation of 25,000-kW sets, namely, in the Deptford station of the London Electric Supply Corporation, Ltd.; the Spondon station of the Derbyshire and Nottinghamshire Electric Power Co.; the Dalmarnock station of Glasgow Corporation; the Willesden station of the London Power Co.; the Blackburn Meadows station of Sheffield Corporation; and the Freeman's Meadow station of Leicester Corporation. In

* H.M. Stationery Office, price 3s. net.

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the case of two applications for consent to extend existing stations, made by the Metropolitan Borough Council of Southwark and the Corporation of Darwen, the Commissioners found it necessary, after local inquiries had been held, to refuse their consent as a case for extended local generation, as compared with the alternative of a bulk supply, had not been proved to their satisfaction.

Main Transmission Lines.

Apart from the applications to the Commissioners during the year under review of the Central Electricity Board for consent to the establishment of 132,000-V overhead transmission systems, formal consents were issued in repsect of sixty-four applications. In eighteen cases they related to 33,000-V transmission lines, and in two instances they covered the establishment of 66,000-V transmission lines, namely, by the Shropshire, Worcestershire and Staffordshire Electric Power Co. and the North Wales Power Co., Ltd., respectively. The consent issued to the latter company was of a comprehensive character, covering twenty-six sections of the main transmission system ranging from 6,600 to 66,000 V.

Special Orders.

At the commencement of the year ninety-five applications for special orders relating to the establishment, or extension, of distribution undertakings, &c., were under consideration. During the year eighty further applications were received and one of the applications previously made was divided by the Commissioners into two parts, thus making a total of 176 applications under consideration. During the year the Commissioners made special orders in respect of eighty-one of the applications before them, all of which had been submitted to the Minister of Transport for confirmation by March 31st, 1928. Of the other applications, four were refused and ten were withdrawn, while in the case of an application made by a statutory gas company, the Commissioners were unwilling to make an order and referred the application to the Minister of Transport. The eighty remaining applications were under consideration at the end of the year.

Of the eighty applications received during the year, thirty-nine related to the establishment of new distribution undertakings and thirty-six to the extension of existing areas of supply; as in previous years, a noteworthy feature of many of the applications was the large extent of the proposed areas of supply. There was again a pronounced element of competition between applications, as many as twenty-four of the applications lodged during the year competing, as regards the whole, or a portion, of the proposed area of supply, with current or prior applications. In the course of the year ten inquiries, affecting seventeen applications, were held by the Commissioners and parties concerned in other cases were also heard.

(To be continued.)

D.C. Cable-Testing Equipment.

Some of the general principles and theoretical considerations involved in the use of a high-voltage thermionic a.c. rectification outfit.

At a recent meeting of the London local technical group of the Electrical Power Engineers' Association, held in the rooms of the Junior Institution of Engineers, Mr. H. B. Gough, discussed the general principles and theoretical considerations involved in the high-voltage d.c. testing of cables with the aid of thermionic valves, the design and construction of testing equipment, and procedure when testing. Testing sets were usually designed to meet the specific requirements of the individual user, and a complete outfit was possibly more useful and time-saving when actually on site, as few connections had to be made; but, from the point of view of portability, it was of advantage to divide the set up into a number of small parts, each of which being reasonably portable. He illustrated a typical set of this character.*

If the cable was perfectly sound and the leakage current infinitesimal, the most simple means of voltage measurement was by the use of an electrostatic voltmeter connected directly across the cable under test, as the percentage ripple on the cable was practically nil. When the leakage current was of considerable value, however, as it might be on an overhead line in foggy weather, voltage measurement by that means should be viewed with suspicion, as the peak voltage was greater than the r.m.s. value. Under such circumstances it was advisable to use a sphere-gap voltmeter, which might be set at the required test pressure and the voltage gradually increased by means of the primary controls of the testing equipment until sparking over the sphere gap took place; a sphere-gap voltmeter should not be used without a limiting series resistance. The reading of the primary voltmeter and the electrostatic voltmeter should be noted at the moment of spark-over: the sphere-gap might then be opened, say, 10 per cent. more than for the required test pressure, and the test carried out in accordance with the previously noted readings of the electrostatic and primary voltmeters. Incidentally, the primary voltmeter reading gave a very accurate indication of the secondary voltage, which might be calculated from the formula: $E = \sqrt{N}e$, where E = test voltage, e = primary volts, and N = transformer ratio. The result obtained was for a single-valve test; when using equipment for a two-valve test, the figure obtained by the formula must be doubled.

In designing transformers for cable-testing equipment the experience gained in X-ray work had been of the greatest value, the conditions being somewhat similar for both classes of work. The secondary winding of small transformers for voltages up to 60 kV was of the single-section layer type, graded and spaced to provide mechanical stability and electrical strength. For regulating the testing output voltage a regulator was connected in the primary circuit of the step-up transformer. Perhaps the simplest method was to use a shunt rheostat. As a means of control for small sets used for pressure testing only, a potentiometer was suitable, as the voltage output might be varied evenly from zero to the maximum. For fault burning and locating when large currents were required, the size and cost of a suitable rheostat became prohibitive, and another method must be adopted; an induction regulator was suitable under certain conditions, and had been used in connection with cable-testing equipment, but the size and weight were out of proportion to those of the rest of the apparatus; also, it was expensive, and in the event of a breakdown of the cable under test it did not limit the amount of current flowing through the equipment, unless an additional choking coil was connected in series. The most suitable method of control was by means of a combination of a tapped auto-transformer and variable choke coil: the voltage on the cable under test might be raised by means of the auto-transformer until the test pressure was almost reached, the final adjustment being made by the variable choke coil. The advantages of that system were simplicity, low first cost, and the inclusion in the primary circuit of a large choke coil which, in the event of a fault occurring suddenly, acted as a current limiter and saved the component parts of the equipment (especially the valves) from being overloaded.

It was inadvisable to discharge a cable by direct connection to earth, although one engineer had adopted that method, so far without harm. It was a harsh method, and in the opinion of many engineers it was liable to cause breakdown of the cable, due to the surges set up. Therefore, it was advisable to include high resistance in the discharge circuit: a simple method was to fill a rubber tube with water, connect one end of it to earth, and attach the other terminal to the cable. Wire-wound resistance was unsuitable, owing to breakdown between individual turns, but a method which had given satisfaction was to discharge through a wooden resistance; the equipment was rather cumbersome, however, and seemed to be unnecessary. The most successful method was by the use of water-moistened cotton tape, which had the advantage of cheapness and portability, and discharged the cable quickly and safely. To nearly every testing equipment was fitted a bank of resistances, usually "Silit" (a type of carborundum) rods, and if the resistance value of the bank was great enough the cable might safely be discharged through it. After being discharged, all the cores must be solidly earthed for some hours; if that was not done, a potential would build up again on the cable, due to the "soakage" effect of the insulation, sufficient to give an unwary worker a severe shock if the cable were touched.

High resistance (usually of the order of 5 ohm per volt) must be included in the circuit with the valves and cable under test (water wire-wound, or a bank of "Silit" rods) to protect the valves against surges and help to limit the current which would flow in the event of a fault taking place. When testing overhead lines it often happened that high-frequency oscillations found their way back into the set through the capacity of the valves, and to prevent damage to any of the primary circuits it was advisable to place between the primary and secondary windings of all transformers metal shields solidly connected to earth.

Should a fault occur on the line during test, it would be indicated by a sudden increase of leakage current, accompanied by a corresponding fall of voltage across the cable. If a fault was of the "self-sealing" variety, after the pressure reached a certain value a heavy current would flow suddenly, the

* Elec. Rev., February 15th, 1929, p. 307.

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pressure falling away; gradually the pressure would rise again, the current decreasing until the whole cycle of operations was repeated. When that occurred, pressure should be kept on the cable, and as a rule the frequency of the charge and discharge became more and more rapid, until finally a steady value of current was obtained. The fault should be located at once, and a special point was that there should be no delay between switching off, connecting the fault-locating bridge in circuit, and proceeding with the localising.

Direct pressures up to 200,000 volts could be obtained by means of the two-valve arrangement, but to obtain pressures greater than that it was necessary to use condensers and join two circuits in series.

Discussion in London.

Mr. Allen, who presided, suggested that the wooden discharge device was simpler than moistened cotton tape, and that it was not necessarily cumbersome. Within 1 or 1½ minutes the discharge was effected quite sweetly, and there was no question of surges occurring. He was particularly interested to note how accurately it was possible to localise faults; he had got to within 0.2 per cent. of the correct position, which he regarded as an excellent result. He agreed with a suggestion made by Mr. Gough, that the osmosis effect caused a d.c. test to be very much more severe, relatively, than theoretical people would have them believe.

Major A. M. Taylor noticed that in diagrams exhibited by Mr. Gough the three cores were shown bunched together: presumably that was practicable with his form of test, but it would hardly be practicable with the power-factor form of test. About 72 drum lengths totalled 9½ miles of 33-kV cable, and, presumably, when a cable went wrong the trouble was just as likely to be due to one particular drum length having been wrongly impregnated, or to possess some other fault, as to anything else. If a particular drum length doubled its power factor, could one detect that in 9½ miles of cable with Mr. Gough's method of testing? That was rather a tall order, but he believed one could do it with the power-factor test. One did not wish to break down the cable at once, but to ascertain if there had been any diminution since it was laid; one wanted to keep a regular month-by-month record. In that sort of test obviously one wanted considerable accuracy, because 1 in 72 was only 1⅓ per cent., and if there were a departure of 1⅓ per cent. from the original test leakage one wanted to detect it and to know whether, under those conditions, it was possible to detect it without going any further in the way of breaking down the cable. In the case of six trunk cables in Birmingham, 18 cores would have to be tested, and one had to consider very seriously how to work them in and out, because 60,000 kW would be transmitted, and they would probably be working for all they were worth during the whole of the 24 hours of each day under the Government scheme; one had to consider when they could be out of commission for testing, and the time occupied by the test was, therefore, important. He gathered that the sets described by Mr. Gough would be expensive, but he did not suppose power-factor testing apparatus was very cheap.

Mr. F. Charles Raphael asked if the osmotic effect would become evident, assuming there was moisture in the cable, during a quarter-of-an-hour's test. Mr. Gough's fault-locating results were extremely accurate. In ordinary testing with d.c. batteries, or whatever was used, and with an ordinary slide-wire resistance and galvanometer, there was no difficulty in achieving accuracy within 0.1 per cent. of the total length of the cable; it was wrong to calculate it as a percentage of the distance of the fault. What would happen to the step-down transformer for heating the filament if the cable broke down during a test? Should a high voltage surge take place in the secondary winding, the latter would act as a primary and the voltage would be stepped up in the real primary. Did Mr. Gough rely simply upon the series resistance, or was there any other method of protecting the transformer?

Major Taylor said he was anxious to find a method of ascertaining what change might occur in the condition of a cable during a period of, say, a year, and he asked whether a test applied a year after the installation of a cable could be relied upon to show the same voltage, within a fraction of 1 per cent.

Mr. Fernie regarded the method of fault location described as being rather "chancy." He did not think that as the result of using that method one could scrape one's foot on the ground at a particular spot and say with certainty that the fault was there. One could do that with confidence only when using a search coil and a telephone, so far as he knew. He asked if Mr. Gough's d.c. apparatus could be adapted for finding faults in that way, and whether it would be practicable to include in the circuit some kind of interrupter to make and break the current.

Mr. Hilling gathered that when testing by the two-valve method between two cores, one would be positive and the other negative. If that were so, would the osmotic effect be neutralised?

The Author, in reply, remarked that factors of inaccuracy to be looked for included the human element; the necessity for making quite sure that one obtained a dead balance, by observation, of the galvanometer; and also it was advisable to check the bridge against a very accurate Wheatstone bridge. The County of London Co.'s engineers had a very accurate Wheatstone bridge, and occasionally checked their fault-locating bridge against it, but generally the latter was found to be sufficiently accurate to enable one to find a fault. Major Taylor could carry out definite period tests with d.c. testing equipment, whereby he could reproduce exactly the original voltage; that type of test had never caught on in this country, but in Holland, particularly, he believed the majority of power engineers tested all their cables at definite intervals of time to measure the leakage current; if there were a rising characteristic they immediately suspected an incipient fault. Fault-locating on long lengths of cable by the County of London Co. was fairly accurate.

The examples of fault locating to which he had referred were actual tests, and they indicated a very high degree of accuracy. One might not be able to locate the exact point of a fault, but could get to within a very few yards of it; the natural thing to do then was to examine the nearest joint. The interrupted d.c. method mentioned by Mr. Fernie would not be very successful. Osmosis did occur in a cable. Some engineers, who realised that, adopted the practice of carrying out half the test one way round and then reversing the connections and testing the other way round for the other half of the period of the test. The method of testing back from the other end of the line when locating faults, as suggested by Mr. Watson, had been tried, and a greater degree of accuracy could be obtained thereby.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

American Control of Electricity Companies.

On February 18th Mr. Wellock asked the Minister of Transport if he was aware that an American utility company had acquired through the Greater London and Counties Trust, Ltd., the control of seven British power companies and substantial interests in others, all of which enjoyed a statutory monopoly; and if the Government would consider whether, and in what ways, this step might affect British interests.

Colonel Ashley said he had seen statements in the Press to the effect mentioned in the first part of the question. With regard to the general question raised in the second part, he did not think that he could usefully say more than that it had engaged his attention.

Electrical Explosions.

On February 19th Mr. Hore-Belisha asked the Minister of Transport if he would state whether attention had been given to the annual reports for 1925 and 1927, of Dr. Waldo, Coroner for London, with regard to electrical explosions and fire prevention; and what steps were being taken in support of his recommendations that the existing regulations for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy should be revised.

Colonel Ashley said he was informed by the Electricity Commissioners that attention had been given to the reports referred to, and that they were at present engaged upon the revision of the regulations referred to.

Electricity in Rural Areas.

On February 21st Rear-Admiral Sueter asked the Minister of Transport whether, in view of the information contained in the eighth annual report of the Electricity Commissioners, recently issued, any steps could be taken to speed up the supply of cheap electricity to rural areas; if he would state when he anticipated electricity would be available to rural areas within a 50-mile radius of London; and whether he had a representative of his Department who had the sole duty of pressing forward the development of electricity for rural areas.

Colonel Ashley replied that the general question had engaged his special attention, and, so far as his Department and the Electricity Commissioners were concerned, all possible steps would continue to be taken to expedite the supply of electricity to rural areas. Much expansion had occurred in the last two or three years. As regarded the London area, the whole of it, with the exception of a few parishes in the south, was either already covered by statutory powers for the supply of electricity or by applications which were now before the Commissioners for such powers. He would expect that electricity would be available throughout this district within the next three or four years. The answer to the last part of the question was in the negative.

Ratable Value of P.O. Wires.

On February 21st Mr. Hurd asked the Secretary to the Treasury whether, as a promise was made by the Treasury to the Central Valuation Committee that the ratable position of Post Office overhead and underground wires and cables should be investigated, he would say what was being done in the matter; and whether meanwhile the assessments of other electrical properties were being raised under the Act of 1926.

Mr. A. M. Samuel said that this matter had been carefully considered. The Central Valuation Committee had been in-

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formed that the Government was not prepared to alter the existing arrangements as regarded Post Office wires and cables. He had no information as to the assessment of other electrical properties.

The Inland Telegraph Service.

On February 21st Commander Bellairs asked the Postmaster-General, in view of the loss of £1,300,000 or more per annum on the inland telegraphs, whether he was aware that the Hardman-Lever Committee of 1927 was not permitted to consider the aspect of transfer to private enterprise; and whether, as the situation had been changed by recent legislation transferring the external cables to the new Communications Company, the Government would open negotiations on similar lines with that company with regard to the remaining telegraphs.

Mr. F. G. Penny, who replied, said that the circumstances under which certain overseas services were to be transferred to a Communications Company had no analogy in the case of the inland service; and the reply to the latter part of the question was in the negative.

The Co-ordination of Communications.

Commander Bellairs also asked the Postmaster-General whether he was aware that, in Section 66 of the Hardman-Lever Report of 1927, the Committee unanimously advised that the possibility of the complete fusion of the telegraph, cable, wireless, and telephone services might with advantage be explored; and whether it was the intention of the Government to obtain the evidence of officials of American companies.

Mr. F. G. Penny said that the answer to the first part of the question was in the affirmative, and to the second part in the negative.

Lancashire Electric Power Co. Bill.

On February 20th, the Unopposed Bills Committee of the House of Lords passed this Bill, which empowers the company to raise additional capital to the extent of £1,000,000 and to increase the borrowing powers from one-third to one-half of the issued capital.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

E.D.A. Activities.

The latest production of the British Electrical Development Association is a coloured poster (E.D.A. 761) in connection with the spring-cleaning campaign. It measures about 19 in. by 28 in., and depicts a little girl operating a vacuum cleaner. It is really an anti-spring-cleaning poster, for it announces that "Electricity Cuts Out Spring Cleaning." The Association announces that the principal speaker at the annual dinner on March 14th (Piccadilly Hotel) will be the Earl of Birkenhead.

The F.B.I. and Industrial Conferences.

The Federation of British Industries and the National Confederation of Employers' Organisations have addressed a joint letter to the General Secretary of the General Council of the Trades Union Congress, stating that they would welcome an opportunity of a conference with the General Council at which they could examine the question of consultation together upon matters of common interest to British industry. At this conference they could explain the difficulties which stand in the way of consultation through a National Industrial Council as proposed in the "Melchett-Turner" Report, which the two bodies are unable to accept. They are conscious of the importance of doing everything in their power to further the promotion of industrial peace in British industry, and the invitation is made in the hope that the discussions will be such as to help forward a better mutual understanding in industry generally.

Commercial Electrical Travellers.

The annual dinner of the Electrical Trades' Commercial Travellers' Association was held at the Connaught Rooms, Great Queen Street, W.C., on February 22nd, Mr. Arthur Chamberlain, J.P., presiding. Following the loyal toast, Mr. Chamberlain, in thanking the Association for electing him as its president, said that there was a common bond between him and the Association as he was a manufacturer. As chairman of a number of electrical manufacturing companies he sidered that good commercial travellers were pearls beyond considered that good commercial travellers were pearls beyond price. Another bond with the Association was that he also was a commercial traveller, and he briefly outlined the many products in which he had travelled. Referring to the art of salesmanship, he recommended that travellers should take up a course in the science of salesmanship, and suggested that the Association might engage a professor of the science of selling to give a series of lessons. He congratulated the Association on its continued growth, and commended it to travellers not already associated with it as a means of increasing their efficiency. In proposing the Association and its charities, Mr. H. Wynne Roberts suggested that the members should also become members of the Electrical Development Association. He was of opinion, from the disappointing discussions at the salesmanship conferences of the latter association, that the conferences had not achieved their aim and that they should take the form of schools instead. Their Association was not yet representative of the electrical industry, and it could increase its usefulness by opening branches in provincial towns such as Birmingham. In responding, Mr. J. W. Ward, chairman, said that in connection with the opening of branches in the provinces, the Association had received a proposal from a traveller to form a branch in Nelson, and it had promised him its support. He agreed that they still had a lot to learn and should acquire sufficient technical knowledge of the products they were endeavouring to sell. A Development Committee had been set up to consider this problem, and a scheme would be ready in due course. The toast of the Press was proposed by Mr. F. H. Page, and Mr. Keir suitably responded. An appeal made by Mr. W. T. Rushton for the Association's charities realised £8 18s.

The German Glow Lamp Trade.

A favourable development in the German foreign trade in glow lamps is reported to have taken place in the past two years. Since 1926 the number of metal filament lamps exported has risen from 20 millions to 69 millions, and the export value has increased from nearly 14 million marks to 34 million marks. At the same time a decline in foreign competition in the German inland market has been noticed; the imports of metal filament lamps, which advanced by 2½ millions in 1927 to 6.25 millions, declined to 5½ millions in 1928. The imports are almost entirely from Hungary and Austria, and only 242,000 lamps were received from Holland last year.

Suggested Overseas Advertising Fund.

Mr. Percy Lister, managing director of Messrs. R. A. Lister and Co., Ltd., has addressed a letter to the Prime Minister in which he suggests the creation of a fund for the purpose of advertising British goods in overseas markets. The proposal is that British industrialists should raise half-a-million sterling, and that the Government should provide a similar amount. Mr. Lister, on behalf of his company, offers to provide £5,000 if 99 other firms will do the same.

Employment during January.

The February *Ministry of Labour Gazette* states that during January employment in the engineering industry declined and was very slack on the whole, conditions being worse in nearly all districts. It was fairly good in electrical engineering, although some decline was experienced in this section. The number of unemployed in the engineering industry as a whole rose by 6,944 to 94,455, and the proportion from 8.9 to 9.6 per cent. The number of unemployed in the electrical engineering section increased to 4,249, the proportion rising from 4.7 to 5.3 per cent. In the electric cable, wire and lamp manufacturing group there was also an increase in unemployment, the number being 5,224 and the proportion rising from 4.9 to 6.1 per cent. The same applied to the electrical wiring and contracting industry, the total of 1,209 representing an increase from 6.4 to 7.8 per cent.

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Craigweil House.

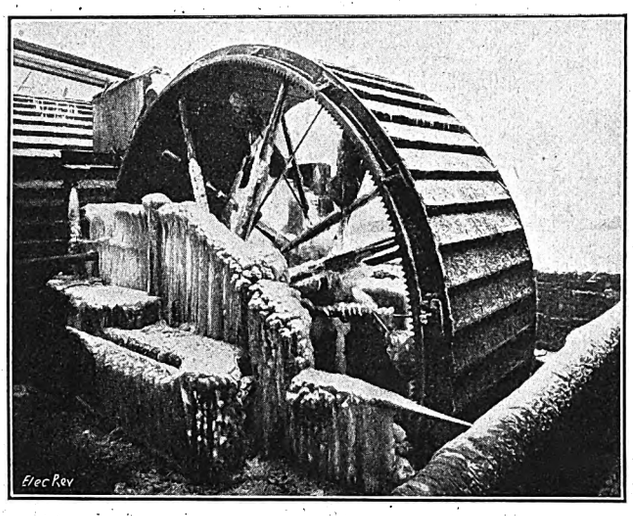
We have before us an interesting photograph received from Messrs. Berry's Electric (1928), Ltd., of Newman Street, Oxford Street, W.1, showing one of their motor vans leaving the gates of Craigweil House, the temporary residence of His Majesty the King, after delivering a large Berry-McClary electric cooker and hotplates, also a "Wilton" Magicoal electric fire for use in the dining room.

The Proposed Russian Visit.

The *Daily Telegraph* reports that the proposed visit of British industrialists to Russia will not now take place before March 8th, the date fixed upon. Delay has been caused by certain difficulties in organisation and arrangement, but the visit will be made later in the year.

Waterwheels Held Up by the Frost.

One of the results of the recent hard weather is illustrated in the accompanying picture. It shows one of the century-old



The D.P. Battery Co.'s Frozen Waterwheel.

water-wheels used by the D.P. Battery Co., Ltd., Bakewell, Derbyshire, which were put out of action by the freezing of the water supply.

Swedish Telephones for Rumania.

The *Industrie und Handels-Zeitung*, Berlin, has received information from its Bucharest correspondent to the effect that a group of Swedish capitalists has submitted to the Rumanian Government an offer to develop the country's telephone system. It is proposed to carry out a considerable extension by installing new exchanges in all the larger towns and bringing the network to the villages. The establishment of a factory for producing telephone apparatus is also proposed.

Bankruptcy Proceedings.

L. H. Lawrence, electrical engineer, 43, Canterbury Road, and Alexandra Road, Margate.—The first meeting of creditors was held on February 22nd at the London Bankruptcy Buildings, before Mr. E. T. Sanders, Official Receiver. The debtor filed his petition on January 16th, and has lodged a statement of affairs showing total liabilities of £1,049 (unsecured £1,001) and net assets valued at £517. He attributes his failure to lack of working capital, heavy overhead charges, and trade depression. The Official Receiver reports that the debtor commenced business on his own account in May, 1923, as an electrical engineer at Margate, without capital. He estimated his turnover for the year immediately preceding the receiving order to have been about £1,600, but states that in consequence of heavy overhead charges there was a net loss of £200. The meeting passed a resolution for the appointment of Mr. C. S. Scarlett, 5, Cecil Square, Margate, as trustee of the estate, with a committee of inspection.

T. F. Cowan, company director, 189, Regent Street, W.—The public examination of this debtor was held on February 20th, before Mr. Registrar Warmington, at the London Bankruptcy Court. The accounts showed assets £51, against liabilities £2,973, of which £2,371 represented the unsatisfied debts of a previous bankruptcy in 1927, from which proceedings the debtor had not applied for his discharge. Debtor stated, in reply to the Official Receiver, that in December, 1927, he, in conjunction with another person, formed Portable Wireless, Ltd., with a nominal capital of £500, to deal in wireless receivers; his associate gave him 251 shares in the company, of which he subsequently acted as director. After May, 1928, the company dealt in motor-cars and accessories; in September its name was changed to De Luxe Cars, Ltd., and he continued to act as director until disqualified by the present failure, which he attributed to his liability for £580 on guarantees. The examination was concluded.

E. C. Jenkins, 124, Cheltenham Road, Bristol, wireless dealer.—The first meeting of creditors was held on February 20th, at the Official Receiver's Office, Bristol. According to the statement of affairs there were liabilities expected to rank at £426 and a deficiency of £362. The debtor stated that he commenced business in August, 1926, without capital, as an electrical engineer at his residence. The business consisted mainly of jobbing work which he did himself, but in November, 1927, he rented a lock-up shop. He attributed his failure to bad trade, illness of his wife, and lack of capital. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

H. H. D. Radcliffe and F. Haddleton, trading as "City Electric Services," 51, Islington Row, Birmingham, electrical engineers.—The first meeting of creditors was held on February 21st, at the Official Receiver's office, Birmingham, when the statement of affairs showed a deficiency of £332, with liabilities of £489, against assets of £157. The debtors attributed their failure to insufficient capital, loss on contracts, and excessive drawings of partners. They commenced trading in partnership in July last, Radcliffe having commenced the business in January, 1927. The business had never been a success, and they became aware of their position in October last. The matter was left in the hands of the Official Receiver as trustee.

H. J. Brownhill, back of 48, Whitehouse Street, Walsall, lately 34, Broadstone Avenue, Leamore, Walsall, electrical engineer.—The public examination herein was held on February 20th, at the Court House, Walsall. According to the statement of affairs there were liabilities estimated at £335 and a deficiency of £296. Debtor stated that his work had chiefly been the wiring of houses, but he had got into difficulties. He attributed his failure to competition and lack of capital. The examination was adjourned.

K. Jolivard & Co., electrical engineers, late of 66, Victoria Street, S.W.—The receiving order in this case was made at the London Bankruptcy Court on February 6th upon the petition of Messrs. Baxter & Caunter, Ltd., the act of bankruptcy alleged being failure to comply with the requirements of a bankruptcy notice. The first meeting of creditors was held on February 18th, when it transpired that no one had then surrendered to the proceedings. The case was left in the hands of the Official Receiver.

E. G. Batt, electrical engineer, 20, Iverna Gardens, Kensington, W., and Magnet House, Kingsway, W.C.—Trustee, Mr. H. E. Cooper, 1-2, Bucklersbury, E.C., released December 20th, 1928.

J. R. Hereford-Lavey and V. De Frece (Radio Cash Stores), electricians, 371, Upper Street, Islington, N.1, and 5, New Station Street and Parliament Street, Nottingham. Trustee, Mr. C. Latham, 78, New Oxford Street, W.C., released January 10th.

H. A. Sanders, electrical contractor, The Black Cat Restaurant, Chawston, Beds.—Trustee, Mr. H. Ball, Duke Street, Bedford, released February 6th.

G. Dodd, wireless dealer, Arches, and Radcliffe Road, Crimble, Golcar.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released February 11th.

Company Liquidations.

Attaix, Ltd., wholesale electrical and wireless dealers, late of 106, High Street, Southampton.—A meeting of creditors was held on February 19th at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. K. M. Scott, of Messrs. Merrett, Son & Street, 32, Finsbury Square, E.C., who reported that a receiver for the debenture holders had been appointed, and the usual resolution for voluntary liquidation had been passed. The statement of affairs submitted showed net assets estimated at £7,348 to meet the claims of the debenture holders totalling £7,416. There was thus a deficiency as regarded the debenture holders of £68, and there were no assets available for the unsecured creditors, whose claims aggregated £2,335. The ranking liabilities were put down at £2,403, with a deficiency of the same amount. The issued capital of the company was £7,170, and the deficiency as regarded the shareholders was £9,573. The company was registered in 1925, with a capital of £1,000, which was subsequently increased in stages to £8,000. The issued capital of £7,170 was all fully paid up, and shares to the value of more than £5,000 had been issued for cash. In 1926 the company acquired freehold premises at Southampton for £5,000, arranging loans of £4,000 for the purpose by mortgages. In the course of the trading there was an overdraft which varied from £1,000 to £2,000. In 1927 the Marconi Wireless Telegraph Co. alleged that the company was infringing patents in regard to wireless sets and convertors, but it was advised by patent agents that the sets, which were of French manufacture, did not infringe the Marconi patent. The board, however, came to an agreement with the Marconi company to pay a certain royalty. A guarantee provided with the sets involved the company in some expense. A sum of £7,000 was borrowed from a new bank, on the security of debentures, and that was utilised as to £4,300 in discharging the claim of the old bank, whilst £1,000 went to the second mortgagee of the premises. The balance was used in the business. The Marconi Company did not receive anything on

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account of royalties, and commenced proceedings. About the same time one of the company's sub-agents for convertors commenced proceedings against the company in the High Court. The company was successful in the latter action, but the sub-agent's business went into liquidation. Last November the bank appointed a receiver, who had disposed of the stock, &c., for £6,700, and was also collecting the book debts. The creditors decided that the voluntary liquidation should be continued with Mr. Scott as liquidator.

The following are creditors:—

	£		£
Blackwell & Co.	34	Obree & Co.	23
Electric Conduits, Ltd.	96	Revo Elec. Co., Ltd. ...	96
Electric Cables, Ltd. ...	140	Radia, L. L.	45
Einar Ekstrom	186	Roberts, Boone & Hellyar	24
Fuller Accumulator Co., Ltd.	28	Schlethawrer, L. F. ...	46
Bailey, L. N. H.	229	Scupham & Wood ...	22
Douglas Advt. Co. ...	104	Schwarzstein, R.	92
Gaisser, C., & Co.	135	Soc. des Lampes	25
General Accessories Co., Ltd.	30	Seem Accumulateur ...	40
Herbelot & Vorms ...	146	Rogers, S.	43
Iliffe & Sons, Ltd. ...	44	Ward & Goldstone, Ltd.	43
Lamport, Bassett & Hiscock	90	Wolf Arns	35
Moore, H. A., & Co. ...	46	Watson, S. G.	65
Mewburn, Ellis & Co. ...	55	Zik-Zak	58
Nathan, J. F.	34	Marconi's Wireless Telegraph Co., Ltd. (approx.)	500

Whitfield Electrical Co., Ltd.—A petition for the winding up of this company has been presented to the County Court of Hertfordshire by Messrs. Hailwood & Ackroyd, Ltd., of Beacon Works, Morley, and will be heard at Barnet on March 5th.

Epoch Electrical Society, Ltd.—A meeting of creditors was held on February 28th at the offices of the liquidator, Mr. C. Hughes, 24-25, Ironmonger Lane, E.C.

Maldon Electric Works, Ltd.—Winding up voluntarily. Liquidator, Mr. A. F. Lovell.

Central Electricity Board.

In our advertisement columns to-day the Central Electricity Board invites tenders for the following:—North-West England and North Wales Electricity Scheme, 1928—33,000-V overhead transmission lines.

New French Company.

A company has been formed in Paris (38, Rue de Mont Thabor), with a capital of 600,000 fr., and the title La Société de Matériel Electrique et Mécanique.

New Catalogues and Lists.

Messrs. Wheeler & Esser, 7, Upper Marylebone Street, W.1.—A price list of electric candle tubes.

The Credenda Conduits Co., Ltd., Oldbury, Birmingham.—An illustrated pamphlet dealing with a new form of oven temperature indicator. Priced.

X-Rays, Ltd., 47, Red Lion Street, W.C.1.—A priced and illustrated mailing card describing the "Thermo-Tank" for developing, &c., X-ray negatives.

The Vale-Royal Electric Lamp Manufacturing Co., Ltd., Vale Royal, York Road, Islington, N.7.—A price list of electric lamps with straight and spiralised filaments, &c.

Messrs. J. B. Brooks & Co., Ltd., Criterion Works, Great Charles Street, Birmingham.—Illustrated pamphlets advertising the company's patent steel tools and "Evertaut" steel chairs.

The Parsons Oil Engine Co., Ltd., Town Quay Works, Southampton.—Catalogue No. 98, fully describing with illustrations and diagrams the company's latest 10-20-h.p. petrol engine.

The Regent Lampshade Co., 16, Brighton Terrace, Brixton, S.W.9.—Priced pamphlet illustrating a new line of vellum lampshades.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester.—Section No. 27-2 of their catalogue well illustrating and describing their outdoor type motor-operated induction regulator.

Sir W. G. Armstrong, Whitworth & Co., Ltd., Kinnaird House, Pall Mall East, S.W.1.—47-page illustrated publication setting forth brief particulars both of their works and their products. The information is given in three languages—British, French and Spanish—and will have a wide circulation throughout the world, through the company's overseas agents. Engineers, technical schools, libraries and students are invited to apply for copies.

Higgs Motors, Witton, Birmingham.—February stock list of a.c. motors and d.c. motors and dynamos.

Messrs. Paterson & Service, 38, Bath Street, Glasgow.—A priced and illustrated leaflet dealing with "Feno" electric radiators.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—A folder containing illustrated notes on the company's electric refrigerators, with a separate price list.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—An album containing 15 views of the company's cable works, &c. The titles are printed in five languages.

Crossley Bros., Ltd., Openshaw, Manchester.—Publication 1240, illustrating and describing the company's compressorless Diesel engines.

Wild-Barfield Electric Furnaces, Ltd., North Road, N.7.—Catalogue Section C/F and J, describing industrial electric furnaces with automatic temperature control. Illustrated.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—Publication No. 401, containing illustrations and prices of "Phililite" fittings which are supplied already wired.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—List D.C. (p. 58), containing a full illustrated description of the company's "No. 46" electric cooking cabinet. Priced.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—Three adhesive window bills advertising the company's hire-purchase system, moving-coil loud speakers and h.t. radio batteries.

The Economic Mission to Australia.

Upon his return from Australia last Friday, Sir Hugo Hirst, Bt., was interviewed by a *Daily Telegraph* correspondent with regard to the work of the British Economic Mission in the Commonwealth. Sir Hugo said that although at first they met with suspicion, that phase passed, and it was a source of satisfaction to them that they were largely responsible for bringing about the first "peace in industry" conference in Australia. He was convinced that the bulk of the Australian people desired to co-operate in trade and other matters with the United Kingdom. As a result of persistent propaganda and concerted business efforts other countries had succeeded in planting themselves deeply in the commercial and industrial life of Australia, and it was high time that a resolute effort was made by Great Britain to assume her proper position in the face of that competition. We must offer Australia freely of our financial and technical assistance if trade between the two countries was to increase as it should. The social conditions in Australia and the standard of living there implied a great purchasing power, and altogether there was a big field for trade expansion between the Commonwealth and ourselves.

Recent Contracts.

Among the more important orders recently received by Messrs. Yarrow & Co., Ltd., are the following:—One Yarrow boiler, for 50,000 lb. per hour normal evaporation, fitted with mechanical stoker and arranged to work under balanced draft in conjunction with an air heater for Messrs. Brown & Adam, Ltd., Glasgow. Messrs. Yarrow are main contractors for a complete boiler-house plant for the India Rubber, Gutta-Percha & Telegraph Works Co., Ltd., including building, coal- and ash-handling equipment, pipework and valves, the boiler plant itself comprising three boilers each for 40,000 lb. per hour normal evaporation with superheaters, economisers, chain-grate stokers, fans, &c. Two boilers, each for 50,000 lb. per hour normal output, and including superheaters, economisers and chain grate stokers, fans, chimney, &c., are being supplied to Harrogate Corporation. Here again Messrs. Yarrow are main contractors, the work including also the boiler-house building, and coal- and ash-handling plant.

Egyptian Railway Electrification Contract.—It was reported this week that tenders had been opened for the electrification of the Helouan railway line to Cairo, and that the lowest was that of the English Electric Co., Ltd., at £261,570.

The Co-ordination of London Traffic.

The London and Home Counties Traffic Advisory Committee has considered the Bills providing for the co-ordination of the transport systems of the "Underground" group and the London County Council, and expresses approval of the measures. The Minister of Transport is advised to facilitate their passage through Parliament. There were three dissentients from the report, who considered that the systems should be under the supervision of a public body.

Visit to English Electric Works.

On February 12th a party of students from the University of Cape Town paid a visit to the "English Electric" works at Stafford. The students were under the care of Professor A. E. Snape and Mr. G. Stewart, and the tour of the works was carried out in accordance with a pre-arranged programme; an expert was present in each department to explain the various processes and special features of design. Informal addresses on technical subjects were given later on in the Guest House. Before returning to London the party was entertained to dinner, and in speeches made by two of the visitors the view was expressed that the English Electric Co., Ltd., had no reason to fear comparison with the electrical works which they had seen in Germany.

Morgan Crucible Russian Director Arrested.

The Riga correspondent of *The Times* reported on February 18th that the Soviet authorities had commenced to liquidate the Leningrad branch of the Morgan Crucible Co., Ltd., and had ordered the trial of its director, M. John Volfman and others. The business has never been nationalised and its preservation has been due to a great extent to M. Volfman. The Soviet Government opened a crucible works of its own in 1924, but the products are said to have been unsatisfactory.

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The charges against M. Volfman are that the success of his business has been due to the bribing of officials to place orders. The defence says that the charges are ridiculous, as the works has never had to seek orders, being unable to cope with the work received without solicitation. The trial was opened in Leningrad on February 20th, an agent, two engineers and a foreman being joined as defendants with M. Volfman.

The Times reports that the evidence offered against the accused men was of such a trivial character that the tribunal would not convict. Thereupon the prosecutor preferred a charge of espionage, and the discovery of a "plot" was alleged.

Employés' "Dabbling" at Monmouth.

The National Federated Electrical Association recently wrote to the Monmouth Corporation pointing out that the position of electrical contractors in the district was being prejudiced by the amount of work which employés of the Electricity Department were carrying out in their spare time. The Corporation took no action, and the N.F.E.A. has therefore written again, stating that the attention of the Minister of Labour is being drawn to the matter. It is alleged that some of the work done by employés of the Department is of a deplorable nature which would still further damage local contractors' prospects. The letter encountered some hostility from the Council, but a Labour member considered that the matter should be investigated. It was decided, however, to await the reply of the Minister of Labour before taking any action.

For Sale.

The directors of the Great Southern Railway Co. (Ireland) invite offers for d.c. motors, pillar controllers, a 500/570-h.p. Belliss & Morcom engine, &c. By order of the receiver for the debenture holder, Messrs. W. B. Hallett, Fox & White will sell by auction on March 5th, at 161, Wardour Street, the machinery, equipment and stock of an electrical advertisement sign manufacturer. (See our advertisement pages to-day.)

A Polish Marconi Company.

Works have recently been started in Poland by the Polskie Zahlady Marconi, a concern which is affiliated with the Marconi Co., for the manufacture of radio transmission and reception apparatus for the Polish market. Chief attention is being devoted to crystal and valve receivers and loud speakers made in accordance with the Marconi patents.

Wages in the Engineering Industry.

A conference of representatives of the engineering trade unions was held in London on February 22nd, at which the report of a special committee which had been studying the ability of the industry to pay higher wages was considered. The report was accepted, and it was decided that the conference should meet again in May.

Unemployment.

The total number of registered unemployed on February 11th was 1,342,500. This represented a decrease of 26,980 as compared with February 4th, when the total was 1,369,480. At the corresponding date of last year (February 19th) the total was 1,159,772.

Book Notices.

"Aluminium Bronze." Pp. x+76; illustrated. London: British Aluminium Co., Ltd.—In its useful tables, appendices, and selected bibliography, this well-produced booklet deals with the remarkable range of properties and wide potential application of the metal.

A reprint from the *Lancet* contains the results of an investigation into the action of foodstuffs on aluminium utensils.

"Science Abstracts" A and B. Indexes to Vol. XXI. 1928. 3s. each net. London: E. & F. N. Spon, Ltd.

"Railway Electrification and Traffic Problems," by P. Burtt. Pp. xvi+197; figs. 23. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVIII. February. No. 2. New York: The Institute. Price $1.

"Maste und Türme in Stahl," by Dipl. Ing. P. Sturzenegger. Pp. vi+218; figs. 362. Berlin: W. Ernest & Sohn. Price 23 Rmk.

Social Events.

On February 16th the staff of the Greenwich Cable Works, Ltd., held a dinner to celebrate the company's forthcoming move from Greenwich to new works at Croydon. A number of prizes were given for dancing, humorous songs, and a Limerick competition. The chairman (Mr. J. H. C. Brooking), in reply to the toast of the company, made special mention of the chairman of the company (Mr. Sam Bibby), who was unable to be present; he had served the company since it was formed in 1902.

The A.T.M. Golf Club, whose membership is drawn from the personnel of the Automatic Telephone Manufacturing Co., Ltd., held its fourth annual dinner on February 16th at the Childwall Abbey Hotel; Mr T. A. Eades presided over a gathering of some fifty members and friends. Apart from some enjoyable musical items, a novel entertainment followed the dinner, taking the form of a film display showing well-known members of the club on the Bowring Park Course. The originals were photographed on the links by Mr. G. W. B. Pope. The prizes and trophies won during the season were presented by Mr. Eades.

New Municipal Showrooms.

The Douglas (Isle of Man) Town Council has decided to open showrooms, &c., in Ridgeway Street in connection with the electricity undertaking, and the borough electrical engineer has been authorised to obtain the necessary electrical appliances at an approximate cost of £500.

Trade Announcements.

Mr. J. W. Norton has severed his connection with Messrs. Bathe's radio department, and opened business as Norton and Shapley at Radio House, 23, Lucius Street, Torquay.

Messrs. Buck & Hickman, Ltd., 2, Whitechapel Road, E.1, have taken over the business of Messrs. John Phillips and Co., Walworth Road, S.E.17, inventors and manufacturers of commutator grinders and notchers; the business will be conducted at the Whitechapel Road premises, remaining under the supervision of Mr. G. L. Precious, the present proprietor.

Messrs. H. T. Boothroyd, Ltd., Bootle, Liverpool, have opened an office at 62, Great Russell Street, W.C.1.

Messrs. Brookes (Oldbury), Ltd., announce that they have purchased the business of the Regent Sheet Metal Machine Tool Co., Ltd., Wakefield, which will in future be carried on at Oldbury. A catalogue of "Regent" guillotine and rotary shears has been received.

Messrs. T. Mason & Co., suppliers of electric motors, machine tools, &c., have removed to 95, Belmont Row, Birmingham. (Telephone: Aston Cross 2400.)

From March 4th the telephone number of Messrs. Wm. Cory and Son, Ltd., and their associated companies will be Monument 2500 (twenty lines).

The address of Messrs. George Becker, Ltd., is now 39, Grafton Street, Tottenham Court Road, W.1. (Telephone: Museum 7439).

Prices of Raw Materials.

In the course of their letter dated February 23rd Messrs. James Forster & Co. state that consumption of lead in this country remains good, while arrivals are likely to be light for the next three weeks, although more lead is expected during the latter part of March and early April. The Continent has been quiet, due no doubt to the severe weather prevailing there, but a revival in demand from that quarter should be seen. The intrinsic position of the metal is sound; stocks are small, and higher values yet will probably be gained.

Messrs. F. Smith & Co., and Messrs. James & Shakespeare report, February 26th: No change in copper prices.

Messrs. James & Shakespeare report, February 26th: English pig lead, £24 15s., 5s. inc.

Messrs. Edward Till & Co. report, February 26th: India-rubber, Para fine, 1s. 1½d., ½d. inc.

Lighting and Power Notes.

Armitage (Staffs.).—Inauguration of Supply.—An electricity supply was recently switched on by the chairman of the Parish Council. The supply has been provided by the Trent Valley and High Peak Electricity Co., which held a two-days' exhibition of electrical fittings.

Aylesbury.—Overhead Lines.—The Town Council has decided to proceed forthwith with the construction of overhead transmission and distribution lines in the rural area at a cost of £13,973. The work is to be completed within a year.

Barnes.—Electricity Supply.—At an estimated cost of £7,243, work is to be carried out by the Electric Lighting Committee to provide for future development, correction of pressure regulation and greater flexibility in supply. Subject to an approved agreement with Messrs. Watney, Combe, Reid and Co., Ltd., a duplicate 500-kW unit is to be installed at the Mortlake brewery sub-station at a cost of £2,500.

Bedford.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. R. W. L. Phillips) for the year ended March 31st last show a total income of £96,780 and working expenses of £54,018, leaving a gross profit of £42,761. The figures for the preceding year were: Income, £94,077; working expenses, £55,839; gross profit, £38,238. To the gross profit was added unemployment relief grants and interest on investments, making a total of £46,605 available, of which capital charges absorbed £44,931, leaving a net surplus of £1,674, as compared with £2,815 in 1926-27. A contribution of £1,379 was made to the borough fund. The capital expenditure during the year amounted to £60,377, the chief item being £31,714 for mains. The electrical energy sold increased from 12,808,113 to 15,198,879 kWh, and the maximum supply demanded from 5,350 to 6,980 kW.

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Bingley.—EXTENSION OF SUPPLY.—The Electricity Committee recommends the extension of electricity supply by the Urban District Council to property in the rural districts of Keighley and West Morton, that sanction be sought to borrow £3,500 and £470, respectively, and that the Ministry of Transport be asked for authority to the erection of overhead lines.

Bury St. Edmunds.—LOAN.—The Town Council has applied for sanction to a loan of £4,180 for mains.

China.—SHANGHAI.—Mr. T. H. U. Aldridge, engineer-in-chief and manager of the municipal electricity undertaking, has sent us the following comparative statistics showing the continued development of the undertaking:—The sales of electricity during 1928 totalled 458,360,215 kWh, as compared with 400,343,385 kWh in 1927, the increase in the supply for power and traction, which rose from 350,224,626 to 401,512,721 kWh, being mainly responsible. It is interesting to note that the actual sales exceeded the estimates for the year by 10,760,215 kWh.

Continental.—SWEDEN.—At the end of last year the development of water power in Sweden totalled 1,474,000 h.p. In 1928 extensions of existing power stations and construction of new stations were commenced, to yield an additional 33,000 h.p., and, together with the work commenced before 1928, an additional 130,000 h.p. is in preparation at private stations. No new Government-owned station was begun during 1928, but the extension which had been going on since 1926 of the Porjus power station by a seventh unit of 18,000 h.p. was continued. The annual increase in the consumption of electricity from stations belonging to the central system of Government-owned works is about 50,000,000 kWh. In order to meet this steady increase, it is estimated that new developments will be necessary in about four years, and construction will probably be put in hand of a water power station at Vargoen, which could be completed in three or four years and would supply an additional 115,000,000 kWh. Next would come the exploitation of waterfalls on the Motala river and of the Tyttbo falls on the Dal river, the latter of which, it is estimated, would yield about 80,000,000 kWh. By these measures and the regulation of the Vaener lake, which supplies water to several power stations, the demand for electricity could be met for at least the next ten years.—*Reuter's Trade Service* (Stockholm).

ITALY.—Approval has been given to a proposal of the Società Generali Elettrica dell' Adamello, to erect a 125,000-V transmission line between the power station at Cedegolo and a sub-station at Gorlago, province of Bergamo, and to the Società Elettrica Bresciana, of Brescia, to erect a 40,000-V line between Narda, Pisogne and Sale Marasino.

Croydon.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £1,042.

Glasgow.—PROGRESS DURING JANUARY.—Under the Corporation Electricity Department's scheme 387 houses were wired in January, making the total to date 11,578, while hired appliances numbered 372, making the total 18,221.

MAINS EXTENSIONS.—The Electricity Committee has recommended that distributing mains be laid, at a cost of £2,103.

Irish Free State.—DUNDALK.—At a recent meeting of the Urban District Council it was suggested that the Electricity Department be called on to reduce the price of electricity for lighting from its present price of 10d. per kWh to 6d. per kWh. The matter was referred to the Electricity Committee.

Lincoln.—INSTITUTION SUPPLY.—The Visiting Committee of the Bracebridge Mental Hospital has approved a scheme of improvements to the lighting and heating submitted by the engineer. The scheme involves extensions being carried out to the boiler-house, engine-room and dynamo-room, and additional plant. The engineer states that the existing generating plant is inadequate for the present demands, and he estimates the cost for the engineering portion at £6,000. The architect states that a further £7,700 will be required for structural alterations.

Liverpool.—ELECTRICITY SUPPLY PROGRESS.—Members of the City Council have received from the Electric Power and Lighting Committee, a report by Mr. P. J. Robinson, city electrical engineer, dealing with the electricity supply arrangements for the city. He points out that an increasing proportion of the load has been transferred from the Lister Drive Nos. 1 and 2 stations to the more efficient No. 3 station. The first of the three new pulverised fuel boilers has been in operation since the middle of December. Another would be ready by the end of February, and the third some time after. The pulverised fuel system has enabled cheaper grades of fuel to be used with a corresponding reduction in the generating costs. This reduction should increase when the other two boilers are in service. The Committee's estimates show an expenditure of £1,311,918 on capital account, £102,085 on reserve and renewal account, and £1,388,169 on revenue account. The main item of expenditure will be in connection with the scheme for the erection of the new riverside power station at Clarence Dock and covers purchase of land, civil engineering work, plant, buildings, &c. No further extensions are anticipated at Lister Drive power station, but provision has been made for the erection and equipment of static sub-stations which may be required in various districts as necessity demands, h.p. mains from Clarence Dock to Pumpfields, and h.p. mains to supply Whiston and Sefton rural districts if the application of the Council for a Special Order is successful.

London.—WANDSWORTH.—The Special Electricity Committee of the Borough Council, in a report on the two-part tariff proposals of the County of London Electric Supply Co., Ltd., states that it does not consider the proposals are a satisfactory response to the public demand for a reduction in the charges for electricity. The Committee has informed the Electricity Commissioners that the Council desires that the inquiry held last May into its application for a reduction of the maximum price which the company may charge under the Wandsworth Electric Lighting Order, 1892, which was adjourned, should be resumed at the earliest convenient date.

BERMONDSEY.—The Borough Council Electricity Committee has reported that, in view of the altered conditions for the bulk supply of electricity to the Council from the London Electric Supply Corporation, the borough electrical engineer has been in communication with the London County Council with a view to the revision of the terms for the supply of electricity by the Council for the tramways. The following terms have now been accepted by the L.C.C.: The Borough Council to supply the necessary power, on the basis of a maximum demand of 1,000 kW at a pressure of about 600 V, and at a cost of 0.86d. per kWh delivered to the d.c. track switchboard, subject to adjustment in respect of variations in the cost of coal.

Mexborough.—INAUGURATION OF NEW PLANT.—New plant, consisting of two 1,000-kW convertors, installed for the purpose of converting a bulk supply from the Yorkshire Electric Power Co. to d.c. for local distribution, was put into commission by the chairman of the Electricity Committee at the Urban District Council's power station on February 14th. The station has cost £12,000.

Millport (I. of Cumbrae).—ELECTRICITY SUPPLY.—The Town Council is inquiring into the possibility of introducing electricity by a submarine cable from the Ayrshire mainland. It is estimated that the cost would be about £3,000.

Mirfield.—ASSISTED WIRING SCHEME.—The Urban District Council has approved an assisted wiring scheme for dwelling houses, the installations to be carried out by the Council or its agents. Where not more than five lighting points are required, the price of electricity will be 1½d. per kWh in excess of the ordinary lighting rate until the cost of the installation is paid. In cases of from six to ten points the repayment is to be by quarterly charges, with electricity at the ordinary rates.

Okehampton.—SPECIAL ORDER OPPOSITION.—The Town Council has decided to oppose an application which is being made by Mr. W. G. Heath, of Plymouth, for a Special Order authorising him to supply electricity within the borough.

Preston.—LOANS.—The Electricity Commissioners have sanctioned a loan of £42,000 for works in connection with the provision of additional main transmission lines between Blackpool and Preston.

The Corporation Electricity Committee is applying for sanction to a loan of £23,000 in connection with the supply of electricity to Kirkham.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

STRATFORD-ON-AVON.—*The Shropshire, Worcestershire and Staffordshire Electric Power Co.*—The flat rate for electricity reduced by 1d. per kWh.

MAIDSTONE.—Power: intermittent use, from 3d. to 2d. per kWh during factory hours, and from £7 per annum per kW of maximum demand, plus 1d. per kWh to £6 and 1d.

BOLTON.—Lighting: from 4¾d. to 4½d. per kWh. Heating and cooking on business premises: from 1d. to ¾d. per kWh. Industrial power: a reduction of approximately 3 per cent.

TORQUAY.—Rates of ⅞d. and 1d. per kWh respectively for the Borough, Newton Abbot, Abbots Kerswell, Coffinswell, and Kings Kerswell, reduced to ¾d. per kWh. Rates of 1½d. and 1⅜d. per kWh in the remaining area of supply reduced to 1⅜d. and 1¼d. Discount for prompt payment of accounts reduced from 5 per cent. to 2½ per cent. Special sliding scale, power rate, to be revised so that the lowest price will be ¾d. instead of 1d. per kWh.

BARNES.—Private lighting: flat rate, from 3½d. to 3d. per kWh, the charge up to 26 kWh supplied per quarter to be 6s. 6d., with 1s. meter rental; ratable value tariff: fixed charge of 7½ per cent. on ratable value, instead of 10 per cent.

DEPTFORD.—*The London Electric Supply Corporation, Ltd.*—Lighting: first 2,000 kWh per annum, 5½d. per kWh; next 2,000, 5d.; beyond, 4½d. Power: first 10,000 kWh per annum, 2d. per kWh; next 15,000, 1¾d.; beyond, 1½d. Heating and cooking: 1½d. per kWh. Exterior shop and sign lighting: 4d. per kWh. Shop lighting after 8 p.m.: 2½d. per kWh. Private dwelling houses: "All-in" domestic tariff, 1d. per kWh, plus a fixed quarterly charge.

HALIFAX.—Lighting: From 7d. to 6d. per kWh.

LAUNCESTON.—*Launceston and District Electric Supply Co., Ltd.*—Power: From 4d. to 3½d. per kWh. Heating: From 2d. to 1½d. per kWh.

Ross-shire.—HYDRO-ELECTRIC SCHEME.—The new hydro-electric supply in Ross-shire has been handed over by the contractor, and is now in general use between the generating station at Lochluichart and Invergordon, serving also Dingwall, Strathpeffer, and other centres. The line is being extended to Tain, and farms along the route are being offered supplies on special terms.

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Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by Liverpool Corporation authorising it to extend its area of electricity supply so as to include the rural district of Sefton, and parts of the rural district of Whiston; the Ilfracombe Electric Light and Power Co., Ltd., to supply electricity in part of the rural district of Barnstaple; and the Central Sussex Electricity, Ltd., to amend the Haywards Heath and District Electricity (Extension) Special Order so as to include parts of the parishes of Clayton and Hurstpierpoint.

Stoke-on-Trent.—Loans.—The Corporation Electricity Committee is applying for sanction to the following loans:—Mains extensions, £7,620; e.h.p. feeder, £17,000; change-over in various districts, £10,800; supply to sewage works at Ford Green, £800.

Weymouth.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £19,464 for mains and £2,238 for sub-station equipment.

Tramway and Railway Notes.

Brighton.—Proposed Abandonment of Tramway.—The Corporation has under consideration a scheme for the gradual replacement of the tramway service by motor omnibuses. It is proposed to form a new statutory company providing for a merging of the interests of the Corporation tramway and the Brighton and Hove section of the omnibus system of Messrs. Thomas Tilling, Ltd. The company would replace the tramcars by omnibuses, and generally improve the transport facilities of the district. The draft heads of agreement include the payment by the new company of a perpetual annuity of £10,000 to the Corporation, the board of the company to consist of three representatives of the Corporation and three representatives of Messrs. Tillings, and the permanent chairman of the board always to be a representative of the company. The capital of the new company would total about £750,000, of which £300,000 would represent interests of the Corporation. The Corporation General Purposes Committee has postponed consideration of the scheme for two months, and in the meantime the Town Clerk has been instructed to obtain counsel's opinion with regard to the promotion of a Parliamentary Bill on the lines of the draft agreement.

Continental.—France.—The authorities of the Midi Railway have lately submitted plans to the French Ministry of Public Works for the electrification of the railway between Beziers and Neussargues.

London.—"Underground" Improvements.—Of 101 new cars ordered for the District Railway, 25 are now in service, and the remainder are being delivered at the rate of three a week. These cars contain many new features which add considerably to the passengers' comfort and the more efficient working of the train. As regards the operating of the new cars, the motors are of a higher-powered and speedier type; acceleration and deceleration also is automatic and more rapid than in the older rolling stock. Work is in hand at Acton works to completely re-equip 410 of the older cars with the latest type of motors and driving equipment, and, to date, 54 cars have been dealt with. One of the old-type escalators at Oxford Circus, in service since 1912, is to be converted to one of the latest comb pattern. The new escalator will have a speed of 100 ft. per minute, as compared with the present 90 ft. There are now five escalators at this station, handling a daily traffic of 90,000 passengers. On the whole Underground system there are 83 escalators, of which 15 have been installed in the last 12 months.

Salford.—Co-operation Proposals.—By a resolution passed by the Tramways Committee on February 19th, the Corporation is seeking to settle its difficulties with neighbouring local authorities with regard to the working of the Corporation tramway and omnibus services in their areas. According to *The Times*, the Committee, with a view to effecting an amicable settlement, has now instructed the Town Clerk to address to Prestwich, Eccles, and Swinton a letter suggesting that a satisfactory solution of the difficulties existing might be found in the setting up of a joint tramway and omnibus board for all tramway and motor-omnibus services worked by or leased to the Salford Corporation. The view is taken that omnibus competition must eventually damage the tramways of all the districts. The remedy, in the opinion of Salford, lies in treating tramway services and omnibus services as one system, provided that the privately-owned omnibus companies can be kept off the routes. The Corporation would undertake to run an adequate service of motor omnibuses if the various authorities concerned would agree not to renew existing licences for omnibuses in their respective districts or grant any new licences for the running of motor omnibuses in these districts except to the Corporation omnibuses. The Corporation is prepared to withdraw the private Bill it has promoted in the present Session of Parliament, and is willing to promote a new Bill next Session to constitute and incorporate the tramway and motor-omnibus board, consisting of representatives of the constituent authorities, or, alternatively, a Bill to enable it to submit to the Ministry of Transport a scheme or schemes for the constitution of such a tramway and motor-omnibus board. Each Council has been invited to send representatives to a conference on the question, to be held at Salford Town Hall shortly.

Sunderland.—Track Extension.—The Ministry of Transport has notified the Corporation that it is prepared to confirm the Light Railway (Extension) Order, permitting the Corporation to extend its Durham Road tramway for three-quarters of a mile to the Humbledon housing estate. The estimated cost of the scheme is £20,266.

United States.—New York.—A fire which broke out in the tube under Hudson River resulted in injuries to about 50 passengers. It is stated that the fire was caused by the spark of a preceding train igniting oil on the track. The driver of the train which followed attempted to dash through, but when the third coach was over the fire there was a short-circuit which brought the train to a halt and cut off the lights.

Telegraph and Telephone Notes.

Rumania.—Telephony.—It is reported from Bucharest that the Government is in possession of a proposal made by a Swedish financial group which offers to undertake and carry out the extension of the telephone network in Rumania. The group proposes to connect all the communes in the country with the telephone network, to establish new exchanges in the towns, and to erect and carry on a works in Rumania for the production of technical material. The offer is being examined by the Government.

Ship-Shore Communication.—New Station.—A coastal wireless station at Parkeston and three new steamers for the L. & N.E. Railway Co.'s continental route, *via* Harwich-Hook of Holland, are to be equipped with Marconi valve transmitting apparatus. The interrupted-continuous-wave method of signalling will be used and the transmitters will each have a power of 1½ kilowatts and work on wave-lengths between 600 and 800 metres. The use of valves instead of the older spark method of signalling has many advantages: interference, even on the same wave-length, can be reduced considerably, and the arrangement is such that the power of transmission can be reduced to about one quarter of the full range of the installation. If the distant receiving station complains of interference, an alteration in the speed of the generator of the transmitter will produce an alteration in the tone of the transmitted signal, which can be made sufficiently distinct from the interfering signal to allow communication to continue without delay. The power of transmission can be reduced in small stages, making it very convenient for communicating over short distances only, and also reducing the amount of interference with other wireless services.

The Telephone Service.—Yorkshire.—The annual report on progress in the West Yorkshire district, prepared for the Advisory Committee (superintending engineer: Mr. J. W. Atkinson, M.I.E.E., North-Eastern District, Leeds) shows that in 1928 the number of lines increased by 4.54 per cent. to 42,674, and the number of stations by 4.72 per cent. to 65,540; some 41.5 per cent. of the lines and 42.5 per cent. of the stations were automatic. Trunk calls numbered 5,859,892 and local and junction calls 39,782,024; phonograms sent by subscribers numbered 430,242. Street kiosks increased by 132 to over 500. During the year five automatic and five manual exchanges were opened, while nine automatic and 10 manual ones were in progress.

York.—During 1928 stations increased by 6.7 per cent. to 27,843, of which 9,397 were automatic, and only 20.29 per cent. was at the residence rate. Effective trunk calls increased by 7.4 per cent. to 2,718,829, and the local calls amounted to 12,900,000, an increase of 10.6 per cent. Phonograms increased by 5 per cent. to 325,775.

Transatlantic Telegraphy.—Tariff Reduction.—The rates charged for lengthy night submarine cable and wireless telegraph messages from Gt. Britain to North and South America and Eastern Canada, were reduced last week by the Western Union Telegraph Co. and Marconi's Wireless Telegraph Co., Ltd. Week-end message rates have also been revised.

United States.—Ford Wireless Station.—The Ford Motor Car Company has applied for permission to erect a new wireless station to enable it to communicate with the Ford rubber plantations in Brazil for both private and limited public service.—*Reuter's* (Washington).

Telephone Revenue.—The combined gross operating revenue of all telephone companies in the United States in

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1928 has been estimated at $1,100,000,000, an increase of 7 per cent. over 1927. More than 19,300,000 telephones are estimated to be now in use throughout the United States. The combined investment in telephone and telegraph systems is estimated roughly at slightly over $4,000,000,000, and their combined gross operating revenues are estimated approximately at $1,260,000,000.

West Africa.—Radio Station.—A wireless station is being built at Takoradi, Gold Coast. It will be equipped for communication with other West African colonies, says *The Times*, and to link up with the nearest stations of the main Empire service.

Radio Notes.

Licences.—Record Increase.—According to the British Broadcasting Corporation's estimates, the number of listeners during December, 1928, and January, 1929, increased by about 500,000, one of the biggest advances recorded. The increase in the number of licences for the two months is stated to be over 120,000, and is 20,000 more than the figures for the same months last year. The number of licences now current is 2,684,941.

Jugo-Slavia.—Licences.—Before the opening tests last September of the new transmitter at Ljubljana, which serves the whole of Slovenia, Zagreb was considered the "local" station for Slovenia. When Ljubljana took over on October 1st, 1928, there were exactly 2,512 licences in force in Slovenia, but, says *World-Radio*, the latest figure is 4,246, and since January 1st, 1929, the 5,000 mark has been passed. The number of actual listeners may be four times the number of licences, or about 20,000. Ljubljana is, of course, close to the Italian frontier; the Italian authorities, however, do not issue licences for sets within 30 km. of the frontier.

New Zealand.—Licences.—According to *World-Radio*, there are now 42,801 listeners' licences in force, besides 169 transmitting and 1,464 dealers' licences. Approximately three-quarters of the licences are held by residents of the North Island. Among the listeners are 179 blind persons, to whom the privilege of listening is granted without cost. There is now much greater satisfaction among listeners than was the case twelve months ago, and the Radio Broadcasting Company has received many compliments.

Relays.—The successful relaying of a recent concert in Wanganui over landlines to (2YA) Wellington, 150 miles away, marked the first relay of any distance in New Zealand, and general interest has been aroused by the announcement that the R.B.C. is to co-operate with the local Radio Society in running a relay station at New Plymouth.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—March 15th. Victorian Railways. Armoured telephone cable. (B.X. 5126.)*

Ballinrobe (Co. Mayo).—March 9th. County Board of Health. Electric lighting installation, Creagh House. Particulars from Mr. T. Flanagan, county surveyor, Courthouse, Castlebar.

Belgium.—Antwerp.—March 22nd. Municipal Council. Electrical cable and accessories. (B.X. 5124.)*

Bromley.—March 4th. Education Committee. Installation of electric lighting at the Raglan Road Council school. Specifications, &c., from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

Canada.—British Columbia.—Extension of hydro-electric plant at Stave Falls. (A.X. 7529.)*

Cardiff.—March 19th. Electricity Department. E.h.p. and l.p. cables, and one natural draught cooling tower. (See this issue.)

Cheam.—March 7th. Croydon and District Joint Small-pox Hospital Board. Wiring and electric lighting installation at the various sanatorium buildings. Specifications from Mr. G. F. Carter, surveyor to the Board, Town Hall, Croydon. (Deposit £3 3s.)

Dover.—March 4th. Harbour Board. Electrical sundries and electric cables for 12 months. Mr. Rutley Mowll, Registrar, Castle Street (deposit of 2s. 6d. for each schedule).

Dundee.—March 13th. Electricity Department. L.p. cable. (See this issue.)

Edinburgh.—March 25th. Electricity Supply Department. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuse-board, electricity supply meters. (February 15th.)
March 15th. One 1,500-kW motor convertor. (February 22nd.)

Fort William.—March 12th. North British Aluminium Co., Ltd. Material required for the electric power and lighting distribution system at the works near Fort William. (February 22nd.)

Holbeach.—March 6th. Board of Guardians. Electric light installation at the Institution. Mr. S. S. Mossop, jun., clerk.

Hull.—March 21st. Electricity Committee. Electrically-driven circulating water pump, motor, motor-starter, &c. (See this issue.)

Lancaster.—March 18th. Electricity Department. Two water-tube boilers (36,000 lb. per hour), with mechanical stokers, economisers, air heaters, steel chimney and fans. (February 22nd.)

Liverpool.—Water Committee. Electrically-driven pumping sets for the Aubrey Street pumping station. (February 22nd.)

London.—Central Electricity Board.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (See this issue.)

Metropolitan Asylums Board.—March 20th. Installation of automatic telephone system at the North-Western Fever Hospital, Lawn Road, Hampstead. (See this issue.)

Manchester.—March 6th. Electricity Committee. House wiring material for the assisted wiring and hired apparatus schemes. (February 22nd.)

New Zealand.—Wellington.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Oldham.—March 11th. Board of Guardians. Electric lamps and fittings. Forms of tender from Mr. F. W. Fletcher, clerk to the Guardians, Union Offices.

Pentre, Rhondda.—March 30th. U.D.C. Electricity Department. A.c. ordinary and prepayment meters, mains and house service material. (See this issue.)

Portsmouth.—Electricity Department. Four electrically-driven vertical circulating pumps. (See this issue.)

Sheffield.—March 14th. Electricity Supply Department. Buildings and civil engineering works and constructional steelwork, transformers, pipework and valves, e.h.p. switchgear, battery shunting locomotive and accesorises. (February 22nd.)

South Africa.—Johannesburg.—March 21st. Town Council. 65,500 porcelain insulators. (B.X. 5114.)* Weatherproof wire. (B.X. 5113.)*

Southend-on-Sea.—March 4th. Electricity Department. 1,200 d.c. house-service electricity meters. (February 22nd.)

Warrington.—March 11th. Electricity and Tramways Committee. Motors and transformers. (February 22nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aberdeen.—Tramways Committee. Accepted. In connection with supply of 12 tramcars:—
Bodies and trucks.—Brush Electrical Engineering Co., Ltd.
Electrical equipment, motors and controllers.—English Electric Co., Ltd.

Bedford.—Electricity Committee. Recommended:—
Interconnecting switchgear (£18,685).—British Thomson-Houston Co., Ltd.

Bournemouth.—Pavilion Committee. Accepted:—
Generator, induction motor, &c., for kinema at pavilion, including fixing and wiring (£198); resistances and flood lighting installation for band platform (£202).—Aish & Co.

Bromley (Kent).—Town Council. Accepted:—
Wiring 91 houses for electric light (£532).—A. Sutton.

Croydon.—Electricity Committee. Recommended:—
One 1,000-, two 750-, two 500-, and two 400-kVA oil-cooled transformers (£2,706).—British Electric Transformer Co., Ltd.

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Glasgow.—Housing Committee. Recommended:—
Electrical installations at 318 houses (Haghill estate) (£1,241), and at 174 houses (Saracen estate) (£716).—Mr. R. J. M'Intyre.
Electricity Committee. Recommended:—
Sub-station switchgear.—A. Reyrolle & Co., Ltd.
Four 400-kVA transformers.—Ferranti, Ltd.
Six 200-kVA ditto.—Bruce, Peebles & Co., Ltd.
Tramways Committee. Accepted:—
Ten cable groove rings for subway power station (£418).—Fullerton, Hodgart & Barclay, Ltd.
Manganese steel rails.—Edgar Allen & Co., Ltd.
28-in. copper bonds.—British Insulated Cables, Ltd.
Improvements Committee. Recommended:—
Passenger lift at Glasgow Cross buildings (£1,173).—Waygood, Otis, Ltd. Goods lift (£411).—A. & P. Steven, Ltd.

Government Contracts.—The following Government contracts were placed during January, 1929:—

Admiralty (Contract and Purchase Department).

Accumulators and cells.—Oldham & Sons, Ltd.; Hart Accumulator Co., Ltd.; D.P. Battery Co., Ltd.; Chloride Electrical Storage Co., Ltd.; Fuller Accumulator Co., Ltd.
Electric bells.—Hawkers, Ltd.; Engineering and Lighting Equipment Co., Ltd.; D. H. Bonnella and Sons.
Condenser boxes.—Engineering & Lighting Equipment Co., Ltd.; L. Weekes (Luton), Ltd.
Cable clips.—Aston Chain & Hook Co., Ltd.; Freckleton and Co.; Hawkers, Ltd.; R. & F. Keates.
Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.; General Electric Co., Ltd.; W. T. Glover and Co., Ltd.; Connollys (Blackley), Ltd.
Inert cells.—General Electric Co., Ltd.
Electric cranes.—H. Morris, Ltd.; Sir Wm. Arrol & Co., Ltd.; Vaughan Crane Co., Ltd.
Electric heating elements.—Credenda Conduits Co., Ltd.
Table fans and spares.—General Electric Co., Ltd.; Veritys, Ltd.
Lampholders.—Rainsford & Lynes, Ltd.; Sperryn & Co.; W. McGeoch & Co., Ltd.; General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Incandescent electric lamps.—General Electric Co., Ltd.; Siemens Electric Lamps & Supplies, Ltd.; Metro-Vick Supplies, Ltd.; Edison Swan Electric Co., Ltd.; British Thomson-Houston Co., Ltd.
Electric motor.—Laurence Scott & Co., Ltd.
Switchboards.—Park Royal Engineering Co., Ltd.
Insulating tape.—Ioco Rubber & Waterproofing Co., Ltd.
Testing sets.—Everett, Edgcumbe & Co., Ltd.
W./t. tuners and amplifiers.—Radio Instruments, Ltd.
Aerial wire.—Thos. Bolton & Sons, Ltd.
Copper wire.—General Electric Co., Ltd.; Concordia Electric Wire Co., Ltd.; Ward & Goldstone, Ltd.; Kent Bros. Electric Wire Co., Ltd.; E. H. Phillips, Ltd.
Tin wire.—C. Clifford & Son, Ltd.
X-ray tubes.—C. Andrews; Philips Lamps, Ltd.; Victor X-Ray Corporation, Ltd.

War Office.

Boxes for telephone sets.—H. W. Sullivan, Ltd.
Electric cable.—Hackbridge Cable Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Generating sets.—Blackstone & Co., Ltd.
Motor alternator.—Electric Construction Co., Ltd.

Air Ministry.

Alternator sets (Cranwell).—Electric Construction Co., Ltd.
Cable.—London Electric Wire Co. & Smiths, Ltd.
Receivers and rheostats.—C. A. Carter & Co.

Post Office.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.; Standard Telephones & Cables, Ltd.
Cable.—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cables, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Union Cable Co., Ltd.
Joint-box castings.—Jones & Attwood, Ltd.; United Steel Co., Ltd. (T. Butlin & Co. Branch).
Loading coils.—Standard Telephones & Cables, Ltd.
Steel masts.—W. Baird & Son, Ltd.
Telegraph poles.—J. Kennedy & Co., Ltd.
Battery (Glasgow Central Telephone Exchange).—Tudor Accumulator Co., Ltd.
Enlargement of battery (Canterbury Telephone Repeater Station).—Chloride Electrical Storage Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Anglo-Irish (Douglas-Port Erin section): British Insulated Cables, Ltd.; Plymouth-Torquay: Johnson and Phillips, Ltd.
Electric lift (Oxford station sorting office).—R. J. Shaw and Co., Ltd.
Electric lighting (Newcastle-on-Tyne Central Automatic Telephone Exchange).—Devereux, Moodie & Co., Ltd.
Electric overhead crane (Birmingham Post Office Stores Depôt).—H. Morris, Ltd.
Short-wave radio-telephony transmitter (No. 1 Rugby radio station).—Standard Telephones & Cables, Ltd.
Telephone exchange equipment.—Hanley multi-exchange area, Newcastle-under-Lyme, Burslem, Stoke, Longton, and Bexhill-on-Sea: General Electric Co., Ltd. Sub-contractors: Crompton Parkinson, Ltd., for charging and ringing machines; D.P. Battery Co., Ltd., for batteries. Hazel Grove: Siemens Bros. and Co., Ltd. Sub-contractors: English Electric Co., Ltd., for charging machine; Crompton Parkinson, Ltd., for ringing machine; Premier Accumulator Co., Ltd., for batteries. Davidson Mains (Edinburgh multi-exchange area): Siemens Bros. & Co., Ltd. Newcastle Central: Standard Telephones & Cables, Ltd. Sub-contractors: Electric Construction Co., Ltd., for charging machines; Chloride Electrical Storage Co., Ltd., for batteries. Felling, Jarrow, Benton, Whickham, Kenton, Newcastle East, Gosforth, Newcastle West: Standard Telephones and Cables, Ltd. Sub-contractors for Newcastle East, Gosforth, and Newcastle West: Electric Construction Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Hart Accumulator Co., Ltd., for batteries. Gateshead, Wallsend, Low Fell: Standard Telephones & Cables, Ltd. Sub-contractors for Gateshead, Wallsend, and Low Fell: Electric Construction Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; D.P. Battery Co., Ltd., for batteries. Farnborough: Automatic Telephone Mfg. Co., Ltd.

Crown Agents for the Colonies.

Accumulator.—Chloride Electrical Storage Co., Ltd.
Cables.—Brown, Lennox & Co., Ltd.; W. T. Glover and Co., Ltd.
Generating sets.—General Electric Co., Ltd.; Norris, Henty & Gardners, Ltd.
Switchgear.—Taylor & Challen, Ltd.
Telegraph apparatus.—Creed & Co., Ltd.
Telegraph ironwork.—Bullers, Ltd.
Telephone equipment.—Ericsson Telephones, Ltd.
Train-lighting equipment.—J. Stone & Co., Ltd.
Transformer kiosks.—Metropolitan-Vickers Electrical Export Co., Ltd.
Transformers.—British Thomson-Houston Co., Ltd.
X-ray apparatus.—Schall & Sons.

Grimsby.—Electricity Committee. Recommended:—
Steam and water pipe work in connection with plant extensions (£6,729).—John Thompson, Ltd.

London.—Metropolitan Water Board.—Recommended:—
Three sets vertical high compression heavy oil engines and reciprocating pumps at Woodford pumping station (£20,382).—Lilleshall Co., Ltd.
Two sets of high compression heavy fuel oil engines at Honor Oak pumping station (£3,947).—Ruston and Hornsby, Ltd.
Two sets centrifugal pumps at Honor Oak (£1,186).—Mirrlees-Watson Co., Ltd.
Copper wire (£170).—W. T. Henley's Telegraph Works Co., Ltd.

London County Council.—Housing Committee. Electric lighting, cooking and heating installation in the tenements on the Ossulton Estate, St. Pancras.

C. Luidop & Son	£1,393
Alexander Hawkins & Sons. (Recommended.)	1,739
G. V. Francis	1,794
Hall's Longitudinal Lighting Co., Ltd.	1,835
Electricity Services, Ltd.	1,960
A. V. Gifkins & Co., Ltd.	1,999
Alpha Manufacturing and Electrical Co., Ltd.	2,150
E. Dyne	2,246
Eons Electrical Co.	2,348
Tredegars (1923), Ltd.	2,354
Harland & Wolff, Ltd.	2,358
W. Davey	2,362
Engineering Works (Electrical & General), Ltd.	2,367
Joseph Vigor	2,498
A. Higginbotham & Sons	2,530
Aldwych Electrical, Ltd.	2,593
H. H. Bucklar	2,701
E. Wight & Co.	2,858
Fred Hodgson & Co., Ltd.	2,879
J. Nicoll	3,684
General Electrical Maintenance Co.	4,219

The chief engineer's comparable estimate is £1,790.

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Hornsey.—Estates Committee. Recommended :—
Installation of electric clocks at Town Hall.—Synchronome Co., Ltd.

Morecambe.—Fire Brigade Committee. Accepted :—
Installation of fire alarm system (£175).—W. B. Hodgson and Son.

Preston.—Electricity Committee. Recommended :—
E.h.p. switchgear for Preston and Blackpool transmission line sub-station (£14,020).—English Electric Co., Ltd.

Southend-on-Sea.—Town Council. Accepted :—
Alterations and extensions of the electric lighting at the Cliffs Bandstand, &c. (£327).—F. P. Richard & Co.

Staines.—Board of Guardians. Accepted :—
For wiring, &c., a portion of the Infirmary, and also the Girls' Home (£261).—Cooksey & Son.

Tunbridge Wells.—Accepted :—
Installing electric light at the Parish Church and Memorial Hall, Brinchley.—H. Featherstone.

West Ham.—Education Committee. Accepted :—
Installing electric light at South Hallsville School (£545).—Harland & Wolff, Ltd.

Forthcoming Events.

"Daily Mail" Ideal Home Exhibition.—Tuesday, February 26th, to Saturday, March 23rd. Olympia, W.

Finsbury Technical College Old Students' Association.—Friday, March 1st. Trocadero Restaurant. 6.30 for 7 p.m. Annual dinner.

Batti-Wallahs' Society.—Friday, March 1st. Hotel Cecil. 7 p.m. Annual dinner and dance.

Junior Institution of Engineers.—Friday, March 1st. 39, Victoria Street, S.W. 7.30 p.m. "The Control of Electric Lifts." Mr. L. S. Atkinson.

Electrical Power Engineers' Association (London Western Section).—Saturday, March 2nd. St. Ermine's Hotel, Westminster, S.W. 6.30 for 7 p.m. Annual dinner.

Royal Institution of Great Britain.—Saturdays, March 2nd and 9th. 21, Albemarle Street, W. 3 p.m. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford.

London Association of Foremen Engineers.—Saturday, March 2nd. Cannon Street Hotel. 6 p.m. Anniversary festival.

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 4th. Institution, London, W.C.2. 7 p.m. "Variable-speed A.C. Motors." Mr. L. J. Hunt.

(Meter and Instrument Section).—Friday, March 1st. Institution, London, W.C. 7 p.m. "The Rotor Bearings of Electricity Meters." Mr. W. Lawson.

(Wireless Section).—Wednesday, March 6th. Institution, London, W.C.2. 6 p.m. "Single Wave-length Working." Captain P. P. Eckersley and Mr. A. B. Howe.

(Irish Centre (Dublin)).—Thursday, March 7th. Trinity College, Dublin. 7.45 p.m. "Picture Telegraphy." Mr E. S. Ritter.

(North-Western Centre).—Tuesday, March 5th. Engineers' Club, Manchester. 7 p.m. "An Introduction to Researches on Circuit Breaking." Messrs. E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce. (Electrical Research Association Report.)

(South-Midland Centre).—Monday, March 4th. University, Birmingham. 7 p.m. "The Anticipation of Demand and the Economic Selection, Provision, and Lay-out of Plant." Capt. J. M. Donaldson and Mr. J. G. Hines.

(North-Eastern Students' Section).—Friday, March 8th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Informal discussion. 'That the Electrical Industry is Moribund." Mr. V. A. H. Clements.

(London Students' Section).—Tuesday, March 5th. "Les Gobelins" Restaurant, Regent Street, W. 7.15 p.m. for 7.30 p.m. Annual dinner.

(Scottish Centre).—Friday, March 8th. Cowdray Hall, Aberdeen. 8 p.m. Faraday Lecture: "How Electricity Does Things." Mr. Ll. B. Atkinson.

Electrical Society of Glasgow.—Tuesday, March 5th. Reid's Smoke Room, Glasgow. 7.30 p.m. "Brevities." The president and others.

Association of Supervising Electrical Engineers.—Tuesday, March 5th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Television." Mr. H. A. Hankey.

Faraday House Old Students' Association.—Tuesday, March 5th. Victoria Halls, Southampton Row, W.C. 8 p.m. Dance.

Physical Society.—Friday, March 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Beauty massage vibrators.
Glamor British tumbler switches.
Auto-Safe electric iron.
Vicma cables.

Notes.

Mining Electrical Engineers' Dinner.

The South Wales branch of the Association of Mining Electrical Engineers held its annual dinner at Cardiff on Saturday last, the branch chairman, Mr. T. S. Thomas, presiding. Submitting the toast, "The Mining Industry," the chairman said it was a pleasure to read of collieries opening up and not, as had become the custom, closing down. H.R.H. the Prince of Wales had emphasised the part of the salesmen. They were usually a keen and active body of men and he had no doubt that, given a period of peace and goodwill in the industry and markets free from reparation coal, the salesman would acquit himself as efficiently as the British engineer.

Replying, Mr. D. Farr Davies, chairman of the South Wales branch of the Colliery Managers' Association, said he was proud to say there was a spurt in the industry, but the coal trade had been very sick. It would not be wise to be too optimistic; better to face the future with courage and determination that they, as engineers, would leave no stone unturned to make the industry as prosperous as it had ever been in the past.

"The Association of Mining Electrical Engineers" was submitted by Capt. Carey, H.M. Divisional Inspector of Mines, who referred to Welsh coal as the finest in the world; yet, he said, they found themselves in the "slough of despond." That should not be. If their American friends had such a product, they would set up a "Woolworth's" store in every part of the world and sell it in big lots as well as little. Few people realised that it was cheaper in the long run to buy a more expensive coal, when, ton for ton, so much more could be got out of it, not only in heat units, but in many indirect ways.

In reply, Mr. F. Anslow, national president of the Association of Mining Electrical Engineers, referred to the mutual admiration and sympathy which they had always fostered between, not only the colliery electrical engineers and the manufacturers, but particularly with the Mines Department and the Inspectors, who had been of great service to the Association. He also referred to the need for improved educational facilities for those wishing to pass the Association's examinations. The Council felt there was a great gap in the system between the time of leaving the elementary school and taking, say, a university course.

Responding to the toast of "Kindred Associations," which was ably proposed by Mr. Idris Jones, Prof. Knox, president of the South Wales Institute of Engineers, said a Government committee had been appointed a short time ago to enquire into the question of the relationship between education and industry. An excellent report had been made by that committee and if the scheme suggested were put into operation it would overcome the difficulty mentioned by the president.

Mr. W. J. Bache, chairman of the Western Centre, Institution of Electrical Engineers, said the mining industry was a vast and complicated industry which required the co-operation of all engineers. In connection with the activities of the Central Electricity Board he was astonished to learn of the tremendous amount of work which had been done by colliery engineers in South Wales.

Major E. Ivor David referred to the certification of various grades of colliery officials. The Mines Department had asked for assistance in the matter. As regards the mining electrical engineer that assistance would be given by his Association, and they would have to back it up with all the power they could.

The toast "Our Guests" was given by Major W. Roberts, and replied to by Mr. T. Allan Johnson (past president, South Wales Institute of Engineers).

Electro-Harmonic Societies.

Members of the Manchester Electro-Harmonic Society will be the guests of the Liverpool Electro-Harmonic Society at the hot-pot supper and concert on March 22nd at the St. George's Restaurant, Liverpool.

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Electricity in French Rural Districts.

Strong efforts are being made in France to extend the use of electricity in agricultural districts, and important credits have been voted for this purpose by the Government. The Inspector-General of Rural Development has recommended in a recent report that electrically driven apparatus for agricultural purposes in France should be standardised in order to avoid all possibility of complication to individuals who are unacquainted with even rudimentary mechanical principles, and that such apparatus should be limited to 1 h.p. for appliances hitherto driven by hand, to 3 h.p. for similar apparatus employed on more important undertakings, and to 5 h.p. for special appliances requiring greater power, such as saws, hoists, presses, and pumps. While strength of design must be retained, simplicity of operation and low price are also vital. The actual efficiency of the apparatus is almost of secondary importance, for very few agricultural appliances are employed for long periods, and the excellent finish given to industrial plant is not necessary.

Rotary Snow Ploughs in Sweden.

Two electrically-driven rotary snow ploughs have recently been installed on the Swedish State Railways to clear the lines of snow which, in places, is occasionally several metres deep. The *Révue Générale des Chemins de Fer* states that each is mounted on the front of a coach, and consists of a turbine wheel three metres in diameter rotated at 125 r.p.m. by a single-phase motor (similar to those employed on Swedish electric locomotives), which develops 565 h.p. continuously, and double that power momentarily when a deep bank of snow has to be cleared. The coach, however, has no propelling motor, and is pushed along the line to be cleared by an electric locomotive controlled from the snow wagon. The turbine wheel is surrounded by a circular case provided with an upper funnel through which the snow is thrown to the sides of the track, while a hinged door operated from the cabin allows the angle of throw to be varied as desired.

Appointments Vacant.

Personal technical assistant and boiler house charge engineer for the Hull Corporation Electricity Department. Storekeeper for the Hongkong Electricity Co., Ltd. Shift charge engineer for the United Alkali Co., Ltd., Widnes. Switchboard attendant (£241) for the Norwich Corporation Electricity Department. (See our advertisement pages to-day.)

The A.S.E.E. Dinner.

The annual dinner of the Association of Supervising Electrical Engineers was held at the Hotel Cecil, London, on Saturday last, the President, Mr. S. B. Donkin, M.Inst.C.E., &c., occupying the chair. After the honouring of the loyal toast, the health of "Our Guests" was proposed by Mr. A. H. Dykes (past-president), who considered that the presence of so many distinguished men proved that the Association held an important position in the industry. Referring to the presence of representatives of the leading engineering institutions, he said that he had always thought it regrettable that the younger branches should have broken away from the Institution of Civil Engineers. The speaker looked upon the supervising electrical engineers as liaison officers between the workers and the management.

In responding, Sir Brodie Henderson (President of the Institution of Civil Engineers), said that he had always had a great respect for those who entered the electrical branch of civil engineering. The electrical industry's progress was a thing to wonder at, and the world was becoming more and more dependent upon electrical engineers. The end of this progress was by no means in sight. Electricity was so essential to every citizen that it needed no advertisement—it advertised itself.

Sir William Noble (late chief engineer to the General Post Office), who also replied, did not agree that one large engineering institution was practicable. Even the Post Office engineers found that they had to form a separate institute in order to give proper attention to telegraph and telephone developments.

Lt.-Col. K. Edgcumbe (President of the Institution of Electrical Engineers), proposing the toast of "The Association," said that the I.E.E. and the A.S.E.E. had a great deal in common. He felt that no new associations should be formed if it could be avoided, but he was sure that no pre-existing body could have carried out the work of the Association. There had recently been a discussion in the technical Press upon the question of whether studying for one's job was worth while. He had no doubt that it was, but studying by itself could not produce something from nothing. The Association was a trade union, but while, generally speaking, trade unions tended to level downwards, the opposite was the case with the A.S.E.E.

Mr. Donkin, in reply, said that the Association was now 15 years old, and had matured. In spite of the qualifications required of candidates, the membership was increasing at the rate of about 10 per cent. per annum. They believed in proper remuneration for their work—and so did the Association of Consulting Engineers, of which he was a member. Education was an important part of their activities, taking the form of lectures, their journal *Contact*, works visits, and a debating society. Some proof of the success of this work was the good attendances. The Association was represented on the I.E.E. Wiring Rules Committee and the B.E.S.A. Conduits Committee, and it had been asked to nominate a member to the B.E.S.A. Accessories Committee. Mr. Donkin also referred to the Association's apprenticeship scheme and to the Employment Board. The latter, he said, had found work for 500 men in 2½ years. In conclusion, he paid a tribute to the officers of the Association:—Mr. L. W. Medcalfe (chairman), Mr. B. C. Garman (vice-chairman), Mr. E. E. Gammon (hon. treasurer), and Mr. A. Brammer (general secretary). Mr. Medcalfe also responded to the toast, and said that with salesmanship so much to the fore it should be remembered that electrical salesmen should be technically-trained men, able to deal promptly with the problems raised by customers who knew what they wanted. The works, too, should back up the salesmen with articles of good quality and with satisfactory delivery. He referred with regret to the absence, through ill-health of Mr. W. J. Revell, to whose past activities the Association owed a great deal.

E.A.W. Activities.

On February 7th a large party of members of the Electrical Association for Women visited the Soho School of Cookery, when Miss Mabel Collins, the principal, gave a lecture-demonstration on a "five-course dinner."

The second evening lecture of the E.A.W. was given at the E.L.M.A. Lighting Service Bureau (London) by Mr. A. de H. Donisthorpe, of the General Electric Company, on the history of wireless transmission and reception.

On February 19th many members availed themselves of the invitation to visit the showrooms of the Singer Sewing Machine Company.

The British Thomson-Houston Co., Ltd., has tendered an invitation to members of the Association to visit the Ideal Home Exhibition on March 13th, and the Hotpoint Electric Appliance Co., Ltd., is inviting the party to luncheon and tea.

On January 28th the Birmingham and Midlands Branch visited the offices, electric canteen and control house of the Shropshire, Worcestershire and Staffordshire Electric Power Co. In a speech Mr. Legge showed how the E.A.W. could help to further the cause of "Electricity and more electricity."

A mid-Gloucestershire branch of the Association was inaugurated at Gloucester recently. The first president of the branch is the Countess of Berkeley.

The first meeting of the Bristol Branch will be held on March 5th. Lady Augusta Inskip will preside, and the chief speakers will be Miss C. Haslett, director, E.A.W., Miss M. Partridge, B.Sc., and Mr. J. H. Inskip.

Motor Fuel Production at Electricity Stations.

The Société des Automobiles Bovy, of Brussels, in conjunction with the Société des Centrales des Flandres, entered in a recent trial in France and Belgium a 30-cwt. motor lorry, the engine of which consumed fuel produced at the electricity station at Langerbrugge, Belgium. In order to utilise the whole of the heat value of the coal used for steam raising at the station rotary low-temperature carbonising furnaces have been installed between the stoking apparatus and furnaces of the boilers. The carbonised coal, in the form of a semi-coke, is fed to the furnace proper, to which, if necessary to assist combustion, part of the gases obtained by the carbonisation process can also be supplied. In addition to the semi-coke and gas, about 13 gallons of tar is derived per ton of raw coal, an excellent quality of motor fuel being obtained from the tar by the Kling cracking process. During the trial the vehicle, which (with its load) weighed 3 tons 9 cwt., maintained an average speed of nearly 20 m.p.h. on a consumption of approximately 13½ m.p.g.

Fultograph Photo-telegraphy.

Satisfactory results are claimed to have been obtained with a new method adopted by the Fultograph Gesellschaft for the transmission of still pictures. The altered system, which allows the immediate transmission of topical pictures, was first used, says *The Times*, on February 21st, by the Königswusterhausen station. Hitherto the Fulton system has necessitated the conversion of the picture at the transmitting end into a specially prepared foil, covered in varying degrees with insulating material. The new method replaces the metal point used in connection with the prepared foil to produce the electrical oscillations by a very fine ray of light, which plays upon a rotating glass cylinder, on which a photographic negative is placed. A Kalium cell inside the cylinder converts the light impulses into the required electrical impulses. Pictures have been transmitted on the Fulton system from the German national station at Königswusterhausen since November 20th last. The hours of transmission are from 9.45 to 10.15 p.m. (Greenwich mean time) on Tuesdays and Fridays, and 12.45 to 1.15 p.m. on the other week-days and Sundays.

A Coalfield Survey.

A publication of the Department of Scientific and Industrial Research, "Physical and Chemical Survey of the National Coal Resources, No. 13" (H.M. Stationery Office, 3s. net), contains a report on the Parkgate seam of the South Yorkshire area of the Yorkshire, Nottinghamshire and Derbyshire coalfield. It gives the results of a comprehensive and detailed examination, from floor to roof, of sixteen complete sections of the seam taken at different points well distributed over the

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area. Appendices deal with general considerations of the uses of Parkgate coal for various purposes and with a comparison of the value of Parkgate and Barnsley "hards" for use as a locomotive fuel. The report includes a map of the South Yorkshire area, diagrams of the sections of the seam used for this investigation, and photographs of typical cokes from the Gray-King assay.

A Turbo-Electric Liner.

Acceptance trials took place on February 19th of the P. & O. liner *Viceroy of India*, built by Alexander Stephen & Sons, Ltd., the first large passenger liner in this country to be fitted with turbo-electric propelling machinery. In addition, the vessel is the first ship of notable size to have single-berth first-class rooms. The whole of the electrical equipment has been manufactured by the British Thomson-Houston Co., Ltd.

An International Telephone Directory.

In view of the rapid growth of international telephony, it has been arranged to publish shortly in Great Britain and on the Continent the first International Telephone Directory. This will be printed in English, French and German, and subscribers' entries will be classified under countries, towns, and trades in alphabetical order. It will thus be possible according to Mr. C. Ramussen, the London representative of the Copenhagen firm responsible for its production, to find out in a few seconds the principal firms engaged in a particular line of business in any one country at home or abroad, with their addresses and telephone numbers. The directory will include the principal cities in nearly thirty European States, and negotiations are proceding for the inclusion also of Canada and the United States.

A Japanese Automatic Convertor Station.

Some years ago the municipal authorities of Tokio, Japan, decided to ease their traffic problem by building an underground railway, the first double-track section (about 1¼ mile) of which was opened about a year ago. In the construction work due regard had to be paid to earthquakes; therefore the supporting structure of the tunnels consists of steel frames joined together in a longitudinal direction. The cars conform to the usual design of those employed for rapid-transit railways, being equipped with twin-bogey under frames and bodies with three sliding doors on each side. Electricity is collected from a third top-contact rail fed from a sub-station in the immediate vicinity of the Ueno underground station, Tokio, which will house five rotary convertor sets. At present two machines only are installed with apparatus for effecting the automatic starting of the convertors. The two incoming 11-kV lines are three-phase, and the entire h.p. equipment is so designed that it will be suitable, without modification, for a working pressure of 22 kV when the system is eventually extended. Four feeders equipped with over-current air circuit-breakers feed the railway, the machines being sufficiently protected by their own high-speed breakers, but each railway feeder is equipped with over-voltage arrestors: each of the latter consists of several cells (the number determined by the value of the working voltage) housed in a common case, each cell having two aluminium plates immersed in an electrolyte; the plates are covered with a film of aluminium-hydroxide.

The two rotary convertors installed are designed for a continuous output of 1,000 kW at a normal working voltage of 600 volts, 750 r.p.m., 50 cycles. They can be overloaded to 1,500 kW for two hours and to 3,000 kW for one minute. The machines are provided with shaft-oscillating gear and a commutator protective device which, in conjunction with the high-speed circuit breakers, prevents arcing between the brushes on the occurrence of heavy short-circuits. The slip-rings are totally enclosed, and brush-dust is extracted by a fan under the slip-rings.

Although no marked economy in service costs is effected thereby, it was decided to include automatic gear for starting the convertors. The plant, which was supplied by the A.E.G. Co., of Berlin, has now been in operation for about twelve months, and has proved so satisfactory that the Japanese Railway Authorities have decided to carry out certain extensions in which similar means of control will be adopted.

Institution Notes.

Institution of Electrical Engineers.

Informal Meeting.—At the informal meeting on February 18th, Mr. C. F. Mounsdon was in the chair when Mr. R. L. Morrison opened a discussion on "Modern High-power Rectifiers: their Development and Use." He observed that the optimism with which he had spoken of the future of that apparatus when he addressed a meeting on the subject a few years back had been thoroughly justified, for they were being generally adopted throughout the world. Simultaneously they had increased in size, so that where they were formerly in sets of hundreds of kW, now they were of thousands of kW. Their progress he attributed chiefly to the seal of mercury which enabled a valve to be left for periods as long as six months without appreciable loss of vacuum; there was no foundation for the fear that mercury vapour poisoning was possible, there was not a single instance on record. He gave some remarkable figures of their efficiencies, especially at higher voltages, and claimed that when coversion was required, the high-power rectifier was unchallenged because it was stationary, silent and vibrationless; maintenance was negligible and service reliable.

Mr. A. M. Browne preferred the glass bulb rectifier which, though limited to some 130-kW capacity, could be multiplied indefinitely with the responsibility limited. It had the advantage that no pump was needed to maintain vacuum.

Mr. T. F. Lister said the reason rectifiers had made more headway abroad than in England was because our conservatism liked to see something moving, and had a sneaking affection for rotary plant. When the expense was justified it was possible to adopt 12-phase rectification and eliminate all telephone and wireless interference.

Messrs. R. Blennerhassett, J. Eck, W. A. Erlebach, W. Lang, M.M. Macmaster, J. F. Shipley, S. A. Stevens, E. O. Taylor, and H. H. Taylour also spoke.

Mersey and North Wales (Liverpool) Centre.—The opportunity was taken on the occasion of the annual Faraday lecture at Liverpool to present the Coopers Hill War Memorial prize, consisting of a bronze medal, certificate, and money award, to Mr. W. Phœnix, of the Warrington Corporation Electricity Department, for a paper on electricity in agriculture. The presentation was made by Mr. S. E. Britton, chairman of the Centre.

Institution of Mechanical Engineers.

The annual report of the Council of the Institution of Mechanical Engineers for the year 1928 shows a total membership at December 31st of 10,466, representing an increase of 210. The revenue and expenditure account for the year shows an expenditure of £28,760, leaving a surplus of £3,181.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mrs. Allen, writing from 114, East Dulwich Grove, S.E.22, asks us to express her thanks to all the friends of her late husband, Mr. A. H. Allen, for their letters of sympathy.

Mr. W. E. Woodeson, general manager, and Mr. W. Q. Henriques, in charge of the London office, have been elected directors of Messrs. Clarke, Chapman & Co., Ltd.

Sir James Donald, C.S.I., C.I.E., has joined the Board of the Calcutta Electric Supply Corporation, Ltd., in the vacancy caused by the death of the late Mr. P. V. Luke, C.I.E.

Mr. J. W. Simpson, formerly town clerk of Thornaby-on-Tees, has been appointed secretary to the Incorporated Municipal Electrical Association.

Mr. Percy Huggins, A.M.I.E.E., has resigned the post of departmental manager of the Electrical Engineering Section of Messrs. Royce, Ltd., on his appointment to the technical staff of the Lancashire Dynamo and Motor Co., Ltd.

Mr. W. P. Hicks has left the technical sales department of Crompton Parkinson, Ltd., to join the staff of the Haviland Engineering Co., Alloa. His colleagues have presented him with a silver cigarette case.

Sunderland Corporation Tramways Committee has recommended the Town Council to appoint Mr. C. A. Hopkins, general manager of Wigan Corporation tramways, motor 'buses and trolley undertaking, as engineer and general manager of Sunderland Corporation tramways, at £800 per annum.

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Mr. Frank Buckley, general manager of the Bury Municipal Tramways, who is leaving to become general manager to the Norwich City Tramways Co., has been presented with a gold hunter watch by the officials and staff of the Tramway Department; with a spirit tantalus by members of the Lancashire and Cheshire Tramways and Transport Managers' Association; and with a case of cutlery and other gifts by the Bury Corporation officials.

Mr. Lennox B. Lee, chairman of the Calico Printers' Association, has been nominated president-elect of the Federation of British Industries.

Sir Hugo Hirst, Bt., and Sir Ernest Clark, two members of the British Economic Mission to Australia, arrived at Southampton on Friday last week on board the *Tamaroa*. Sir Hugo intends to lecture in the provinces shortly, the first lecture being due for delivery before the Federation of British Industries early this month.

The Croydon Corporation has been recommended to increase the salary of Mr. A. C. Cramb, borough electrical engineer, from £1,500 to £1,600 per annum.

The many friends of Mr. F. H. Nalder, M.I.E.E., managing director of Nalder Bros. & Thompson, Ltd., will learn with regret that he has been seriously ill, and has been confined to the house for over two months. We are glad to learn that he is making satisfactory progress, and hope that he will soon be restored to good health.

The Hull Corporation Electricity Committee has recommended that Mr. C. I. Shuttleworth, A.M.I.E.E., Deputy City Electrical Engineer, be paid the difference between his salary as deputy engineer and the full salary paid to Major Bell, M.I.E.E., for the four months during which he was in charge of the undertaking before Mr. J. N. Waite, M.I.E.E., took up his appointment in Hull. It was also unanimously resolved that a letter of high appreciation of the services of Mr. Shuttleworth should accompany the payment.

By the death of his father, Lord Barnby, Col. the Hon. Francis Vernon Willey, who is a member of the Central Electricity Board and was president of the Federation of British Industries in 1925-26, assumes the peerage.

Obituary.—Mr. C. W. V. Schaefer.—We briefly announced in our last issue the death of Mr. C. W. V. Schaefer, M.I.E.E. Mr. Schaefer entered the service of the Eastern Telegraph Company as a probationer at Malta in September, 1884, his father being in the service of the company at that station. In 1887, Mr. Schaefer was transferred to Gibraltar, remaining there until 1890, when he joined the electrical staff of the cable-ship *Electra*. He subsequently served afloat in the cable-ships *Chiltern*, *Great Northern*, the old *Mirror*, *Amber*, and the *John Pender*, in which ship he took over electrical charge from Mr. F. Ryan in February, 1902. Mr. Schaefer left the cableship *John Pender* upon his appointment to the H.O. Staff in April, 1906, and was promoted to the position of electrician-in-chief upon Mr. F. Ryan's retirement in March, 1923. It was a coincidence that Mr. Schaefer should have relieved Mr. Ryan both as chief electrician afloat and electrician-in-chief of the associated companies. The long practical experience in cable construction, laying and repairing, gained by Mr. Schaefer especially fitted him for his position as head of the department responsible for this work, and he was a recognised authority on cable engineering in all its branches. The benefit of this experience, too, is reflected by the utility of his various tests for the localisation of breaks and faults in submarine cables, the well-known "Schaefer" break test being practically universally adopted by the cable community at large, and he leaves behind most valuable data in the field of cable engineering. During the time Mr. Schaefer was electrician-in-chief of the Associated Companies the system of working the companies' cables was entirely altered by the introduction of the regenerator on all the principal routes. The change-over of the system was difficult and required much detailed organisation to ensure that the normal working of the cables was in no way jeopardised. He took a large share of this work on his shoulders, the scheme only being completed shortly before his death. Ability of a marked order, combined with an equable temperament, endeared him to all those who had the privilege to serve under him.

Mr. E. Raymond Barker.—We regret to record the death, which occurred on February 21st, at a nursing home in London, of Mr. Edward Raymond-Barker, M.I.E.E. He had been ill for many years. Mr. Raymond-Barker, who was born in 1857, entered the School of Submarine Telegraphy in London in 1875, and held appointments thereafter with the Eastern and Brazilian Submarine Telegraph Companies. He became first assistant chief electrician at the submarine cable works of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., at Silvertown, in 1891, and remained with that company until his retirement in 1912. He saw service in many submarine cable-laying expeditions, invented a calculator board for cable ships and the multi-tone transmitter, wrote many articles in the Electrical Review, and published various books and pamphlets regarding the apparatus and methods which were so closely related to his submarine cable career.

Mr. R. E. Gallaher.—Mr. Raphael Eccleton Gallaher, president of the New York Insulated Wire Company, died in New York, on February 10th. He was 78 years of age and was a pioneer in the wire and cable industry of the United States. In 1884 he organised the above company, which is now a member of the Wire and Cable Section of the National Electrical Manufacturers' Association. He held the position of secretary of his company from the time it was organised until 1927, when he became president.

Lady Lodge.—We believe that in expressing our deep sympathy with Sir Oliver Lodge, F.R.S., on the death of Lady Lodge, which occurred on February 20th, at the age of 78 years, we are also voicing the feelings of the whole electrical and scientific world.

Mr. C. F. Wilkins.—We regret to record the death, which occurred on February 21st, of Mr. Charles Frederick Caxton Wilkins, managing director of Muirhead & Co., Ltd., Elmers End, Beckenham. Mr. Wilkins, who was 57 years of age, passed away at a nursing home after an operation.

Mr. J. Dugdill.—We regret to learn of the death at the age of 67 years, of Mr. John Dugdill, of John Dugdill & Co., electrical fittings manufacturers, of Hazel Grove, near Stockport.

Mr. R. B. Yeardsley.—The death is announced of Mr. Robert B. Yeardsley, who had for some time been on the electricity staff of the Birkenhead Corporation.

Mr. F. Hill.—We regret to learn that Mr. F. Hill, chief engineer and manager of the Hammersmith Electricity Department, died on February 13th, at Penzance, of pneumonia. The funeral service was held at Hammersmith (St. Paul's) Parish Church on Monday, February 18th.

Mr. R. J. Cartwright.—The death occurred on February 18th of Mr. R. J. Cartwright, electrical and lighting engineer, Upton Park, Essex, where he had been in business for 13 years.

Will.—The late Mr. H. T. Newbigin, of Newcastle-on-Tyne, left £12,026 net and £15,370 gross personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

C. Haddon Poupard & Co., Ltd.—Private company. Registered February 18th. Capital, £1,000 in 940 7 per cent. cumulative preference shares of £1 each and 1,200 deferred shares of 1s. each. Objects: To carry on the business of mechanical and electrical engineers, manufacturers of and dealers in accumulators and primary batteries, wireless receivers, gramophones, motors, sound reproducing instruments, wireless loud speakers and components, &c. The first directors are: C. H. Poupard, electrical engineer (permanent), and Mrs. K. M. Poupard, both of 82, Wanstead Lane, Ilford. Registered office: Thermion Works, 50a, Cranbrook Road, Ilford.

Mitcham Works, Ltd.—Private company. Registered February 19th. Capital, £100,000 in £1 shares. Objects: To carry on the business of makers and suppliers of valves, machines, apparatus, and appliances of every kind and component parts thereof used in connection with the production, recording or transmission of sounds or other signals, or for television or other kind of communication, mechanical and electrical engineers, manufacturers of and dealers in mechanical and electrical appliances, &c. The subscribers (each with one share) are: F. S. Forster, 67, Oxford Terrace, Hyde Park, W.2, clerk; R. Kerrison, "Denholme," 132, Erskine Road, Carshalton, clerk. Registered office: Mitcham Works, New Road, Mitcham Junction.

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British and Polish Engineering Co., Ltd.—Private company. Registered February 20th. Capital, £5,000 in £1 shares. Objects: To acquire and obtain contracts for the construction of electric lighting plants, gas and sewage works, public and municipal buildings and the like, in Poland or elsewhere in Europe, and to acquire and obtain exclusive concessions for the supply of electric light, gas, traction or power in Poland or elsewhere. The directors are: O. C. Ormsby, M.I.C.E., 194, Staines Road, Sunbury-on-Thames; F. O. Reynolds, M.I.C.E., Braemore Lodge, Sundridge Avenue, Bromley, Kent; E. E. Petersen, St. Krzyzka, 17, Warsaw, Poland; W. H. Godfrey, The Moorings, Vicarage Road, Hampton Wick, Middlesex. Secretary: O. C. Ormsby. Registered office: Lincoln House, 300, High Holborn, W.C.1.

Gordon Hughes Electrical Co., Ltd.—Private company. Registered February 18th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical contractors, engineers, manufacturers of and dealers in electrical accessories, and wireless, telegraphy, telephony, and television parts, &c. The first directors are: G. Hughes, electrical contractor, and Mrs. Olive Hughes, both of 72, Tetley Road, Hall Green, Birmingham. Registered office: 163, Moor Street, Birmingham.

Modern Electrical Supplies (Leeds), Ltd.—Private company. Registered February 19th. Capital, £500 in £1 shares. Objects: To adopt an agreement with J. Vashafski and to carry on the business of electricians, electrical engineers and contractors, mechanical engineers, suppliers of electricity, &c. The subscribers (each with one share) are: D. Hyams, merchant, M. Hyams, manager, both of 34, Harehills Avenue, Leeds. Secretary: M. Hyams. Registered office: 98b, North Street, Leeds.

Wardon Manufacturing Co., Ltd.—Private company. Registered February 14th. Capital, £1,000 in £1 shares. Objects: To acquire the business of wireless manufacturers and engineers now carried on by W. J. Ward as "W. J. Ward and Son," at 55, Churchfield Road, Acton, W. The subscribers (each with one share) are: A. E. L. Sawdy, 25, Elmwood Road, Chiswick, W.4, accountant; W. J. Ward, 55, Churchfield Road, Acton, W.3, wireless manufacturer. Secretary: S. J. S. Parker, 162, High Street, Acton, W.3.

Electrical Manufacturers' Finance Co., Ltd.—Private company. Registered February 15th. Capital, £10,000 in £1 shares. Objects:—To carry on the business of financiers, bankers, &c. The subscribers (each with one share) are:—E. H. W. Cooke, "Sunnyhill," The Clumps, Rickmansworth, accountant. C. Collins, "Orchardcombe," Orchard Road, Bromley, accountant. The first directors (to number not less than two or more than five) are to be appointed by the subscribers. Remuneration as fixed by the company. Solicitor: A. R. Monks, Crown House, Aldwych, W.C.2.

Wireless-Electric (Wholesale), Ltd.—Private company. Registered February 16th. Capital, £1,650 in £1 shares. Objects:—To acquire the business of a wireless factor and electrical supplier now carried on by C. E. Coulson at 23, North Street (City), Bristol, as "Wireless Electric Wholesale." The directors are:—C. E. Coulson, 24, North Street, Stokes Croft, Bristol; Mrs. Florence M. Coulson, 24, North Street, Stokes Croft, Bristol. Qualification, £100 shares. Remuneration as fixed by the company. Solicitors: Barnett & Leonard, Bristol.

Radio-Tri-Phone, Ltd.—Private company. Registered February 25th. Capital £100 in 2s. shares. Objects: To carry on the business of manufacturers of and dealers in gramophones, phonographs, records, wireless apparatus, pianos, organs and other musical instruments, electricians, engineers, cabinet makers, woodworkers, carpenters, &c. The directors are: N. H. Fletcher, The Buntings, Ickenham, insurance clerk; W. G. Borrow, 2, Sydenham Park Mansions, S.E.26, incorporated secretary. Registered office: 6, Broad Street Place, E.C.2.

Beam Sign Co., Ltd.—Private company. Registered February 14th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of manufacturers, salesmen, advertising agents, advertisers, distributors and dealers in advertising signs and devices, dealers in electrical, cinematographic or other display pictures or signs, proprietors or managers of theatres and cinematograph shows and exhibitions, manufacturers of and dealers in wireless sets, &c. The directors are:—G. A. Smalley, "St. Benets," Caterham Valley, Surrey; A. E. Leywood, "Bradenhurst," Harestone Hill, Caterham, Surrey (managing director of Adlets, Ltd.). Qualification, 100 shares. Remuneration (except managing director, if any), £100 each per annum. Solicitor: G. J. Armstrong, 24, Bedford Row, W.C.1. Registered office: 20, Kingsway, W.C.2.

Nelson Bros., Ltd.—Private company. Registered February 22nd. Capital, £2,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, &c. The first directors are:—G. R. Nelson, 20, Colwyn Avenue, Blackpool; and A. Nelson and N. Nelson, 1, Sharow Grove, Blackpool (life directors). Registered office: 2, Regent Road, Blackpool.

Official Returns of Electrical Companies.

Lancashire Telephone Systems, Ltd.—Particulars filed of £4,000 debentures authorised February 1st, 1929, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £550.

G. E. Ambatielo & Co., Ltd.—B. L. Clarke-Lens, 76, Newgate Street, E.C.1, was appointed receiver and manager on February 8th, 1929, under powers contained in debenture dated July 9th, 1927.

Phœnix Dynamo Manufacturing Co., Ltd.—Capital, £100 in £1 shares. Return dated October 23rd, 1928. Two shares taken up. £2 paid. Mortgages and charges, nil.

Tubes, Ltd.—Capital, £215,000 in £1 shares. Return dated November 9th, 1928. All shares taken up. £107,584 paid (being £1 per share on 82,859 and 10s. per share on 49,450 shares), £107,416 considered as paid (being £1 per share on 82,691 and 10s. per share on 49,450 shares). Mortgages and charges, nil.

Climax Radio Electric, Ltd.—Capital, £5,250 in 5,000 preference shares of £1 each and 5,000 ordinary shares of 1s. each. Return dated December 5th, 1928. 3,340 preference and 5,000 ordinary shares taken up. £418 10s. paid on 406 preference and 250 ordinary shares, £3,171 10s. considered as paid on 2,934 preference and 4,750 ordinary shares. Mortgages and charges, nil.

Flinders (Wholesale), Ltd.—Capital, £7,000 in 3,000 convertible 8 per cent. preference and 4,000 ordinary shares of £1 each. Return dated October 18th, 1928. 3,000 preference and 3,000 ordinary shares taken up. £6,000 paid. Mortgages and charges, nil.

Radio Service (London), Ltd.—Satisfaction to the extent of £125 on January 15th, 1929, of debenture dated July 25th, 1927, securing £2,750.

Siemens Bros. & Co., Ltd.—Satisfaction to the extent of £33,400 on January 1st, 1929, of trust deed dated January 15th, 1918, securing £1,330,000 debenture stock.

C. F. Casella & Co., Ltd.—Issue on September 30th, 1925, of £100 debentures, part of a series already registered. (Notice filed February 8th, 1929.) Satisfaction in full on February 3rd, 1929, of debentures dated January 21st and September 30th, 1925, securing £1,500.

Rangoon Electric Tramway and Supply Co., Ltd.—Satisfaction to the extent of £10,970 on April 30th, and to the extent of £372 on November 27th, 1928, of debenture stock dated February 1st, 1906, to January 25th, 1924, securing £250,000. (Notice filed February 12th, 1929.)

Strange & Sons Electrical Engineering Co., Ltd.—Capital, £200 in £1 shares. Return dated November 27th, 1928. 69 shares taken up. £69 paid, plus £9 per share premium. Mortgages and charges, nil.

Magna Wire and Cable Co., Ltd.—Capital, £11,000 in 10,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each. Return dated November 30th, 1928. 2,027 preference and 11,500 ordinary shares taken up. £2,027 paid on the preference shares. £575 considered as paid on the ordinary shares. Mortgages and charges, nil.

Siemens-Schuckert (Great Britain), Ltd.—Capital, £10,000 in £1 shares. Return dated December 21st, 1928. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Electroflo Meters Co., Ltd.—Capital, £21,000 in £10 shares. Return dated December 5th, 1928. 2,090 shares taken up. £10,900 paid. £10,000 considered as paid. Mortgages and charges, nil.

S. A. Cutters, Ltd.—Capital, £3,000 in 1,000 preference and 2,000 ordinary shares of £1 each. Return dated July 19th, 1928. 2,000 ordinary shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges, nil.

Ferranti, Ltd.—Capital, £300,000 in 100,000 6 per cent. preference, 100,000 7 per cent. second preference, and 100,000 ordinary shares of £1 each. Return dated November 1st, 1928. 71,166 6 per cent. preference, 75,000 7 per cent. preference, and 60,000 ordinary shares taken up. £206,166 considered as paid. Mortgages and charges, nil.

O. S. Choppin & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated June 6th (filed October 29th), 1928. 702 shares taken up. £2 paid. £700 considered as paid. Mortgages and charges, nil.

Premier Wholesale Electric Co. (Stockport), Ltd.—Capital, £2,000 in £1 shares. Return dated September 11th, 1928. 1,200 shares taken up. 17s. 6d. per share called up on 800 shares. £700 paid. £400 considered as paid on 400 shares. Mortgages and charges, £268 19s. 11d.

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City Notes.

The "Underground" Group.

The reports of the four electric railway companies of this group were reviewed in our last issue (p. 343). On February 21st the combined annual meeting of shareholders was held; Lord Ashfield, the chairman, was absent through indisposition, and his address was read by Mr. H. A. Vernet. In this address it was pointed out that for the first time in ten years the results had been truly satisfactory; this made them more hopeful of the future. The number of passengers carried (1,803 millions) was the highest ever reached by the group, and was the reward of their enterprise in the development of new districts by the extension of their services. Other causes of the increase were the acquisition of the businesses of independent 'bus companies and the exceptionally good weather during 1928. The directors had adopted a prudent policy; while satisfying the shareholders' desire for a larger dividend, they had strengthened the companies' position. The average rate of dividend since the inception of the Common Fund in 1915 had been 3 per cent.; last year the rate was 5.69 per cent. Since the war £21,000,000 had been spent on capital account, and almost the whole of the amount represented had taken priority of the capital. Dealing with the nature of London traffic, the address pointed out that although the average number of journeys per head of population in 1928 was 510, that figure was still surpassed by New York with 563. There was no apparent check upon growth, and so they could look forward to further progress. The undertaking could not stand still, but the end of the current programme was in sight, and they had come to the limit of their present resources. They had not yet reached a position in which they could hope to raise fresh capital by the issue of ordinary stocks and shares at par. Until they could reach and maintain such a position their ambition was thwarted, and their future was not safe. The prior charge securities represented 69 per cent. of the total capital, leaving only 31 per cent. (£17,000,000) in ordinary stocks and shares. The Common Fund arrangement had proved beneficial to everybody concerned; a wider common fund and a broader common management were the cure for the troubles which beset the outer suburbs. Therefore they and the London County Council had promoted Parliamentary Bills to secure this co-ordination. New underground railways were necessary to connect the newer suburbs with the centres of commerce and trade and to relieve the surface traffic congestion. The most urgent development was the extension northward of the Piccadilly section of the London Electric Railway. That was the task which they would set before themselves as soon as they were able to raise the requisite capital. If they could obtain a settlement of the scheme for co-ordination covered by the Bill they would ask the shareholders to venture on the execution of the work. The address concluded with a review of the co-ordination proposals. The reports were adopted, and the Bill was approved.

Power Securities Corporation, Ltd.

The annual meeting was held on February 20th, when Mr. George Balfour (chairman), who presided, said the Lochaber tunnel and hydro-electric works were nearing completion. About a half of the 15-mile tunnel had been concrete lined. The effect of the general strike and coal dispute had been to cause a year's delay, and as a provision against the contract they had left the whole of the profits on other work carried out during the year by Balfour, Beatty & Co., Ltd., in the accounts of that company as a reserve. In addition to the important Lochaber scheme, they had completed during the year a large amount of work in Argentina, including two complete power-station plants totalling 45,000 h.p., and, in addition, they had dealt with a certain amount of plant and other works for Indian and African undertakings and a large volume of mixed construction work in Great Britain. Rapid progress was being made with the Grampians hydro-electric development, which was commenced during the early part of the year. A duplicate transmission line from East Forfarshire to the power station at Rannock (over 75 miles) was under construction, and supplies from the steam reserve station had been given to hitherto unserved districts. They had in hand at the moment other engineering and construction work aggregating about 2½ million pounds, all of which was on a secure basis of remuneration. They had refused financial business in certain directions; in particular, they had declined some business in the electricity supply industry, which, although it would probably have provided a quick profit, would have been effected at valuations which they could not reconcile with the merits of the property; or alternatively at valuations on a basis of early prospective yield much lower than from gilt-edged securities. During the year they had handled public issues for seven electricity supply and allied undertakings to an amount aggregating some £3,000,000, in addition to advances of a temporary nature to similar properties. They had taken over a concession for electric light and power supply for Jerusalem and Bethlehem, and had formed the Jerusalem Electric and Public Service Corporation, Ltd. They hoped also to acquire the water concession for the city. Some little time ago they were asked to take over the administration of a Spanish light and power property. They acquired a large interest in it and had turned a loss of £24,000 per annum into a profit, and the construction of a hydro-electric plant should bring the undertaking into a very satisfactory financial position. After referring to other business undertaken by the company, the chairman reviewed the accounts, noting that the reserve had been increased to £130,000, and that they had set aside £10,000 to form the nucleus of a dividend-equalisation fund. The report and accounts were adopted.

Atlas Light and Power Co., Ltd.

On February 21st an extraordinary meeting was held in connection with the sale of the company's Argentine electricity supply and traction properties to the American and Foreign Power Co., of New York. Mr. W. Sandford Poole, who recently succeeded Sir George A. Touche as chairman, presided, and after reviewing the history of the company, proceeded to detail the negotiations which led to the matter before the meeting. On receipt of inquiries the directors stated that the company had acquired the Argentine properties with a view to developing them itself, and no such price as the inquirers offered could be entertained. It was made clear that the board would not consider any amount less than £8,500,000, and the buyers then expressed their willingness to pay this sum. In addition, a further amount was stipulated on account of unremitted earnings. The agreement provided, *inter alia*, that the Atlas Company should secure the resignation of the directors of the subsidiary companies concerned; that the company should have the option to take up 100,000 shares of preferred stock of the South American Power Co.; and that, for at least ten years, British manufacturers should be given preference for the bulk of the electrical equipment required, other things being equal. A compensation fund of £37,500 was being provided for those who would be adversely affected by the sale, including the technical adviser and the managing director. No part of the fund would be appropriated to the board as a whole without the sanction of a general meeting of shareholders. The directors recommended the sale of the undertakings. America's great wealth had to find an outlet, and thus the buyers could afford to purchase investments at a price at which the company could not afford to hold them. The dividend of 5 per cent., which was all they could pay at present, would not justify the price to which the ordinary shares had risen. The cost of the holdings which they were selling was about £5,000,000. Arrangements were being made to deal with the debentures, and they should have upwards of £5,500,000 available for investment and general purposes. After some discussion the motion was approved.

Baird Television Development Co., Ltd.

The first ordinary general meeting was held on February 20th. Sir Edward Manville (chairman), who presided, said that owing to questions which had been asked in the House of Commons the directors had been compelled to call the meeting earlier than they desired. He claimed that the company's system had attained a remarkable degree of perfection, and although at present the "televised" images were on a small scale, they hoped soon to be able to obtain the same degree of perfection on a larger scale. The Baird International Television Co. was in negotiation for the establishment of broadcasting of television on the Baird system in most parts of the world. The company owned two-thirds of the results of the International Co. from dealing with the patents outside the United Kingdom. The International Co. was formed with a capital of £700,000 so arranged as to give a working capital of a sum exceeding a quarter of a million pounds. Negotiations were in progress for the formation of companies in the Colonies and many foreign countries. Transmitting and receiving apparatus was now being installed in the chief Berlin wireless stations, and at least seven Continental broadcasting stations (including Radio-Paris) had invited the company to install transmitters. The company did not intend to manufacture receiving apparatus, but it had produced a number of such instruments to satisfy the first demand to a certain extent. Another direction in which the company was working was "Phonovision," the recording of images for subsequent reproduction with the sounds corresponding to them. Then there was also "Noctovision" and fac-simile telegraphy. One side line from which they were drawing royalties was a distortionless amplifier circuit. Arrangements had been made with an important French company for the establishment of broadcasting and television in almost all the principal centres of the Continent. After the chairman had answered a number of questions, the report was adopted.

Electrical Distribution of Yorkshire, Ltd.

The accounts for the year ended December 31st last show a profit of £78,281, as compared with £63,217 in 1927. To this is added £18,723 brought forward, making £97,004. From this a dividend of 9 per cent. is paid (4½ per cent. distributed in August last); £17,800 is placed to the reserve fund (making £77,500); and £21,904 is carried forward. A substantial reduction in the price of electricity was made in April last.

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During the last two years some 15,000 new consumers have been connected. The domestic uses of electricity are being encouraged by the provision of apparatus on special terms, and there is an increasing demand. During the year additional agreements for street lighting were made with twelve local authorities. The company has been authorised by Parliament to supply in a number of parishes in the Skipton rural district and in the township of Austhorpe, and the Electricity Commissioners intend to make an Order enabling the company to supply in part of the Worksop rural district. With this addition the company's area will be increased to 1,197 sq. miles with a population of 744,000. In November, 1928, the shareholders authorised an increase of the nominal capital of the company from £1,000,000 to £1,500,000. The large capital expenditure already made and the additional expenditure required to meet new demands necessitates the provision of further capital, and an issue of 600,000 ordinary shares of £1 each will be made to the shareholders shortly after the annual meeting (March 5th) at 25s. per share. This will increase the issued capital to £1,400,000.

Yorkshire Electric Power Co.

Presiding at the annual meeting on February 19th, the chairman (Mr. A. G. Lupton) said that the amount of energy sold during 1928 increased by 8 per cent. Local rates were a growing burden and were approaching the item of fuel in their cost sheets; it was anomalous that the company should not obtain relief from the new Rating Act, and it behoved all engaged in industry to see that their local authorities exercised the strictest economies. The demand for supply in bulk continued to grow, and during the year they had made an agreement with the Gainsborough Urban District Council. The company was seeking powers to supply in parts of the counties of Derby, Lincoln, Nottingham, and the East Riding of Yorkshire; those districts all adjoined the existing supply area, so that the mains could be readily extended to them. They considered that these rural areas could be best served by an already-established company. Referring to the stated tendency of industry to migrate southward, Mr. Lupton said that the facilities for industry in the West Riding were excellent. It was the company's policy to encourage the establishment of new industries by supplying electricity at low prices and rendering service in other directions. The average price of their electricity last year was less than ½d. per kWh. Under the recently-issued Mid-East England Electricity Scheme three of the company's stations would be "selected," and Ferrybridge and Thornhill would be two of the five "base" stations. The company would assist the Central Electricity Board in developing the supply of electricity in the area in the most rapid and efficient manner.

North Metropolitan Electric Power Supply Co.

The directors' report for the year ended December 31st last records a net profit of £374,621 (against £358,271), to which is added a balance brought forward of £19,042, making £393,663. After meeting debenture charges, &c., transferring £120,705 to reserve, and paying the preference dividends, a total dividend of 10 per cent. for the year is paid on the ordinary shares, leaving £28,202 to be carried forward. The capital expenditure during the year amounted to £501,221. Approximately 133 miles of underground and 44 miles of overhead trunk and distributing mains have been laid or erected, making the total length 1,294 miles, and 53 new sub-stations have been put into service, bringing the total up to 311. The sales of electrical energy increase from 143,700,000 kWh to 164,300,000 kWh, an increase of 14 per cent., and the total number of consumers supplied either directly or indirectly rose from 85,000 to 99,300. A supply of electricity was extended during the year to a number of rural districts, including Ashwell, London Colney, Much Hadham, Puckeridge, Redbourn, Standon, Wheathampstead, and Harlow. Further reductions in the rates of supply were introduced from March, 1928, throughout the area. New showrooms have been opened at Barnet and Tottenham, and the new generating station at Brimsdown has been running on load (but not in full operation) since October last. The North Metropolitan Electric Power Supply (Consolidation) Bill received the Royal Assent on August 3rd, 1928.

Metropolitan Railway Co.

Lord Aberconway (chairman) presided at the annual meeting on February 21st, and in presenting the report and accounts (*vide* our last issue, p. 343) said that in view of the continued trade depression last year's results were satisfactory. The increase in the long-distance traffic (coupled with a decrease in short-distance business) was causing them some embarrassment in the matter of rolling stock. They were replacing the older corridor cars by compartment stock, and they had found it necessary to increase the length of trains during rush hours. Parliament had refused the company powers to operate on the roads, but its investment powers had enabled it to make arrangements with an outside company which would put it in an equally good position to exercise some control over the operations of competing 'bus services. After referring to the rating relief measure of the Government and the company's new Baker Street building, Lord Aberconway said that they had replaced a 5,000-kW set at the Neasden power station by an up-to-date 20,000-kW set, which had been in operation since June last, effecting considerable economies. The original boiler plant was to be replaced by six new high-pressure boilers fitted for pulverised fuel. The report and accounts were adopted, and the company's Bill seeking powers to widen the line between Wembley Park and Harrow, &c., was approved.

Northampton Electric Light and Power Co., Ltd.

The directors' report for the year ended December 31st last shows a total income of £173,529, and a net revenue of £69,183, after providing £34,342 for depreciation. After meeting debenture interest, &c., adding the balance brought forward (£9,910) and income from investments (£3,209), a sum of £8,000 is carried to reserve, and £2,000 to the employés' benevolent fund. A final dividend of 5 per cent. on the old ordinary shares is recommended, making 9 per cent. for the year (as for 1927), and £9,690 is carried forward. Two Special Orders were obtained during the year authorising the company to supply electricity in Brackley, Buckingham, Winslow, and rural areas in Northamptonshire and Buckinghamshire. A number of villages were connected to the system. The maximum load rose to 14,360 kW, and the amount of electricity sold increased from 22,578,800 to 26,574,837 kWh.

Rushden and District Electric Supply Co., Ltd.

The total income for the past year was £22,907, and the net revenue, after providing for depreciation, £6,864. From this debenture charges are met, £401 is written off debenture expenses, and £500 is transferred to the reserve fund. A final dividend of 4½ per cent. is proposed, making 8 per cent. for the year, as in 1927, leaving £1,250 to be carried forward. The sales of electrical energy rose from 1,602,759 to 2,256,704 kWh. A proposal for increasing the capital will be laid before an extraordinary general meeting which is being convened.

Midland Counties Electric Supply Co., Ltd.

The trading profits during 1928 of the companies owned and operated by this company amounted to £306,510 (against £250,031 in 1927). The undertakings appropriated £80,274 for depreciation and reserves, and the balance at credit of profit and loss (including £4,106 brought forward) is £217,810. After meeting debenture interest, &c., and placing £15,000 to investment reserve, the directors again propose to pay a dividend at the rate of 6½ per cent. per annum upon the old ordinary shares, and at the same rate on instalments upon new ordinary shares, leaving £5,675 to be carried forward. The report states that the demand continued to grow satisfactorily and further generating plant was put into commission. Further necessary extensions are now in hand. During the year an issue was made of 250,000 preference and 500,000 ordinary shares, and the premium on these has been credited to the investment reserve account. Meeting: March 4th.

Dublin United Electric Tramways Co., Ltd.

At the annual meeting on February 19th, the chairman, Mr. William Hewat, in the course of his address, said that in a recent letter the company had been informed that it was required to take its electricity from the Electricity Board as soon as the Shannon works were in a position to supply electricity, which was estimated to be before the end of the current year. The questions arose: What were the terms on which the supply in bulk was to be given?; and How was the company's valuable power station at Ringsend to be dealt with? Presumably the station would no longer be required. They were awaiting a communication from the Board on that important question. At the same time he had no reason to assume that the claims of the company would not be fully recognised, and fairly dealt with, or that the Electricity Board would adopt a policy of confiscation in relation to it.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Simms Motor Units, Ltd.—100,000 6 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 1 to 100,000.

West London and Provincial Electric and General Trust, Ltd.—18,000 new shares of £5 each, fully paid, Nos. 1 to 18,000.

Newcastle-upon-Tyne Electric Supply Company.—1,400 new five per cent. preference shares of £1 each, fully paid, Nos. 1,537,553 to 1,538,952. (Ranking for dividend from January 1st, 1929.)

Underground Electric Railways Company of London.—3,109 new shares of £1 each, fully paid, Nos. 7,061,165 to 7,064,273. (Ranking for dividend from January 1st, 1929.)

Utilities Power and Light Corporation.

Reuter (New York) reports that the United Utilities Power and Light Corporation, which has acquired all the ordinary shares of the Greater London and Counties Trust, Ltd., offered on February 20th, $36,000,000 of 30-year 5 per cent. debentures with stock purchase warrants. Part of the proceeds of the debentures, which are priced at 98, and interest, will be used to withdraw 5½ per cent. debentures. There was no mention of British financing in the announcement.

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London and Suburban Traction Co., Ltd.

The receipts from investments, &c., for 1928 rose by £4,922 to £55,381. The net income was £10,141, to which was added £25,996 brought in, making £36,137, which is carried forward. It is stated in the report that the combined receipts of the Metropolitan Electric Tramways, the London United Tramways, the South Metropolitan Electric Tramways and Lighting Co., and the M.E.T. omnibus undertaking increased by £185,179 to £2,404,938 and the surplus by £70,632 to £95,560. The number of passengers carried rose by 22,149,122 to 323,050,448.

London United Tramways, Ltd.

The traffic receipts for the past year rose by £41,234 to £453,447, while the net income was £16,698 higher at £68,483. After deducting fixed charges there remains a balance of £14,589 (against a loss of £2,445), which is applied to the reduction of the accumulated deficit. The adverse balance carried forward is £53,431. The report states that the number of motor 'buses working over the tramways has become generally stabilised, and improvements in equipment and services have led to a gain in traffic.

Metropolitan Electric Tramways, Ltd.

The accounts for 1928 show traffic receipts totalling £679,369, an increase of £41,518 over the 1927 figure. The net income was £41,677 higher at £164,788. The net result, after providing for fixed charges, was a profit of £17,277; in the preceding year there was a deficit of £25,470. This is applied in reduction of the accumulated deficit, making the amount to be carried forward £80,827. A number of improvements to rolling stock have been carried out, and further developments in this direction are under consideration. Debenture stock to the total amount of £28,287 was redeemed during the year.

Metropolitan Electric Supply Co., Ltd.

The gross revenue for the past year rose by £18,818 to £901,753, and the net revenue by £18,612 to £337,617. After adding interest and £83,508 brought forward, £480,755 is available. Debenture interest, &c., and preference dividends are paid, and the final ordinary dividend is at the rate of 12 per cent. per annum, making 9 per cent. for the year (as for 1927); £87,149 is carried forward. During the year the new connections represented 20,291 kW, making the total 147,730 kW.

North Wales Power Co., Ltd.

At an extraordinary general meeting on February 22nd the proposals for the reduction of the company's capital, &c. (outlined in our last issue, p. 344) were approved. In moving the resolution the chairman (Mr. S. G. Bibby) pointed out that the Maentwrog works had taken nearly two years longer to construct and had cost £300,000 more than was originally estimated. No engineers in the world could have foreseen what the ground was going to be like.

Shawinigan Water and Power Co.

The directors of the Shawinigan Water & Power Co. announced on February 19th a new stock issue on the basis of one new share at $50 for each six held by shareholders on the register on March 22nd. The gross income of the company in 1928 totalled $11,562,000, being an increase of 2¼ millions on 1927. Fixed assets have increased from $68,000,000 to $138,000,000, and the net income is equivalent to $2.83 a share, as compared with $2.63 in 1927, despite the double depreciation provision made in the previous year.—*Reuter* (Montreal).

Ever-Ready Co. (Great Britain), Ltd.

The directors have addressed a letter to the shareholders offering them 395,200 ordinary shares of 5s. each at the price of 20s. 6d. per share. The shareholders are entitled to subscribe for one share for every five shares already held by them. The ordinary dividend for each of the last two years has been 35 per cent. The new capital is required in connection with the acquisition of interests in Lissen, Ltd., and the Ever Ready Trust & Finance Co., Ltd., and the extension of the company's factories and equipment, representing a total expenditure of approximately £380,000.

Smithfield Markets Electric Supply Co., Ltd.

The net profit for 1928, after providing for debenture interest and other charges, and placing £3,000 to debenture stock redemption fund, is £10,778, to which is added £2,530 brought forward, making £13,308. The directors recommend a further dividend of 5 per cent. (1s. per share), for the half-year, making 8 per cent. for the year, and the transfer of £6,000 to reserve, leaving £2,508 to be carried forward.

Torquay Tramways Co., Ltd.

The profit for 1928 was £34,521, and after meeting debenture charges there is a balance of £27,921, plus £1,786 brought forward. £9,712 is put to reserve and renewals, £4,400 to income tax, and after paying 9 per cent., free of tax, for the year, £1,786 is carried forward. The gross revenue rose from £73,015 to £74,853; passengers carried rose from 7,533,841 to 7,775,730; and the number of car-miles run from 742,318 to 758,663.

South Metropolitan Electric Tramways and Lighting Co., Ltd.

The net income for the past year was £65,783, and after deducting interest and other fixed charges and reserving £30,000 for renewals, &c., there remains £26,491, to which is added £9,148 brought forward, making £35,639. A dividend of 5 per cent. is to be paid, leaving £11,139 to be carried forward. During the year 50,000 £1 ordinary shares were issued at par to meet capital expenditure on the electricity supply undertaking and to pay off a bank overdraft.

Crompton Parkinson, Ltd.

The directors announce that in order to correspond with the payment of the dividends on the 8 per cent. first preference shares, they propose in future to declare dividends on the 6 per cent. second preference shares half-yearly, payable on March 31st for the half-year ending the preceding December 31st, and on September 30th for the half-year ending the preceding June 30th, so far as profits may allow. The next half-year's dividend should, therefore, be payable on September 30th next.

Lancashire United Transport and Power Co., Ltd.

The traffic receipts for 1928 increased by £29,645 to £330,576 and receipts from electricity sold, &c., amounted to £27,538, making £358,114. The gross profit was £82,412. After meeting expenses, debenture interest, &c., a balance of £12,554 is carried to depreciation account. It is stated that the business continued to be adversely affected by the state of the coal industry in the area served by the company.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

The net income for the past year (including receipts from the West Riding Automobile Co.) was £28,133 (against £35,600 for 1927). From this the 6 per cent. preference dividend is paid, roadway reinstatement takes £4,876, and depreciation absorbs £11,144, leaving £1,010 to be carried forward. The traffic receipts were again badly affected by the state of trade in the area.

Mather & Platt, Ltd.

The report for the year ended December 31st last shows a net profit of £200,610 (after providing for income tax), against £192,036 in 1927. A balance of £131,945 brought forward is added, making £332,555. The final ordinary dividend is 5 per cent., and a bonus of 5 per cent. is also paid, again making a total distribution of 15 per cent. for the year; £108,006 is carried forward.

Launceston and District Electric Supply Co., Ltd.

The report for the year ended December 31st last shows a net profit, after providing for debenture interest, preference dividends, &c., of £1,326, to which is added a balance brought forward of £1,726, making £3,053. It is recommended that £600 be put to reserve, £800 to depreciation, and that a dividend of 8 per cent. for the year (free of tax) be paid on the ordinary shares, leaving £1,141 carried forward.

National Gas Engine Co., Ltd.

The directors' report for the year ended December 31st last shows a net revenue, after providing for depreciation, &c., of £72,440. After meeting the dividend on the preference shares and transferring £20,000 to general reserve, it is proposed to pay a dividend of 7 per cent. for the year on the ordinary shares (less income tax), leaving £23,050 to be carried forward.

Chiswick Electricity Supply Corporation, Ltd.

After providing for depreciation the net profit for 1928 was £33,442 (against £28,798 for 1927). It is again proposed to pay a dividend of 16 per cent., £9,000 is set aside for consumers' refund (against £5,250), and £2,654 is carried forward. The number of consumers rose from 5,803 to 6,283.

Official Notice re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Ace Battery Co., Ltd.
Aldon Portable Wireless, Ltd.
Bradwell Electric Wire and Engineering Co., Ltd.
Gray Electrical Co., Ltd.
Portarlington Electric Light and Power Co., Ltd.
Sparkes Electrical Co., Ltd.
Wireless Warehouses, Ltd.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

Brotherton, Ediswan Tubes & Conduits, Ltd.
Electro-Hydro, Ltd.
Radieco, Ltd.
Wireless Equipment, Ltd.

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Sir W. G. Armstrong, Whitworth & Co., Ltd.

Although there was some criticism of the directors, the proposals for the reconstruction of the company, briefly outlined in our issue of February 15th, were carried by large majorities at meetings of the holders of the company's debentures and shares on February 19th.

Central Electric Supply Co., Ltd.

The balance to the credit of the revenue account for 1928 was £26,894; to this is added £48 brought forward, making £26,942. The "standard" dividend for the year (£7 18s. 5.538d. per cent.) is paid and £1,192 is carried forward.

Barcelona Traction, Light and Power Co.

The company has declared a final dividend of 50 cents per share on the ordinary stock and an additional 1 per cent. on the 7 per cent. non-cumulative participating preference stock.

Clyde Valley Electrical Power Co.

The declaration of a final dividend of 5 per cent. on the ordinary shares maintains the dividend for the year at 8 per cent.

Liverpool Overhead Railway Co.

The directors recommend the payment of a dividend for the year ended December 31st last at the rate of 5 per cent. per annum on the preference shares.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The directors recommend a balance dividend on the ordinary shares of 10.1811d. per share, making up the "standard" dividend for the past year.

Isle of Thanet Electric Supply Co., Ltd.

A dividend of 4 per cent. is recommended on the ordinary shares, as for 1927, and it is proposed to place £30,000 to general reserve and depreciation account.

National Gas Engine Co., Ltd.

The net profit for the past year rose from £51,350 to £72,440. The ordinary dividend is increased from 5 to 7 per cent., and £20,000 (against *nil*) is placed to reserve.

Pennsylvania Water and Power Co.

A dividend of $⅝ per common share has been declared in respect of the quarter ending March 31st.

Cowans, Sheldon & Co., Ltd.

An interim dividend of 5 per cent., actual, less tax, has been declared.

Swiss Company.

The *Alioth Electricity Co.*, of Basle, reports an increase in the net profits from 422,000 fr. in 1927 to 573,000 fr. last year, and the dividend is advanced from 6 to 7 per cent. The share capital is to be increased from 6,000,000 to 12,000,000 fr.

German Company.

The report for 1928 of the *Electro Works Company*, which is entirely owned by the German Reich and whose works are situated on the site of the lignite deposits near Bitterfeld, states that the production increased from 1,677 million kWh in 1927 to over 2,000 millions last year. Owing to the conclusion of new contracts, the extensions at Zschornewitz, Trattendorf, and Lauta were expedited, and the total capacity available will soon be 700,000 kW. The net profit amounts to 5,220,000 marks, as compared with 5,150,000 marks in 1927, and the dividend remains at 8 per cent.

Stocks and Shares.

Monday Evening.

The fear, to which reference was made here last week, in regard to the possibility of another rise in the Bank of England rate, has proved so far to be groundless, and Stock Exchange markets are now hoping that the period of stringency can be surmounted without the necessity for giving the financial screw another twist. In any case, the present 5½ per cent. Bank Rate is sufficiently high to make for restraint on the part of a good many investors, whose inaction finds reflection in the more passive attitude adopted by the speculative brigade that has been hanging upon America and American influences. Business in the Stock Exchange markets is quiet, though here and there spurts of activity enliven markets where sometimes these spurts are not expected. One such may be illustrated by mention of County of London Electric ordinary shares, which, quiet and steady-moving as a rule, have come up very rapidly indeed during the past few weeks. Investment and speculation are intent upon the endeavour to foresee what effect the result of the forthcoming General Election will exercise upon Stock Exchange prices. The readiness to support Election anticipations finds vent in dealings in what are called "Majorities"—Unionist, Liberal and Labour.

County Electric.

County of London Electric ordinary make, for the time being, the most interesting shares of the market in which they are dealt with. An accession of lively buying ran up the price from 52s. to 57s. 3d. without a break. Various rumours flew into circulation to account for this boomlet. The most popular report was that which hinted at the County of London Company having under contemplation a scheme for the segregation of various assets, and of forming a new trust company to take them over. (Here, it may be remarked, is one of the new and popular developments of to-day's finance.) The report obtained a certain degree of attention, and of admission that it contained the likelihood of favourable consideration from the County of London directors. Caution was inclined to regard the idea as being premature, and, on this latter view, the price of the shares reacted to 53s., leaving a net gain of a shilling on the week.

London Electricity Supply.

The late spell of severe weather, with its queues of oil buyers outside suburban shops, and its processions of frozen-out householders carrying pails of water, is said to have given a brisk impetus to the demand for radiators and other electrical apparatus. Consumption of energy no doubt increased amongst private users. The London electricity supply companies are declaring the same dividends as those of a year ago, but the County Company's results are not out at the time that this is being written. The Metropolitan Company's 12 per cent. makes 9 per cent. for last year, the same as for 1927, and the price of the shares drooped to 45s., on a shade of disappointment with the figures. Electric Supply Corporations hardened to 57s., and London Electrics at 27s. 6d. gained sixpence.

Provincial Electrics.

Midland Counties Electric ordinary are firm at 30s. 6d. on the issue of an annual report that shows solid progress. Gross profits rose £56,500, to £306,500. The dividend on the ordinary shares is repeated, at 6½ per cent. The capital was increased last year by the issue of half a million ordinary shares and 250,000 preference. A rise to 2¼ in Electrical Distribution of Yorkshire ordinary shares followed upon the report, and the news that the company is about to offer 600,000 new ordinary shares at 26s. to its proprietors. This is the same price as that of the 1928 issue, when 300,000 shares were offered. Isle of Thanet Electric ordinary advanced to 41s. 3d. on gossip to the effect that the company is going to be taken over by one of the bigger brethren. Shropshire, Worcestershire and Staffordshire ordinary rose to 21/16. The inclusion of Edmundson's in the septet of electricity supply concerns acquired by the Utilities Power and Light Corporation, led to demand for Urbans. The price rose 3/16 to 44s. 6d.

New Ever-Ready Issue.

A new issue of shares, at 20s. 6d., is offered to its proprietors by the Ever Ready Company (Great Britain), Ltd. One new share is available in respect of every five old shares held. The Ever Ready Trust and Finance Company guarantees the issue for a fee of £11,000. Seeing that the old Ever Ready shares stand at 24s. 6d., it may well be asked why the company should pay anything at all for a guarantee that looks so superfluous. The £11,000 might have gone to Ever Ready shareholders by offering them the new shares, of which there are 395,000, at a pound instead of sixpence higher. The new Ever Ready shares changed hands actively on the basis of 2s. 6d. premium above the issue price.

A Hundred Points Rise.

From the spectacular point of view, the most striking movement in the Stock Exchange lists, during the past week, was a rise of exactly 100 points in British Electric Traction deferred ordinary stock. So slight is the public interest taken in the stock that the advance attracted scarcely any notice. Stock has changed hands at 910 and 935. Market opinion was voiced here, a few weeks ago, as to the likelihood of the price attaining a four-figure level in the near future; the quotation has been putting on 50 points or more, almost every week, with a monotonous regularity. To-day's financial disposition sets strongly in the direction of the bringing under one control, or group, a number of other undertakings. The British Electric Traction deferred ordinary stock consists of a bagatelle, £147,888. The company has substantial interests in electrical, tramway, telegraph, railway, commercial and industrial undertakings, foreign bonds, &c.

Tubes and Trams.

The Home Railway market is better, and Underground income bonds are a point higher than they were this time last

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year. The Metropolitan Railway meeting was interesting, by reason of a speech from the chairman which suggested that the company's limit of expansion is still very far from being reached. The Underground Electric Railways of London held its meeting on the same day, and Lord Ashfield was quietly confident of the approach of the time when the company, or the group, will be so unified that a passenger can have complete freedom of travel in London, through exchange of fares and tickets. There has been a slightly better tendency amongst Home Railway stocks as a whole. Tramway descriptions are dullish. London & Suburban Traction preference have gone back another 6d. to 12s., and the ordinary to 4s. 3d. London United Tramways preference are quoted at 8s.; the ordinary at a florin. Metropolitan Electric Tramways ordinary were last done at half-a-crown, the preference at 6s. 3d. Tilling and British Automobile Traction ordinary are moving between 2 and 2⅛. Business took place last week in Aldershot and District Traction ordinary at 31s. 6d. The old shares and the new partly-paid stand relatively at nearly the same levels.

The Atlas Argentine Sale.

Atlas Light and Power ordinary shares underwent no change, from the previous price of 28s., on last week's meeting, at which a large majority of holders approved the resolutions for sale of the Atlas holdings in Argentine subsidiary companies. The chairman stated that the properties to be sold for 8½ million pounds sterling "probably stand at about five million pounds in the company's accounts." The money remaining over, after the deal is completed, will be available for the purchase of general investments, and possibly the acquisition of other electrical holdings.

Dollar Stocks.

Brazilian Tractions are a point up, at 71, and San Paulo Tramway 5 per cent. first mortgage debentures are similarly higher at 103¼. Shawinigan Water dropped 2, to 89½. Power Corporation of Canada, of no par value, are lower at 121. Pennsylvania Water and Power common have gone back to 93. Montreal Light, Heat and Power shares remain tolerably firm at 116. Movements in the Mexican utility group are somewhat uneven.

Indian and Other Shares.

The disturbances in India have had no marked effect upon prices of shares in the Indian companies. Calcutta Electric Supply ordinary are 58s. 9d., and Calcutta Tramways ordinary 20s. Madras Electric Supply ordinary keep at about 35s., and Delhi Electric Supply ordinary at 52s. 3d. Tata Power 7½ per cent. "B" debenture is unchanged at 104: the company's 4½ per cent. "A" debenture comes into the Trade Facilities Act stocks guaranteed by the British Government, and the price is 97. Another in the T.F.A. group is the 5 per cent. debenture stock of the Perak River Hydro-Electric Power Company, and the price is 100. The company's 7 per cent. participating debenture stock stands at 118, at which price a transaction was recorded to-day, Monday, and the shares have attracted moderate attention around 19s. 6d. North Wales Power 4½ per cent. debenture stock, another Trade Facilities issue, came in at 96½: the ordinary shares are quoted at about 15s. 3d. Mersey Power 6 per cent. preference change hands occasionally at 23s. Hendon Electric ordinary stand at a shade above £3. The new London Power 5 per cent. debenture scrip, offered at 99½, has strengthened to 5s. premium.

Wireless and Cables.

Marconis have improved to 4 1/16, expectation being on tenterhooks in regard to the terms which shareholders will be offered in the new Communications scheme. It is declared that an official announcement is on the eve of being published. The Eastern cable group found, however, no comfort in this rumour, and the prices of its stock and shares are lower, though to no important extent. Marconi Marines gave up the rise of 2s. 6d. which their price secured last week. Canadian Marconis, on a few American purchases, rallied to 31s. Bogota Telephones are slightly better at 28s. 6d.; Venezuela Telephones, ordinary and preference, lost a few pence at 28s. Baird International Television "A" shares went back to 11s. 3d. Baird Television Development 10 per cent. participating preferred ordinary last changed hands at 35s. 9d., and the deferred ordinary at 13s. 6d. Telephone Manufacturing shares at 5s. 3d. show a small gain.

Manufacturing and Equipment.

Callender's Cable ordinary are a good market, with a rise of 1/16, to 4⅜. Otherwise, the manufacturing and equipment companies' shares exhibit a dullish disposition. British Insulated have gone back to 4¾, and Johnson & Phillips to 38s. 9d. India Rubber shares weakened to 11s. 3d. Amongst engineering issues, Babcock & Wilcox reacted to 70s. Vickers at 11s. 7½d. are a trifle better than they have been. The rubber share market is enjoying a new lease of life. Upon a rise in the price of the product to 1s. 1¼d. per lb., a general improvement occurred in share values. As usual at such times, the main difficulty was to find shares with which to supply the would-be buyers. It may be said, therefore, that the substantial advance in prices was out of due proportion to the amount of actual business which accompanied it.

Share List of Electrical Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Feb. 25, 1929.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14†	15	72/-	—	... ..
Brompton Ordinary	1	8⅝	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8½	8½	26/6	+6d.	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 6
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	53/-	+1/-	2 16 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	57/-	+9d.	3 17 0
Kensington Ordinary	1	8	8	27/-	—	5 3 6
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/6	+6d.	5 1 10
Metropolitan	1	8	9	2¼	—1/16	4 0 0
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties'	1	6	6½	30/6	—	4 5 3
Mid. Elec. Power	1	—	15	2 3/16	—	.. ..
Newcastle-on-Tyne Ordinary ...	1	5	6	26/3	—	4 11 5
do. 7% Pref. ...	1	7	7	26/6	—	5 5 6
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	—	4 14 9
South London	1	8½	8½	27/6	—	5 2 6
Urban Ordinary	1	7	7	44/6	+3/16	... —
Westminster Ordinary	1	8½	8½	27/-	—	5 3 6
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	—	6 1 8
Yorkshire Elec.	1	8	8	36/-xd	—	4 9 0

†4% of which was tax free.

Home Rails.						
Central London Ord. Assented ...	Stock	4	4	72xd	—1	5 11 1
Metropolitan	,,	3	3	65	—	5 7 8
do. District	,,	3½	4	80½	—	6 4 8
Underground Electric	£1	1½	5	25/6	—	5 9 10
do. do. Income ...	Bonds	6	6	122	+1	4 18 4

Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	108	—	5 16 6
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	10	2⅛	+1/16	4 14 1
Eastern Extension	10	10	10	21⅜	—⅛	*3 15 9
Eastern Tel. Ord.	Stock	10	10	265½	—2	*3 15 6
Globe Tel. and T. Ord.	10	10	10	26⅜	—⅛	*3 15 9
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	20	33	—	... ...
Indo-European	25	10	10	55½	+1	*4 10 0
Marconi	10/-	5	*10	4 1/16	+⅛	... ...
Marconi-Marine	1	8¾	12½	8⅜	—⅛	3 9 2
Oriental Telephone Ord.	1	12	12	3 1/16	—	... ...
Western Telegraph	10	10	10	26⅜	—⅛	3 15 9

*Interim.

Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8¾	—	7 6 8
do. do. 2nd. Pref. ...	5			8⅝	—	8 5 6
do. do. 5% Deb. ...	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	,,	—	—	925	+100	... ..
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	6	7	71	+1	2 16 4
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 8 7
Londen & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—6d.	.. ..
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	83½	—½	5 19 9
Mexican Light Common	100	Nil	Nil	92	+2	... ...
do. 7% Pref.	100	Nil	7	77½	—1	9 0 8
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... —

Manufacturing Companies.						
Babcock & Wilcox	1	18	15	8½	—1/16	*4 11 5
British Aluminium Ord.	1	10	10	47/6	—	*4 4 2
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4¾	—⅛	3 8 8
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4⅜	+1/16	3 8 6
do 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 8
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	5 16 6
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	28/9	—	5 16 6
Enfield Cable Ord.	1	20	20	5⅜	—	3 14 6
English Electric	1	Nil	Nil	8/9	—	... ..
do. do. Pref	1	3	Nil	9/6	—	... ..
Gen. Elec. Pref.	1	6½	6½	21/6	—	5 6 1
do. Ord.	1	7½	10	3 3/16	+3/16	3 0 0
Henley	1	25	25	6 7/16	—7/16	4 1 8
do. 4½% Pref.	5	4½	4½	4¼xd	+2/-	5 6 0
India-Rubber	1	Nil	Nil	11/3	—1/16	... —
Johnson & Phillips	1	12½	10	1 15/16	—⅛	5 3 1
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	25½	—	*4 15 8

*Dividends paid free of Income Tax.

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The British Industries Fair.—III.

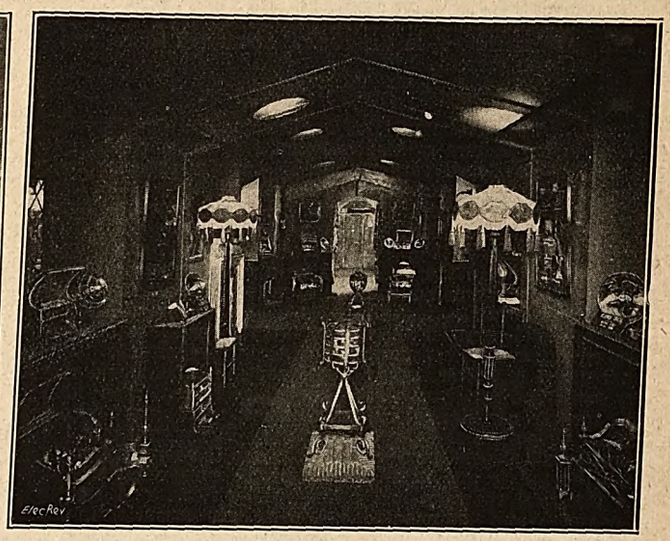
Functions and Exhibits in London and Birmingham.

THE Fair closes to-day (Friday) after what appears to have been a very successful run. Practically all of the leading organisations of the electrical profession, industry and trade have had an opportunity of inspecting the exhibits, and we hope that they have been duly impressed. These visits of potential customers should prove of great advantage to the exhibitors for, after all, the home market is as important as those abroad, whose representatives are especially invited to the Fair. Last Friday was an "electrical" day at the Birmingham Section. Delegates of several associations turned up in good force, and there was a conference arranged by the British Electrical Development Association, followed by a luncheon. The subject of the speakers at both functions was "Salesmanship." Although the matter has received very considerable attention lately, several new aspects were presented.

On Saturday last members of the Electrical Power Engineers' Association visited Castle Bromwich and were entertained to luncheon. In the course of proposing the toast of "The Electrical Industry," Mr. T. R. Martin touched upon the salesmanship question which was being stressed so much. He asked for a clearer view of the matter. Some said that we were producing too many types and patterns, while others wanted us to meet every customer's individual requirements. Manufacturers could not follow both directions. Mr. Martin also considered that a little more might be said of the achievements of British industry, instead of stressing its shortcomings.

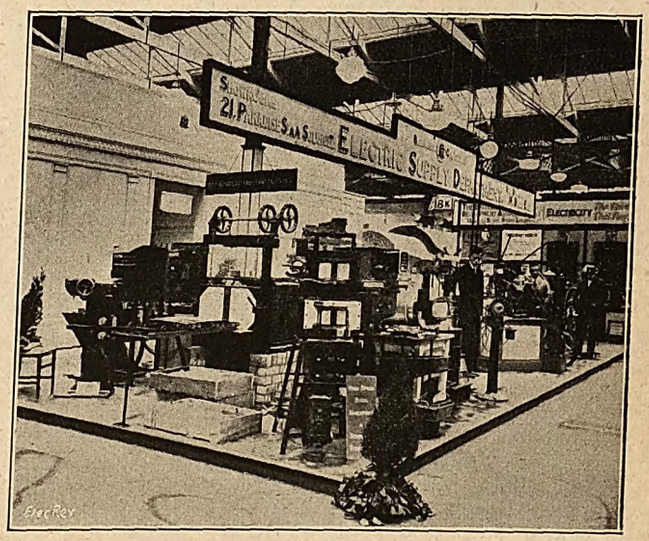
To-day further electrical organisations are paying an official visit to Birmingham. They are the Institution of Electrical Engineers, the Association of Supervising Electrical Engineers, the Electrical Contractors' Association, the E.C.A. of Scotland, the Electrical Wholesalers' Federation, the Electrical Merchants' and Manufacturers' Association, the Association of Mining Electrical Engineers, and the Illuminating Engineering Society. A luncheon is to be held, and we hope to report the speeches in our next issue. In the afternoon members of the Electrical Association for Women are making a tour of the Section.

British Thomson-Houston Co., Ltd.



Berry's Electric (1928), Ltd.

General Electric Co., Ltd.



Birmingham Electric Supply Department.

Some More of the Stands at Castle Bromwich.

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Electrical Organisations at Birmingham.

Conference and Luncheon.

Friday last was an important electrical day at the Birmingham Section of the Fair, when the following organisations paid an official list:—The Incorporated Municipal Electrical Association, the British Electrical Development Association, the Incorporated Association of Electric Power Companies; the Provincial Electric Supply Association; the Municipal Tramway and Transport Association; and the Tramways and Light Railways Association, as well as a number of non-electrical bodies.

Under the auspices of the British Electrical Development Association a conference was held, with Sir John Gatti, president of the Association, in the chair. About 200 ladies and gentlemen were present.

Address by Lt.-Col. Vignoles.

Lt.-Col. W. A. Vignoles, D.S.O., director and secretary of E.D.A., in an address pointed out that the use of electricity had not yet developed very far in this country as compared with the United States. Taking the domestic field alone, less than 25 per cent. of the houses at present in the areas of supply of existing undertakings appeared to be connected. The number of houses in the supply areas of Great Britain was seven millions, and the estimated number of consumers was 1,600,000; the estimated annual increase in domestic consumers was 250,000. There was great scope for additional sales; the field open for the sale of further quantities of electrical energy and for consuming apparatus was enormous. The development of power supply would continue and would rise very rapidly when there was a revival in trade. The field open for the use of electricity for domestic purposes and industrial purposes was almost staggering. The progress in the future would depend on the rate at which the industry could teach the public and persuade the people to use electricity. The electrical industry had strong competitors, and as the Prince of Wales had pointed out, what was essential to-day was expert salesmanship. It did not follow that a man who required a fire wanted an electric fire; and what was necessary was that they should apply themselves to efforts to get prospective consumers in the frame of mind favourably to consider the advantages of electricity. Much could be done by co-operative methods. As to the prospects of new business, Col. Vignoles mentioned, in addition to domestic requirements, the great possibilities that existed with regard to industrial electrical heating. The amount of energy used in works for heating processes was very considerable. A general survey by the N.E.L.A. (United States) of the electrical industrial heating position indicated that the industrial heating load in 1935 would equal the motor load. The available economic industrial heating load was three times the motor load. In 1925 about 5,000 million kWh was sold in the United States for industrial heating. So far as Birmingham was concerned much electricity was being used in works. In four works in that city he found that the power required annually amounted to 7 million kWh, and already they were using electricity for heating purposes to the extent of nearly 3½ million kWh. At the Fair on the previous day he had heard a speaker at a gas industry luncheon state that that industry was too modest and did not adequately push its claims. The British Commercial Gas Association was, however, spending about £100,000 per annum in trying to overcome that modesty. They should bear in mind that the electrical industry had to contend with an enormous gas propaganda. Those interested in electricity, had a much better article to sell than any of their competitors. One point in favour of electricity was that it was free from the disadvantages of combustion. It was no longer true to say that electricity was expensive; in most parts of the country it was cheap. It was not necessary to bring the price down to too low figures if first-rate service was given to the consumer. But the importance of advertising could not be exaggerated, and he asked all sections of the industry to join with the Association to provide the necessary national propaganda. An effort was being made by means of area committees to secure this co-operation.

Sir John Gatti, in thanking Lt.-Col. Vignoles, said it was important that all sections should realise their independence. A break in co-operative effort meant the retardation of the upward movement. He strongly appealed to all engaged in the industry to take a big view for the common interest. A good start had been made; there was now steady progress; and the point had been reached when a little extra effort would give just the right impetus.

Discussion.

Mr. R. A. Chattock, city electrical engineer, Birmingham, in opening the discussion, emphasised the need for pushing the business. He felt that during the past five or six years they had done it at an accelerating rate. Salesmanship was essential; upon it depended the success of an undertaking. In Birmingham salesmanship had been most successful, and to-day 10,000 new consumers were being added yearly. In this connection tribute was due to the work of the contractors who had co-operated admirably. There was a danger lest business should not expand when saturation point from the lighting point of view had been reached; but there was an enormous field for extensions among the existing consumers. He viewed the outlook with regard to industrial uses with optimism, particularly if prices were reduced. At present only the big industrial undertakings could make extensions on big scale lines. Salesmanship should be developed on a broader basis, and great strides could be made through the area committees. It was of the utmost importance that a serious attempt should be made further to conserve their efforts.

Councillor Thickett (chairman, Walsall Electricity Committee) complained that local advertising was not adequate. Salesmanship and propaganda must be carried out on more liberal lines; the gas industry should not be allowed to persist in its monopoly in these things.

Mr. Donovan, Birmingham, pointed out that of all the associations and institutions in the electrical industry, E.D.A. was the only one which set out to increase the sale of electricity. That was the all-pressing need of the moment. The gas industry at the Fair gave the electrical industry a lesson in advertising. It was deplorable that electricity was so backward in that respect, but he supposed that was due to inadequate financial resources.

Mr. W. A. Turnbull (Aylesbury) considered that there was very great need for showrooms in relatively small towns in country districts, and information should be forthcoming as to what would be done in that direction when the small power stations were done away with.

Mr. A. Nichols Moore (president, I.M.E.A.) said that every facility should be afforded for the display to the public of cheap and moderately priced electrical fittings.

Colonel Vignoles, replying on points raised in the discussion, said he appreciated the importance of showrooms, and places like Aylesbury should certainly have such facilities, but it was obvious that in relation to cost, each case must be considered on its merits.

Luncheon.

At the invitation of the Birmingham Chamber of Commerce the visitors attended a luncheon. The chairman was Mr. R. C. Rodgers (president of the Chamber).

Among those present were Sir Arthur Steel-Maitland (Minister of Labour), Sir Edward Crowe (Department of Overseas Trade), Sir John Gatti, and Mr. A. Nichols Moore.

Sir John Gatti, in proposing the toast of "The Electrical Industry," said a great change had come about within the recollection of many who were present in relation to the attitude of the public towards the electrical industry. In spite of disappointments and discouragements the industry had made a tremendous stride forward, and had done as well as, if not better than, any other trade. It was a very complex industry, which had to link up and work together with a number of industries. We had generating stations which compared very favourably with those in America, and the price of electricity in this country compared well with any others. In spite of the greatly increased cost of production compared with pre-war days, the electrical industry was selling at less than pre-war prices. That had been brought about by a constant desire to improve, and by a readiness to face the cost of scrapping machinery and equipment and also by constantly taking advantage of every improvement that engineers and manufacturers and the technical knowledge of the day had been able to produce. Although electricity was cheap, it had to become cheaper. He thought that they had concentrated too much on the cost of generation. The capital costs of distribution were as great, at least, as the capital costs of generation. If they were going for a unification of tariffs, they must remember that whoever drew up that tariff would have a very nice problem to solve. In conclusion, Sir John said that extraordinary as their progress had been, they could look to still further advances in the future.

The toast was responded to by Mr. A. Nichols Moore, who pointed out that the British Industries Fair was a form of intensive propaganda, and it seemed to him that the electrical industry might in that respect copy its methods. The supply side of the industry had had tremendous growth, but with regard to the other sections of the industry, he did not think one could take the same optimistic view. When the national schemes had been completed, the demand for heavy plant would probably show a diminution, and it seemed to him that it would be wise if manufacturers turned their attention to the development of the trade in relation to apparatus and fittings.

Sir Arthur Steel-Maitland congratulated the promoters of the Fair on its great success. He hoped the effect would be to increase employment, so that the only person unemployed in the country would be the Minister of Labour.

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Some of the Exhibits.

A Further Instalment of Illustrated Notes.

Consolidated Pneumatic Tool Co., Ltd.

A range of standard electrical machines is exhibited by this company. Included in the display are some "Hicycle" tools—drills, reamers, sandpapering machines, &c. Increase of speed makes for greater output. High-speed d.c. motors are satisfactory within limits, but the commutator is a vulnerable part and windings are easily burned out, so that the maintenance cost is high. With a.c. the maximum speed is determined by the frequency of the supply and if this can be raised, the speed of the motor is also increased and a lighter machine can be built for the same power. This principle has been adopted in the construction of "Hicycle" tools which operate usually on a frequency of from 180 to 200 cycles. A frequency changer is necessitated but it is claimed that the increased output offsets

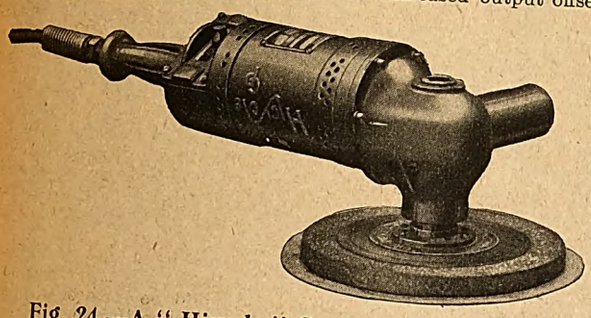

Fig. 24.—A "Hicycle" Sandpapering Machine.

its cost where a reasonable number of tools are in use. With high frequencies the self induction of the stator winding is so great that the current cannot rise high enough to burn it out if the rotor is stalled. The rotor itself is bar wound in some sizes; in others it is wound with bare copper so that burning out becomes impossible. Fig. 24 illustrates a sandpapering machine, one of the "Hicycle" range. This has been designed for metal-finishing operations, such as grinding, polishing and buffing of car bodies and sheet-metal work. It has a self-contained right-angle drive to the polisher head eliminating the flexible-shaft drive and equipment. It weighs only 13½ lb., the disk is 9 in. in diameter, and the speed at light load is 3,600 r.p.m.

H. H. Vivian & Co., Ltd.

This company's exhibits include solid drawn condenser tubes in full length, manufactured of ordinary 70/30 brass, Admiralty mixture, the company's special "Durable" brand, and cupro-nickel; locomotive tubes; general tubing; coils of brass and copper wire for various purposes; copper strip, tape and wire for electrical purposes; rolled brass, copper, and nickel-silver in the form of sheets and strip; and a method of using thin copper sheet for roofing.

Bureau of Information on Nickel, Ltd.

The Bureau exhibits, which include typical examples of the more important alloys of nickel and their applications, are grouped according to the type of alloy to which they belong, the main classes being:—Nickel alloy steels, nickel brass and bronze, heat-resistant alloys, nickel cast iron, nickel copper, &c., malleable nickel, and nickel-plating. One of the newest applications of ferro-nickel alloys is in the field of electrical communication, for which alloys containing about 78 per cent. nickel, the balance iron, known as "Permalloy," "Mumetal," &c., and distinguished by remarkable magnetic permeability at low intensities of the magnetic field, have been recently developed. By "loading" submarine cables with these materials and thus eliminating the attenuation and distortion of signals, it has been possible to increase the rate of cable communication from 300 to 1,500 signals per minute. The portion of cable exhibited illustrates clearly how "Permalloy" is used in this connection. Samples of "Mumetal" wire and strip, supplied by the Telegraph Construction & Maintenance Co., Ltd., are exhibited. Nickel has a very wide use as sparking plug electrodes on account of its excellent electrical and heat conductivity and its resistance to corrosive influences. A sectional sparking plug by A. C. Sphinx Sparking Plug Co., Ltd., is a good illustration of this application. Several well-known storage batteries require a substantial amount of nickel for the active chemical constituents of the cells. A large battery of this type, by Batteries, Ltd., is exhibited, while a sectional cell of another type shows clearly the method of construction. Examples of nickel-plated articles by Messrs. W. Canning and Co., Ltd., have been contributed to the nickel section. A group of alloys consisting chiefly of nickel-chromium and iron are now coming into great prominence on account of their excellent mechanical properties and strength at high temperatures (650 deg.-1,200 deg. C.) in comparison with steel or other structural materials. They have, as well, high electrical resistance combined with low temperature co-efficients. Some electrical applications are illustrated by the electrical range unit and other products which are displayed.

Hollings & Guest, Ltd.

On this stand there are shown typical examples of the company's hydraulic presses, pumps, accumulators, valves, &c. The press of greatest interest to the electrical industry is a vertical four-column model with steam-heated platens specially designed for the manufacture of insulating materials. This press is fitted with two hot plates, made of cast-iron in which the steam heating coil is cast solid in the plate, making it practically impossible for a fracture to occur at any steam pressure which may be reached. The hot plates are 15 in. square, machined on both faces, and polished on their working surfaces. The top one is firmly fixed to the press head and the bottom one is attached to the press table. "Ellmar" mouldings form another section of the display. A varied collection of moulded "Bakelite" products is on view, which are now being marketed by a subsidiary company—the Ellmar Mouldings Co. The mouldings are specially suitable for the manufacture of all kinds of insulating materials for the electrical trade, wireless parts, magneto fittings, motor-cycle and motor-car fittings, gear lever knobs, advertising novelties, &c. They are made in various colours and are not affected by oils, acids, or water.

Brook Motors, Ltd.

This company is exhibiting a.c. motors in sizes from 1 h.p. to 50 h.p., of the following types: crane, pipe-ventilated, totally-enclosed, and protected. There are also shown d.c. motors interchangeable with the a.c. motors; and special motors that the company makes for driving woodworking machinery, and motors that are built into woodworking machines to become part of the machine itself, whereby no belts or gears are required. Motors attached to pumps and fans are exhibited, particularly a fan coupled to a motor, with contactor gear so as to enable any person viewing the exhibit to start up the unit by pressing a push button. Various types of switchgear and starters are also shown. The whole of the units exhibited are wound for working on single-phase current, and there are special motors for two- and three-phase supply.

British Domestic Arts, Ltd.

The "Pellon" electric radiators which are displayed by this company are unique of their kind. Generally, they are of circular plan, and consist of a base and a domed head. In the

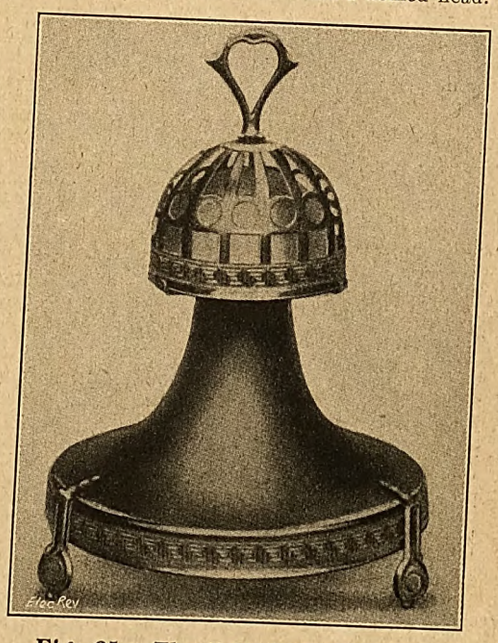

Fig. 25.—The "York" Radiator.

latter is a heating element, and air is drawn up through the centre of the radiator, passes over the element, and comes out at the base of the dome. The sides are so designed as to reflect the heated air towards the floor of the room. One of these radiators is illustrated in fig. 25—the "York" model. This particular pattern has a 1-kW loading. Its height is 18 in. and the diameter of the base is 12 in. It is handsomely ornamented, and is given a brass, copper or oxidised silver finish.

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Wild-Barfield Electric Furnaces, Ltd.

The exhibits of this company occupy a part of the Birmingham Electric Supply Department's stand. Among them is a "Wild-Barfield" electromagnetic steel-hardening furnace (type 12 F), with a chamber measuring 23 in. long by 16½ in. wide by 6 in. high, oval shape; the power consumption is 7.9 kW maximum. This furnace is operated by a hardener from B.S.A. Tools, Ltd., which company is supplying screwing taps and dies, &c., from its works, to keep the furnace in constant operation. Another electromagnetic furnace shown (type 16 R.) has a chamber measuring 16 in. diameter by 28 in. deep and a power consumption of 11.9 kW maximum. This furnace is operated by a hardener from the Moss Gear Co., Ltd., Birmingham, who demonstrates the heat-treatment of automobile gear wheels. The Imperial Enamel Co., Birmingham, is operating an internally-heated box-type furnace (type M.F.12) with a chamber measuring 40 in. long, 24 in. wide, and 12 in. high, fitted with automatic temperature control to keep the furnace temperature constant within required limits.

Fig. 26.—A "Wild-Barfield" Electromagnetic Furnace.

A high-speed steel-hardening and preheating tempering furnace (type H.S.F.2) is also shown in operation. This furnace has a high-temperature chamber for hardening, and a preheating chamber measuring 15 in. by 6 in. by 3½ in., which, being fitted with a separate regulating resistance for hand control of temperature, can also be used for tempering after hardening, and for this purpose also a thermo-couple is fitted in the preheating chamber. Each chamber has a separate main switch and fuses, and the whole is mounted as one complete unit. In addition to the foregoing, an air-tempering muffle for tempering tools, &c., automatically, after hardening (type A.T.O.2) is shown in operation. This oven is fitted with a fan in the floor, beneath a perforated metal basket to carry the work, providing maximum efficiency of heat circulation. The furnace is supplied with automatic temperature control, which keeps the temperature constant within plus or minus 3 deg. C. This furnace and its control panels are illustrated in fig. 26. There is also a Vickers "Pyramid" diamond hardness testing cachine.

Ray Engineering Co.

This exhibit, as last year, comprises a complete range of "Ray" switchboards and switchgear. In addition there is a new type of enclosed controller for electric lighting plant, which is claimed to be absolutely "foolproof" and interlocked in all its operations. Resistance battery-charging units, automatic cut-out switches, shunt regulators and instruments are also shown, together with a sample of the company's open type power switchboards.

Gledhill-Brook Time Recorders, Ltd.

A very complete display of time-recording and cost-checking devices is made by this company. The Gledhill-Brook "Clipper" recorder is a card machine which the worker operates on arrival and departure. Every manufacturing process or operation can be timed in the same simple manner, and various systems of time checking and costing can be combined with this one machine. The company also markets other models for simple time checking of workmen or clerical staff, also for registering time or dockets, waybills, cost cards, &c. All the Gledhill-Brook models print the exact minute, hour and day.

Lacy-Hulbert & Co., Ltd.

On this stand are shown examples of the company's ball-bearing compressors especially designed for direct coupling to electric motors, petrol engines, and other high-speed prime movers. Some are shown as fixed and portable sets direct coupled to d.c. motors and petrol engines. The combinations exhibited include sets for use in garages and service stations for tire pumping, &c., and for paint spraying, operating pneumatic tools, road breaking, &c. The range includes sizes from 2½ cu. ft. to 80 cu. ft. of free air per minute for any pressure up to 150 lb. per sq. in. Other exhibits are combined electrically-driven compressors mounted on air receivers; a variety of air compressors and vacuum pumps; a portable electric air blast for cleaning electrical machinery and similar applications, also larger sets for the same purpose as used in generating stations, &c.; rotary blowers and pumps; hand pumps, &c.

Thermo Path Co., Ltd.

A number of examples of its "Meracol" electric fires are shown by this company. The distinctive design produced takes the form of a projector fire in which, it is claimed, the whole of the heating element is approximately in the focus of the reflector. The element is guarded by a metal centre-piece. Fires of this type are mounted in screens, finished and ornamented in several styles, and examples of these are shown. The company also makes bar-fires, vertical and horizontal, in which the elements are mounted on the focal line of a parabolic trough reflector. Another exhibit is a cabin heater which, although designed for use on board ship, can also be usefully employed in the home.

A-1 Electric Welding Appliances Co.

This firm manufactures electric resistance welding machines and heaters and two of its machines are shown on the Birmingham Electric Supply Department's stand. They are a spot-welding machine, and a hand-wheel-operated, automatically-controlled, butt-welding machine for welding tubes, bars, rims, and various sections, the special feature of which is that the control of the welding is automatic and independent of the skill of the operator, and allows unskilled labour to produce efficient and consistent work; and an electric rivet heater.

Moorwoods, Ltd.

An outstanding feature of this stand is the way in which two electric fires are fitted into fireplaces of the company's manufacture. In one case the fire is simply hooked on in place of the canopy. The fires themselves are very well finished in stainless steel and nickel. Examples of the company's electric radiators are also shown; these are of the "utility" type—plain but efficient. Cookers form another part of the exhibit and among them is the "Moorwood Junior," which is a small oven (12 in. by 10¾ in. by 11 in.) fitted with top and bottom elements totalling 3,000 W, each controlled by a three-heat snap switch. A special cast-iron stand is provided for this.

Rd. Johnson, Clapham & Morris, Ltd.

The exhibits on this stand, whilst including examples of many of the company's activities, are in the main confined to a range of manufactures demonstrating its position as a source of supply for bare and tinned copper conductors in rod, strip and wire, and in cotton covered and braided rod, strip, laminated strip and instrument wires in all standard sizes and finishes designed to meet the general requirements of every department of the electrical industry. "Pacem" dead flat galvanised wire netting is shown in a selection of standard sizes. Other exhibits include a wide range of examples of woven wire and wirework for the engineering and allied industries. Screening for every industrial purpose is produced.

British Electrical Repairs, Ltd.

As in previous years, this company exhibits a model vacuum and pressure impregnation plant, as used in its works at Birmingham, Glasgow, London, Manchester, Swansea, and Newcastle-on-Tyne. It is also showing coils impregnated and unimpregnated to demonstrate the advantages of vacuum and pressure impregnation. Samples of armature, stator and field coils, also magnet coils of all shapes and sizes, which the company makes to specification, appear, as well as commutators which are made in a special department of the London works.

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Stuart Turner, Ltd.

Small petrol and gas engines and lighting and pumping plant are exhibited on this stand, and the latter itself is illuminated by means of a "Stuart" plant. The smallest set is a 120-W size for battery charging and cottage lighting. High-voltage as well as low-pressure batteries can be charged, as the dynamo is a double output machine—16 and 100 V. A "Type P.4" 1-b.h.p. engine is shown driving a ½-kW dynamo. This directly-coupled lighting plant is very

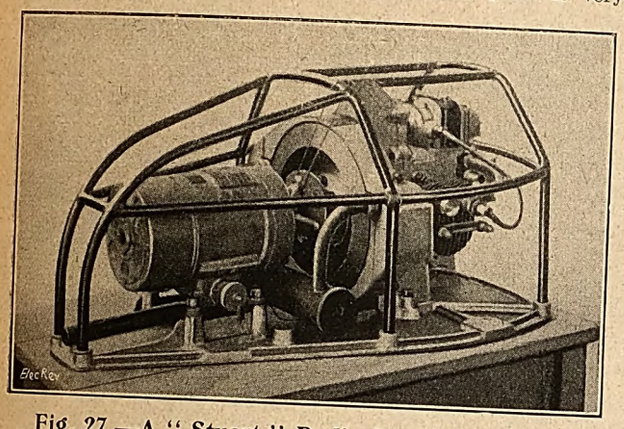

Fig. 27.—A "Stuart" Radio Supply Generator.

compact, and is suitable for the modern small country house. A useful feature is the auxiliary pump (300 gal. per hour) which can be fitted to the plant. Yacht lighting sets with circulating pumps are shown. The pump is geared down so that it runs quite slowly. The 1-h.p. engine is shown in section, so that the materials employed and method of construction and working can be clearly seen. The largest plant shown at work on the stand is a 1½-kW lighting set, driven by a 3-b.h.p. engine, whilst other exhibits include small pumping plant and a special very light weight air-cooled engine for mule pack wireless sets (fig. 27). This engine is used by the Royal Corps of Signals. The War Office has already acquired over 300 of them, and they are in use throughout the British Empire. Although solely air-cooled, they are said to function as well under the most trying tropical conditions as in England. One of the tests which each engine undergoes is a full load 6-hour run at a temperature of 140 deg. F.

Frederick Smith & Co.

The exhibits of this company exemplify the variety of wire which it produces. They include hard-drawn h.c. copper trolley wire, h.d. and soft copper wires and strip, sectional copper strip, h.d. copper strand for transmission lines, copper plating wire, silicum-bronze and cadmium-copper telephone wire, plain and steel-cored aluminium strand, &c.

Uniflo Pump Co., Ltd.

The examples of hand- and power-operated pumps shown by this company are all claimed to give constant and uniform flow. A special feature of these is that all working parts in contact with the liquid pumped are of non-ferrous metal, making the pumps suitable for hot or cold water, oil, petrol, tar, and other non-corrosive liquids. The pump can be constructed in special metals for dealing with corrosive liquids. The bottom cover can be removed very easily for inspection purposes without disturbing the pipes.

Vac-Tric, Ltd.

Various patterns of its electric vacuum cleaner are shown by this company and demonstrations are being given.

Young, Osmond & Young, Ltd.

Tubular electric heating in various forms is the subject of this company's exhibit. Among the items on view is a domestic type radiator with four bars and a low energy consumption, several towel rails, &c. The company has produced a 1,800-V heater for use on a Spanish electric railway and one for 600-V for the heating of tramcars. Another exhibit of the company is the "Satchwell" thermostat, an excellent device of its kind, which we dealt with in connection with last year's Fair.

William McGeoch & Co., Ltd.

In the switch- and fuse-gear section of this stand are patent self-aligning H.O. type fuses; Warwick type knife and ironclad switches; and unit-type switchgear. Special attention is directed to the unit-type ironclad switchboard exhibited. Examples of distribution and fuse boards are also on show. There is also a good selection of electric lighting fittings, many in modern style. The types shown are suitable for houses and public buildings, and there are others for ship use. Various types of miniature fittings for yachts, motor boats, motor omnibuses and cars, are also on view. Other special exhibits include lampholders, ship's navigation lamps and indicators, flashing lamps, direction signs, "Klidos" connection boxes, and plugs and sockets.

Rainsford & Lynes, Ltd.

A large collection of electrical accessories of all kinds has been arranged by this company. Among them are lighting fittings; pendants, bowls, electroliers, candelabra, &c., are included in this section. There are 67 different patterns of lampholders on view, covering a wide range of purposes. Examples of fuse-gear, in teak and iron cases, for from 10 to 300 A and low- and medium-pressure switchgear are also included in the display. Other exhibits are voltmeters, ammeters, valve-testers, &c.

Gramo-Radio, Ltd.

This company exhibits and demonstrates the "Concert-Grand" combined radio set and gramophone. It is designed to operate six loud speakers and the tone can be controlled within very wide limits. An "all-electric" "Coruso" gramophone (with electric motor and pick-up) is also shown.

S. G. Brown, Ltd.

Loud speakers make up the bulk of this exhibit, all the company's various designs (including the latest "Cubist" model) being represented. In addition there is a selection of the company's "Electro-megaphone" equipment. This comprises various forms of loud-speaking telephones for use mainly in noisy situations. Many of these have been supplied to the Admiralty and shipping companies and one type has been introduced on the London 'buses for communication between the driver and conductor.

Birmingham Electric Furnaces, Ltd.

One of the features of this exhibit is a full scale half section of a large "Birlec" furnace, which illustrates the method of construction and the special patented resistor arrangement employed. The heating elements in this type of furnace consist of heavy-section strip nickel-chromium having an exceptionally long life. Owing to the size it is impossible to show an example in operation at an exhibition. Photographs of some large installations are shown, these include furnaces for the annealing and general heat treatment of steel and non-ferrous metals, carburising, hardening, colour firing, &c. It is claimed that these cheapen production and improve the quality of the product.

Two standard portable "Birlec" furnaces, out of a range extending from 8 to 40 kW, are included in the exhibit. The small one, "C.P.2" (fig. 28), designed to operate on single or two-phase circuits, has a hearth 30 in. long by 16 in. wide, and is shown oil hardening steel parts. The larger model, "C.P.4A," having a maximum rating of 30 kW at 440 V, 3-phase, has a hearth 36 in. long by 24 in. wide, and is shown carburising. The portable type of furnace consists of a welded steel cylinder lined with refractory and insulating material. The hearth, however, is flat, and is covered with nickel-chromium plate. The heating elements, which consist of nickel-chromium strip, are mounted in the roof, sides and hearth, which, together with the circular construction, gives a very even distribution of heat. "Sil-o-cel" insulation is employed, ranging from

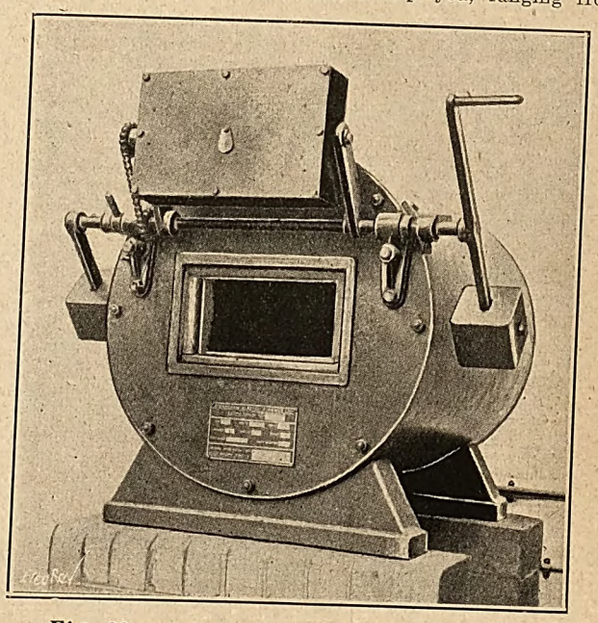

Fig. 28.—A Portable "Birlec" Furnace.

4½ in. to 9 in. thickness. The door is of a patented parallel motion type giving tight closing without clamping; opening the door cuts off the current. Automatic temperature control is fitted to all models.

Petters, Ltd.

Messrs. Petters exhibit a representative selection of oil engines and electric lighting and power plants, giving an excellent idea of their capabilities between the comprehensive range of 1½ and 600 b.h.p., and demonstrating the advantages

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of the smooth-running Petter improved two-stroke cycle engine.

Possibly the most interesting exhibits are the new "T" type engine, the "PCR" engine, and the "Auto-Petter Light," an automatically-controlled electric lighting set which made its *début* at the Smithfield Show recently.

The new 25-b.h.p. Petter "Atomic Diesel" high compression airless injection, cold starting oil engine (fig. 29) is exhibited in operation, driving a 220-V generator, direct coupled. Engines of this type are now being built in a range of sizes up to 160 b.h.p. in single, twin, three and four cylinder units. The design is extremely simple, and a number of new features are incorporated. High thermal efficiency, consequent on perfect combustion, is achieved by the special design of the combustion chamber. During the latter portion of the compression stroke a high degree of turbulence is attained, and the fuel oil, which is mechanically injected into the combustion chamber in the form of a mist or atomised spray of very finely divided particles, meets the turbulent air and intimate mixture results. Ignition is caused by the temperature due to the compression pressure.

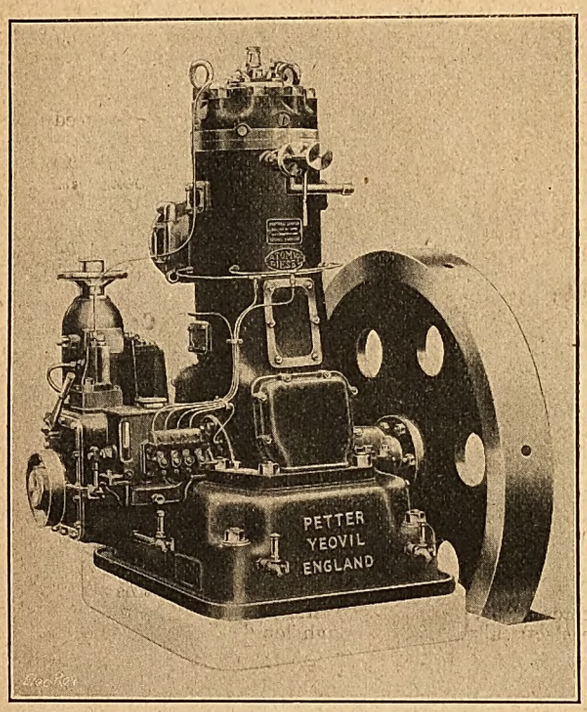

Fig. 29.—A Petter "Atomic Diesel" Engine.

The "Auto-Petter-Light" set, a compact self-contained plant without storage batteries, is a development of the company's "Petter-Light" house-lighting plant. The plant is automatically controlled and is started and stopped by hand by pressing a controlling switch placed anywhere in the house to suit the convenience of the occupier. The speed of the engine is controlled by a centrifugal governor which regulates the consumption of petrol in proportion to the number of lights in use. When electricity is no longer required the house switch can be operated, and there is no need to visit the actual installation itself. If desired additional controlling switches may be installed in any part of the house. There is no switchboard and none of the delicate control mechanism found in many automatic plants. The set consists of a two-stroke water-cooled engine fitted with a self starter similar to that on the ordinary motor car, and direct coupled to a compound wound dynamo. The plant is made in three sizes, 700, 950 and 1,450 W, 110 V, and can be supplied in other voltages if desired. Other exhibits include a 5-b.h.p. Petter "S" type engine direct-coupled to a "G.E.C." generator; a 1¼-kW "Petter-Light" electric lighting plant, and several examples of the company's larger engines.

Sturge & Baker, Ltd.

Numerous designs of electric fires are exhibited by this company. One new model is a fire with three 500-W vertical elements mounted at different angles giving a wide dispersion of heat. Another design has a slightly inclined horizontal triangular element, the reflectors being of similar shape. Miniature bowl fires and a new kind of electric bed-warmer are other exhibits.

Blackstone & Co., Ltd.

The company shows what is claimed to be the first British vertical high-speed engine to work on residual oil, the Blackstone "Spring Injection" high-speed engine. A 35-b.h.p. 4-cylinder engine is fitted in a tractor for farm and road haulage work. The engine runs normally at a speed of 1,000 r.p.m and is suited for all classes of vehicles for road haulage, locomotives, electric lighting, and other power purposes.

In addition to the tractor, a 2-cylinder high-speed engine of 17½ b.h.p., coupled to a dynamo, and a 6-cylinder, 52-b.h.p. size are exhibited. Other notable exhibits on this stand are the new "Blackstone" petrol-electric sets with outputs of from 1 to 3½ kW, and several other stationary and portable petrol engines, a range of special mills for crushing, &c., are shown. A further exhibit is the Blackstone "Unchokeable" pump for pumping liquids containing any class of solids, hard or soft.

On another stand the company has a selection of its "Spring Injection" heavy-fuel-oil engines. One, a 64-b.h.p. size, is shown, complete with dynamo and switchboard.

A new range of generating sets has recently been introduced by the company; they embody Blackstone "no trouble" petrol engines directly coupled to dynamos, with common cast-iron bases. It is claimed that the sets are simple to handle, easy and reliable to operate, and economical in running costs. Fig. 30 shows one of these sets. The sets supplied have normal outputs of 1, 1½, 2½ and 3½ kW. In each case the engine works on the four-stroke principle, has high-tension magneto ignition, and is water-cooled. It is fitted with a special patented mechanical device, which, actuated by the governor, regulates both the quantity and quality of the mixture fed to the combustion chamber, according to the load.

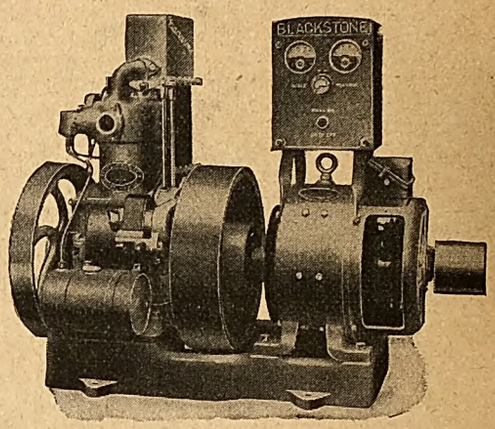

Fig. 30.—A Small "Blackstone" Generating Set.

S. Berendsen, Ltd.

The principal exhibit of this company is the "Uwana" combined four-valve radio set and gramophone, and it also shows models of portable 5-valve sets, loud speakers, &c. The "Electricon" is shown; this is a simple device consisting of a plug and socket for tapping flexible wires.

Northern Rubber Co., Ltd.

A varied display of rubber products appears on this company's stand. Among the articles of electrical interest which are shown are switchboard mats, rubber gloves, and various kinds of insulators for electrical applications.

Holman & Co. (Engineers), Ltd.

A range of "Lightning" electric shearing machines is on view on this stand. One of these, Model "A," is illustrated in fig. 31. This particular example is designed for cutting mild steel sheets up to 14 s.w.g. or correspondingly thicker sheets of brass, copper, aluminium, &c. The motor has a power consumption of 250 W, and the net weight is only 41 lb. Models "B" and "D" are also shown; these are for larger work, and the motors drive through belting. Both are equipped with 3-h.p. motors and are capable of dealing with mild steel sheets up to 8 s.w.g.

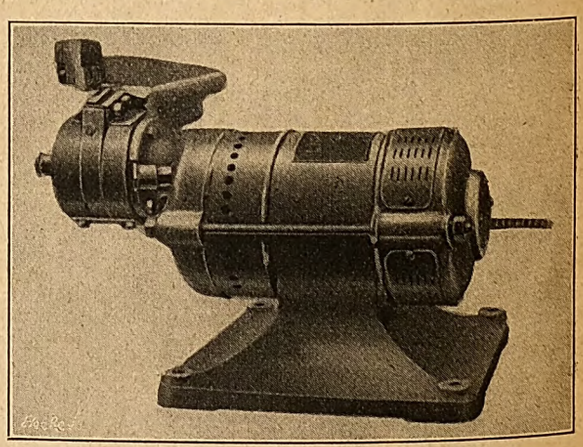

Fig. 31.—A "Lightning" Shearing Machine.

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Castle Fuse and Engineering Co., Ltd.

The principal exhibit upon this stand is a three-unit fuse assembly. This has a cast-iron distribution box with removeable panels on each side and a lid with machined face, and spring-loaded hinges, which ensure a gas-tight joint. The patented divided bus-bar combines the function of bus-bar and support bar. The fuse unit is of "Triumph" patented design with a special clamping arrangement so that any size of fuse from 60 to 350 A may be readily attached to the bus-bar. The switch box is fitted with a removable back and side plates; it houses a switch panel carrying a 1,000-A triple-pole change-over switch. Sealing chambers and glands for two sets of incoming mains, and adjustable cable connectors are provided, and there is an arrangement which prevents compound from leaking from the sealing chamber due to hydrostatic pressure. The top section cover has a hinged lid, which fits on the front of the switch box, enclosing the switch panel and mechanism in a gas-tight box, and it is of sufficient depth to enable the switch blades to be left in any position with the lid closed. The metering equipment is mounted on the top of the upper section of the switch box, and the ampere-hour meter is contained in a cast-iron case with hinged front and a glass window.

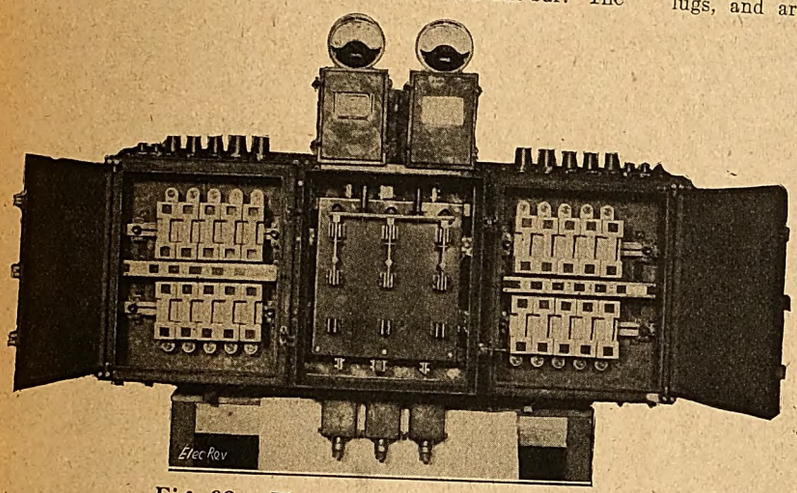

Fig. 32.—Three-unit Fuse Equipment.

The divided bus-bar, mentioned above, can be used for all power fuses in sizes from 60 to 350 A. Outgoing circuit strap connections of a flexible nature are provided, with sweating lugs, and are of such a length that all the cable lugs are brought into line for the various sizes of fuse. A loose plug can be attached to the lug for short-circuiting any fuse unit. Brass clamping plates, with flexible straps, form the interconnections between the switch box and the distribution box, or between two distribution boxes. A short-circuiting socket is provided on the top.

The company also shows a balanced 3-wire service distribution box having four 60-A ways, switch and metering equipment; a 2-wire service distribution box with eight 60-A ways; two new larger unit boxes with removable panels, for 3-phase distribution or to house circuit breakers; a feeder pillar, incorporating several new features, ironclad fuseboards, &c.

Henry Wiggin & Co., Ltd.

Among this company's exhibits are electric fires of various makes fitted with "Brightray" elements; a range of sample reels of "Brightray" and "Glowray," both nickel-chromium electrical resistance - wires; "Ferry" for motor starters, &c.; various small resistances and rheostats; and photographs of heavy electrical equipment using the company's resistance materials.

Flextol Engineering Co., Ltd.

Tools for many applications are shown upon this stand. They include drills, grinders, riveters, polishers, &c., many of which are electrically driven through long flexible shafts.

Exhibits at the White City.

The exhibits at the White City (London) Section of the Fair are confined to the lighter trades, these being divided into nineteen different groups, the floor area occupied having increased from 257,700 sq. ft. in 1928 to over 317,000 sq. ft. on the present occasion. There is about eight miles of stand frontage, while to provide for the lighting 32 miles of cable, and about 30 miles of flex have been installed. There is no special electrical section, apart from that devoted to radio apparatus, but exhibits of an electrical or cognate character are to be found in the majority of the groups, cropping up in many unexpected places. Notes on some of the stands follow :—

Accurate Recording Instrument Co., Ltd.

Some very interesting examples of distance recording and indicating thermometers and pyrometers are to be seen at this stand. Although the majority of these work on the vapour-tension principle, some thermo-electric and other instruments are shown as well as "Reid" sparking plugs, in which the working spark is visible from the exterior.

Ajax, Ltd.

The "Sunviray" ultra-violet ray apparatus is shown on this stand in a variety of sizes, ranging from a hospital appliance capable of treating as many as 600 patients in an hour down to a well-designed set for home use. Equipment for dental and veterinary purposes is also on view, while several electrically-operated appliances for use in ladies' hairdressing establishments are also shown.

Bower Electric (1926), Ltd.

A full range of "Uvral" ultra-violet ray instruments for electro-medical treatment is to be seen at this stand, the apparatus on view ranging from a set designed for hospital use to a new domestic twin-arc model. The latter is adapted to be worked off an ordinary house lighting circuit, and is fitted with two resistance units incorporated with a reflector. The apparatus is also so arranged that it can either stand on a table or be hung on a wall. The larger instruments are fitted with a special time-control device known as an "expometer," which automatically cuts off the current at the end of a predetermined period. High-frequency and diathermy radiant heat appliances are also displayed.

At this stand is also to be seen a novel illuminated advertising sign known as the "Neosyne." The lighting effect is obtained by a neon tube, but in this case the tube is not made in special lettering form, but in parallel lines. The tube is mounted in a metal frame adapted also to receive a stencil cut with special lettering or design, the light only showing through the cut portion of the stencil. One special advantage of the arrangement is that the message given out by the sign can be changed as often as desired at the cost only of the additional stencils.

J. A. Brook.

A device for locking electric lamps with a special key in the form of a spanner is exhibited at this stand. The device, which is made in forms suitable for different types of lampholders, is now being widely used in many works and Government Departments. At this stand is also to be seen in operation Brook's super-sparker, an ingenious device adapted to be fitted on the dashboard of motor vehicles to give a visual indication of the regular or irregular running of the magneto or the sparking plugs.

Burovox, Ltd.

This company is again demonstrating its "Burovox" loud-speaking telephones for use in offices, works, mines, ships and noisy engine rooms. The marine patterns include both portable and bridge pedestal types, in which the loud-speaker and microphone are housed in non-corrosive aluminium waterproof hoods.

I. Calvete, Ltd.

This firm occupies a large stand, and has a complete display of electro-medical appliances, including the "Solart" ultra-violet and "Icalite" radiant-heat lamps which are made in a variety of sizes ranging from hospital apparatus to a small portable appliance. Other specialities shown include the "Everay" h.f. massaging apparatus, electric hair dryers, clippers, and curling iron heating stoves, for hairdressing establishments; a new series of "Thermical" diathermy apparatus; and an "Icall" pedestal combination provided with attachments for vibro-massage, hair-cutting, manicure and chiropody.

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A. C. Cossor, Ltd.

In addition to a full range of radio valves and receiving set components, this firm is showing "Cossor" electric lamps for motor vehicle lighting, and the "Empire" and "Imperial" h.f. generators for electro-medical purposes. Of special interest to power supply undertakings are the "Cossor" vacuum detectors for carrying out tests of circuits at pressures of from 1,000 to 15,000 V. Three sizes of portable detectors are made. The detector itself is mounted in a stout glass tube surrounded by a protecting insulating sheath. One end terminates in an aluminium cap and the other is attached to a long insulated handle, which, for convenience of transport, is made in three pieces. A 10-ft. length of highly insulated flex is provided for earthing one end of the tube. A switchboard type of detector is also made, the detector tube in this case being enclosed in a cast-iron case and mounted on porcelain insulators which are prolonged outside the case so as to pass right through the switchboard panel.

Dakol Electric, Ltd.

This exhibit comprises a number of electric lamps embodying the "Dakol" blue glass screen and special diffusing screen which, used in conjunction with gasfilled lamps, is claimed to give an artificial light closely approximating that of daylight. The effect of the screens is to cut out the yellow rays of the light and at the same time emphasise the blue and violet rays, a restful light without any dazzle resulting. The system is shown as applied to pendant globes and bowls, wall brackets, table and desk standards, and also for use in connection with microscope work. It is also being largely used in establishments where much colour matching work has to be done.

Electric Drives, Ltd.

In view of the increasing use of small fractional h.p. motors for operating sewing machines, gramophones, and small tools generally much interest is being taken in the display of "Eldrive" universal motors shown by this company. The motors, which can be operated by either a.c. or d.c., are made in sizes ranging from ⅛ to 1/100 h.p., to run at speeds of 2,000 and 4,000 r.p.m. The company makes a foot-operated starting switch and speed regulator for use in connection with the motors.

Thermaga, Ltd.

"Thermaga" electrically-heated pads for human body local heating and also bed blankets are again being exhibited by this firm. The pads are suitable for use with any voltage between 100 and 250, and are supplied for either a single temperature or with a three-heat switch.

Hailwood & Ackroyd, Ltd.

Among a wide range of illuminating glassware and fittings to be seen at this stand are examples of special electric pendants and globes made by the firm from the designs of Sir Frank Baines, for use in the large new London offices of Imperial Chemical Industries, Ltd. Another interesting exhibit is an electric table lamp for use in the boardroom at the same offices, the shade taking the form of a globe built up of three layers of respectively frosted, opaque white, and red glass, the layers being so cut away as to form a map of the world, with British possessions standing out in red. Samples of "Hailuxo" heat-resisting glass and of metal stampings and pressings for use in pendants and wall brackets are also shown.

British Insulated Cables, Ltd.

This company exhibits examples of its "Prescot" electric rivet heaters and welders. The former embody a single-phase transformer for converting a.c. of standard voltage to the large current necessary for heating rivets. The machines are made in several sizes ranging from 10 to 50 kW, and it is claimed that the 10-kW machine will heat 70 lb. of rivets per hour, and that it be used continuously without overheating. The welding machines shown comprise Prescot electric spot and seam welders for wrought iron, mild steel, brass or aluminium. Like the rivet heaters, these are all made in various sizes, and are designed for use with single-phase a.c.

Premier Electric Welding Co., Ltd.

This company also shows a typical electric welding machine together with specimens of "Premier" and "Belfinish" welding electrodes.

Marconi's Wireless Telegraph Co., Ltd.

In the Wood Lane entrance hall this company has a joint exhibit with the Eastern Telegraph Co., Ltd., consisting of a number of instruments used in connection with wireless telegraphy. Among the apparatus shown is a "Jell" perforator and transmitter operated by a keyboard similar to that of a typewriter, and a Marconi high-speed recorder.

T. & F. Mercer.

This firm is showing several examples of the "Octo" synchronised electric clocks, the types on view including a series specially adapted for marine time-keeping. Interest is also being shown in the improved "Holden" recording chronograph for the electric timing of motor speed trials and races.

George Nobbs, Ltd.

The "Genii" electric tubular heaters for the heating of rooms, cupboards, &c., occupy a prominent position on this company's stand. The heaters are made up in lengths of from 2 to 17 ft. to consume from 25 up to 70 watts per foot run. The outer tubes are made of seamless steel tubing enclosing a mica element without coils so arranged that it can be easily withdrawn for examination or renewal; the elements are bolted together in short sectional strips. The firm is also showing a range of "Genii" electric immersion heaters which are made in single-, double- and four-bladed patterns, and in capacities from 100 to 9,000 W. Also shown is a range of the "Genii-MacLaren" thermostats for regulating water heaters, boilers, furnaces, incubators, &c.

Peerless Electrical Manufacturing Co., Ltd.

This concern specialises in the manufacture of electrically-operated appliances for tradesmen's use. A number of different machines are displayed, among them being a cake-mixing machine for confectioners, and a mincing and sausage-making machine for butchers. The various appliances are driven by small ball-bearing electric motors which, like the gearing, are entirely enclosed, starting and stopping being effected by a flush-type push button.

Sun-Vi-Lite, Ltd.

This is another company specialising in electro-medical equipment, which includes the "Vilite" ultra-violet ray appliances ranging in size from those designed for hospital use down to a domestic set embodying two polished circular reflectors arranged one above the other, one housing semi-automatic twin-arc mechanism, and the other an infra-red element which also acts as the arc resistance. Also displayed is the "Viliteometer" exposure unit consisting of a small rectangular box containing mechanism for automatically controlling the period of exposure in ultra-violet ray apparatus.

Synchronome Co., Ltd.

Various patterns of "Synchronome" electro-magnetically operated clocks are shown by this company. The current for the working of the clocks is supplied from dry cells, and an electric bell is incorporated in the circuit in such a way that it comes into action when the cells tend to become exhausted, so giving a warning for their replacement.

Fuller Accumulator Co. (1926), Ltd.

On a large stand this company shows a full range of accumulators for radio purposes as well as for central station and house lighting use, and train and motor vehicle lighting, and block accumulators for telephone, telegraph, and railway signalling work. Attention is also drawn to the "Fuller" unspillable accumulators, dry batteries, and the "Sparta" loud speakers.

Ernest Turner.

Some examples of highly-finished galvanometers, ammeters, micro-ammeters, voltmeters and other electrical measuring instruments attract attention at this stand. Appliances are made for all classes of work from small instruments for use with radio sets to those for power stations.

The Canadian Section.

Among the exhibits of an electrical character in the Canadian Section are the "Beatty" combined domestic electric washing and wringing machines handled in this country by Beatty Bros., Ltd. The machine comprises a round copper tub containing a three-armed reversing agitator driven through gearing by a 1/6th-h.p. motor mounted below. The agitator driving gear is also connected to the wringer, which is provided with a quick release. Another domestic electric washer, wringer and ironer hailing from Canada, is the "Locomotive" made by the Brantwood Washing Machine Co., Ltd., and shown by the Sloan Electrical Co., Ltd. This machine also appeared at Birmingham and is described in that section of our notes.

Messrs. Nathan & Allen, Ltd., display several examples of electric "rangettes" and hot-plates made by the Tudhope Metal Specialities Co., of Orillia, Ontario. These are light, compact and artistically-finished cooking appliances made in single, double and triple heating element form. The single hot-plate element has a loading of 660 W, the twin element sets are of 600 W each, while the largest size has two of 600 W and one of 1,200 W on a lower shelf. With the larger sizes an oven is supplied, this being detachable so that it can be placed over either one or two elements. The outfits are each fitted with a three-heat switch, and the fittings, being chromium-plated, are untarnishing.

Hoover, Ltd., show examples of its well-known suction cleaners and floor polishers. The Monarch Battery Manufacturing Co., Ltd., of Kingston, Ontario, displays a range of secondary batteries suitable for radio, motor vehicle, house lighting, and central station use. The Northern Aluminium Co., Ltd., represented in this country by Aluminium II, Ltd., exhibits examples of various aluminium products, including power transmission cables.

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Electrical Exports of Germany.

Figures for 1927 and 1928 Compared.

THE following statistics showing the value (in thousands of Reichsmarks), weight in double centner (equals 220 lb.), and in some instances the number of pieces, of electrical apparatus exported from Germany in 1928 are based on the official foreign trade returns of that country. The figures for 1927 are added for purposes of comparison, and notes of increases and decreases are made. For both years the totals include exports on reparation account. With regard to the destination of the exports of dynamos, motors, convertors, and transformers, Argentina, Holland, Denmark, Sweden (and Great Britain in the smaller sizes), figure prominently amongst the destinations of machines up to 150 kg. in weight; Russia, France, Argentina, and Brazil were good customers for those from 150 kg. to 3,000 kg., whilst of those over 3,000 kg. 69 went to Argentina, 63 to Spain, 508 to Russia, 36 to Norway and 37 to Japan, during last year.

	1927.	1928.	Inc. or dec.
Electric lighting and starting apparatus for motor vehicles—			
Value	5,710	6,942	+ 1,232
Number	65,954	80,307	+ 14,353
(Double centner)	5,034	6,904	+ 1,870
To Czecho-Slovakia ,,	17,358	18,952	+ 1,594
,, Austria ,,	13,463	16,741	+ 3,278
,, Italy ,,	8,936	12,797	+ 3,861
Dynamos, motors, convertors and transformers up to 5d.-centner—			
Value	27,007	35,624	+ 8,617
Number	512,661	610,719	+ 98,058
(Double centner)	86,845	103,017	+ 16,172
Ditto, from 5 to 30 d.-centner—			
Value	17,707	17,698	− 9
Number	7,642	7,289	− 353
(Double centner)	79,125	78,653	− 472
Ditto, over 30 d.-centner—			
Value	15,070	21,249	+ 6,179
Number	957	1,274	+ 317
(Double centner)	86,206	119,010	+ 32,804
Armatures and commutators—			
Value	6,650	9,338	+ 2,688
(Double centner)	15,387	26,182	+ 10,795
Accumulators, plates, &c.—			
Value	8,165	7,841	− 324
(Double centner)	44,919	44,209	− 710
To Denmark ,,	9,111	5,174	− 3,937
,, Finland ,,	1,682	5,332	+ 3,650
,, Holland ,,	9,497	10,080	+ 583
,, Sweden ,,	8,871	7,235	− 1,636
,, Argentina ,,	1,942	2,723	+ 781
Electric cable—			
Value	40,662	47,127	+ 6,465
(Double centner)	425,956	490,395	+ 64,439
To Denmark ,,	*	2,796	—
,, Gt. Britain ,,	13,082	*	—
,, Holland ,,	133,254	93,282	− 39,972
,, Norway ,,	9,058	16,469	+ 7,411
,, Sweden ,,	19,326	29,150	+ 9,824
,, Poland ,,	11,600	10,120	− 1,480
,, Argentina ,,	59,645	88,300	+ 28,655
,, Japan ,,	4,825	21,900	+ 17,075
,, Finland ,,	15,249	27,500	+ 12,251
,, France ,,	8,000	44,000	+ 36,000
Arc, mercury, quartz, &c., lamps—			
Value	2,734	3,375	+ 641
Number	19,648	32,037	+ 12,389
(Double centner)	2,189	2,807	+ 618
To Gt. Britain ,,	1,020	3,700	+ 2,680
,, Russia ,,	1,600	2,500	+ 900
,, Sweden ,,	3,700	5,100	+ 1,400
Measuring and recording instruments—			
Value	32,936	37,597	+ 4,661
(Double centner)	28,210	29,235	+ 1,025
To Gt. Britain ,,	1,871	1,770	− 101
,, Italy ,,	3,309	3,290	− 19
,, Holland ,,	2,634	2,640	+ 6
,, Russia ,,	2,281	3,050	+ 769
,, Sweden ,,	1,644	1,600	− 44
,, Spain ,,	1,438	1,270	− 168
,, Czecho-Slovakia ,,	1,062	1,160	+ 98
,, Japan ,,	1,274	1,080	− 194
,, Argentina ,,	2,256	1,700	− 556
Metal filament lamps—			
Value	25,893	33,861	+ 7,963
(Hundreds)	554,392	689,856	+135,464
(Double centner)	10,257	12,964	+ 2,707
To Denmark ,,	30,533	36,250	+ 5,717
,, Finland ,,	12,331	16,950	+ 4,619
,, France ,,	10,700	22,070	+ 11,370
,, Gt. Britain ,,	73,606	84,300	+ 10,694
,, Italy ,,	44,462	64,950	+ 19,488
,, Norway ,,	14,723	15,360	+ 637
,, Mexico ,,	12,624	21,400	+ 8,776
,, Sweden ,,	34,721	38,100	+ 3,379
,, Switzerland ,,	11,787	20,500	+ 8,713
,, Czecho-Slovakia ,,	33,098	42,400	+ 9,312
,, China ,,	14,370	23,000	+ 8,630
,, Argentina ,,	26,187	32,050	+ 5,863
,, Brazil ,,	*	18,400	—
Telephone material—			
Value	21,825	27,493	+ 5,668
(Double centner)	11,839	15,615	+ 3,776
To Holland ,,	1,084	2,640	+ 1,556
,, Switzerland ,,	504	780	+ 276
,, Japan ,,	723	960	+ 237
,, Italy ,,	2,508	2,200	− 308
Wireless material—			
Value	41,983	49,348	+ 7,365
(Double centner)	35,412	42,796	+ 7,384
To Denmark ,,	3,160	4,050	+ 890
,, Gt. Britain ,,	10,795	10,700	− 95
,, Holland ,,	3,162	4,500	+ 1,338
,, Sweden ,,	2,711	2,500	− 211
,, Japan ,,	200	700	+ 500
,, Argentina ,,	1,171	2,200	+ 29
Electric irons—			
Value	1,409	1,471	+ 62
Electric heating and cooking apparatus—			
Value	5,946	8,346	+ 2,400
Ignition apparatus, other than magnetos, and accessories for motor vehicles—			
Value	16,874	20,101	+ 3,227
(Double centner)	13,525	18,746	+ 5,221
To Great Britain ,,	726	1,270	+ 544
,, Italy ,,	751	1,400	+ 649
,, Holland ,,	960	770	− 190
,, Czecho-Slovakia ,,	1,117	1,500	+ 383
,, United States ,,	3,685	4,800	+ 1,115
Electric safety and signalling apparatus—			
Value	5,765	7,594	+ 1,829
(Double centner)	9,419	11,535	+ 2,116
To Denmark ,,	292	750	+ 458
,, Great Britain ,,	3,864	3,860	− 4
,, Italy ,,	283	450	+ 167
,, Holland ,,	1,147	960	− 187
Electrical apparatus for lighting, power transmission, electrolysis, resistances, &c.—			
Value	85,381	111,877	+ 26,496
(Double centner)	242,394	312,089	+ 70,695
To Finland ,,	9,129	8,500	− 629
,, Great Britain ,,	18,809	21,300	+ 2,491
,, Holland ,,	29,511	33,900	+ 4,389
,, Austria ,,	12,705	11,700	− 1,005
,, Russia ,,	22,622	42,400	+ 19,778
,, Sweden ,,	13,389	17,800	+ 4,411
,, Dutch East Indies ,,	11,372	9,700	− 1,672
,, Argentina ,,	15,115	16,800	+ 685
Electro-medical and dental apparatus—			
Value	16,000	19,500	+ 3,500
Galvanic batteries and parts and heating elements—			
Value	13,093	12,340	− 753
(Double centner)	63,734	60,841	− 2,893
To Great Britain ,,	36,371	30,500	− 5,871
,, Holland ,,	5,643	4,400	− 1,243
,, Sweden ,,	5,764	6,200	+ 436
Insulating material of asbestos, mica, and micanite—			
Value	569	601	+ 32
(Double centner)	612	552	− 60

* Figures not available.

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	1927.	1928.	Inc. or dec.
Telegraph or telephone insulators—			
Value	7,097	6,270	− 827
(Double centner)	67,238	61,349	− 5,889
To Russia ,,	7,054	4,800	− 2,254
,, Switzerland ,,	5,803	6,500	+ 697
,, India ,,	4,937	2,500	− 2,437
,, Dutch East Indies ,,	4,106	3,800	+ 306
,, Irish Free State ,,	4,145	4,850	+ 705
Carbon brushes, microphone carbons, &c.—			
Value	1,768	1,920	+ 152
(Double centner)	660	791	+ 131
Arc lamp carbons—			
Value	1,768	1,920	− 152
(Double centner)	6,836	6,844	+ 8
Electrodes—			
Value	7,942	9,819	+ 1,877
(Double centner)	207,837	275,753	+ 67,916

The total value of the imports in 1928 of electrotechnical products was 488,689,000 marks, as against 398,716,000 marks in 1927, while that of imports was 45,635,000 marks, against 33,462,000 marks. There were, however, some alterations in the method of compilation in October and November, 1928, which render these comparisons not quite exact.

A Large Turbo-set Contract.

A 20,000-kW turbo-alternator was recently shipped to Japan by the British Thomson-Houston Co., Ltd.

Among recent important contracts that have been secured by manufacturers in this country for the supply of electrical equipment abroad is that for a large turbo-alternator set made by the British Thomson-Houston Co., Ltd., for the Imperial Government Railways of Japan, through Messrs. Mitsui & Co., Ltd. This machine, which is shown in fig. 1 as it appeared on the test bed in the B.T.H. works, has some interesting features. Designed to meet special overload requirements, the turbine is of the two-cylinder type with 25 stages, suitable for steam conditions of 350 lb. per sq. in. and 700 deg. F., with a vacuum at 25 per cent. overload of 28 in. with the barometer at 30 in. The normal speed of the machine is 1,500 r.p.m., and the normal rated output is 20,000 kW, 6,600 volts, three-phase, 50 cycles, at 90 per cent. power factor.

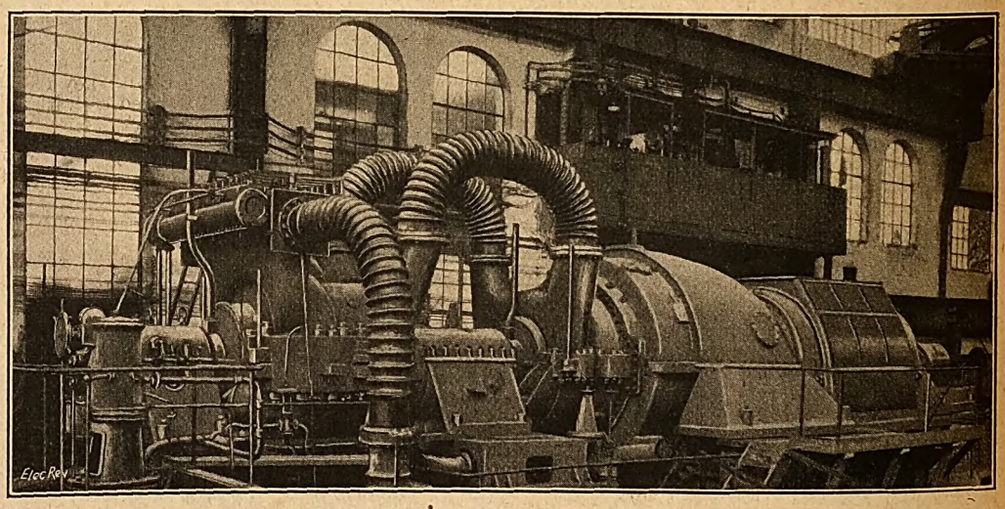

Fig. 1.—20,000-kW Turbo-Alternator on Test at the B.T.H. Works.

The transport of the set presented some difficult problems which were successfully overcome. The machine was shipped from Liverpool by the S.S. *Keemun*, of the Blue Funnel line (Messrs. Alfred Holt & Co., Ltd.), and for transport from Rugby to the docks over 20 railway wagons, including several specially constructed vehicles, and 10 Scammell road vehicles were brought into use; the total weight shipped was about 400 tons. The London, Midland & Scottish Railway Company arranged a special running schedule for its train, as several of the parts were considerably over-gauge, and it is interesting to note that only five days elapsed between the first dispatch from Rugby and the stowage on board the S.S. *Keemun* of the whole set.

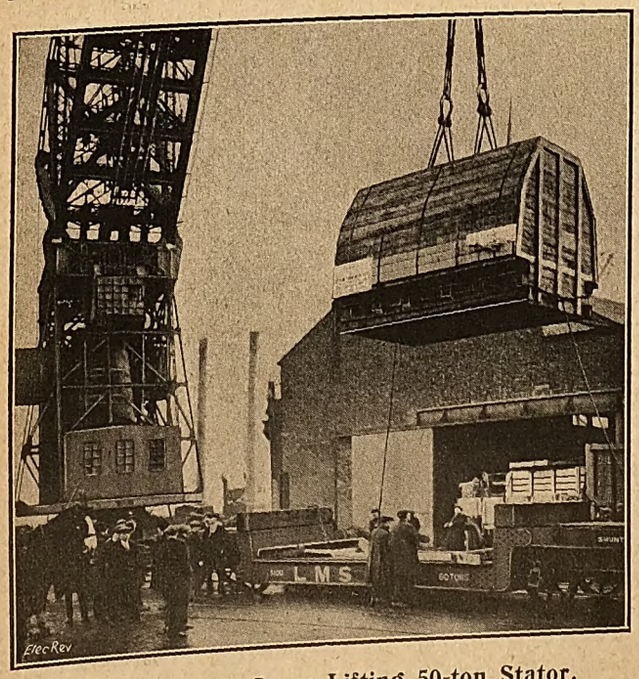

Fig. 2.—Dock Crane Lifting 50-ton Stator.

The weight of the low-pressure steam rotor, circular boarded and with skids ready for shipment, was over 17 tons, the dimensions being 16 ft. by 10.5 ft. by 10.6 ft. The railway gauge was thus exceeded by 9 in. on either side. The alternator stator weighed 50 tons 7 cwt., and measured 14 ft. by 10.5 ft. by 10 ft., and was therefore 8½ inches over gauge on either side. The stator is shown in fig. 2 being lifted by the Mersey Docks and Harbour Board's 200-ton floating mammoth crane at Birkenhead. Although not notable on account of its weight, the bottom half of the exhaust casing, which weighed 30 tons 10 cwt., was somewhat awkward to transport because of its shape, size, and unbalance, and special guying arrangements had to be made to lower it into the ship's hold. The turbine top half of the exhaust casing weighed 12 tons, boarded, and was 4 in. over gauge; it measured 15 ft. by 9.6 ft. by 8 ft.

Messrs. Southern Roadways, Ltd., of Birmingham, were responsible for the transport of the various pieces which passed by road, the largest piece being the alternator rotor, which weighed 28 tons 6 cwt., boarded, and measured 22 by 5 by 6 ft., approximately.

Illuminated Road Marking.

According to the *Daily Telegraph* the Paddington Works Committee has recommended to the Borough Council that a "white line" 25 ft. to 30 ft. in length at the junction of Bayswater Road and Edgware Road be electrically illuminated. The Ministry of Transport has received an offer from a company to install illuminated road marking as an experiment, and has asked the Council to grant the necessary facilities.

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Voice-frequency Telegraphy.

Brief notes on the five systems that have been developed, and some account of the research work carried out by the British Post Office.

By W. CRUICKSHANK, M.I.E.E.

(*Extracts from a Paper read before the* Institution of Electrical Engineers.)

In the tone- or audio-frequency system the signals are made up of trains of a.c. impulses, the frequencies of which fall within the range of sounds uttered by the voice and audible to the human ear. Incidentally, the amplitude of the electromotive forces impressed on the line and the resultant currents are of the same order as those used in the electrical transmission of speech by means of telephone lines.

The best line from a telegraph transmission standpoint is an aerial copper line, well insulated and free from inductive interference, but such lines are not immune from the effects of gales and snowstorms, which fact, combined with difficulties in large towns and the growth of electrical power distribution by overhead lines, has driven most of the main telegraph circuits underground. The first result of a change-over is either a reduction in the speed of working, or an inordinate and uneconomical increase in the number of repeater stations. Concurrently with the change-over in this country, which has been taking place during the last 30 to 40 years, there has been developed an elaborate system of machine printing telegraphs which has almost entirely supplanted the high-speed Wheatstone service formerly worked on main routes. Baudot multiplex systems, giving as many as six duplex channels on a single wire, or pair, and printing direct in Roman characters on a tape, possess many advantages over high-speed morse, and although the operating costs are admittedly high, the British system to-day compares very favourably with that of other countries, whether State-owned or run by operating companies. This claim is put forward advisedly, because it might appear that this country has lagged behind others in the development of new methods of communication.

Even before the close of the war a start had been made with the manufacture and laying of multiple cables with small-gauge conductors, loaded and worked with valve repeaters, to extend the main backbone trunk network. The necessity for a stable and reliable service between all industrial centres has compelled the Department to place telegraph circuits in cables which are not wholly used for telegraph purposes, and at the moment the channels of communication are more than sufficient to cope with the traffic. In Germany, on the other hand, an entirely new cable network had to be laid down after the war and it was highly desirable that it should be used in the most efficient manner for both telephone and telegraph purposes. Operation of telegraph circuits by d.c. methods, using voltages as high as 120 volts on both sides of earth potential and currents of some 30 mA, would introduce a serious disturbing influence in even a carefully balanced telephone cable, and cross-fire and cross-talk of considerable magnitude might ensue. Messrs. Siemens & Halske, closely associated with the Reichpost Administration, have developed an a.c. multiplex telegraph system which is admirably suited for operation in a telephone cable and is extremely economical in its demands for pairs in the cable. In the United States a system based on the same broad general principles has been produced independently by the Western Electric Co. to meet the demands for telegraph circuits, public and private, in the cable routes of the Bell system. The long distances between large towns on the American Continent have fostered the telegraph habit in the States, and the administrating companies make the most of long cable routes, which have involved considerable capital expenditure in their erection. Elaborate terminal and intermediate apparatus form but a small fraction of the first cost and standing charges on these cables, and it pays to superpose or composite telegraph circuits on telephone pairs. When a pair is reserved entirely for telegraphs the company sees that as many channels as possible are packed on to it. Successful operation of 12 channels, each carrying a start-stop printing telegraph, has been achieved on many important routes, giving an overall speed of some 480 to 600 printed words per minute on the single pair of wires. Since the frequencies used are kept within the audio spectrum, telephone repeaters function as efficiently on the multiplex telegraph pair as on the telephone circuits, and the interference between the telegraph and the telephone is no greater than that between telephone pairs themselves.

*Siemens and Halske System.**—The design installed in this country between London and Manchester provides six sending channels for operating in one direction on a pair of wires, and six receiving channels on another pair. Double-current working incoming to the instrument rooms is secured in the ordinary way and at the *sending ends* six 3-electrode valves, the anodes and grids of which are magnetically coupled, generate the oscillations for the six channels.

The telegraph sending relays (50 ohms+50 ohms) are capable of repeating Wheatstone signals at 150 words per minute with 36 mA; the receiving relays (500 ohms+500 ohms) under the same conditions use 4 mA. They are, however, difficult to adjust, due mainly to the alignment of the cores and to the lack of control by the adjusting screw on the armature. The amplifying and rectifying valves are of the 2-grid type. The workmanship and finish of the valves sent over to this country with the sets are of a very high-class character. After initial runs the following allocation of the channels was decided upon, with a telephone repeater at Derby:—

	Equivalent Wheatstone speed w.p.m.
Channel (1) Teletype (Stock Exchange)	45
Channel (2) Morse key (Stock Exchange)	40
Channel (3) Baudot quad, auto	90-100
Channel (4) Bolton key circuit	30
Channel (5) Creed circuit (news)	100
Channel (6) Western Electric multiplex	100

The trials on the auto Baudot were successful, but owing to the lengthy propagation time of the loaded circuit the receiving plate had to be retarded four or five segments and the receiving brush put as far back as possible. The Western Electric multiplex was working at its limit and the channel did not give sufficient margin for the commercial operation of this apparatus. The Teletype and Creed channels were quite satisfactory.

Western Electric Co.'s System.—It is suitable for application on a larger scale than the German arrangement. In a large office the production of frequencies by an oscillating valve for each channel (Americans operate as many as 12 channels per circuit) would become a serious business. An inductor alternator supplies 40 mA at a terminal voltage for each frequency of about 0.7 volt at full load. A spare machine is installed as a stand-by and the driving motor is run from the standard 24-volt battery which also supplies current to the two field coils of the alternator which are common throughout the stator. The rotor is made up of 12 soft-iron disks mounted and spaced evenly on a common shaft. Slots are cut round the peripheries of the disks, the number on each disk being determined by the frequency required. Winding slots are cut correspondingly on the pole arcs of the stator to take the stator coils which are brought out to the various frequency circuits. The flux in any stator tooth is a maximum when a disk tooth is opposite, and a minimum when a slot is opposite.

At the sending end the machine normally runs on resistance loads which are closed through the armatures and spacing stops of the sending relays. Beyond these short-circuits are connected in each case non-reactive resistances in series and in shunt; across the shunts are the individual band-pass sending filters which lead to the common input transformer of the sending repeater. Signals from the instrument room open the short-circuits on the sending-relay contacts and a.c. passes through the sending filters. The frequencies used are multiples of 85, beginning with the fifth, *i.e.*, 425, and going up in steps of 170.

At the receiving end the output transformer of the home repeater is commoned on to the receiving filters, which are closed on potentiometers for individual adjustments. The alternating currents are first amplified and then rectified, the receiving relays being connected directly in the anode circuits of the rectifying valves, with bypass condensers across their coils.

To convert a 4-wire telephone circuit for voice-frequency telegraphy, the terminal hybrid coils and balances are disconnected from the two pairs and the telegraph senders connected to one pair and the telegraph receivers to the other pair. The 4-wire repeaters along the cable function as before.

In a demonstration given at Woolwich in April, 1928, apparatus was joined to a line to Derby and back, equal to some 300 miles of normally-loaded circuit. Six channels in each direction were fitted, five with Morkrum-Teletypes and the sixth with Wheatstone in one direction and Teletype in the other: 90 words per minute speed could be demonstrated on any desired channel.

A Japanese System.—A 4-channel system was successfully designed by Messrs. T. Horie and H. Sugiura several years ago, but the apparatus and results of the trials were com-

* See Elec. Rev., March 18th, 1927, p. 421.

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pletely destroyed during the earthquake of 1923. Since then the apparatus has been reconstructed, and the frequencies used are 500, 700, 900 and 1,100 cycles, generated by thermionic valves with tuned anode and grid coupling. The sending keys are connected in circuit with the output coils of the several oscillators, and each output circuit is closed on a resonant circuit, individual to itself, but all are joined in series and connected to the secondary winding of a 10 : 1 line transformer. On an artificial line of 25 standard miles, Wheatstone signals corresponding to 110 words per minute in English were successfully transmitted without using a sending amplifier. Receiving filters of two stages, designed to transmit a band of 200 cycles for each channel, were connected in parallel to the receiving-line transformer. Rectifying valves, with P.O. standard relays connected directly in their anode circuits, were utilised as receivers, the h.t. battery and relay being shunted by a condenser of about 2 μF. These results are quite remarkable when it is considered that neither sending nor receiving amplifiers were used, but no information is available about trials on working lines.

General Electric Co.'s System.—This was developed at Wembley and Stoke with the co-operation of the Post Office; valve-driven tuning-forks are used as sources of alternating e.m.f.'s. The component parts, including anode, grid and pick-up coils, polarising electromagnet and tuning condensers are assembled on the fork mounting and wired to two telephone pin plugs, so that the entire unit can be readily changed. The mountings are fitted on horizontal shelves on the back of the assembly racks and are enclosed in soundproof covers. The frequencies used are the same as those of the German system, ω increasing from 2,500 in steps of 1,500.

The installation is working between London and Leeds on two pairs in the London-Derby cable; 20-lb. conductors, loaded with 78-mH coils at 2,000 yards spacing, are used; there are repeaters at London, Fenny Stratford, Derby and Leeds, and Wheatstone signals were successfully transmitted on all six channels at 100 words per minute. Perfect signals were printed on Creed apparatus on all arms at this speed.

A French System.—The S.E.L.T. system is a duplex one, four channels being used in each direction on a loaded pair of wires. The frequencies used are ω=5,000, 7,000, 9,000 and 11,000 in one direction and 6,000, 8,000, 10,000 and 12,000 in the other. The line is balanced in a manner similar to that used in 2-wire telephone repeater systems, so that the outgoing signals may not interfere with the incoming signals. Valve oscillators are used as generators.

Dollis Hill Experimental Work.—A considerable amount of work has been carried out at the Post Office engineering research station at Dollis Hill. As one-direction multi-channel working had already been definitely proved to be capable of satisfactory operation both in America and in Germany, the first trials were made with the application of both-way working on the same pair of wires. The results indicated that working in both directions on a pair of wires is a practicable proposition: the two extreme frequencies should be selected first, and, as the traffic demanded, converging channels would be introduced. Four channels in each direction, beginning at, say, 425 cycles on the low side and with 1,955 cycles as the highest value on the upper side, would appear possible on our British cables for start-stop apparatus speeds.

Owing to storm breakdowns in the aerial circuits connecting the radio beam stations in Tetney and Skegness with London, and the possibility of these stations being utilised for radio-telephony, the provision of loaded underground cables has been under consideration; they would have to carry the existing high-speed telegraph circuits. The method hitherto in use in this country for this purpose would have been to reserve a certain number of unloaded pairs, probably of heavier gauge than the telephone pairs, and work them with d.c. and perhaps with telegraph repeaters at Leeds. As already indicated, this practice is liable to produce noise in the telephone pairs and, when it is remembered that the pairs would be used for international telephony, such a scheme could not be defended. Telegraph speeds of 200 w.p.m. are demanded to cope with the speed and exigencies of the beam traffic. A voice-frequency system was devised at Dollis Hill to meet the demand and a single-channel set without filters was set up and tried on existing loaded cables and on the actual circuits that would be used. The results were as follows:—

Circuit.	Voltage impressed on line.
Dollis Hill-Fenny Stratford-Dollis Hill (108.40 miles) ...	0.4
Dollis Hill-Grantham-Dollis Hill (354.44 miles) ...	0.25
Dollis Hill-Catterick-Dollis Hill (509.44 miles) ...	0.25

Telephone repeaters at	Speed w.p.m.
Fenny Stratford	350
Fenny Stratford, Derby (go and return)	300
London (TSX), Fenny Stratford, Derby-Leeds (go and return)	300

Systems in Practice.—The application of the voice-frequency system to commercial use to-day may be summarised briefly as follows:—

Germany.—Main routes are now mainly operated on this system, voice-frequency lines and channels radiating from Berlin and other large centres.

United States.—By the end of 1928 some 40 voice-frequency circuits, each of 12 channels, were to be in operation. The average length of the circuits is from 400 to 500 miles, so that there are about 200,000 channel-miles in use, which is approximately one-fifth of the total telegraph milage of the American Telephone and Telegraph Co. The system so far has been restricted to extra-light-loaded [No. 19 gauge (20 lb.)] 4-wire circuits, with telephone repeaters spaced about 50 miles apart.

France.—The following circuits are in use:—

1 quadruple Paudot:—Le Havre-Paris-Hamburg.
1 triple duplex:—London-Paris-Berne-Zurich.
1 double duplex:—London-Paris-Basle.
1 Hughes:—Paris-Fechamp.

England.—London-Manchester, six channels each way; London-Leeds, six channels each way.

The International Consultative Committee has laid down the following recommendation: the sum of the effective voltages corresponding to the frequencies used simultaneously over the same circuit should be less than 2 volts, and the sum of the effective currents corresponding to the frequencies used simultaneously over the same circuit should be less than 2 mA. When it is required to use currents or voltages greater than the above values, it is desirable, for preference, to choose the circuits allotted to telegraph purposes in outer layers of the cable and to balance them in separate groups. No difficulty has been found in working within the limits of current and voltage prescribed above.

The Committee has also received a proposal for the selection of telegraph frequencies to be used in loaded telephone cables and (*a*) has recommended for cables the use of frequencies of harmonic multiple telegraphy instead of separate wires; (*b*) has suggested that it would be very desirable to have standardised frequencies for harmonic multiple telegraphy. The proposed figures of frequencies submitted for approval have not yet been formally adopted. It is proposed to employ voice-frequency operation for international traffic on loaded cables, and a study is being made to determine what output it is possible to obtain from the circuits with start-stop apparatus, Siemens high-speed telegraph, and multiplex apparatus.

No direct comparison can legitimately be made between the various countries, since the conditions are not alike in all. In this country telegraph traffic is diminishing and there is an annual loss on the service of some 1½ million pounds. There are sufficient channels (of a sort) to carry the traffic, and one naturally hesitates before recommending the expenditure of additional capital under such conditions. In the Hardman Lever Committee's report of January, 1928, the average price paid per telegram is given as 14.76d., while the cost amounts to 22.14d. Of this amount 15.24d. is absorbed in administration and management, operating, delivery and sub-postmasters' allowances for telegraph work, while maintenance and depreciation of plant and interest on capital amount to 2.58d. Parliament has laid down a uniform charge for telegrams in the United Kingdom, irrespective of distance and of the number of re-transmissions. It would appear to the author that the most promising field for the introduction of a voice-frequency system in this country would be to utilise the many channels on a pair of wires which the system can provide, for the purpose of eliminating as far as possible the "X" message, *i.e.*, a telegram that has to be re-transmitted by hand at an intermediate office or offices. In the industrial midlands, north and west countries, there are many groups of large towns, congregated round a larger centre, which form the re-transmitting centres to and from the others. The telegraphist is the most costly item of the equipment and every re-transmission adds very appreciably to the cost, and incidentally also to the delay.

Any one channel can be extended to operate direct-current apparatus on an existing line, and there must be many towns between which there is appreciable traffic without direct communication. The introduction of voice-frequency working between large centres with extensions carried on spare wires in the underground networks, or on open lines, would provide direct service between many towns which does not exist at present. Single channels extended and operated at key speed can be composited readily on existing telephone trunk circuits, and, if need be, the channels can be terminated on concentrator switches and plugged through as required. Start-stop apparatus on, say, 4 channels of a 6-channel 2-wire circuit could carry the direct traffic between the larger centres and thus avoid synchronisation and brush troubles which require skilled and highly-paid attention on rotary multiplexes, while the other two channels could be utilised as morse circuits for extensions. The whole process would tend towards the reduction of the re-transmission operating costs and it is considered that the 15.24d. factor in the total expenditure could be lowered at a greater rate than the 2.58d. would increase.

The author holds no brief for the system; its general adoption in this country could be justified only by a reduction in operating costs and by the general improvement of transmission in cables carrying both telephone and telegraph circuits. A considerable additional expenditure per circuit per station would be involved (since the actual instrument-room equipment would still be required), but in the direction already indicated, and also in the gradual recovery of purely telegraph cables and the shutting down of telegraph repeater stations, increasing savings could be effected and a more efficient operation of and larger earning capacity obtained from the Department's line plant as a whole.

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Discussion in London.

Col. T. F. Purves, O.B.E., vice-president, occupied the chair.

Mr. E. Shaughnessy opened the discussion by remarking that he knew of no reason why good buzzer signals should not be as good as those produced by a sounder. Thermionic valves had been used for converting a.c. in wireless long before the 1914-18 European war; what the author meant was that they had not been used in land-line circuits. His fig. 4 did not convey a correct picture of the envelope, as the e.m.f. and current scales were not quite clear. Did not sending filters add to the cost? Also six channels on four wires did not seem to be too economical. At what distance would it pay to use the voice-frequency system, compared with installing direct wires?

Mr. G. C. Marris observed that a variety of systems could be devised for different ways of operating them also; which was the best for use in this country? There were about a dozen methods of converting, or rectifying, the signal, which subject might form a separate paper by itself. In amplification of the author's filter curves, he showed an oscillograph record of a transient in a 400-cycle band filter.

Lieut.-Col. A. G. Lee thought the author's picture attractive, but there were difficulties in fitting in and switching on individual messages. The operator time would be increased, and too many channels were not desirable, for not more than six were needed in any one instance. On very long lines, no doubt multiplex operation paid for itself, but it was not economical on short lines; compositing was not complicated, was stable and could be used over telephone circuits. The voice-frequency system cost about the same as compositing, but it needed two pairs of wires, the cost of which was several times that of the terminal apparatus. Voice-frequency operation would only be economical in this country where compositing could not be employed, but both those systems were attractively stable, compared with multiplex operation.

Mr. A. E. Thompson considered the system uneconomical, as it did not secure maximum operator time, a most expensive item. It was itself a duplex system, and it was bad engineering to so divide up frequencies as to necessitate the introduction of additional apparatus to make proper use of the facilities available. A multi-frequency generator was preferable to separate valves; thermionic apparatus was costly and needed the sole use of telephone facilities, but the system was suitable for very heavy traffic over very long lines.

Mr. E. S. Ritter pointed out that in some cables special pairs had been set aside for telegraphy, but never used, and they could be made up for telephony. They never would get "something for nothing," and if compositing were adopted it would involve changing the telephone ringing periodicity.

Mr. J. M. Olven explained that on very long lines, some 880 miles, it had been possible to work perfect teletype.

Mr. V. J. Terry said that the Küpfmüller bloomer was again being given prominence. His building-up value was calculated on the basis of a perfect, ideal filter, and the fact that his expression had been verified by experiment was misleading, for the experiment happened to be favourable.

Mr. W. Cruickshank, in reply, maintained that telegraphists did not like buzzer signals, and could not go on reading 50's for eight hours. He could not agree with Mr. Shaughnessy's channel definition, for any communication system required both sending and receiving channels, and it was too much to expect 48 channels per pair of wires. The compositing system cost money and space.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

London Trunk Power Cables.

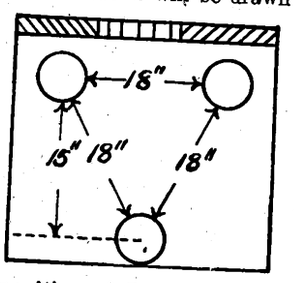
Mr. K. Bell raises the following objections:—Item 1, that cables must inevitably be laid in a tortuous path to avoid other obstructions. I, however, who have had working experience of the laying of high-voltage cables, both in London and other towns, do not find the same conditions as Mr. Bell relates.

There should be no occasion, if the trench is properly prepared, to lay a cable in anything but a fairly straight course, except, of course, where it is necessary to change direction, such as for crossing a road, &c., and even then a wide sweep is taken to minimise any possible cause of trouble. Engineers responsible to their respective cable companies are usually men who do not take any undue risks with cables. Some extra-high-voltage cables have now been laid a considerable time without breakdown, but they are armoured.

Mr. Bell further comments on the use of a ½-in. mesh sieve (or riddle) for bedding and covering the cables, but my experience is that when a cable is laid at reasonable depth damage is not possible with pebbles of this size. If a smaller mesh sieve were used, it would be a most laborious job with some classes of soil, especially if the cables were laid during the winter months when the soil is usually damp. All cable engineers realise the need for keeping cable trenches free from falling and large pebbles, and where this is likely to occur the sides of the trench are close-boarded.

The usual method of covering cables for protection with concrete covers marked "Electricity," appears to be quite satisfactory; but I do not favour wooden protective covering. Mr. Bell states that the slightest touch with a pick would penetrate a cable, but this is hardly the case, as it would require a fairly heavy blow to damage the sheath, and then there is a possible ½ in. of dielectric to penetrate before the core is reached.

With regard to the formation of the cables to be laid, it appears obvious that the triangular disposition is used to minimise trench width and, at the same time, to give the greatest radiating distance for the cable; but it is presumed that one cable will be laid at the bottom in the middle of the trench, then a soil separating medium of, say, fifteen inches, and then the two other cables will be drawn in, as shown in



Disposition of Cables in Trench.

the accompanying illustration. Cables are usually laid in this fashion to minimise the replacement of costly paving, and it is more desirable, in this sense, for a narrower trench means less obstruction by other concerns' mains.

Laying cables in open trenches is obviously a much cheaper proposition than drawing them into ducts. First, it would be extremely difficult to draw a Hessian-covered cable into ducts, and even if it had an exposed lead covering the maximum length of cable it would be possible to draw-in with safety would be one hundred yards, whereas, when laid direct, from one hundred and seventy-six to two hundred yards could be laid by using the usual cable rollers common to cabling jobs; but the most important point is that by drawing cables into ducts one increases the number of joints by nearly 100 per cent., and the weakest point in any cable is the joint.

Resident Engineer.

February 19th, 1929.

Overhead Electric Lines.

Will you please allow me space to accurately present misinterpretations of mine on page 247 of the I.E.E. *Journal* (Vol. 67, No. 386) of February, 1929. In the first column . . . "His tests are quite as important as those described in the present report, because they give the limit for a rigid base, whereas the present report gives the same tests" . . . should read "The Wade tests are more important than those described, because they give the true internal moment of pole by using a rigid base, whereas the present report gives certain tests for . . ."

Also, in the second column (same distance up the page) . . . . "If we want to get the maximum strength, not maximum possible bending moment" . . . should read "If we want to get the maximum strength, or maximum possible bending moment. . . ."

It would also seem necessary to add that my remarks had nothing to do with the use of sawn wood, nor with concrete foundations, and about as little with stays. They refer almost exclusively to the testing of a wood pole, or a frame, so that its true strength is obtained. Surely Mr. W. B. Woodhouse does not recommend sawn timber for a pole, which latter is one leg of a frame? Surely he does not consider a wood pole foundation (such as concrete) that completely stops drainage and ventilation from the pole to be satisfactory? And, surely he would stay, or stub-stay, or strut, or support in some way, a pole, or a frame, subjected to the lateral pull (or a longitudinal pull) of the character referred to in the paper as actual practice, &c.; and, surely he would divert any such dangerous point of the line where it is impossible to support it for any reason whatsoever? Surely, good practice can be interpreted as the highest strength at reasonable cost, and highest strength surely means greatest safety? Hence, interpreting the three conditions mentioned, is it not evident that the best practice demands that we use the natural grown and trimmed and treated tree, not sawn timber; avoid any type of foundation that rapidly causes decay, or rapidly decreases the pole-timber factor of safety, such as a solid concrete foundation does; and always use supports (stay, or stub-stay, or stub, or any other means) where the transverse force is of the nature referred to by Mr. Woodhouse. These three conditions would therefore seem to differ widely from his views.

William T. Taylor.

London, N.2, *February 22nd*, 1929.

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Gramophone Reproduction.

My feeling of annoyance at Mr. P. K. Turner's original criticism of my article was, I feel, justified by the fact that he had apparently made his criticism on purely superficial summarising instead of careful reading. As a case in point, Mr. Turner, in his second letter, tells us that "the latest information in his hands (with reference to recording) is that constant output is maintained down to 150 cycles and constant amplitude below that frequency." I suggest that Mr. Turner might have learnt this earlier if he had read my article (page 140, bottom of column 1). "In practice it is not possible . . . energy output a rising characteristic."

As regards my suggestion that Mr. Turner's letter was of an advertising nature, if the idea of publicity was not intended, I freely apologise, although surely Mr. Turner is sufficiently well known for his name to be enough on a letter of this nature.

In my criticism of Mr. Turner's loud-speaker, I stated (perhaps a little crudely) that the only confirmation of the claims made, which had come to my notice, was through the medium of advertisements. Surely Mr. Turner does not expect me to accept the inclusion of his claims on such evidence? My criticism of the loud-speakers themselves is made in all good faith, on the very small experience stated, and I cannot retract my opinion until convinced to the contrary.

Whilst agreeing with Mr. Turner about the difficulties of sufficiently overcoming a tendency to back-coupling, I prefer to employ a more reliable means of prevention, when necessary, than that of a choke-fed transformer. The question of the steady d.c. through the primary of an output transformer being an unwanted factor is one on which I disagree, even at the risk of being considered out of date.

In conclusion, I would like to thank Mr. Turner for the courtesy of his letter, and trust that he will accept the foregoing remarks as being written with the same courteous intention.

Ernest W. Braendle.

Blackheath, *February 16th*, 1929.

Catalogues.

Mr. H. R. Taunton, in his very interesting article on "Catalogues" in your number of February 15th, asks why, if the E.C.A. sanctions net trade price lists for wires and cables, it should be averse to net trade price lists for conduits, &c.?

In 1912 we commenced issuing to the trade only a net price list of cables, conduits, and wiring accessories—no fittings, no illustrations—so that it could only be of interest to actual trade users. Being an inexpensive list, when prices of cables or conduits changed we were able to issue an entirely new list. This has happened on an average three or four times per year since 1912. Our contractor friends (many of them members of the E.C.A.) appreciated this list, and said how useful it was to them when estimating, to have a list of current net prices to work with.

The E.C.A. took exception to our net list, and though we assured it we had no wish to publish a list that was detrimental to the electrical contractor, from whom we obtain 80 per cent. of our business, and, further, that we contended that net price lists of conduits, switches, fuseboards, &c., unillustrated, were of no more interest to people outside the trade than the net wires and cables price lists of which it approved, the E.C.A. still objected. So, to meet its wishes, since December our list prices have been gross and subject to standard discounts.

Some of our contracting friends are now asking us to revert to the practice of giving the net price for our goods. We still see no adequate reason why these should not be listed at net prices, except that the E.C.A. is too powerful for a factor to offend.

P. L. Dwyer & Co.,
P. L. Dwyer.

London, S.W.1.
February 13th, 1929.

The Regulation of Cookers.

I was interested in the letter last week from "Regulator" and agree with him that "electric cooking is not economical without a water heater."

With this conviction six years ago, after spending considerable sums of money experimenting, I obtained patents both in this country and America covering a "Combined Electric Cooker and Water Heater." I had sample apparatus made at the cost of about £10, which embodied a water-jacketed oven, using the heat of the oven to heat the water after cooking was completed, and also having a subsidiary immersion heater in the water jacket by which means "the potentiometer principle," mentioned by "Regulator," could be easily applied. The sample has been in use at my home ever since, and after each cooking period at least three buckets of nearly boiling water is obtained, the oven loading being practically the same as the present type of electric oven on the market.

I offered the idea to most of the electric oven manufacturers until I was tired of doing so, as it seemed hopeless to attempt to broaden manufacturers' views, which appear to be that "what was good enough for our grandfathers is good enough for us."

I remember one manufacturer's excuse was that the I.M.E.A. would not be prepared to consider any type that differed from the standard, but I think that Association is still looking for a "standard."

I am afraid the trouble is that manufacturers think "they know it all," but I suggest that an ideal electric oven is far from an established fact at present. You are at liberty to give my name to any correspondent who is really interested.

Combination.

February 23rd, 1929.

Prepayment Meters.

I would like to have your, or your readers', views on the following, arising from the installation of prepayment meters, particularly the strictly legal position relative thereto.

When prepayment meters are installed, special locks and seals are fitted in order that only the supply undertakers' officials can have access to the coins inserted for payment for electricity consumed. It would therefore appear that as soon as the coins have been inserted, both the property and the risk have passed from the consumer to the undertakers. If, therefore, the meter is broken open, and the money stolen, the undertakers would seem to have no right of redress against the consumer, unless it can be proved that the latter was the actual thief. A point which seems to strengthen this position is that it is entirely at the option of the undertakers whether the inserted coins are collected daily, weekly, monthly, or quarterly.

The recovery of expenses in connection with damage to the meter also raises an interesting point. In this case also, it would seem that no action can be taken against the consumer, unless proof is forthcoming that he, or she, was the actual person causing the damage, or who suffered the damage to be caused. A clause similar to the following is usually inserted in the terms and conditions under which a supply is given:—

"The consumer is responsible to the undertakers for all damage done to their property, which may be laid, placed, or fixed, in or on consumer's premises. Consumers are recommended to insure this against fire."

Is the foregoing clause sufficient to give the undertakers the necessary authority to recover from the consumer the equivalent of stolen coins, and expenses in connection with the repair to the damaged meter, irrespective of who may have extracted the coins, or who may have caused damage?

Coin Register.

February 22nd, 1929.

Conditions in Bagdad.

I should be much obliged if any of your readers could give me up-to-date information about the cost of living in Bagdad for a man and his wife. Any further information as to climate, clothing, and general living conditions will be much appreciated.

Bagdad.

February 25th, 1929.

[Pressure on our space has necessitated several letters being held over.—Eds. Elec. Rev.]

Legal.

Fraudulent Consumption of Electricity.

A householder who used electricity for lighting from the heating circuit was fined £5 at Fleetwood on February 20th. A meter inspector said that he noticed a light in the front room. After taking the meter readings he switched off the power circuit, and there was a cry from someone in the room that the light had gone out. Defendant was seen by Mr. W. P. Lilwall, the electrical engineer, and he admitted having used the power circuit for a reading lamp. He said that he had no intention of defrauding.

At Blackburn on February 22nd, Harry Kenyon, watchmaker and jeweller, Penny Street, was fined £5 for fraudulently consuming electricity. Mr. C. S. Robinson, prosecuting, said defendant had been using electricity supplied through the power circuit for lighting purposes.

British Thomson-Houston Co., Ltd., v. Isow and Finegold.

In the Chancery Division on February 19th, Mr. Justice Clauson, on a motion for judgment in default of appearance and defence, granted an injunction to the British Thomson-Houston Co., Ltd., restraining J. Isow, of Alvington Road, Hackney, and A. L. Finegold, of Blakesby Road, E., from infringing two of its incandescent electric lamp patents, and passing off.

His Lordship also made an order for the delivery-up of infringing lamps.

Mr. Tookey, for the plaintiffs, said the particulars of sale referred to 44 cases of infringing goods.

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British Thomson-Houston Co., Ltd., v. City Incandescent Light Co.

In the Chancery Division before Mr. Justice Eve on February 22nd, Counsel again mentioned this case in which his Lordship on February 15th granted *ex parte* an injunction restraining infringement of plaintiff's letters patent with respect to gasfilled lamps.

His Lordship asked if the defendant now appeared.

Mr. Nesbit said that he appeared for the defendant, and he would submit to the usual order and consent to treat the motion as the trial of the action. So far as the defendant was concerned, he appeared to be innocent. The lamps were not what he ordered, and when they were delivered he wanted to get rid of them, but he could not trace the agent to whom he gave the order.

His Lordship granted a perpetual injunction.

Glasgow Electricity Department's Accounts.

At the Glasgow Sheriff Court on February 24th, a petition was heard from a local ratepayer for the production by Glasgow Corporation of full details concerning the following items of the accounts of the Electricity Department:— Rents, rates, and taxes, £189,058; management expenses, £12,644; and outstanding revenue assets, £29,769. The items referred to the year ended May 31st last. Counsel for the petitioner said that at present it was a general challenge of the items, and afterwards it would be necessary for the Court to decide as to the legality of certain payments and other matters. The Corporation objected to the petition on the ground that the objections to the accounts were not sufficiently detailed to allow of their production at this stage. The Sheriff will issue his decision later.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

362. "Electric fuses." R. H. D. Barklie. November 4th, 1927. (Addition to 265,263.) (305,243.)

19,150. "Electric heating devices." British Thomson-Houston Co., Ltd., H. W. H. Warren, and R. G. Green. September 11th, 1928. (305,160.)

20,195. "Amplifier device for use in conjunction with an electrostatic microphone, gramophone, or the like." H. Andrewes and Dubilier Condenser Co. (1925), Ltd. July 29th, 1927. (305,052.)

22,583. "Method of and means for recording sound on and reproducing sound from phonofilms." L. Mellersh-Jackson (Siemens & Halske Akt. Ges.). August 27th, 1927. (305,245.)

22,895. "Method for electric arc welding." M. Zack. May 25th, 1927. (Addition to 277,005.) (291,042.)

25,408. "Television and other signalling apparatus employing light-sensitive devices." J. J. Rowe and C. L. Rowe. September 26th, 1927. (305,079.)

25,426. "Frame aerials as employed in the art of wireless-telegraphy and telephony." B. Hesketh. September 27th, 1927. (305,109.)

25,471. "Apparatus for sirgeing of cloths and yarns." British Thomson-Houston Co., Ltd., and R. D. Given. September 27th, 1927. (305,110.)

25,721. "Electric switchgear." British Thomson-Houston Co., Ltd., H. Pearce, and E. D. Regis. September 29th, 1927. (305,055.)

26,086. "Apparatus adapted for use in radio-telegraphic direction finding and for similar purposes." R. A. W. Watt and L. H. Bell Bainbridge. October 3rd, 1927. (Addition to 252,263.) (305,250.)

28,311. "Electromagnetic reproducing and recording devices for gramophones." A. A. Linsell. October 25th, 1927. (305,058.)

28,323. "Combined kinematographic and sound-reproducing apparatus." H. J. Kuchenmeister. November 2nd, 1926. (280,188.)

28,493. "Electrical indicating instruments." Weston Electrical Instrument Corporation. September 16th, 1927. (297,093.)

28,496. "Thermionic valves." Edison Swan Electric Co., Ltd., and L. H. Soundy. October 26th, 1927. (305 063.)

28,774. "Coating articles." W. E. Beatty (Bell Telephone Laboratories, Inc.). October 28th, 1927. (305,084.)

28,800. "Thermionic valves." C. S. Franklin. October 28th, 1927. (305,251.)

28,827. "Methods of, and apparatus for, covering cores, particularly applicable for insulating cables." W. E. Beatty (Bell Telephone Laboratories, Inc.). October 29th, 1927. (305,085.)

28,861. "Electric relays." A. Reyrolle & Co., Ltd., and N. Cooke. October 29th, 1927. (305,069.)

28,896. "Push-pull connection for thermionic and like valves." Siemens and Halske Akt. Ges. October 30th, 1926. (279,899.)

28,904. "Micronhones." A. Whitaker and Gramophone Co., Ltd. October 29th, 1927. (305,073.)

28,906. "Means for controlling the intensity of a beam of light for use, for example, in recording sound." W. H. Eccles, A. Whitaker, and Gramophone Co., Ltd. October 29th, 1927. (305,074.)

28,910. "Telegraphic receiving and transmitting apparatus." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks) (deceased)), and A. L. Horn. October 29th, 1927. (305,075.)

29,145. "Electric power-transmission controllers for locomotives and other vehicles." P. C. Saccaggio. November 1st, 1927. (305,156.)

29,172. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. November 1st, 1927. (305,158.)

29,175. "Milking machine having electrically-controlled pulsations." Aktiebolaget Separator November 17th, 1926. (280,893.)

29,179. "Machines for printing and issuing tickets." Siemens & Halske Akt. Ges. November 2nd, 1926. (280,207.)

29,245. "Electrical terminal boards." Siemens Bros. & Co., Ltd., W. E. Goodwin, and F. Baker. November 2nd, 1927. (305,256.)

29,287. "Gyro compasses." P. R. Jackson (Sperry Gyroscope Co.). November 2nd, 1927. (305,258.)

29,432. "Recording or reproducing of sound in talking kinematography." De Forest Phonofilms, Ltd. November 27th, 1926. (281,248.)

29,784. "Electrical coupling circuits for transmitting voice and like complex-frequency currents." W. E. Beatty (Bell Telephone Laboratories, Inc.). November 7th, 1927. (305,284.)

30,179. "Telephone systems with amplifiers." Siemens & Halske Akt. Ges. November 15th, 1926. (280,565.)

30,511. "Electric junction boxes." British Thomson-Houston Co., Ltd., C. J. Morton, and T. H. Woodfield. November 14th, 1927. (305,296.)

30,836. "Horns for loud-speakers, gramophones, and other sound-reproducing apparatus." M. Ward. November 16th, 1927. (305,301.)

30 846. "Pasting of electric accumulator plates." C. A. Vandervell and Co., Ltd., R. C. Paterson, and P. J. Beddous. November 17th, 1927. (305,302.)

32,110. "Method of, and means for, controlling polyphase induction motors." R. B. Hunter. December 15th, 1926. (282,368.)

32,419. "Tap-changers for electric transformers." W. A. Coates, J. Fowler, and Metropolitan-Vickers Electrical Co., Ltd. December 1st, 1927. (305,318.)

32,694. "Radiographic apparatus." R. K. Hezlet, V. E. A. Pullin, and A. G. Warren. December 3rd, 1927. (305,322.)

32,731. "Loud-speaker diaphragms." J. Wilson. December 5th, 1927. (305,323.)

33,223. "Combined automatic and manual electric circuit controllers." British Thomson-Houston Co., Ltd. December 13th, 1926. (282,074.)

33,421. "Electrically-driven timepieces." H. Bold. December 10th, 1927. (305,327.)

34,091. "Gas vents for electric accumulators." Pritchett & Gold and E.P.S. Co., Ltd., and C. R. D. Pritchett. December 16th, 1927. (305,330.)

34,210. "Fixed contacts of electric tumbler switches." J. A. Crabtree. December 17th, 1927 (305,332.)

34,414. "Battery-charging systems and control relays and circuits for use in such systems." H. E. Bucklen. December 19th, 1927. (305,335.)

35,228. "T-shaped joint for electric cables." T. Yamanouchi. December 29th, 1927. (305,345.)

35,430. "Electric globe holders." A. McKellar. December 31st, 1927. (305,348.)

35,446. "Selective relays, particularly for electric protective systems." International General Electric Co., Inc. December 31st, 1926. (282,838.)

1928.

802. "Carrier-arms for electrical pick-up devices for sound-reproducing machines." Consulting & Radio Service, Ltd., and N. Turner. January 10th, 1928. (305,354.)

1,107. "Telephone systems." Associated Telephone and Telegraph Co. March 14th, 1927. (287,079.)

1,146. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. January 12th, 1928. (305,356.)

2,260. "Means for regulating the strength of sound in photo-electric reproduction from sound films." H. J. Kuchenmeister. January 27th, 1927. (284,285.)

2,834. "Detection of variations in the frequency of high-frequency oscillations." Elektromekano Aktieselskabet. January 28th, 1927. (284,356.)

3,078. "Connection of the ends of oil-filled hollow cables." Siemens-Schuckertwerke Akt. Ges. March 29th, 1927. (287,893.)

6,589. "Induction furnaces." E. F. Russ. March 2nd, 1928. (305,388.)

7,374. "Electric supply and distribution systems." W. Frensdorff and Deutsche Schiff und Maschinenbau Akt. Ges. March 9th, 1928. (305,393.)

7,430. "Vehicle lamps." J. Pintsch Akt. Ges. March 14th, 1927. (287,088.)

8,052. "Automobile head lamps." O. Jensen. March 16th, 1928. (305,397.)

10,375. "Refrigerator cabinets." British Thomson-Houston Co., Ltd. April 12th, 1927. (288,576.)

10,740. "Arrangement for the automatic regulation of the efficiency of transmission systems, particularly of high-frequency transmission systems." August 31st, 1927. (Patent of addition not granted.) (296,397.)

11,484. "Single and multi-phase commutator motors." J. Sousedik. June 27th, 1927. (292,942.)

12,985. "Heat-operated electric switch." G. Richardson. May 3rd, 1928. (305,420.)

13,802. "Electric drives for paper machines." International General Electric Co., Ltd. May 10th, 1927. (290,226.)

13,825. "Negative electrode for zinc electric accumulators." A. Pouchain. January 10th, 1928. (303,823.)

13,826. "Lead electrode for electric accumulators." A. Pouchain. January 10th, 1928. (303,824.)

14,009. "Grip for electric cables." P. F. Hellermann. May 31st, 1927. (291,376.)

16,656. "Electric fuses." F. Whipp and Whipp & Bourne Ltd. June 8th, 1928. (305,428.)

16,742. "Electrically-operated vibratory devices such as are used in the recording or reproduction of sound." M. Trouton and Wireless Music, Ltd. January 30th, 1928. (Divided application on 293,131.) (Cognate application 18,676/28.) (305,429.)

21,448. "Filaments for electric incandescent lamps." Falk, Stadelmann and Co., Ltd. November 23rd, 1927. (Addition to 297,052.) (301,014.)

22,544. "Joining of sheet metal by electric welding." British Thomson-Houston Co., Ltd. August 8th, 1927. (295,281.)

25,277. "Radio and the like receivers." Marconi's Wireless Telegraph Co., Ltd. September 1st, 1927. (296,678.)

29,243. "Boxes or containers of mechanism for electrically operating tramway or railway points, switches, and the like." S. T. Quilliam. October 11th, 1928. (305,447.)

34,385. "Electric clocks." F. Conrad. March 17th, 1927. (Divided application on 287,182. (300,992.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from the dates mentioned:—

FEBRUARY 13th.

Anhydrene. No 498,281. Class 50. Electrical insulating preparations.—Berry, Wiggins & Co., Ltd., Channelsea Road, Stratford Market, E.15.

FEBRUARY 20th.

Tefag, Continental (lettering and design). No. 492,017. Class 8. Telephonic and telegraphic instruments and apparatus and parts thereof.—Die Telephonfabrik Berliner Gesellshaft, Berlin. (British representative: A. A. Thornton, 7, Essex Street, Strand, W.C.2.)

Voltex, Made in Germany (lettering and design). No. 493,844. Class 8. Electric dry batteries (not for medical purposes).—M. F. Bockh, 234, Perry Hill, Catford S.E.6.

Selecta (lettering and design). No. 493,936. Class 8. Radio-telephonic receiving sets and apparatus.—Selecta Gramophones, Ltd., 81, Southwark Street, S.E.1.

Phonotrol. No. 494,497. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.

Stradonelle. No. 497,057. Class 8. Sound reproducing and recording apparatus and instruments and apparatus for use in radio-telegraphy and telephony and parts thereof.—A. J. Balcombe, Ltd., 51, Tabernacle Street, E.C.2.

Movex. No. 497,587. All goods in Class 8, but not including thermionic valves, electric discharge tubes and other similar vacuum tubes.—I. G. Farbenindustrie Gesellschaft, Frankfurt-am-Main. (British representatives: Abel and Imray, 30, Southampton Buildings, W.C.2.)

Beta. No. 496,093. Class 13. Electric lamps (ordinary).—J. W. Naylor, 53, Lancaster Gate, W.2.

Electra. No. 498,358. Class 15. Glassware.—I. S. Greenberg & Co., Ltd., 125, Great Hampton Street, Birmingham.

Jacelite. No. 489,391. Class 16. Electrical insulators made of porcelain and earthenware.—J. A. Crabtree & Co., Ltd., Lincoln Road, Walsall.

S.P. (lettering and design). No. 498,902. All goods in Class 16.—Steatite and Porcelain Products, Ltd., 56, Victoria Street, S.W.1.

Electro Lux (lettering and design). No. 493,884. All goods in Class 18, but not including electric lighting and ignition sets for motor vehicles.—Electrolux, Ltd., 153-155, Regent Street, W.1

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Improvement scheme at Beach, including scenic railway; city architect.

ARGYLL.—Rebuilding cattle-food factory at Cardwell Bay; ex-Provost H. McCowan, Oban.

AYR.—Stores and finishing rooms, for W. C. Gray & Sons, Newton Carpet Mills (£8,000); the manager. Shops and garage (£2,400), for J. Robertson, motor engineer, Fotheringham Road.

BATLEY CARR (Yorks.).—Works and offices, Upper Road, for Joseph Brooke & Sons.

BEDWAS.—Senior school, Trethomas, for Monmouthshire E.C.; director of education.

BOURNE END.—Housing scheme (30), for High Wycombe R.D.C.; Charles H. Wright, architect, 24, Temple Street, Aylesbury (returnable deposit of £2).

BRANSTON (Lincoln).—Additional 86 houses, for the R.D.C.; surveyor.

BRIDGWATER.—98 houses at Victoria Road housing estate; Samson & Colthurst, architects.

BURSLEM.—Warehouse, Waterloo Road; T. & R. Boote, Ltd.

BURY.—Housing scheme (88 flats, 122 houses); borough surveyor.

CHADDERTON (near Oldham).—Extension of sewage disposal works (deposit £2 2s.); J. Diggle & Son, engineers, Hind Hill Street, Heywood.

CHADWELL HEATH (Essex).—Works extensions, Metropolitan Cable Co., Ltd.; F. Smith, architect; N. J. Cearns, builder, Stratford, E.

CHARTHAM.—Operating theatre, Mental Institution; Kent C.C.

CHEAM (Surrey).—Church; Rev. Canon H. Wesley Dennis, rector.

CROYDON.—Rebuilding and extending post office, for H.M. Office of Works, King Charles Street, London, S.W.

DEAL.—Police station, London Road (£6,000); Kent Standing Joint Committee.

DRIFFIELD (Yorks.).—Hospital (£6,000), for the Cottage Hospital Committee; secretary.

DUNDEE.—Mill, for Baxter Bros., jute manufacturers; the manager.

EDINBURGH.—School at Gorgie Road (£10,000), for education authority; master of works. Junior department for Royal High School (£36,865); Reid & Forbes, architects.

ELLESMERE PORT.—Extensions, cottage hospital; T. W. Francis, hon. sec., Council Offices (returnable deposit of £2 2s.).

EPSOM.—Nurses' home, Mental Hospital (£24,500); L.C.C. architect.

FIFESHIRE.—Special school and hostel at Halbeath (£30,000); master of works, Education Authority, Kirkcaldy.

FULBOURN.—Works at mental hospital (£10,664); Isle of Ely C.C.

GALSTON.—Hosiery factory, Titchfield Street, for James Prentice.

GLASGOW.—204 houses, Saracen Street site; housing director and trade contractors.

GOLBORNE.—Housing scheme (32), for the U.D.C.; H. Eckersley, clerk (returnable deposit of £2 2s.).

HALIFAX.—Model bakery, for the Economic Stores, Ltd.; G. R. Oddy, architect, Ward's End Chambers.

HANLEY.—Extensions, printing works, Trinity Street and Foundry Street; Staffs. Sentinel, Ltd.

HARROGATE.—Housing scheme (50), for the T.C.; borough surveyor.

HARTSHILL (Staffs.).—Operating theatre, Royal Infirmary; governors.

HORNCHURCH (Essex).—Houses (46), for T. A. Clarke; Houses (44), Grey Towers estate, for C. A. Piper.

INCE (Wigan).—Plaza Kinema, for the Union Playhouses, Ltd.; W. Cyril Sykes.

KIDDERMINSTER.—Works extensions, for Hurcott Paper Mills, Ltd. Premises, Castle Road, for Brintons, Ltd., carpet manufacturers.

KNARESBOROUGH.—Alterations to the Institution and Union offices; S. Blenkhorn, architect, Westminster Bank Chambers.

LEIGH-ON-SEA (Essex).—Cinema (£23,500), Leigh Road, with electrical and heating work; J. Saunders, architect, Westcliff, Southend-on-Sea.

LINCOLN.—School, Hampson Street (£15,250), for the Education Committee; W. G. Watkin, architect, Silver Street.

LIVERPOOL.—Extensions, with storage shed, Princes Dock; Mersey Docks and Harbour Board.

LONDON (Becontree, E.).—1,151 houses, Barking section, Becontree estate (£610,000); L.C.C. architect.

(E.C.).—Rebuilding *Punch* offices, Bouverie Street; Thompson & Walford.

(S.E.).—New St. Andrew's Church, Burnt Ash Lane (£8,500), with electric light and heating work; Rev. J. M. T. Griffiths, vicar.

(Greenwich, S.E.).—Housing scheme (79), Charlton Park, for the T.C.; borough engineer (returnable deposit of £2 2s.).

(Lewisham, S.E.).—Town hall extensions (£125,000), for the T.C.; town clerk.

(Piccadilly, S.W.).—Alterations, London Pavilion, Piccadilly Circus; G. T. Coote.

(Soho, S.W.1).—Additions, Royalty Theatre, Dean Street; R. Cromie.

(Westminster, S.W.).—Shops and flats, West Chapel Street and Market Mews; S. Burgoyne.

(Covent Garden, W.C.).—Improvements, Opera House; Covent Garden Opera Syndicate, Ltd. Market buildings, Tavistock Street; Covent Garden Properties, Ltd.

(Holborn, W.C.).—Extensions, Hospital for Sick Children, Great Ormond Street; Governors.

(Ealing, W.).—136 houses, Hurley Road, Keats Lane, Queen's Avenue, Mansell Road; H. S. Bostock, architect, Broadway Chambers, Southall; G. Wimpey and Co.

LONGTON (Staffs.).—Reinstatement (after fire) of the Royal Art Pottery Works, Waterloo Street, for Aynsley, Ltd.

LOWESTOFT.—Extensions, boat-building shop, Lake Lothing; J. W. Brooke & Co., Ltd.

MORECAMBE.—44 houses, Albert Road; Wm. Gardner and Co.

PERSHORE.—School, Croome estate, for Worcestershire E.C.; director of education, Worcester.

RAMSGATE.—Electric lamps, electric cable, strip lighting material, switchboards, &c., for bandstands, concert halls, &c., for the T.C.; R. J. Costerton, entertainments manager, West Cliff Concert Hall.

READING.—Additional 111 houses, for the T.C.; borough surveyor.

RICHMOND (Surrey).—Cinema and café, Bridge Street; C. Aish, architect, 22, Bedford Street, W.C.

RUSHDEN.—Housing scheme (42), for the U.D.C.; J. W. Lloyd, surveyor.

ST. HELENS (Lancs.).—Senior school, Parr, for the borough E.C.; secretary.

SALFORD.—Hotel, Broughton (£24,000), for Groves and Whitnall, Ltd.

SALISBURY.—Housing scheme (52), for the T.C.; W. J. Goodwin, city engineer (returnable deposit of £2 2s.).

SOUTHEND-ON-SEA.—High school for girls (£59,400), and extensions, Westcliff High School for Boys (£6,000), for the borough E.C.; director of education.

STIRLING.—Police buildings, Spittal Street (£9,875); chief constable.

STOCKPORT.—Billiard hall, Southwood Road, for William Millward, Jun., 10, Mytton Street, Hulme, Manchester. Housing scheme (114), for the T.C.; borough surveyor.

STOKE-ON-TRENT.—Shops, café, and dance hall, Church Street; Stoke Finance Co.

STOURPORT.—Houses (100), for the Steatite and Porcelain Products, Ltd.

STRATFORD-ON-AVON.—Extensions, King Edward VI Grammar School; A. C. Bunch, architect, 27, Binswood Avenue, Leamington Spa (returnable deposit of £2 2s.).

SWANSEA.—Extensions, Mumbles Cinema; T. E. Merrells.

SWINTON (near Rotherham).—Sewage disposal works; W. H. Radford & Son, engineers, Albion Chambers, King Street, Nottingham.

TAMWORTH.—Housing scheme (90), Mile Oak, for the R.D.C.; H. L. Kent, surveyor (returnable deposit of £3 3s.).

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The

Electrical Review

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The "Viceroy of India."

THE official trials of the T.S.S. *Viceroy of India* which took place on the River Clyde the other day in the presence of a distinguished gathering of shipowners, shipbuilders, and engineers, may truly be said to mark an epoch in the history of electrical engineering in this country. She is not, of course, the first electrically-propelled ship to be built in this country; indeed, as we showed in a recent article, Great Britain can rightly claim to be the cradle of the idea of applying electricity to the propulsion of ships, but she is the first large passenger liner built in this country in which electric propulsion has been adopted, and as such not only was her performance watched with the greatest interest, but her future career will also be carefully followed by all who are convinced of the merits of electricity for marine propulsion.

The *Viceroy of India* is a P. & O. vessel 612 ft. long of about 19,700 gross tons which has been built at Linthouse, Glasgow, the propelling machinery consisting of two 9,000-kW turbo-alternators which supply power to two three-phase synchronous motors, each capable of developing 8,500 shaft-horse-power at a maximum speed of 109 revolutions per minute, one of the motors being directly coupled to each of the two propeller shafts. Steam is obtained from six oil-fired boilers at a working pressure of 350 lb. per sq. in., the steam being superheated to a final temperature of 700 deg. F. The whole of this equipment was supplied by British companies.

Although one of the great advantages which is usually claimed for electric propulsion is that it enables the large amount of electricity required in an up-to-date liner for operating the auxiliary machinery, cooking, lighting, &c., to be obtained from the large main generators, rather than from smaller auxiliary generators, thereby obtaining a higher overall efficiency, it has been deemed advisable on the *Viceroy of India* to install separate direct-current generators for auxiliary purposes. There are four turbo-generators each of 500-kW capacity for dealing with the auxiliary load when at sea, while for use in port, particularly when the boiler plant may be shut down, there are two Diesel-engine-driven sets, each of 165 kW capacity. A feature of the auxiliary equipment is the adoption of the

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Austin constant-current system for the motors which are used for driving the cargo winches, the windlass, the refrigerating machinery, &c. It may also be noted that while the majority of the pumps in the engine room are electrically driven, the boiler feed-water pumps are of the steam turbo-driven type, and the Weir closed-feed system with three stages of feed-water heating is used.

The chief advantage of electric propulsion as applied to a mail and passenger liner, which must keep more or less to a scheduled time-table, lies in the fact that she can run at a cruising speed with the same efficiency as at full speed. Thus, in the *Viceroy of India*, with only one alternator in service, the power delivered to the motors aggregates 11,600 s.h.p., which is capable of giving the vessel a speed of 16½ knots; but at the designed full speed of 19 knots both alternators are brought into service, the full power of the motors, totalling 17,000 s.h.p., being delivered to the propellers. Arrangements have naturally been made for economical operation of the boilers according to whether one or two alternators are running, since the P. & O. service between London and India, picking up mails at Marseilles, is such that running sometimes at cruising speed and sometimes at full speed is demanded. This feature of the equipment was stressed by Mr. A. E. Stephen, the chairman of Alexander Stephen & Sons, the builders, at the luncheon on board the vessel during the course of the trials, it having been found that with one turbo-alternator in use, a speed of 17.1 knots was realised, the propelling motors delivering 10,410 s.h.p. at 97 r.p.m. Unfortunately, owing to fog, it was impossible to run full-speed trials, and for the same reason fuel-consumption figures are not yet available.

While, however, optimism was expressed about the results achieved, those responsible for the ship make no secret of the fact that they will expect any subsequent vessel to do even better. Thus, Mr. A. S. MacLellan, a director of the builder's firm, in paying tribute to the B.T.H., Yarrow and Weir companies, which were mainly responsible for the machinery, mentioned that they had learned a great deal during her construction, and he felt sure that if the installation were repeated they could make many improvements in simplifying the control gear, in the general arrangement, in reducing cost, and in increasing the overall efficiency. He had been in the United States investigating the electric drive and had been amazed by what he had seen; but about one thing he had no doubt, he believed that the electric motor was the ideal drive for marine propulsion. We echo Mr. MacLellan's faith and pay tribute to his belief that subsequent vessels will show a marked improvement on the new P. & O. liner, satisfactory as that vessel undoubtedly is. This is the spirit of enthusiasm for which the Prince of Wales called in his recent B.I.F. speech on "Salesmanship" and the spirit which will convince shipowners of the merits of the electrically-driven ship. We sincerely hope that some of the shipowners who were present at the trials of the *Viceroy of India* may be persuaded to adopt this system of propulsion on any new ships which they may be ordering, so that the builders and the engineers may speedily have an opportunity of justifying their faith in future vessels.

The New Year Honours.

We are sure that there will be general satisfaction amongst our readers with the inclusion of two well-known electrical men in the King's New Year Honours List. We offer the profession's congratulations to Dr. John Ambrose Fleming, M.A., F.R.S., Emeritus Professor of Electrical Engineering at University College, inventor of the thermionic valve and a scientist of great distinction at home and abroad, who receives the honour of knighthood. An account of his career appeared in the Electrical Review for February 24th, 1922, when he delivered a lecture on "Michael Faraday and the Foundations of Electrical Engineering" in connection with the Jubilee Celebrations of the Institution of Electrical Engineers. Congratulations will also be freely given to Col. Thomas Fortune Purves, O.B.E., M.I.E.E., engineer-in-chief of the General Post Office, and a vice-president of the Institution of Electrical Engineers, upon his knighthood. Col. Purves, it will be remembered, succeeded Sir William Noble as engineer-in-chief of the Post Office in 1922. A record of the important work that has been accomplished in the past seven years appears on our "Personal" page to-day. His Majesty's Trade Commissioner in New Zealand, Mr. L. B. G. S. Beale, is made a C.B.E. (Civil Division), and the additions to O.B.E.'s (Civil Division) include Major J. A. Sadd, B.Sc., A.C.G.I., A.M.I.E.E., Superintendent of the Defensive Munitions Department, Porton, and Mr. P. A. Theis, assistant secretary to the Pacific Cable Board. Mr. J. A. B. Jones, assistant electrical engineer to the Sudan Government Railways, is made an M.B.E. (Civil Division), and Mr. E. E. Gunter, director of the Persian Gulf Telegraphs, Indo-European Telegraph Department (retired), receive the honour of Companion of the Order of the Indian Empire.

We may be permitted to indulge in the not unusual discontent with the small measure of recognition that is given to men of electrical distinction.

Electrical Publicity by Wireless.

Most of our readers, doubtless, switch in occasionally, without the broadcasting programme in hand, just to find out what is on. The result is sometimes distinctly interesting and it suggests that very few people are qualified to pass wholesale strictures on the service given unless they listen all the time. For example, quite by accident during the past month or six weeks we have switched in just in time to be unexpectedly impressed by some electrical point. On one occasion a lady speaker was holding forth in admirable manner regarding different ways of cooking, and the splendid testimonial that she was giving to electric cooking, wherever energy can be obtained at a low charge per kWh, formed a most valuable piece of publicity matter reaching the ears of thousands of ladies who make a practice of listening to household matters. The second electrical occasion that we have in mind was the talk by Dr. T. Z. Koo on "China To-day" on a recent Wednesday evening, in which the new situation that is developing in China was described. We cut in just as the speaker was saying: "China is waiting for electrification!" "China is waiting for machinery!" We have long dwelt upon the great field that mechanical and electrical engineering must have in the China that makes economic progress based upon stability, and as the authority of the broadcaster seemed to give weight to his remarks, we pass them on to the British electrical manufacturer, engineer, financier and trader. If we are thinking more of Russia now, let us not regard China as an impossibility. Let us act in time, with big ideas, efficient organisation, and big financial backing.

Copper.

The prolonged rise in the price of copper which carried the price of cash standard from £60 15s. to £74 12s. 6d. and of electro from £66 15s. to £74 5s. last year, which figures have been exceeded enormously during the past couple of months, has been little short of remarkable. Certainly it went far beyond the anticipations of the market generally, even of the big producers themselves, whose plans had long been laid to put the metal upon a permanently and substantially better basis of price. Even to-day, and after the big advance established to a level almost exceeding the dreams of avarice, there is a pretty general feeling that the force of the upward movement has not yet spent itself entirely, and that a further rise may occur, under the control exercised by the powerful group of producers co-operating under the title of the Copper Exporters, Incorporated. We doubt whether the present price is really justified, but to-day this group and its ramifications rule the market for the metal. Control, it is asserted, has come to stay. Dominating as they do the great bulk of the world's output, having at their fingers' ends all the most inti-

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mate details of consumption and of prospective demands, the Associated Producers can, temporarily at all events, regulate and adjust supplies and demand to the nicest degree of equilibrium, and nothing is less likely than that they will abandon voluntarily their commanding position. Greed may be their undoing ultimately, as it has been in other cases, while there is, of course, the bare possibility of Governmental investigation of the copper situation by the United States. The Associated group had to exercise considerable ingenuity to steer clear of the law in America affecting trade combines, and would scarcely welcome any probing of their ramifications, or examination of their policy. They will, therefore, endeavour, no doubt, to entrench themselves without stirring up active trade hostility, which might result in official interference. Whatever may be the case in Europe, the consumption of copper in America this year promises to beat all records, especially in the matter of wire, thanks to the big programmes of railway electrification, telephone and telegraph extensions, &c. The public utility companies in America, for example, contemplate an expenditure this year of over $850 millions, a record total. Prices to-day are hugely profitable and prudence would suggest that the pace be not forced too much lest consumption suffer. Any signs of pressure of re-sale copper from over-bought consumers would give the market a nasty jar. That a long-ahead view is being taken by American copper interests is shown by the very close attention certain of these are paying to the possibilities of African copper being, in years to come, an active competitor with American. Hence the recent boom in Rhodesian copper properties, which forced the shares of many concerns to a very high premium under the stimulus of persistent American buying. Bwana M'Kubwa is a case in point, but there are also others in which American capital is interested. It is to be hoped that British copper producers, actual and potential, in Africa, will not fall under the control of United States capital. Working arrangements as between rival producers may be all very well, but it would be a misfortune if foreign financial control were obtained of the Rhodesian mines.

The Kennedy Memorial.

Invariably inapposite in her gifts, Nature denies to the many the comfortable quiescence they covet and urges others to activities in which few are fitted to partake. One of the most difficult of the problems confronting the engineering industry to-day being the recruitment of men of character, intellect, and initiative, it is appropriate that attention should be directed to the projected endowment of that department of University College, London, over which the late Sir Alexander W. B. Kennedy, LL.D., D.Eng., F.R.S., M.Inst.C.E., M.I.E.E., M.I.Mech.E., long presided with such distinction.

That there should be a permanent and lasting memorial of the affection and esteem with which he was regarded is a feeling common to all who knew him and his work; and what more fitting one than the endowment of the chair to which he consented to give his name? He was a pioneer in engineering education, and as an engineering practitioner his wide mechanical and electrical knowledge was always available for the service of his country.

Of the total sum of £30,000 needed, £11,965 still remains to be subscribed. The project must command the sympathy of all who benefited by Kennedy's great work, no less than that of all who knew him personally. Donations are invited to be sent to the Right Hon. Lord Meston, chairman of the University College Centenary Fund, at University College, Gower Street, London, W.C.1.

A Debtless Undertaking.

An electricity undertaking that is entirely free of debt is probably unique in electricity supply finance. This position has been reached by the Hampstead Borough Council which intends to clear off the balance of its indebtedness (£32,310) at the close of the financial year. The total amount borrowed at March 31st, 1928, was £530,627, about half a million of which had been redeemed.

There are, of course, special circumstances in this case. Hampstead ceased to generate electricity in 1922 and a bulk supply has been taken from St. Marylebone since 1921. Thus when the Council had written off the cost of its generating plant, it only had to deal with the far cheaper sub-station machinery, but it has to be remembered that the capital cost of the distribution system has also been written off.

It is obvious that any undertaking could free itself from debt by charging high prices (if it could sustain the necessary demand), but the Hampstead charges are among the lowest in the country. In earlier years they were not so favourable to the consumer, but they could not be considered excessive for a residential district.

We congratulate the Hampstead Council and its engineer (Mr. J. Leadbeater) on achieving this enviable position.

The Faraday Lecture.

That the greatest and most successful industries and manufacturing concerns are those which spend most money on research is a lesson plain for all to learn, if they will. A feature of our age, however, is the vast range of scientific research, the extraordinary number of capable workers in that field, and the enormous accumulation of data that is being made available. Few of us indeed can ever hope to acquire more than a mere fraction of the sum of knowledge extant even in our own particular sphere, consequently the vast majority of professional men, and women too, work within a very limited range.

Thus it was that the annual Faraday Lecture, delivered in London, and at most of the provincial Local Centres too, to large meetings of the Institution of Electrical Engineers this Session, by Mr. Ll. B. Atkinson in his own inimitable manner was greatly appreciated, for he told us "How Electricity does Things."

As the proposer and seconder of a vote of thanks to him remarked, we listened to a scientist, an engineer, and a teacher: how simple it all seems when explained happily! We now know what electricity is, or think we know, for it appears that "electricity is everything." Electrons are all-important, they constitute matter itself, variety being a consequence of their relative movement, or vibration, shall we say. Indeed, it seems that we know more about electrons than we do of matter itself.

In order to fit himself for the adequate control of the vast forces of nature for the benefit of his fellow being, every engineer must endeavour to obtain as comprehensive a view as is possible of the range of contemporary research, in his own section of the profession at least, so as to enable him to visualise the possible practical applications of new discoveries.

Central Board Contracts.

It was very appropriate at the conclusion of the British Industries Fair on Friday last that Sir Andrew Duncan should have announced the near approach of another big stimulus to British industry, in the shape of contracts to the value of £3,000,000.

We were informed that details would not be available until the end of the current week, but it can be said that the contracts are in connection with the South-East England Scheme (London Area) and the Central and North-West England Schemes.

There is no doubt that the electrical manufacturing industry has reason to be grateful to the Board for the way in which it is speeding up its work. Already contracts to the value of £3,000,000 have been placed; we gave a list including the bulk of them in our issue of November 16th last (p. 846). They and the orders being given out this week should have a marked effect upon the British electrical manufacturing industry, and it is to be hoped that the supply industry, and eventually the public, will in time reap further benefits.

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A Large Turbo-Electric Liner.

An account of the first large passenger ship to utilise high-pressure steam and be fitted with turbo-electric propulsion equipment on the British side of the Atlantic Ocean.

MESSRS. ALEXANDER STEPHEN & SONS, LTD., Linthouse, Glasgow, have completed the turbo-electric ship *Viceroy of India*, built for the Peninsular and Orient Steam Navigation Co. The liner is a vessel of 19,700 tons gross with a length of 612 ft., a breadth of 78 ft., and a depth (from the highest of the nine decks) of 82 ft.

On February 19th our representative, as a guest of the builders, took part in a trial trip and visit of inspection. The liner had been weatherbound by fog for several days and so hindered from completing her speed trials, but the morning sun made a very impressive picture of the new all-electric ship lying off Gourock with her bows to the open seas, the snow-covered mountains of the Firth of Clyde forming a striking background to the black hull and twin funnels.

The lines of the vessel are very pleasing, and the straight stem and rounded battleship stern gave the expectant passenger the impression of power and security. Her lofty lee side afforded the visitors on the approaching tender a welcome shield from the unnaturally cold south-east wind, but when we had climbed the gangway and entered the magnificently panelled and carpeted reception rooms all the outside wintry weather was forgotten. Every modern comfort and luxury which ingenuity and good taste suggest seems to have been expended on the fittings and furnishings of the public rooms. The scheme of decorations was carried out by Waring & Gillow, Ltd.

Skilful use has been made of cornice and panel lighting, and delicate colour tones have been introduced by means of illuminated cut and moulded glass. From the great dining-room French windows one seems to look out on a land bathed in afternoon sunlight, and the rich yellow glow from the casements is cheerfully reflected from the mirrors and cut-glass fitments of the pillars and ceiling.

The ventilation throughout is on the "Thermotank" principle, and where and when required silent ceiling pattern electric fans disperse gentle breezes. Local heat is provided mostly by Igranic panels protected by neat metal guards.

The wiring and the fitting of appliances for lighting, cooking, washing, and the like, were carried out by the builders' engineers. The kitchens contain illuminated electric dish washers, electric choppers, coffee grinders, roasters, and so on. Ovens and hotplates abound, and all the multitudinous electric devices which save labour and ensure satisfaction in the art of cookery.

The general illumination of the decks has been well considered, the watertight brackets being of the prismatic type supplemented with ceiling fittings shielded by metal guards to prevent undesired lighting of the deck-cabin windows. The play rooms and large ornamental swimming pond are appropriately and evenly illuminated. Over 6,000 "Mazda" lamps are used for the lighting installation of the liner.

Very complete telephone communication is provided throughout. The ship's indicators are of Siemens make, while the bells are of the "Tangent" pattern.

Proceeding to the open upper deck by an attractively upholstered electric passenger elevator, we were surprised to note how far we were from our starting place and that landmarks were being rapidly left behind, for there had been no perceptible movement in starting and the slightest symptom of vibration was absent. As the ship glided silently and electrically through the water our thoughts went back to the pioneer work of the late Mr. Henry A. Mavor, M.I.E.E., whose dreams of electric drive have been realised too tardily in this country. All must appreciate now that the electric motor is the ideal medium for marine propulsion.

Advantages of the Electric Drive.—Among its advantages there is the absence of noise, as compared with a geared turbine; the elimination of the astern turbine; the absence of propeller racing in heavy seas; and the use of fewer and smaller steam pipes, which helps considerably to keep the passenger accommodation cool. The absence of vibration, due to the fact that the whole of the machinery is of the rotary type, will also prove a great benefit to passengers and to the structure of the ship. Among the more positive advantages are the command of full power when going astern, low maintenance charges, particularly with regard to consumption of stores and overhauling (at reduced power a single turbine is used in place of four, or six, in the case of geared machinery), and the benefit of being able continuously to obtain accurate data about the power absorbed in propulsion.

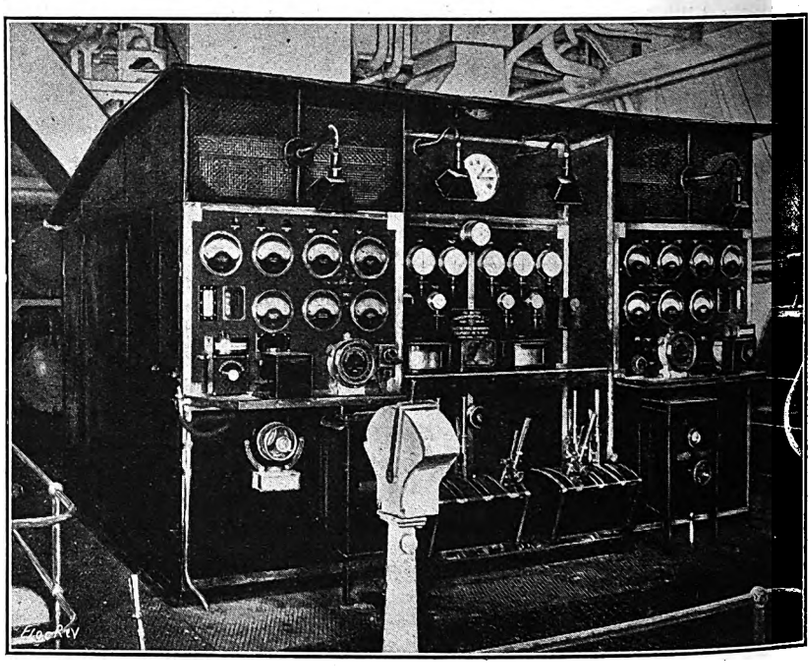

Fig. 1.—Main Ship's Control Board.

Electricity in Navigation.—It would seem that the possibilities of electricity on board this ship are endless. The navigating officers communicate with the power room by Siemens ship's telegraphs and telephones; from the bridge they can note by a glance at the electrically-illuminated signs which of the anchors are cast and the length of the outpaid chain.

The chart room contains a Siemens wireless direction finder which, by the simple rotation of a handwheel, takes the bearings to within half a degree of any transmitting station within 500 miles; it has a wave-length range of from 350 to 1,600 metres. This room also

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contains an echo sounding receiver made by H. Hughes and Sons, of London. The wireless room equipment is of Siemens make and much of it has been built to the specification of Mr. Alex. Shaw, deputy chairman of the P. & O. Co. The short-wave transmitter has been developed from the famous set on the s.s. *Corinthian* (which holds the world's record for short-wave work) has a world-wide range and the main transmitter has an effective range of from 3,000 to 4,000 miles. Both sets of equipment are arranged for c.w. or i.c.w. work and are operated from the 230-V mains. An emergency spark transmitter with a range of 1,000 miles has its own separate aerial and is worked from a battery, while the ship's motor lifeboat has also a wireless transmitting and receiving installation with an output range of about 150 miles and is operated by a nickel-iron battery.

The Propelling Machinery.—Leaving the attractive broad and open upper decks and descending to the main power room, we came to what is a triumph of modern engineering architecture. Entering from an alleyway one finds oneself on an iron bridge at the after end of a spacious and lofty hall. High above are the open skylights, and forward and beneath are the pair of turbo-generators with the starting platform and control cubicle set between them, figs. 1 and 2. Immediately below the bridge on which we stood and at a somewhat lower level than the generators are the two main driving motors, fig. 4. They are coupled directly to the twin propeller shafts, and one only of them is sufficient to drive the ship at three-quarter speed, which permits of great economy when cruising short distances between ports.

Each of the main turbo-alternators develops 9,000 kW at 2,690 r.p.m., the turbines being of the Curtis horizontal type, each having a Weir regenerative underslung condenser, fig. 3; B.T.H. 20-h.p. 1,000/1,600-r.p.m. 220-V vertical-spindle motors drive the extraction pumps. The alternators are air cooled, the air being forced in a closed circuit through the stator and rotor, thence through a cooler situated immediately below the alternator frame.

The main propelling motors are of the synchronous 3-phase type, at the aft end of the engine room, and develop 17,000 shaft-horse-power at 109 r.p.m. Like the alternators, the motors are air cooled, the air being forced through the windings and through a cooler in a closed circuit by two independent motor-driven fans, each of which has sufficient capacity for the full duty. Reversal of the propellers is obtained by changing the electrical connections by means of contactors, which are mechanically interlocked, so that the operator can only close them in the correct sequence. Thus the turbines run continuously in one direction when manœuvring, and the total turbine capacity is available for steaming astern. When the vessel is steaming full speed ahead at 18 knots, it will be possible to reverse the propellers and turn in the astern direction in 30 seconds from the order to reverse.

Electrical Control of the Propelling Machinery.—The main propelling equipment may be classified in three sections as follows:—

(*a*) Two turbo-alternator sets, maximum rating 9,000 kW, 2,690 r.p.m., 2,720 V, 3-phase (maximum speed rating 6,536 kW, 3,110 r.p.m., 3,150 V, 3-phase).

(*b*) Two synchronous propulsion motors, each of 8,500 shaft h.p., 109 r.p.m., 3,150 V, 3-phase.

(*c*) One control apparatus group, and also the necessary exciter sets and ventilating fans.

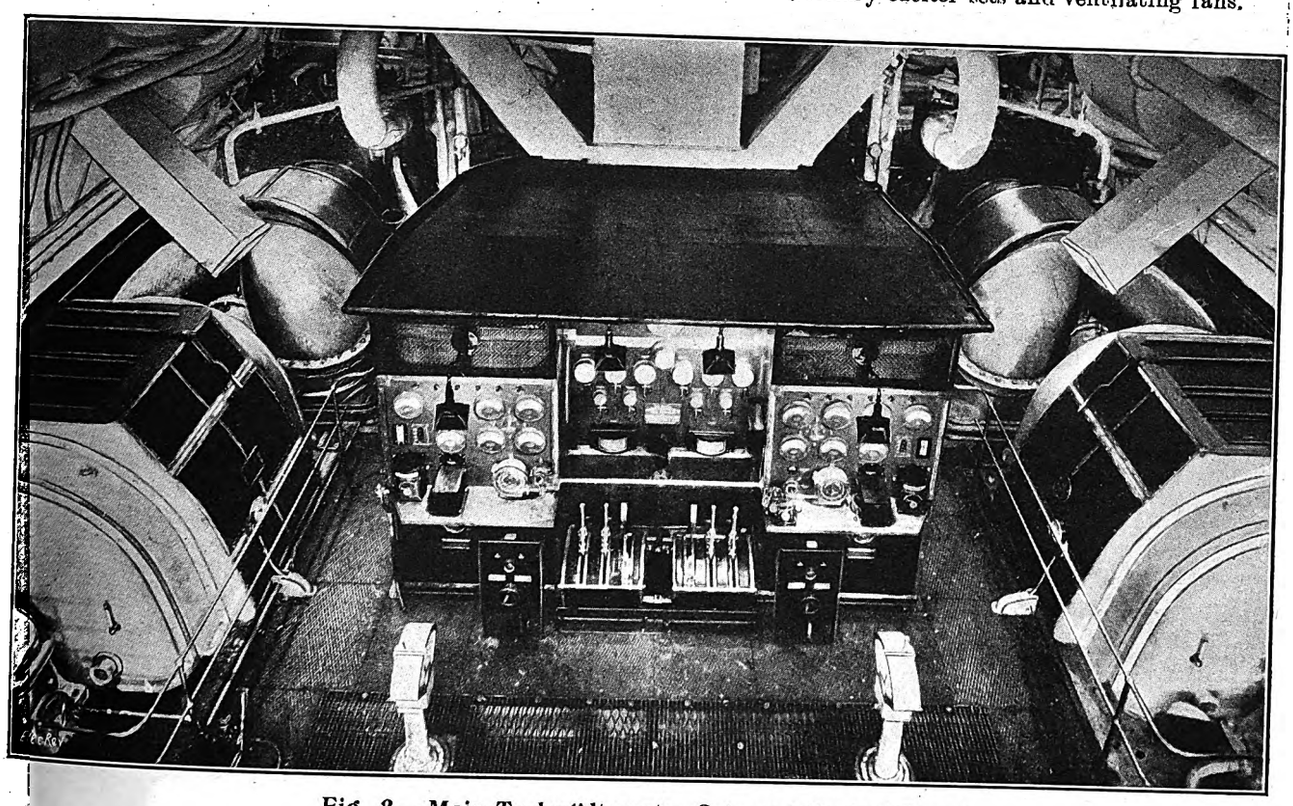

Fig. 2.—Main Turbo-Alternator Sets and Control Board.

At the forward end of the control cubicle, fig. 1, are the isolators and tie switch, each being triple pole, and operated by a handwheel. The isolators enable each alternator to be electrically connected to its respective propeller motor, or either of the alternators to be connected to both propeller motors. The controls are interlocked so that damage cannot be carelessly done to any portion of the equipment when manœuvring; at the same time, indicating instruments are provided by means of which the engineer can carry out orders in a very short time with a minimum of manual effort.

For each propeller three controlling levers are provided for operating contactors and setting the speed of the governor:—(*a*) a direction lever, (*b*) a field-and speed-controlling lever, and (*c*) a dead-slow speed lever. They are all mechanically interlocked to ensure correct working: thus, the direction lever (*a*) can only be moved if the manœuvring lever is at "stop." The field level (*b*) during its first portion of travel operates field contactors in the correct sequence for starting the motor; for the remaining part of its travel the control is on the governor of the turbine, the speed setting of which it varies between one-fifth and full speed. A

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micrometer adjustment is also provided on this lever and permits fine speed settings. Since the same lever is used for both purposes, all manœuvring must take place with the governor setting at one-fifth speed. This lever is interlocked with the low-speed lever (*c*), so that the latter cannot be used for reducing speed below one-fifth, unless (*b*) is in its lowest-speed position and, correspondingly, lever (*c*) must be at its maximum-speed position before the speed can be increased by lever (*b*).

The whole of the control cubicle is "mistake-proof," and special keys make incorrect switching impossible; for example, whenever it is necessary to open, or close, an isolator, or tie switch, it is essential for all contactors to be in the open position. A special lock is therefore fitted to the levers, the key of which is also used to free the isolators; the reversing and field levers must be "off" and locked in that position to release this key. An electrical interlock prevents the circuit breaker on the main d.c. switchboard from closing, unless the field levers are both in the "stop" position. This prevents the fields being switched on to the machines after a shutdown on the d.c. side without bringing the field levers to the "stop" position and starting up again in the usual way.

Immediately aft of the main propelling motors are the thrust bearings, of the single-collar Michell type, and fitted with a hydraulic device for measuring the total thrust on the propellers.

The whole of the main propelling machinery, including both turbo-alternators and motors, has been manufactured by the British Thomson-Houston Co., Ltd.

Oil-fired Boilers.—Steam is supplied at 350 lb. per sq. in. pressure and 700 deg. F. temperature by six Yarrow boilers situated in two separate stokeholds; four of them are placed in the aft stokehold and are of sufficient capacity to enable the forward stokehold to be entirely closed down when the vessel is steaming at 16½ knots. In addition, there are also two Scotch marine-type cylindrical boilers in the forward stokehold for supplying steam when the ship is in port, if needed. Two Diesel-engine generators are installed for harbour purposes.

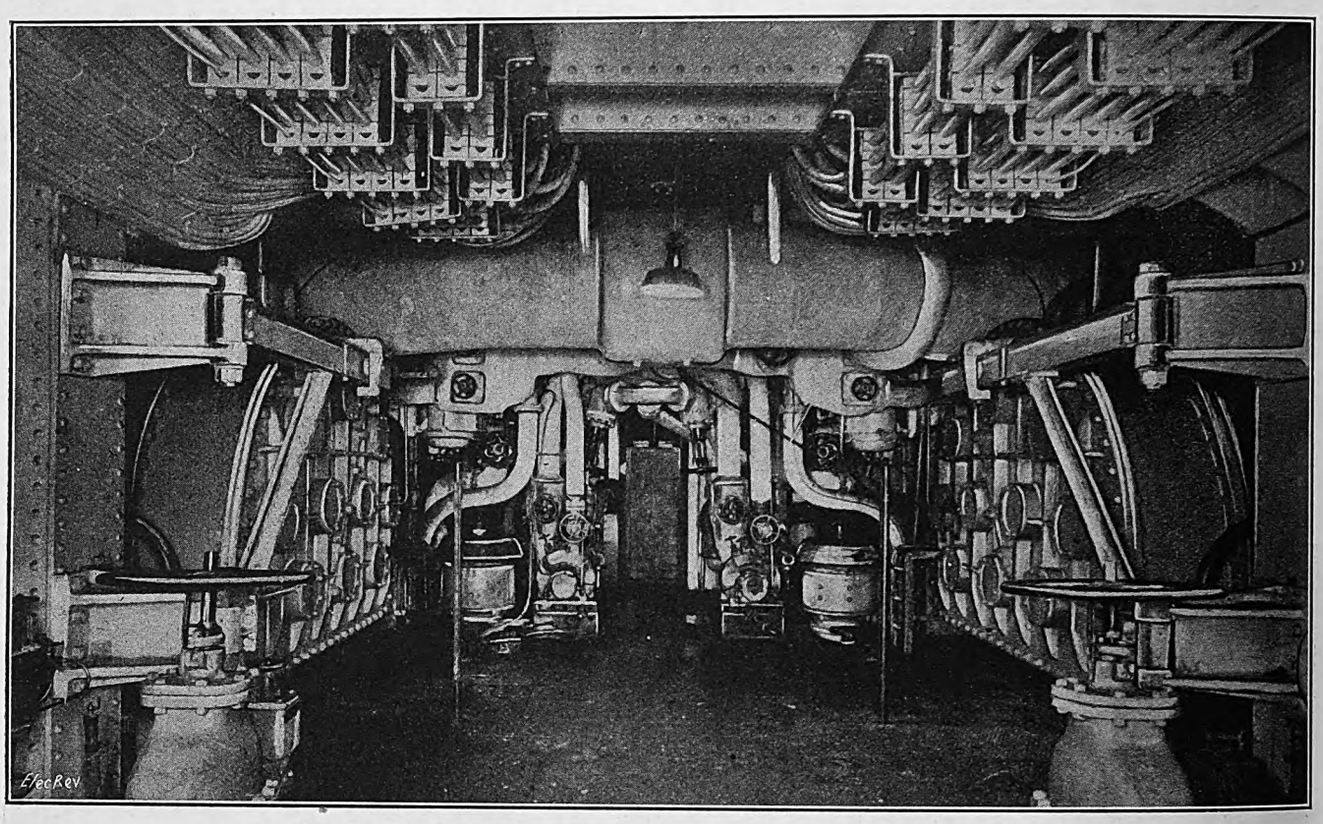

Fig. 3.—Main Turbine Condensers, note Method of Under-slinging.

The air required for forced draught is supplied by six electrically-driven fans; the motors are of the Austin constant-current type, providing a large speed variation by means of ingenious potentiometer controllers designed by Gilbert Austin, which operate at considerable distances, with only three cables between the control switch and the fan motor.

The boilers are arranged for oil-fuel firing on the "Clyde" system, manufactured by the builders.

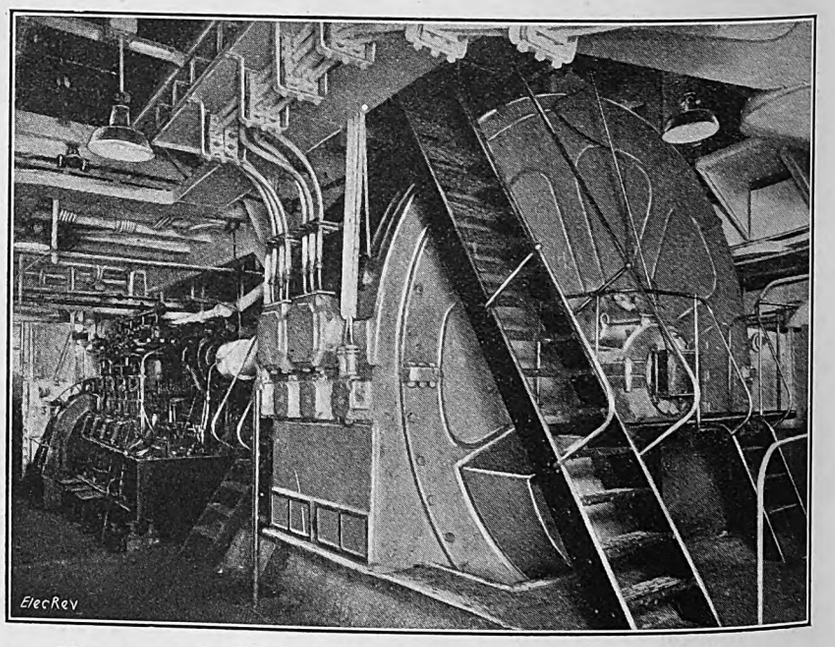

Fig. 4.—Propeller Motor and Auxiliary Diesel Generator.

All oil-fuel plant, including pumps and heaters, transfer pumps and filters, is placed in two separate pump rooms situated between the forward and aft stokeholds; the oil-fuel pumps are electrically operated. Some 2,300 tons of oil-fuel is carried in twenty-two

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tanks surrounding the boiler compartments, the tanks being filled from a central position on each side of the ship; the quantity of oil in each tank may be measured at any time by means of a Negretti & Zambra mercurial gauge.

Feed water for the boilers is supplied by two Weir steam turbo-pumps, and any loss of feed water is made up with fresh water from the double bottom tanks, which is purified by being evaporated in a low-pressure evaporator. The feeding arrangements are designed on the Weir closed system, and feed-water heating is in three stages, there being one surface heater on the discharge side of the water-extraction pumps and two surface heaters (one i.p. and one h.p.) on the discharge side of the turbo-feed pumps. Steam for the heaters is obtained from the main turbines and the exhaust from the feed pumps, and the feed temperature is about 300 deg. F.

The two water-circulating pumps for the main condensers are each driven by a variable-speed electric motor, and are cross connected to allow one pump to circulate water through both condensers; both pumps and motors are of W. H. Allen make.

Auxiliary Generators and Gear.—Owing to the large demand for electricity for heating, lighting, ventilation, and cooking, four auxiliary turbo-generators of B.T.H. make, each developing 500 kW, have been installed, as well as two solid-injection Petter oil-engine-driven generators, each of 165 kW. Two of the turbo-generators, fig. 5, are placed on each side of the engine room at the same level as the main turbo-alternators, while the oil-engine-driven sets are situated below and between the main thrust blocks.

The voltage of all auxiliary machinery, with the exception of that driven by Austin constant-current motors, is 220 V d.c. For supplying power to the Austin motors, three rotary convertors are placed on the port side of the engine room.

The main switchboard, flanked on the port side by the Austin control board, is at the aft end of the engine room and within view of the main starting platform. Among auxiliary machinery situated in the engine room is a Weir "Uniflux" auxiliary condenser with electrically-operated air and circulating pumps, bilge and ballast pumps, both driven by Austin constant-current motors, two sanitary and bath pumps of the Allen vertical electrical type, and two Drysdale "Centrex" electric fresh-water pumps; also a "Centrex" emergency bilge pump is situated in one of the fuel pump-rooms. An electric pump is placed in the forward stokehold for filling and emptying the swimming bath.

At the aft end of the engine room on the port side is situated the engineers' workshop, which is equipped with a lathe and drilling and grinding machines, all operated by independent electric motors. The ventilation of the engine and boiler rooms is of paramount importance in a vessel using highly-superheated steam and sailing in tropical climates, and eleven large ventilators have been installed for this purpose. That they fulfil their function admirably is proved by the pleasant atmosphere of the stokehold, where whiteclad stokers consult the oil gauges and control the valves.

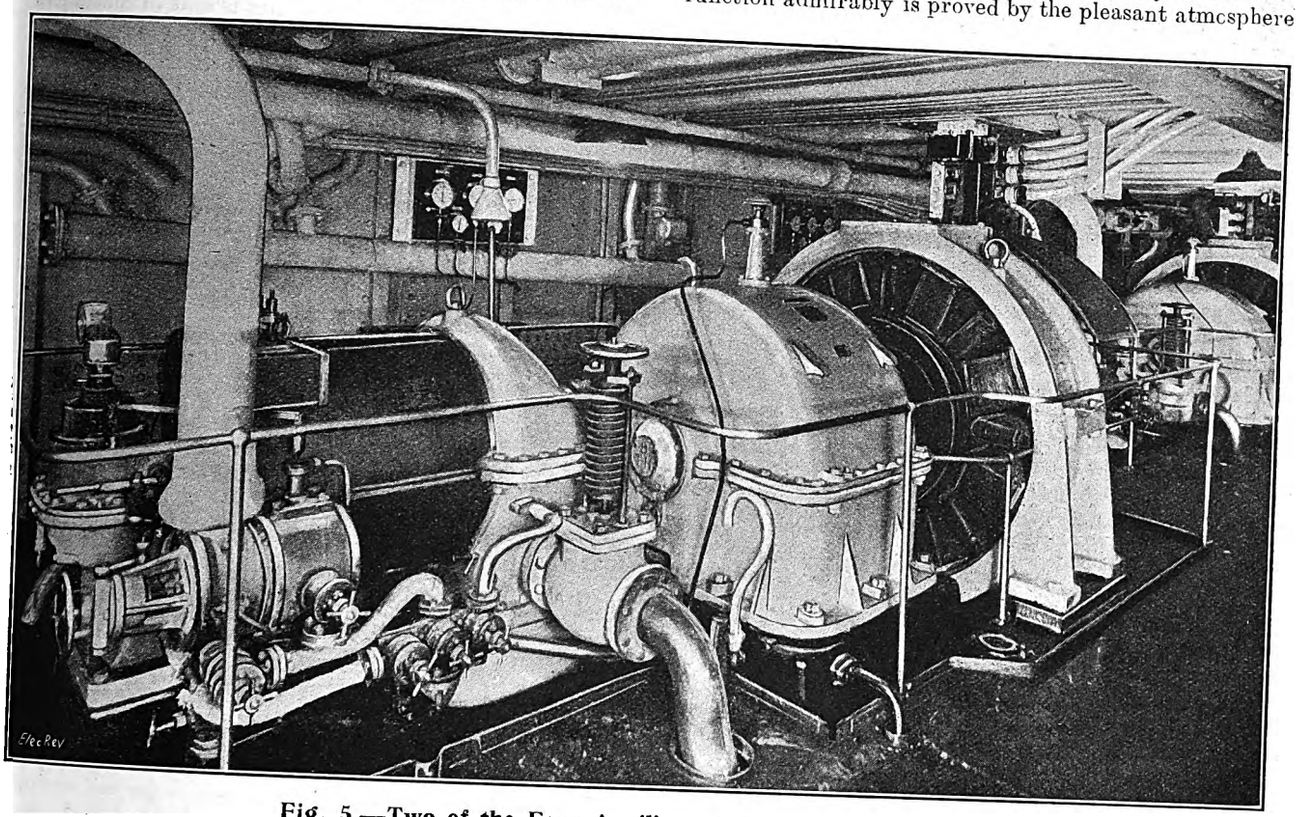

Fig. 5.—Two of the Four Auxiliary D.C. Turbo-Alternators.

At the luncheon on board Mr. A. E. Stephen, who presided, expressed the pleasure his firm had had in working with the owners' naval architect and their superintending engineer, Messrs. R. W. Rugg and R. T. Clarke, respectively. Mr. A. S. McLellan, director of the builders' firm, also paid high tribute to the makers of the electrical machinery who, he said, had spared neither trouble nor expense to make the *Viceroy of India* the best of her kind. He had been in America investigating the electric drive, and he had been amazed with what he had seen there and the boundless possibilities of electricity on board ships. So far they had touched only the fringe of the subject: he believed that the electric motor was the ideal drive for marine propulsion, as it gave everything that could be asked. The prime mover was a matter for the future: it might be the turbine, operating at higher steam pressure and temperature, but they had also to consider the possibilities of the Diesel engine. That was the first prime mover in connection with the electric drive, but it was only even yet in its infancy, because the Diesel engine should run at anything up to 1,000 r.p.m. or over; that was not an impossibility, it was now done in ordinary land practice, and suitable materials would enable a good marine engine to be made to run at a high speed. They had, to a large extent, learned the electric drive from America, but it was only a few years ago that the General Electric Co. of America acquired the last of Mr. H. A. Mavor's patents, for switchgear for marine propulsion.

Among other speakers was Mr. W. J. Belsey, marine superintendent of the British Thomson-Houston Co.

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Progress in Shanghai.

New showrooms and offices have been opened by the Shanghai Municipal Electricity Department in the city area.

THE latest evidence of oversea activity in the electricity supply industry is information to hand concerning the recently established showrooms in the city area of Shanghai by the Shanghai Municipal Electricity Department. The accompanying illustrations will convey some idea of the extent, layout and general suitability of the premises.

The ground floor of the new building is utilised for the display of all kinds of electrical apparatus and current-consuming devices, and is completed by an information bureau where consumers, existing and prospective, can obtain first-hand knowledge and expert advice.

The greater proportion of the displayed apparatus is provided by various contracting firms interested in the sale of the various items, and while actual selling is not undertaken at the showroom, a system is in vogue whereby the contractor concerned is immediately advised of the selection of any displayed apparatus by a client, so that he can then take the requisite action for prompt delivery, payment, and so on. Fig. 1 shows the "shop front."

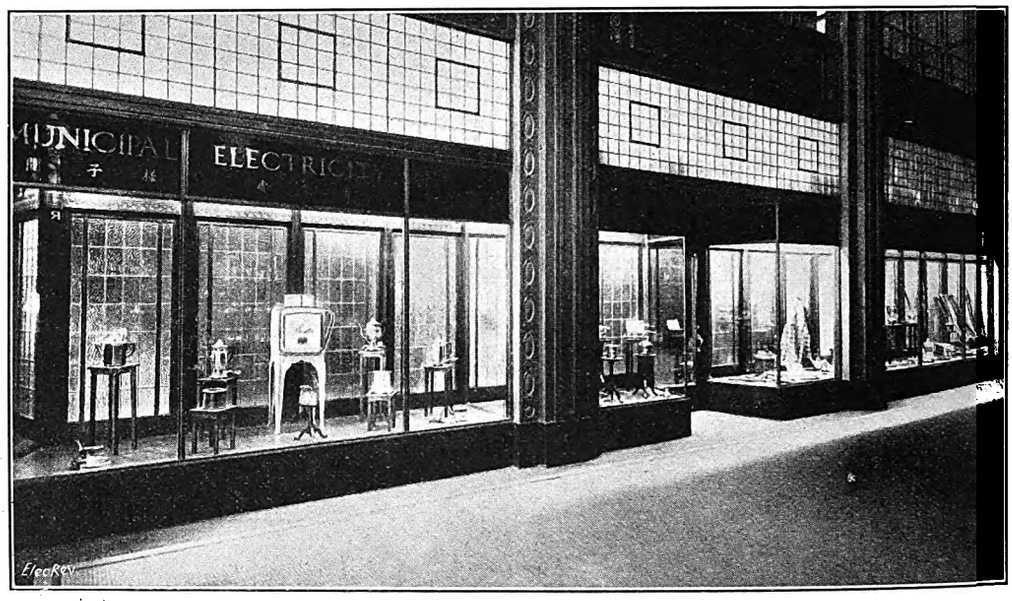

Fig. 1.—Exterior View of Shanghai Showrooms.

It will be noted from fig. 2 that the showroom proper is provided with cubicle-type demonstration rooms suitably equipped to represent kitchens, bathrooms, and so on. All the apparatus is in actual working condition, and demonstrations are given periodically. A professional cook is always available to explain the economic operation of electric cooking apparatus, and when necessary an individual of like training is sent to consumers' premises to advise on the utilisation of cooking apparatus. Fig. 3 is a view in the demonstration kitchen.

The first floor of the new premises is devoted entirely to the collection of accounts, and is equipped along similar lines to a banking institution. An important feature is that in order to obtain access to the accounts department it is necessary for consumers to pass through the showroom; this arrangement is made so as to ensure that the attention of those concerned will be periodically directed to the latest available current-consuming devices displayed therein.

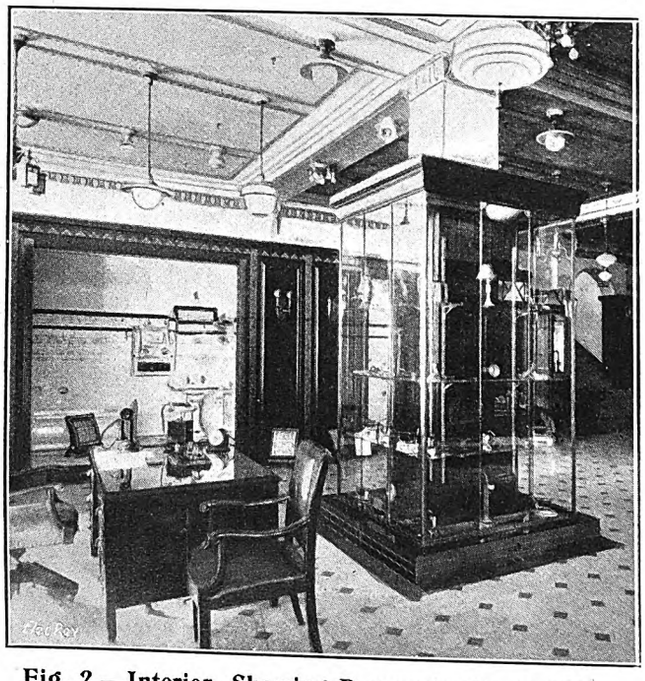

Fig. 2.—Interior, Showing Demonstration Cubicle.

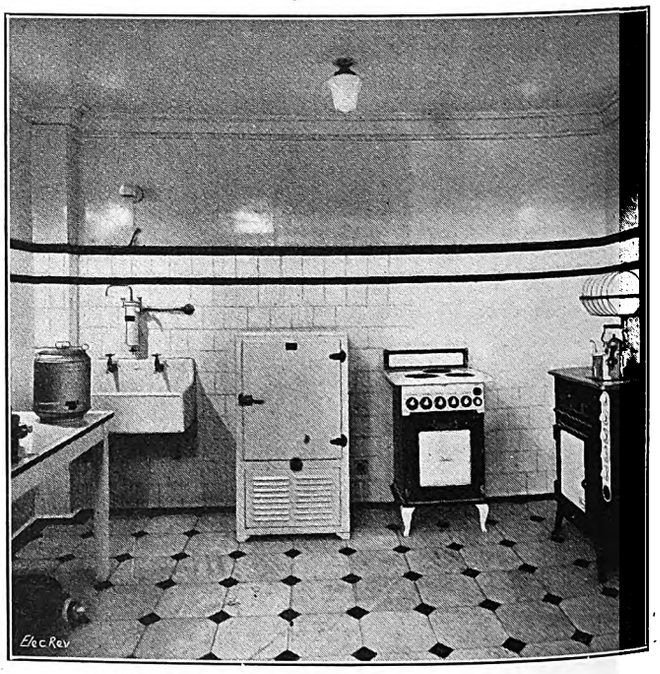

Fig. 3.—Electrically-equipped Kitchen.

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The Off-peak Heating Load.

Some further notes and figures showing its possibilities to the supply engineer, with particular reference to progress in Switzerland.

By L. G. A. SIMS, M.Sc. (Eng.).

(*Concluded from page* 370.)

To encourage consumers to adopt heat storage it has been necessary in Basle, as it will be necessary here, to offer special tariffs, and these have been developed in a scientific manner, the effect being calculated in every case to raise the level of the load curve of the town at those points where improvement is most needed. Thus the general tariff for week-time heating during off-peak hours (10 p.m. to 6 a.m.) is about ⅜d. per unit, but a cheaper tariff is offered, about one half of the above, for week-end heating. Here is a definite encouragement

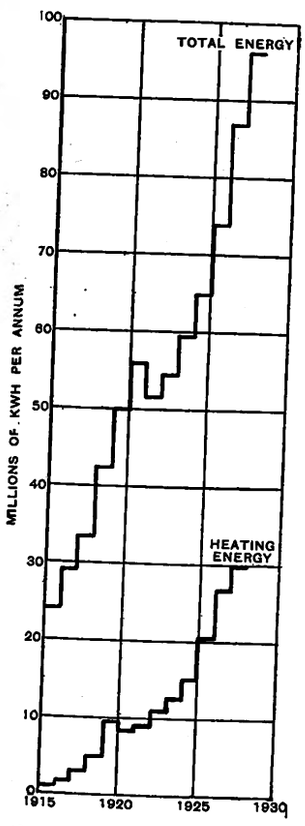

Fig. 4.—Heating and Total Energy Consumption.

to the consumer to improve the week-end load factor of the town, and at the same time to save himself money. As the Basle tariffs were fully analysed in these pages fairly recently,* it is not proposed to dwell on the subject, but a perusal of the translation made by Professor Cramp will prove fascinating, particularly in conjunction with the load curves for the town taken at intervals (figs. 1 and 2 of this article). Mention may now be made, however, of a further development which has not, so far as the writer knows, been dealt with previously, which illustrates the extent to which selective tariffs have been arranged. A rate of 0.9 centime per unit (about one third of a farthing) is offered to large works which are prepared to equip their steam boiler plant for electric heating, the price per unit being fixed to make it profitable to use this method of heating instead of coke firing. From the supply authority's point of view the sale of energy is advantageous even at this extraordinarily low rate, so long as it has the power to discontinue the supply at times when its load is heavy, or when its energy reserve is low. This power it has, and it is exercised when the Augst power station, from which the major portion of the Basle supply is taken, is short of water, owing to the seasonal variations of level of the Rhine, and during times of exceptionally heavy peak load. Extremely cheap energy is therefore available during the night and part of each day, and during the whole of the week-end, for a large part of the year. The beneficial effect upon the load factor of the station does not need stressing. The electric boiler plant is operated direct off the 6,600-volt 3-phase line, and is either combined plant arranged for both coke and electric heating ("doppelanlagen"), or run in conjunction with coke-fired plant. Such a tariff as that quoted above cannot be possible with a coal-fired generating station, nor would there be much room for it here, since our coke prices are lower than the Swiss prices, but the example shows the extent to which Swiss supply engineers have gone in encouraging the off-peak load. The following passage, taken from the 1926 report, is of interest in that it refers to this sale of surplus energy ("restenenergie"), and to the continued development of the lucrative off-peak domestic load on which the major improvement of the Basle load factor has been based:—

"The demand for heating energy increased by 32.4 per cent. if one includes the supply of surplus energy to electric and combined electric boiler plant, which is rapidly increasing each year, and 17.5 per cent. if one does not include this. . . . Omitting the large boiler plant, the increase of demand for heating purposes results, as in previous years, in the greatest part from new accumulation boilers, the number of which increased from 3,535 to 4,540."

The accumulation boilers are mainly domestic water heaters, and the figures given are for the year 1926. The 1927 report shows a still greater increase in their number, with a consequent increase of heating energy demand of about 18 per cent. It was in 1928 that the revenue from the sale of heating energy, mainly at cheap off-peak rates, exceeded one million Swiss francs, or £40,000. Fig. 4 shows the growth of heating energy consumption, compared with the growth of the

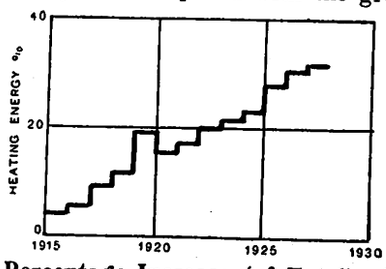

Fig. 5.—Percentage Increase (of Total) of Heating Consumption.

total energy consumption, and from fig. 5 it can be seen that the former represents an ever-increasing fraction of the total.

The secret of the 80 per cent. load factor of Basle is, therefore, not difficult to discern. It has been achieved by keen business methods on the part of the supply authority, which has taken every opportunity of selling its energy reserves by a series of carefully graded tariffs in conjunction with protective clauses, where the safe minimum reserve might have been endangered.

Turning now to our own country, we find on good

* "Electricity Supply Tariffs," Prof. Wm Cramp, ELECTRICAL REVIEW, January 28th and February 4th, 1927.

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authority that the average load factor of the whole country is under 25 per cent.¶ As stated previously, we find also that only about three supply authorities' undertakings in the whole country offer an attractive tariff for the storage heating of water, and that other forms of heat storage are practically unknown. On the other hand, we have to consider the important difference between this country and Switzerland which results from our lack of water-power. In Switzerland water-power produces the bulk of the electrical energy used, and capital charges on the station form the greatest part of the generating costs. It is, therefore, of more importance to the Swiss to utilise their water sources continually (since only a small fraction of their revenue is absorbed by operating costs) than it is to us to generate from coal for which we have to pay, but it would be fallacious to argue from this than an off-peak load is not of importance here. Taking the figures quoted by Sir John Snell, we have for the modern station with a load factor of 40 per cent. to 50 per cent., the following allocation of generating costs:—Coal, 46 per cent., capital charges, 40 per cent., other charges, 14 per cent., an average cost of coal of 20s. per ton, and an average calorific value of 10,500 B.th.u. per lb. On the basis of these figures we may arrive at an estimate of the average generating costs per unit in this country, omitting capital charges. Taking 18 per cent. as a fair value for the thermal efficiency of a modern large station, we have for the cost per unit generated about 0.193d. due to coal. Adding 14 per cent. for costs other than capital charges gives us about 0.252d. per unit. The above figures may be considered to apply more particularly to the large station, but, on the other hand, while the thermal efficiency may do so, there are many stations which buy coal at less than 20s. per ton, and some which generate with a thermal efficiency in excess of 18 per cent. But we may say that a generating cost of one farthing per unit, omitting capital charges, should be possible with the average modern steam plant, efficiently run, and we may form a rough estimate of the possible revenue to be expected from an off-peak load.

Assuming a tariff of ⅜d. per unit, we have the margin of ⅛d. gross profit per unit sold. From figures which the author has published previously for Basle, we know that a daily household demand for hot water will be about 44 gallons for all purposes, or a yearly consumption of about 4,800 units. The annual profit per consumer may therefore reach about £2 10s. The number of consumers required to yield a profit of £10,000 per annum to the supply authority on the above basis is 4,000. The number of consumers connected 3 years ago in the town of Basle, which has a population of only 145,000, had reached this figure. At the present time the number of consumers in the town is such as to yield a profit of £15,000 per annum, reckoned on the above basis, *that is, on the possible British generating costs.* Why, therefore, should not our larger towns, almost without exception, fix attention upon the possibilities of the off-peak load? Even if a tariff of ½d. per unit is needed to yield a reasonable profit, the business can be made attractive to the consumer. All the evidence of those who have experience of off-peak water heating is to the effect that consumers are enthusiastic advocates of the system.

But the load will not be popularised simply by the introduction of a tariff. The tariff must be instituted in conjunction with a hire or hire-purchase scheme to assist consumers to meet the rather high cost of heat-storage apparatus, and with an active sales campaign. It is on these lines that the Swiss scheme has been made successful. It is impossible to foster an electrical water-heating load by attempting to persuade prospective consumers to purchase outright apparatus of appreciable capacity, as the first cost is too great.

There are at present about 1¼ million houses wired for electricity supply in this country. Of these we may say that practically none have at the present time any form of electrical heat storage equipment. There are, moreover, about 5½ million houses available for wiring, an appreciable proportion of which may be wired during the next 10 years. If we wish to improve our load factor from the present average of 25 per cent. to the 80 per cent. enjoyed by the town of Basle, we have the material to work upon, and we may be quite certain that, given the tariff and suitable purchase terms, the householder will not be slow to appreciate the advantages to himself of storage heating, particularly the heating of water.

In conclusion, the writer wishes to acknowledge valuable assistance given by Mr. J. Ammann in the preparation of this article, and the kindness of Herr Gengenbacher, of the Basle electricity works, in furnishing information.

¶ "The Present and Future Development of Electricity Supply." Sir John Snell. Presidential Address, Section G, British Association, 1926.

H.P. Networks Protection.

The protective system adopted by the Union d'Electricite for its 60,000-V network is based on the utilisation of the out-of-balance power components during fault conditions.

By C. W. OLLIVER.

THE problem of the selective protection of power networks is one of increasing importance. The fact that any accidental phonemonon which may occur on a network—at any rate during the first few tenths of a second of a fault duration—leads to currents and e.m.f.'s that are out of balance, affords a singularly effective method of obtaining satisfactory protection by the utilisation, not of the phase currents and voltages themselves, but of their single-phase components to operate suitable relays.

It is thus possible to make use of the out-of-balance power components to operate wattmeter relays, and they may be easily designed for high sensitivity, since they carry no heavy currents under normal conditions. A further advantage is to be found in the fact that the phase angle between the voltage and current components used is better defined, whatever the nature of the fault or whichever phase is affected, than would be the case if the phase currents and voltages were directly made use of. The methods of protection used by the Union d'Electricité are based on these considerations.

In the following notes the term "reverse power" is used to denote the reverse component of the power which is equal to the product of the reverse components of current and voltage, and the term "single-phase power" is used to denote the single-phase component equal to the product of the single-phase or residual components of current and voltage. Single-phase power occurs

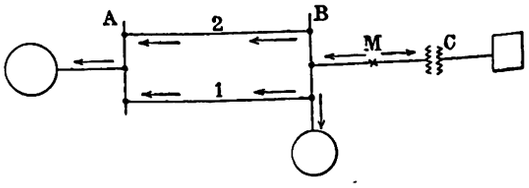

Fig. 1.

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when one or two phases are earthed, and reverse power in all cases when a dissymmetrical short circuit occurs.

Considering a network such as that shown in fig. 1, in which A and B are generating stations, and C a sub-station, with a dissymmetrical short circuit on the sub-station feeder at M, it may be shown that, in effect, the results are such as would be produced if the reverse and single-phase power were generated at M and trans-

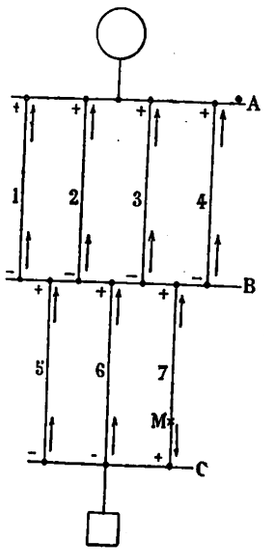

Fig. 2.

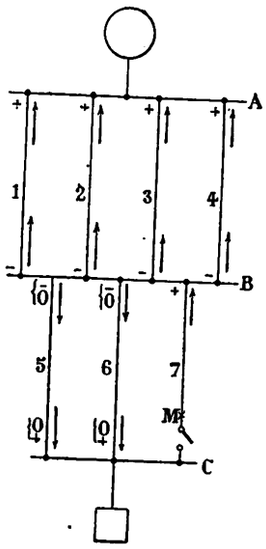

Fig. 3.

mitted from that point to all parts of the network, the impedance of which, in relation to the reverse and single-phase power, was finite. The reverse power from M, therefore, travels on the one hand towards the generating stations A and B, the only impedance opposed by the alternators being the leakage reactance, and on the other hand towards the sub-station C; the impedance of the utilisation network is lower the more the rotating machinery installed, either of the synchronous- or the induction-motor type. Similarly, the single-phase power travels to A and B, the neutral points being earthed at these stations. Between M and C, the single-phase power is zero if the neutral is insulated, or travels from M to C if the neutral is earthed. The impedance in this case varies according to the way in which the transformers are coupled. For the sake of clarity we will call the direction positive from line to adjacent busbars, and negative in the reverse case.

It is possible to obtain fault selection on lines in parallel if we know, at each extremity of the line, the direction of the reverse power (or of the single-phase power) which is indicated by means of a wattmeter connected at that point.

Turning to fig. 2, we have two sets of lines in parallel comprised between two stations A and B on the one hand, and B and C on the other. Supposing a short occurs at M. The direction of circulation is shown on the figure. On lines 1, 2, 3 and 4, it is positive at A, negative at B. On lines 5, 6 and 7, on the other hand, there will always be one extremity (C in the present example) where the power is positive on line 7 and negative on lines 5 and 6.

It will consequently be possible to devise a relay system which will cut line 7 at its extremity C When this occurs, the arrangement is that shown in fig. 3. At station B the reverse power is still positive on line 7, but it becomes zero or negative for lines 5 and 6. It is therefore now possible to install a relay system identical to that at 6, which will cut out line 7 at the extremity B, finally putting the defective line out of commission.

The above remarks may be summed up as follows:—When lines connected in parallel are working under normal conditions, the power at any given extremity is either positive, negative, or zero, and is the same for all the lines. If a fault occurs on any line, the power is positive at both its extremities, and differs at least at one extremity from the other lines where the power is either negative or zero.

The problem therefore reduces itself to devising a system which will remain inactive so long as the power is zero or of the same sign in the network considered, but which will operate and cut out the defective line where the power is positive when the power is negative or zero in the other lines.

The method used consists in the installation at both ends of each line of a wattmeter relay of very rapid action operated either by the reverse or by the single-phase power. The system is illustrated in fig. 4, as applied to three lines operating in parallel, and as installed at one end of the lines.

The tripping coils B_1, B_2, B_3 are connected to a stud p_1 of the relay on the one hand, and on the other hand, to one of the poles of a local accumulator battery. The relays are also provided with studs p_2, which are connected to the opposite pole of the battery through the contactor C which are themselves part of the corresponding circuit breakers. Each of these contactors is opened or closed with the circuit breaker and isolates the relay stud when the line is not in operation, or has been cleared. The relays are so connected that the electrical torque produced brings the moving element up against p_1 when the power is positive and against p_2 when the power is negative.

It will thus be seen that—

(1) When the power is negative or zero in all three lines, the moving elements of all three relays will be in position p_1, and there will be no action.

(2) When the power is positive in all three lines, the moving elements of all three relays will be in position p_2, and there will be no action.

(3) If the power is positive in one of the lines and negative or zero in the others, one of the moving elements will be in position p_1, the others in position p_2. The tripping coil corresponding to the defective line will operate the circuit breaker.

In practice the arrangement is not quite so simple as that illustrated, because the relay contacts have not sufficient surface to feed the tripping coils direct, on account of their high degree of sensitivity. Auxiliary relays are therefore introduced into each circuit, but the principle of operation, of course, remains the same.

It will be seen from the above that this method of protection is very simple, and can easily be extended to deal with any number of lines in parallel. The method is quite independent of the length of the lines

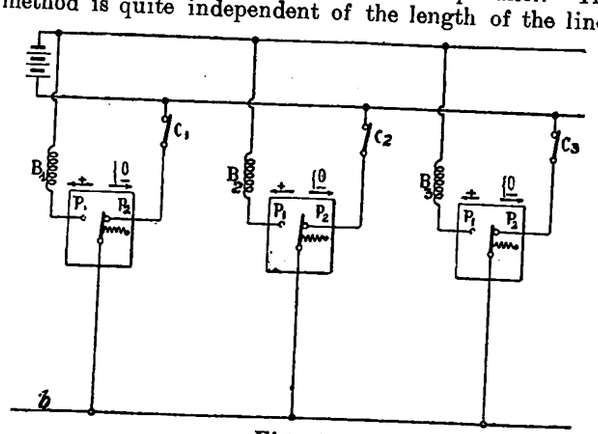

Fig. 4.

or of the power involved, and feeders or lines can be switched in or out of circuit without interfering with the protection system as a whole. Since the relays operate on the "all or nothing" principle, the effectiveness of the protection is quite independent of the metering transformers used. The only disadvantage of the method—one which is shared by many other systems—is that the breakers at either end of the defective line operate successively and not simultaneously. The use of very rapid relays minimises this trouble, and experiments have shown that the time required to clear a line at both ends is of the order of 0.5 to 0.75 second.

The system is used by the Union d'Electricité on its 60,000-volt cable network, and is being extended to its 60,000-volt overhead and 13,200-volt cable networks.

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The Electricity Commissioners' Work.

Brief Extracts from their Eighth Annual Report, for 1927-28.

(*Concluded from page 375.*)

Special Orders in Force.

Inclusive of certain Orders confirmed by the Minister of Transport during the period covered by the previous report, 70 in all were submitted to and approved by Parliament during the year under review.

Sanction of Loans.

At the commencement of the period covered by this Report, 170 applications for sanction to borrow money were under consideration, and during the year under review 768 further applications were received. While the great majority emanated from individual local authorities, certain of them were made by Joint Boards and by Joint Electricity Authorities. Sanctions in full, or in part, were issued by the Commissioners in 751 cases. Allowing for 25 applications which were refused, withdrawn, postponed, or transferred to other Departments when they involved borrowing for purposes not dealt with by the Commissioners, 162 applications thus remained under consideration at March 31st, 1928.

The total amount of the loans sanctioned during the year, less certain cancellations, was £18,020,063, representing an increase of over 17 per cent. on the figure for the preceding year. The applications included a number relating to important schemes of development, and sanctions amounting to over one million pounds in each case were issued to the West Midlands Joint Electricity Authority (£1,886,000), the Corporation of Liverpool (£1,617,540), and the Corporation of Bristol (£1,396,689); in the first-mentioned case, a substantial proportion of the amount sanctioned was for the purpose of enabling the Joint Authority to complete the purchase of existing generating stations in the electricity district. Sanctions amounting to £500,000, or over, were issued in three further cases, namely, to the Corporations of Birmingham, Leeds, and Manchester, while 31 other undertakers received sanctions amounting in total to upwards of £100,000 in each instance. On comparison with the previous year the resultant increase of £2,736,168 in the amount sanctioned was mainly attributable to the large increases in respect of mains and services and "other purposes"; the last named included £1,130,000 in respect of the purchase of generating stations by the West Midlands Joint Electricity Authority, and £323,442 in respect of the acquisition of electricity undertakings by seven other authorities, including the Corporation of Bromley and the Urban District Council of Walton-upon-Thames. The amount under "other purposes" for wiring consumers' premises and for the purchase of domestic apparatus for hire or hire-purchase was £539,404, the corresponding figure for the previous year being £400,941. Of the £102,587,184 sanctioned in the course of eight years, approximately 43 per cent. was for the provision of generating plant, boilers, condensing plant, motors, converters, transformers, switchgear, &c.; about 39 per cent. for main transmission lines, overhead lines and underground mains, services, &c.; and the remainder for a variety of other purposes (land, buildings and other permanent works, meters, wiring, domestic apparatus, &c.), including the acquisition of established undertakings.

Surplus Revenue.

By the Act of 1926 the provisions with respect to the application of electricity revenue by local authorities was amended to enable the undertakers, with the consent of the Commissioners, to apply the net surplus remaining in any year and the annual proceeds of the reserve fund when amounting to the prescribed limit in payment of expenses chargeable to capital on distribution works, such as house services, meters, wiring of premises, provision of apparatus on hire or hire-purchase, and other comparatively short-lived works. The Commissioners gave general consent enabling net surplus to be applied in payment of expenses of providing works of the above-mentioned kinds in any case where the reserve fund of the electricity undertaking was not less than 1/20th of the aggregate capital expenditure, subject however to the amount so applied being not more than 5 per cent. of the revenue of the year in which the surplus was obtained.

The Local Authorities (Emergency Provisions) Acts, 1923-1927, empowered the borrowing of money, with the consent of the Minister of Health, temporarily for current expenses. Of the applications during the past year, nine were in respect of electricity undertakings and were referred by the Minister to the Commissioners for their observations.

Systems of Supply.

The Commissioners approved of the adoption by seven authorised undertakers of systems of supply other than the general systems previously approved, and of the alteration of the declared system and/or pressure hitherto adopted by 29 different authorised undertakers.

Bulk Supplies.

Further progress was made with bulk supply developments, as indicated in Table I.

TABLE I.—BULK SUPPLIES TAKEN AND ARRANGED.

Source of Bulk Supply.	Number including cases of reciprocal supplies. By Local Authorities.	By Companies.	Totals.
From local authorities ...	87	56	143
From companies	120	89	209
From non-statutory and miscellaneous	23	20	43
Totals	230	165	395

There was an increase of 44 in the number of supplies taken or arranged for, and the above approximate figures are inclusive of supplies derived from more than one source by individual undertakers. In the case of the supplies (352) taken, or arranged, from authorised undertakers, the bulk suppliers numbered 88 separate local authority undertakers and 45 separate company undertakers; the Commissioners gave their approval in 36 cases to certain authorised undertakers entering into and carrying into effect arrangements for mutual assistance, or for bulk supplies; 32 were given under the general Acts, two under the provisions of district orders, and two under the provisions of special Acts.

Consumers' Apparatus.

The extent of the liability of an undertaker, on a change-over of his system and/or pressure, in respect of consumers' apparatus replacement cost formed the subject of a conference between the Commissioners and representatives of the principal Associations of the electricity supply industry. After a careful review of the legal position, the Commissioners were advised that it was open to doubt whether any condition of supply made by the undertaker and purporting to require the consumer to give notification of additional apparatus subsequently installed could be enforced in view of the provisions of Section 18 of the Act of 1882; and that the attachment to a consent to a change of system of any condition purporting to confer on the undertaker some measure of control over apparatus installed by a consumer would be open to objection on legal grounds. The Commissioners were advised that it would be open to them to make provision in their consent whereby in cases of the undertakers being prepared to give individual notification to consumers within a reasonable period before the date actually fixed for effecting the change-over of the consumers' apparatus, no liability should rest on the undertakers in respect of additional apparatus installed by the consumer between the date of such individual notification and the date of change-over unless otherwise agreed between the undertakers and the consumer.

The Commissioners subsequently adopted a modified form of consent on the lines indicated above, and notified the Associations accordingly in May, 1928.

Regulations.

The Commissioners reviewed the Code of Overhead-Line Regulations and adopted a revised code embodying a number of relaxations. They also reviewed existing codes of regulations for ensuring a proper and sufficient supply of electrical energy and for securing the safety of the public made by the Board of Trade under the Electric Lighting Acts, and had prepared a preliminary draft of a consolidated code, based in the main upon the suggestions embodied in a draft submitted by the Committee of the Institution of Electrical Engnieers, but had not concluded their consideration of the matter.

The Commissioners served notices and prescribed regulations for securing the safety of the public and for the protection of the electric lines and works of the Postmaster-General in 32 cases of electric lines and works being erected without statutory authority.

Fringe Orders.

The Commissioners granted 101 orders during the year permitting various authorised undertakers to supply electricity to specific premises situated outside their respective areas of supply. They revoked two Fringe Orders previously granted

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to the Hendon Electric Supply Co., Ltd., on being satisfied in each case that the North Metropolitan Electric Power Supply Co., in whose area of supply the premises were situated, was in a position to supply the premises on reasonable terms and had agreed to take over the supply from the Hendon Co.

Railways.

The Commissioners issued two consents to (i) London and North-Eastern Railway Co. to supply electricity from its generating station to the premises of Edme, Ltd., of Mistley; (ii) Metropolitan District Railway Co. and the London Electric Railway Co. to supply electricity from their generating station to the occupants of the new office building adjoining St. James' Park station, Westminster, erected by the Metropolitan District Railway Co.

Transfer of Undertakings.

Deeds of transfer of undertakings were approved in 17 cases.

Loss of Office.

Claims for compensation for deprivation of employment, &c., were referred to the Commissioners in two cases, and a number were dealt with by the referee appointed by the Minister of Labour. The awards made were as follows:—24 claimants £2,132 total; five claimants £340 total; one claim £90; three claims £260 total; ten claims £805 total; one claim £1,500.

Research.

The Commission contributed £1,000 to the B.E.A.I. Research Association towards the cost of e.h.p. transmission investigations.

Charges for Electricity.

During the period covered by this Report, a considerable amount of correspondence was received by the Minister of Transport, and also by the Commissioners, containing representations, or complaints, with regard to the prices charged for electricity. Practically all had reference to company undertakers, and many of them related to the supply of electricity in various portions of the London and Home Counties District.

A communication addressed to the Commissioners by the London and Home Counties Joint Electricity Authority stated that in connection with the consideration of complaints relating to the charges made for electricity in certain metropolitan boroughs and other parts of the electricity district, a summary had been prepared of the rates of charge in existence in October, 1927, and that the complaints received and the wide range of existing charges justified the suggestion that a comprehensive investigation should be made into the whole subject. The matter is under consideration by the Commissioners.

At the commencement of the year under review, five applications for downward revisions of maximum prices were under consideration; and in the course of the year six further applications were made to the Minister, five being in respect of downward revisions, and the other being from an authorised undertaker who sought an upward revision of maximum prices.

Overhead Lines.

The persistent growth since 1920 in the annual number of applications made by authorised undertakers to the Minister of Transport for consent to the erection of overhead lines bears evidence of the increasing extent to which recourse is being made to use them for transmission and distribution in rural and other areas outside the more congested centres of population. The Commissioners dealt with as many as 391 applications, an increase of 63, or over 19 per cent., on the number dealt with in the preceding year. In 112 cases the applications were from local authority undertakers, in 99 cases from electric power companies, and in 180 cases from other company undertakers. The Commissioners were able in the great majority of cases to recommend the Minister of Transport to give his consent, but in certain cases objection was taken by the local authority or the county council to the placing of lines overhead. The Minister gave his consent in respect of 376 of the above-mentioned applications, the remaining cases being still under consideration. The developments represented by individual consents ranged from short distributors for supplying particular consumers up to high voltage transmission lines several miles in length.

The increased activity in overhead-line development was reflected in the number of applications for the consent of the Minister of Transport to wayleaves. The Commissioners dealt with 107 applications in all, as compared with 53 in the preceding year, the former figure including two prior applications which involved further consideration in the period under review. In eleven cases the parties concerned arrived at a settlement and the applications were subsequently withdrawn; in 87 cases the Minister gave his consent after local inquiries had been held; and the nine remaining cases were under consideration. The consents were subject in each case to conditions, the wayleave rentals being prescribed by the Minister.

Private Parliamentary Bills.

The Commissioners, on behalf of the Minister of Transport, examined the provisions relating to the supply of electricity included in the private Bills and Scottish Provisional Orders deposited for the session of 1928, and in 31 cases advised the Minister in conection with the reports required to be made by him in accordance with the standing orders of Parliament.

Staff and Organisation.

As in the previous year, the Commissioners retained the professional services of certain consulting electrical engineers to assist in the technical investigations arising in connection with the preparation of schemes under the Act of 1926. To enable the increasing volume of administrative work to be dealt with they also found it necessary to make additional junior appointments to their staff, which numbered 68 in all, and consisted of 35 established officers and 33 unestablished and temporary officers, inclusive of typists and messengers.

The estimated net cost of administration for the year 1927-28 was £51,440, inclusive of provision of £3,000 for unforeseen contingencies. After allowing for a reduction of £7,440 in the working balance, the total amount to be apportioned among authorised undertakers was £44,000, as compared with £51,000 in the preceding year. With regard to the apportionment of the estimate on the basis of "units of electricity sold," the certified returns submitted for the year ended December 31st, 1926, showed that 5,723,653,523 kWh was sold by authorised undertakers in Great Britain during that year. The corresponding figure of units sold in the year ended December 31st, 1927, was 6,850,162,808. The contributions by the electricity supply industry towards the expenses of the Commissioners for 1927-28 thus involved a payment amounting to 1.84d. per 1,000 kWh sold by each authorised undertaker concerned.

The expenses of the Commissioners relating to the interest and sinking fund charges repayable to the Central Board in respect of the cost of standardisation of frequency will be shown as a separate item in the accounts and demand notes of the Commissioners, and will be apportioned among authorised undertakers on the basis of the revenue received from the sale of electricity, other than electricity sold in bulk to other undertakers.

The year closed with an increase in the working balance of £1,139, as against an estimated reduction of £7,440, the net expenditure thus falling short of the estimate by £8,579, mainly accounted for by the fact that the contingency provision of £3,000 was not drawn upon, by the increase in receipts due to fees on applications for special orders, and by the increased interest earnings on the larger cash balances in hand during the year.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electricity Schemes.

On February 26th, Mr. Kelly asked the Minister of Transport if he would state the schemes put forward by the Electricity Commissioners during 1927 and 1928 to the Central Electricity Board.

Colonel Ashley said that the following five schemes were transmitted by the Electricity Commissioners to the Central Electricity Board during the years 1927 and 1928:—The Central Scotland Scheme, the South-East England Scheme, the Central England Scheme, the North-West England and North Wales Scheme, and the Mid-East England Scheme

Electricity Charges at West Wickham.

On February 26th, Mr. Day asked the Minister of Transport whether he had received a protest from a large number of the residents of the new housing estate, West Wickham, against the high charges made by the West Kent Electric Co. for electricity, and whether his department was taking any action in the matter.

Colonel Ashley said he did not appear to have received any such protest.

Scottish Water Power Bills.

It is stated that 95 petitions have been presented against three Scottish water power Bills—the Galloway, West Highland and Grampians Bills. These measures have been referred to a Select Committtee of the House of Lords under the chairmanship of Viscount Younger.

Electrically-illuminated Direction Lines.

On February 27th, Sir Nicholas Grattan-Doyle asked the Minister of Transport whether his attention had been called to the possibilities of electrically-illuminated white traffic-direction lines on roads; and whether it was his intention to suggest to road authorities that facilities should be given for experimenting with such devices.

Colonel Ashley said he was giving consideration to the possibilities of electrically-illuminated white traffic-direction lines, and was arranging for certain trials to be carried out. He did not consider it desirable to make any special suggestion to highway authorities at the moment.

London and Home Counties J.E.A. Bill Withdrawn.

It is announced that the Bill which was being promoted during the current session of Parliament by the London and Home Counties Joint Electricity Authority has been withdrawn. This is the outcome of the injunction recently granted against the Joint Authority at the instance of the Attorney-General acting on behalf of a number of London electricity supply companies.

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Business and Industrial Notes.

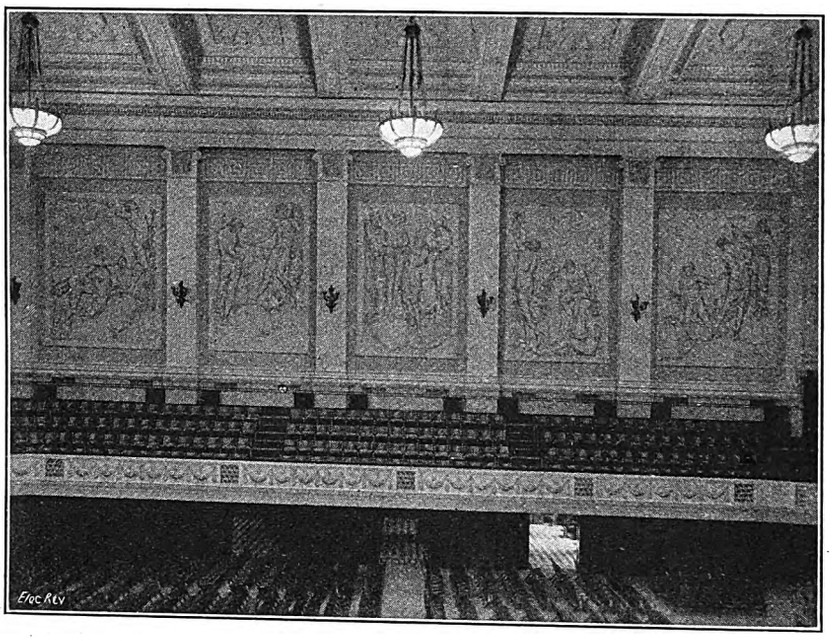
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Local Exhibition.

Morecambe.—We have received from Mr. M. J. Mortimer, the borough electrical engineer, a copy of a booklet which was distributed during the recent Chamber of Trade Exhibition, in which the Corporation Electricity Department arranged an electrical section. It is written in an interesting way around the various applications of electricity, and contains brief descriptions of the stands of the exhibitors, among whom were: The Revo Electric Co., Ltd., the Central Electric Co. (Morecambe), Mr. G. W. Dawson, the Singer Sewing Machine Co., Burnley Components, Ltd., and Messrs. E. & W. Shepherdson, Ltd. Some notes on the electricity undertaking and a full statement of charges for electricity are also included. The booklet was distributed to nearly 7,000 people.

Lighting in Melbourne Town Hall.

The accompanying illustration presents a view of the interior of the Town Hall, Melbourne, showing the handsome nature of the decorations as well as indicating the size of the building. A special feature is the lighting which has been carried out with fittings supplied by the British General Electric Co., Ltd.



Lighting in the Town Hall, Melbourne.

Leyton and Electricity Meters.

The Leyton Urban Council has adopted a recommendation from the Electric Lighting and Tramways Committee not to accept a tender for a large quantity of electricity meters, but that the electrical engineer should purchase meters as and when required, and if unable to obtain them from British firms at prices reasonably near those quoted by foreign firms to purchase suitable meters from foreign firms. When the matter was discussed on February 26th, a motion to refer the matter back in order to have a definite resolution to purchase foreign or British meters was rejected. Councillor Marlow, who proposed this, said that it meant a matter of 4s. 6d. each, but he thought that it would in the end be a wise policy to buy the British meters. Councillor Thorn replied that they were not prepared to accept the tender of a British firm when it meant buying 4,000 meters.

Hampstead Undertaking to Pay off Debt.

At its meeting on February 28th the Hampstead Borough Council decided to pay off all outstanding loans on its electricity undertaking (engineer: Mr. J. Leadbeater), amounting to £32,310, out of accumulated surplus, thus leaving the undertaking free from debt as from March 31st. It is believed that Hampstead will then occupy a unique position in the electricity supply industry. The prices charged to Hampstead consumers are among the lowest in the country, *viz.*, 3d. per kWh for lighting, and ¾d. per kWh for power, heating, and cooking.

Cable Manufacture in Russia.

A Moscow newspaper states that the production of cables in Soviet Russia during the fiscal year 1925-26 exceeded the level of that in the pre-war period, while during the current year the output will be two and a half times greater. It is, however, calculated that it will only be possible to meet the demand to the extent of 55 to 60 per cent. this year owing to the shortage of copper and other non-ferrous metals.

Book Notices.

"Sell's Directory of Registered Telegraphic Addresses, with Telephone Numbers and Classified Trades." London: Business Directories, Ltd. Price 45s.—With this, the 1929, edition this useful publication attains its 44th year. The new and improved system of reference introduced last year is continued in this issue, the Press section has been greatly improved, and several new features have been added, including a special section of American exporters, merchants, Customs brokers, &c., also a Stock Exchange section containing the official lists of stock and share brokers, who are members of the respective Stock Exchanges in Great Britain and Ireland.

"The Official South African Municipal Year Book, 1928-29." Pp. 520 and tables. London: E. G. Allen & Son, Ltd. Price 25s. net. The 1928-29 volume of this municipal year book has been thoroughly revised and brought up to date. The statistics relating to the municipalities of South Africa reflect steady progress in every direction. It is stated that during the past year numerous new undertakings have been laid down in the four provinces, consequent upon the Electricity Supply Commission being in a position to undertake the supply of electricity in bulk from its superpower stations.

"Aircraft Engineering," a monthly publication devoted to the science and practice of aeronautics and to allied and subsidiary branches of the engineering industry. Vol. 1, No. 1. March, 1929. London: 110, Fenchurch Street, E.C. Price 2s.

"Whittaker's Electrical Engineer's Pocket Book," 1929. Sixth edition, revised and enlarged; pp. xiii+775; figs. 356. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.—The 1929 edition of this Pocket Book has been completely revised, important changes and additions have been made in practically every section, and the book has been entirely re-indexed. Entirely new sections have been added dealing with: Electrical Legislation, Industrial Electric Heating, Oscillographs and Wave Analyses, Applications of a.c. Commutator Motors, Rewinding a.c. Motors for different voltages and frequencies, Balancers, Boosters, and Reducers, Mercury Rectifiers, and Transverters. Previously existing matter has been replaced by up-to-date information where necessary, and the size of the book has been increased by about 100 pages, including many new illustrations.

"Fundamentals of Electrical Design." By A. D. Moore. London: McGraw-Hill Publishing Co., Ltd.—We regret that in our review of this book, in our issue of January 18th, the price was given as 25s., whereas it is actually 20s. The reviewer, with the erroneous price in mind, said that the work would "command a wider sale at about 75 per cent. of its price"; if this is accepted then the actual price is not far out.

Olympia to be Reconstructed.

It was announced last week that Olympia, Kensington, W., had been purchased by Mr. P. E. Hill, chairman of Covent Garden Properties, Ltd. It is the purchaser's intention to reconstruct and enlarge the building to make it one of the finest trade exhibition centres in the world. The work is to commence almost immediately, and is expected to be completed before the end of next year.

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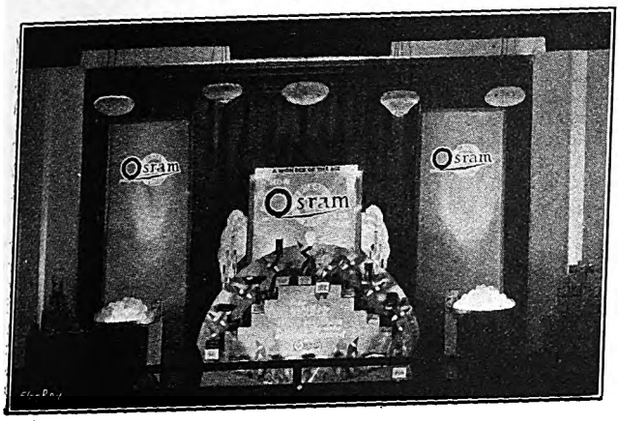
Overseas Trade Inquiries.

The Department of Overseas Trade says that before initiating correspondence on commercial matters with overseas officers of the Department, British firms should bear in mind that the Department may have at its headquarters, 35, Old Queen Street, S.W.1, the information which they require or may have helpful advice to offer on the matter about which they contemplate correspondence.

A Hackney Window Display.

It is the policy of the Hackney Corporation Electricity Department to co-operate with manufacturers in the dressing of its showroom windows. In this way expert assistance is obtained with correspondingly effective results. One of the latest displays dealt with "Osram" lamps, and the illustration reproduced herewith shows that it was novel and attractive. The centre piece, as is explained, illustrates various stages in the manufacture of the lamps.



An "Osram" Display at Hackney.

Social Events.

The annual staff dinner of the Cardiff Electricity Department was held at the Grand Hotel, Cardiff, on March 1st, Mr. C. G. Morley New (city electrical engineer) presiding over a large company, which included representatives of the leading manufacturing and distributing firms and local contractors. The toast of the "Cardiff Corporation Electricity Department" was given by Mr. Arthur Ellis (former chief of the department), who referred to the phenomenal growth of the undertaking and the favourable charges for electricity. In wishing the Department further success, he hoped the burden of the recent re-assessment figures, which were increased from £7,000 to £40,000, would be borne with equanimity. Replying to the toast, Councillor Gough (chairman of the Electricity Committee) said that unfortunately the undertaking was regarded by some members of the Council as a milch cow for the relief of rates. That was not its primary function. Their aim was to provide a cheap and abundant supply of electricity, to take their share in industrial reconstruction and give industry a chance to regain its lost position. The toast of "Our Visitors and Guests" was proposed by Mr. E. Jones, mains superintendent, Mr. J. Williams responding; Mr. R. L. Booth, chairman of the Cardiff Branch E.C.A., proposed the chairman's health, and Mr. Morley New briefly replied. Musical items were given by members of the Cardiff Grand Opera Society.

The students of the Brush Electrical Engineering Co., Ltd., held their annual dance at the Town Hall, Loughborough, on February 22nd. About 120 guests attended, amongst whom were Mr. W. Johnstone (managing director), Mr. A. T. Brotherton (works director), and Mr. F. G. Healey (secretary). Mr. W. H. Cooke, chief electrical engineer, Luton Corporation, was also amongst those present. A very enjoyable evening was spent, a feature being the attendance of a number of ex-students who make this dance the occasion of an annual reunion.

The annual dinner and concert of Evershed's Social and Athletic Association (Evershed & Vignoles, Ltd.) was held on February 23rd, at the Clarendon Restaurant, Hammersmith. Mr. Vines, President of the Association, occupied the chair, and after the dinner there was a very successful concert by staff and works employés.

The committee of the Igranic Electric Company's Rugby football team is to be congratulated on a successful dance which was held on March 1st at the Crofton Rooms, Bedford. Over 200 guests were present.

Australian Trade Development.

The Commonwealth Government has decided to set up a Trade Commissioner service in various overseas markets, including the United States. The first appointment is being made to Canada.

Wages in the Cable Making Industry.

The Joint Industrial Council for the Electric Cable-Making Industry announces that there will be no cost-of-living change in wages in the industry on the third pay-day in March.

Hull Cable Contracts.

Several tenders for cable were considered by the Hull Corporation Telephones Committee on February 27th, and in each case the lowest tender (whether British or foreign) was accepted. Where the difference was only £2 or £3 a motion to accept a British tender was defeated, and the German tender accepted.—*Yorkshire Post.*

The F.B.I. and Industrial Conferences.

At a special meeting on February 26th, the General Council of the Trades Union Congress accepted the invitation of the Federation of British Industries and the National Confederation of Employers' Organisations to discuss the possibilities of joint consultation upon matters of common interest. As was mentioned in our last issue, it is the intention of the employers' representatives to explain their unfavourable attitude towards the "Melchett-Turner" conferences. It is probable that the suggested meeting will be held at an early date.

Recent Contracts.

The contract for the emergency lighting sets for the Canadian Pacific liner *Empress of Britain*, now being built at the yard of Messrs. John Brown & Co., Ltd., Glasgow, has been placed with the Parsons Oil Engine Co., Ltd., of Southampton. The plant will consist of two of the company's "T6SO" paraffin engines direct coupled to 75-kW generators of Messrs. W. H. Allen, Sons & Co.'s manufacture. The company is also supplying the emergency sets for the C.P. liner *Empress of Japan.*

Messrs. Clough, Smith & Co., Ltd., have received a contract from the Doncaster Corporation for the conversion of a further section of the tramway system. The contract includes the reconstruction of the overhead equipment and the supply of six additional "Karrier-Clough" six-wheel double-deck trolley-omnibus chassis.

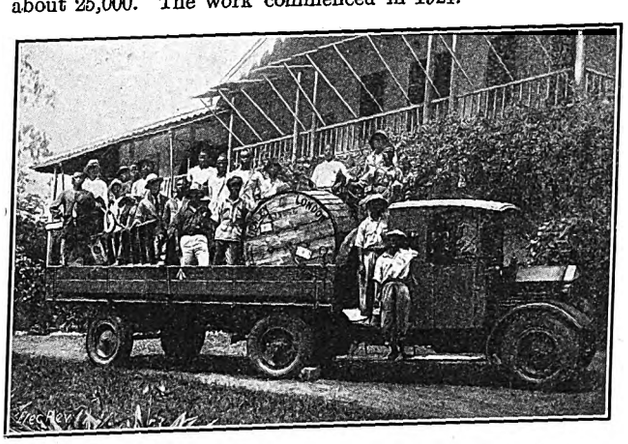
Lighting Fittings for Kansas City.

The British Consul at St. Louis, Missouri (Mr. W. K. Small, M.B.E.) reports that a firm in Kansas City is desirous of importing electric lighting fittings and brassware, such as andirons and candlesticks. United Kingdom manufacturers of such goods can obtain further particulars from the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference B.X. 5132.)

Henley's Overseas Activities.

Another indication of the ubiquity of W. T. Henley's Telegraph Works Co., Ltd., is provided by the photograph reproduced herewith. It shows a drum of cable loaded on a motor lorry for transport to the Agricultural Department at Aburi, Gold Coast. The garb of the native crew shows the influence of European civilisation to a marked degree.

Messrs. Turnbull & Jones, Ltd., electrical engineers and contractors, of Wellington, N.Z., have informed Messrs. Henley's that they have been responsible for the electrical reticulation of Palmerston North, an inland town approximately 89 miles from Wellington, with a population of round about 25,000. The work commenced in 1924.



Henley Cable on the Gold Coast.

In the aggregate there were used 392,970 yd. of "Henley" cables; 120 tons of bitumen; 364 various joint boxes; 37 terminal boxes; 8 manhole network boxes and 450 fuse boxes.

Among the important wiring installations carried out by Messrs. Turnbull & Jones during recent years may be mentioned "Henley Wiring System" fire-alarm installations in the General Post Office, Wellington, and the Auckland Public Library and Art Gallery, and installations with "Henley" cables and wires in the Wellington Grand Opera House; the National Bank of New Zealand, Auckland; the Auckland War Memorial Museum, the building cost of which was in the neighbourhood of £250,000; the Dunedin City Corporation's new gas retort house; and Knox College, Dunedin.

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"Service in Salesmanship."

An address bearing the above title was delivered by Mr. E. L. Colston (Hoover, Ltd.) at a North-East Coast Area E.D.A. Conference at Newcastle on February 20th. Mr. V. A. Pask (Newcastle and District Electric Lighting Co., Ltd.) presided. Mr. Colston gave a number of widely-differing definitions of "service," and came to the conclusion that service was high-grade salesmanship. He went on to show that service could be rendered in many directions not all of which were directly connected with the sale of the goods, and pointed out that complaints provided excellent opportunities for business building. Service in salesmanship soon won a good reputation and a good reputation built up goodwill. The speaker advised the audience never to make misrepresentations or give promises which could not be fulfilled. A discussion followed the address.

The next conference of the series is to be held on March 20th, when Mr. R. Robson is to read a paper on "The Position of the North-East Coast in the Electrical Industry."

Bankruptcy Proceedings.

B. H. Wishaw, Bakewell Road, Matlock, Derbyshire, electrical and wireless engineer.—The adjourned public examination herein was held recently at the Court House, Derby. The previous hearing was adjourned to enable the debtor to file a cash account. He admitted now that he could not give all the details, but he stated that he had sufficient information on which to base a return. Being questioned with regard to an agent, who, he alleged, had failed to pay certain accounts with money entrusted to him for the purpose, the debtor stated that he knew nothing about the man except that he was recommended by a firm from whom the debtor purchased goods. The agent paid out only £63 out of £128 handed to him. He also agreed to guarantee the bills for further goods, but failed to meet the liability, with the result that the debtor had to find another £30. The examination was formally adjourned for closing, on the understanding that the debtor should file a cash account.

N. H. Wood, 32, Highbury Avenue, Thornton Heath, Surrey, lately of 38, St. Charles Square, North Kensington, W.10, electrical engineer.—An application for discharge was made by this debtor on February 21st at the County Court, Croydon. The receiving order was made in July, 1927. The statement of affairs showed liabilities estimated at £173 and assets estimated at £11, which had realised £18. In addition, the debtor had paid £16 out of his earnings. A first and final dividend of 1s. 10d. in the £ had been paid. A creditor had an objection to the discharge, and the judge adjourned the application generally with leave to apply.

H. D. Douglas (H. D. Douglas & Co.), engineer, wireless factor, &c., 32, Queen Victoria Street, E.C.—Bankrupt's discharge suspended for six months until July 30th, 1929.

C. K. Wallis, electrical engineer, Bedford Street and Longford Road, Bognor.—Last day for proofs for dividend, March 12th. Trustee, Mr. R. W. Cave, Official Receiver, 12a, Marlborough Place, Brighton.

T. F. Collier, electrician, 116, Union Street West, Oldham.—First and final dividend of 9s. 1d. in the £, payable at the Official Receiver's offices, Byrom Street, Manchester.

E. F. Lee (F. Newton), electrical engineer, 340a, Kings Road, Chelsea, S.W.—Receiving order made February 22nd on debtor's own petition. First meeting held March 6th; public examination, April 12th, both at Carey Street, W.C.

A. B. Gregory, wireless expert, 29, St. Albans Road, Seven Kings.—Application for discharge to be heard March 18th at the Shire Hall, Chelmsford.

T. F. J. Truss, electrical engineer, 28, Wincobank Avenue, Sheffield.—Receiving order made February 26th, on a creditor's petition.

T. C. Wheeler, electrician, 30, Stockton Street, West Hartlepool. Receiving order made February 25th on debtor's own petition.

L. H. Lawrence (H. F. Lawrence), electrical engineer, 43, Canterbury Road, Margate.—Trustee, Mr. C. S. Scarlett, 5, Cecil Square, Margate, appointed February 25th.

Company Liquidations.

Epoch Electrical Society, Ltd., late Gracechurch Street and Cannon Street, E.C., and Manchester.—The statutory meeting of creditors was held on February 28th, at the offices of Messrs. Linett, Hughes & Co., 24-25, Ironmonger Lane, E.C. Mr. C. Hughes, the liquidator of the company, occupied the chair, and submitted a statement of affairs which showed ranking liabilities of £2,059, and net assets of £323, leaving a deficiency of £1,736. The issued capital was £1,000, making a total deficiency of £2,736. The company was registered in September, 1927, with a nominal capital of £1,000, and the whole of the shares were issued for cash. The company started an entirely new business. Between September 6th, 1927, and February 9th last the turnover was £9,871, and there was a net loss of approximately £2,000. The company was forced to vacate its premises at an unfortunate moment, and the Christmas trade was interfered with. The Manchester shop was closed after a comparatively short period of trading. One of the directors admitted that a certain amount of price-cutting had possibly taken place. He said that when a man entered a shop to purchase a wireless set, he invariably asked for a discount. Practically speaking, no purchaser paid the full amount. A resolution was passed confirming the voluntary liquidation of the company with Mr. Hughes as liquidator, and an advisory committee was also appointed consisting of Messrs. C. Latham, of the Wireless and Radio Trades Guardian Association, A. Ball (Marconiphone Co., Ltd.), and R. A. Bishop (C. D. Dickeson & Sons, Ltd.). The following are creditors:—

	£		£
Marconiphone Co., Ltd.	142	Halcyon Wireless Co., Ltd.	42
Rolls-Caydon Sales, Ltd.	126	Oldham & Son, Ltd. ...	39
Philips Lamps, Ltd. ...	111	Quint, J.	31
Sun Electrical Co., Ltd.	105	Marconi's Wireless Telegraph Co., Ltd. ...	28
Dickeson, C. B., & Sons, Ltd.	96	London Metal Warehouses, Ltd.	24
Harris & Russell, Ltd.	87	Eastick, J. J., & Sons ...	21
Langham Radio Co. ...	26	Iliffe & Sons, Ltd. ...	98
East London Rubber Co.	51	Diggles & Ogden	81
Burndept Wireless (1928), Ltd.	50	Bernard Jones Publications, Ltd.	39
Brown, S. G., Ltd. ...	50	Arnott, R.	150
Mullard Wireless Service Co., Ltd.	44	Hurst, A.	291
McMichael, L., Ltd. ...	45		

A. I. Greenwood, Ltd., Guildford Street, Leeds, wireless and electrical dealers, &c.—The statutory meeting of creditors was held recently at the offices of Messrs. Emmerson, Armitage and Co., 99, Albion Street, Leeds. Mr. B. Armitage (liquidator) submitted a statement of affairs which showed that the assets were estimated to realise £3,494 (net) to meet debentures of £5,000. There was thus a deficiency as regarded the debentures of £1,506, and there were no assets available for the unsecured creditors whose claims aggregated £2,280. The ranking liabilities were set down at £3,786, with a deficiency of the same amount so far as the creditors were concerned. The deficiency as regarded the shareholders was £20,013. The company was registered in March, 1926, and it took over the business as from the previous November. The consideration for the sale of the business was the issue of shares of the face value of £6,000, and debentures for £5,000. The widow of the late proprietor was allotted the whole of the shares and the debentures. During the period to September, 1926, the turnover was £3,595, with a net loss of £2,140, and in the following year there was a net loss of £2,063, on sales of £27,795. During the year to September 30th, 1928, the sales were £19,350, with a net loss of £2,433. Since September 30th last, the sales had been £4,336, with a net loss of £1,176. It was pointed out that the statement showed that there would be no dividend for the creditors, and it was suggested that the debenture holder might be approached to see whether she would allow some portion of the assets to be distributed among the creditors. No definite resolution was passed, and the voluntary liquidation will therefore be continued with Mr. Armitage as liquidator. The following are creditors:—

	£		
A.F.A. Accumulators ...	27	Page, A., & Sons, Ltd.	37
Chorlton Metal Co. ...	32	Philips Lamps, Ltd. ...	29
Collier, H., & Sons, Ltd.	214	Rothermel Corpn., Ltd.	22
Cossor, A. C., Ltd. ...	86	Stevens, A. J., & Co., Ltd.	453
Enfield Cycle Co., Ltd.	416	Siemens Bros. & Co., Ltd.	27
Humber, Ltd.	134	Sellers of Leeds	92
Houghton-Butcher, Ltd.	110	Veeco Cycle Manfg. Co., Ltd.	21
Hardman & Co., Ltd. ...	37	Emmerson, Armitage and Co.	47
Lucas, J., Ltd.	50		
Lassaure, Ltd.	25		
Nesper, Dr.	26		

Marpole & Frisby, Ltd., electrical engineers, 161, Wardour Street, W.—The statutory meeting of creditors was held on February 25th at the offices of Messrs. Gray, Stainforth and Co., 31, Lombard Street, E.C., when the chair was occupied by Mr. F. S. Wilks, the liquidator of the company. A statement of affairs submitted showed liabilities to unsecured creditors of £548, while £76 was due to preferential creditors and £250 to a debenture holder. The assets were put at £309. The liquidator stated that the company was formed in February, 1918, to take over the business previously carried on by Marpole & Frisby. The capital was £2,070, and the trading had been carried on with fluctuating results ever since. During the past few years, however, there had been a decline in the returns, and Mr. Frisby paid in £250, taking a debenture covering this sum. During the last few months the trade had fallen off very considerably. Three weeks ago three writs were issued, and he (the chairman) was appointed receiver and subsequently liquidator as well. The company had worked on a gross profit of about 10 per cent., which was altogether insufficient for a business of that kind. Profits had had to be cut, however, in order to meet competition. It was decided that the matter should be left in the hands of the existing liquidator. The following are creditors:—

	£		£
Imperial Lighting Co. ...	94	Wakefield & Co.	20
Kings Signs, Ltd. ...	125	Wood & Garling, Ltd. ...	40
Matthews Bros., Ltd. ...	24	Young & Wildsmith ...	31
Metro - Vick Supplies, Ltd.	25	Robins, Gore & Mercer...	52
Sampson, Thos.	25	Gray, Stainforth & Co....	31

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County Electrical & Wireless Stores, Ltd.—First meetings of creditors and contributories March 8th at Carey Street, W.C.

Maldon Electric Works, Ltd.—A meeting of creditors was held at the office of the Liquidator, Mr. A. F. W. Lovell, 5, Great Winchester Street, E.C., on March 4th. (This notice is purely formal; all creditors have been or will be paid in full.)

Erith Electrical Co. (Barber & White), Ltd.—A meeting of members is called for March 28th at the offices of the Liquidator, 87-89, Aldgate High Street, E.C., to hear an account of the winding-up from the Liquidator, Mr. L. G. Darling.

Private Arrangements.

A. Rutherford, electrician, Plowman's Yard, Finchley, N.W.—A meeting of creditors was held on February 27th at the Law Society's Rooms, when a statement of affairs was presented by Messrs. Hereward Scott & Co., 133, High Street, N.16, which disclosed liabilities of £735, of which £662 was due to trade creditors. The net assets were £169, leaving a deficiency of £566. The debtor's solicitor stated that the business was commenced just after the war, and the present position had been brought about by the debtor recently incurring a bad debt of £143. The accountant stated that it was impossible to prepare any proper trading accounts, as the debtor's books had not been fully written up. An account prepared as at June 30th, 1928, showed that the stock at cost was £259, whilst there were debtors of £259. The liabilities to trade creditors at that time were £692. There was no offer to put before the meeting. Mr. W. A. J. Osborne, of Messrs. Corfield and Cripwell, was appointed to investigate the matter and report to a further meeting. The following are creditors:—

	£		£
Falk, Stadelmann & Co., Ltd.	209	Pope, H., & Sons, Ltd....	25
Metro - Vick Supplies, Ltd.	41	Wholesale Electric Lamp Co.	39
		Wood & Carling, Ltd. ...	231

Dissolutions of Partnership.

H. A. Jackson & Co., manufacturing electrical engineers and merchants, Caxton Hall, Chapel Street, Salford.—Messrs. J. A. Singleton (J. A. Jackson) and R. Ramsden have dissolved partnership. Mr. R. Ramsden will attend to debts and continue the business.

Central Garage, motor and electrical engineers, &c., Dunstable.—Mr. H. Eames and Mr. L. H. Mattey have dissolved partnership. Mr. Eames will attend to debts and continue the business under the same style.

Trade Announcements.

Mr. E. Fieber having retired, the business of Messrs. E. Fieber & Son, 310a-312a, Euston Road, N.W.1, has been taken over by the Euston Electrical Supplies, at the same address, the directors being Capt. N. A. L. Stilling and Mr. V. Osborne. Mr. A. J. Moore will continue to act as sales manager.

The Alton Battery Co., Ltd., has appointed Mr. Joseph Rea, York Buildings, 32, Ann Street, Belfast, as agent for "Alton" stationary batteries for Ulster and County Donegal.

Electric Cables, Ltd., announces that as Mr. E. Marples has retired on account of ill-health, it has appointed Mr. H. Horsburgh, 61, Great Charles Street, Birmingham, as its agent for the Midland counties.

Messrs. Davis Bros. & Co. have opened an office and showrooms at 13, St. Martin's Court, Charing Cross Road, W.C.2, to deal with stage-lighting and illuminating work.

The telephone number of the City Electrical Co., Emerald Street, W.C.1, is now Holborn 9722 (4 lines).

Mr. William Taylor, electrician, has opened premises at Millstone Yard, Peel Street, Barnsley.

Electric Motor Supplies, Ltd., has moved to John Street, Huddersfield (Telephone No. 1966), where a larger showroom and bigger stocks have been arranged.

The British Secheron Co., Ltd., has moved to new offices and works at 158, Stonhouse Street, S.W.4. (Telephone: Battersea 3852; telegrams: "Brisecolim, Clapcom, London.")

The British Aluminium Co., Ltd., has opened a new branch office and warehouse at 66, Kirkstall Road, Leeds, under the management of Mr. C. F. Batstone. (Telephone: Leeds 28343; telegrams: "Aluminium Leeds.")

The head office of Messrs. Berry, Wiggins & Co., Ltd., is now at Tensulam House, Water Lane, Stratford, E.15. Their telephone number is unchanged.

The Electrified Mumbles Railway.

The new service of electric trains on the Mumbles Railway was commenced on March 2nd. There was no formal inauguration ceremony, but a souvenir booklet was prepared for the occasion. We have received a copy of this booklet, which contains an illustrated history of the railway, which is claimed to be the oldest in the world, four prior concerns having long gone out of existence. The Oystermouth Railway or Tramroad Company Act was placed upon the Statute Book in 1804, and the line has been operating ever since its construction. Horses were employed up to 1877, when steam traction was adopted.

Unemployment.

There was an increase of 115,500 in the number of registered unemployed during the week ended February 18th. The total at that date was 1,458,000, as compared with 1,342,500 on February 11th, and with 1,136,687 on February 20th, 1928. The large increase is attributed to the stopping of work by the recent severe weather.

New Catalogues and Lists.

Messrs. B. & F. Carter & Co., Lark Works, Rochdale.—An illustrated catalogue of cable-braiding machines of various patterns for many classes of cable.

Messrs. G. P. Dennis, Ltd., 66, South John Street, Liverpool.—Two illustrated price-lists giving particulars of "Desco" self-aligning, porcelain-handle fuses.

Ringsdorff Carbons (England), Ltd., Colindale Avenue, Hendon, N.W.9.—Two technical publications dealing with the company's carbon brushes, &c. Illustrated.

Tungsram Electric Lamp Works (Gt. Britain), Ltd., 72, Oxford Street, W.1.—A coloured pamphlet (priced) advertising the company's "Pearl" lamps, gasfilled and vacuum.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—A folder produced on novel lines advertising the company's electric signs of various patterns. Prices are given.

Messrs. Landis & Gyr, Ltd., Victoria Road, North Acton, W.3.—An illustrated pamphlet describing the company's instrument transformers.

The Ray Manufacturing Co., 25b, High Street, Wimbledon, S.W.19.—Circular letters advertising the "Andy" fuse wire carrier, with prices.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—A comprehensive illustrated and priced catalogue of "Elasta" electric lamps.

Lighting Trades, Ltd., 30-31, Farringdon Road, E.C.4.—A well-illustrated catalogue of the company's "Redot" electric fires, cookers, boiling rings, kettles and other domestic appliances. Priced.

B.E.N. Patents, Ltd., 92, Tottenham Court Road, W.1.—An illustrated booklet describing the company's spray-painting and tire-inflating unit.

March calendar-blotters have been received from Pope's Electric Lamp Co., Ltd., 5, Arthur Street, W.C.2; Messrs. S. Rogers & Co., Ltd., 15, Fitzroy Street, W.1; Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow; and Messrs. Warren Bros. (Middlesbrough), Ltd., 91 & 93, Grange Road, Middlesbrough.

The A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—Two illustrated pamphlets dealing respectively with electric fires and small domestic electrical appliances—tea kettles, percolators, irons, &c.

Lectro Linx, Ltd., 254, Vauxhall Bridge Road, S.W.1.—Illustrated price lists of the company's radio plugs and sockets, &c.

The Harland Engineering Co., Ltd., Alloa, Scotland.—Publication No. X56/2810, containing illustrated notes on the design, construction, installation and operation of "Harland" rotary convertors, from 50 to 2,000 kW.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—March price list of electrical materials, accessories, and appliances. Illustrated.

Straight-Lite Reflectors, Ltd., 9-15, Oxford Street, W.1.—A blotter advertising the company's reflectors for showcase, shop-window, and cornice lighting.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—Two price lists dealing respectively with "Vicma" and "Vinazo" wires and cables, and tough rubber sheathed cables.

Wireless Pictures (1928), Ltd., 14-16, Regent Street, S.W.1.—Three illustrated and priced leaflets, giving full particulars of the component parts necessary for the construction of the "Fultograph" picture receiver.

J. G. Statter & Co., Queen Anne's Chambers, Westminster, S.W.1.—Leaflet No. X220, describing the makers' totally enclosed, industrial-type, ironclad oil switches for wall or pedestal mounting.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—A folder containing illustrations and brief descriptions of "Memset" switch-fuse units for house services.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A well-produced catalogue of the company's accessories, including switch- and fuse-gear, plugs and sockets, cable sealing ends, &c. Each item is illustrated and dimensioned, and a thumb-index is provided.

Messrs. C. A. Vandervell & Co., Ltd., Acton, W.3.—A pamphlet illustrating and describing a window display for the use of the company's battery service agents.

Italian Lamp Production.

The output of electric lamps in Italy during September last amounted to 1,212,833, bringing up the total for the first nine months of 1928 to 11,054,324 lamps, as compared with 10,486,212 in the corresponding period of 1927.

German Electrical Imports.

The imports of electrical machinery, instruments, apparatus, &c., into Germany during last year attained a value of £2,281,750, as compared with £1,673,100 in 1927. The exports of similar material of German manufacture amounted during 1928 to £24,434,450, as compared with £19,935,800 in the preceding twelve months. Some details of German foreign electrical trade in 1927 and 1928 appeared in our last issue (p. 403).

New French Company.

La Société d'Installation de Force et de Traction (S.I.F.T.) is the name of a company which has lately been formed in Paris (10, Rue Caumartin) with a capital of one million francs to carry on business as electrical engineers.

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Proposed German Government Holding Company.

The Prussian Government is considering the question of authorising the formation of a company with a capital of nine millions sterling to be known as the Prussian Electricity and Mining Company, to act as a holding company of the shares held by the Government in a number of electricity supply and mining undertakings in Prussia.

For Sale.

Erith U.D.C. Electricity and Tramways Committee has for disposal one 1,000-kW turbo-alternator with surface condenser and auxiliaries, also one 3-ton self-tipping Yorkshire steam wagon; Southampton Corporation Electricity Committee invites offers for one Cole, Marchent and Morley vertical triple expansion steam engine with surface condenser, &c., direct-coupled to a 1,000-kW Dick, Kerr d.c. generator; Basingstoke Corporation Electricity Department has for disposal one motor booster set with switchgear. Blackburn Corporation Electricity Department has for disposal a number of second-hand d.c. motors. St. Helens Corporation Tramways Department invite offers for a G.E.C. motor-generator. Sheffield Corporation Water Works Department has for disposal surplus generating and power plant. Guildford Corporation Sanitary Committee invite offers for one 2½-ton electric tipping lorry by Electricars, Ltd., with Edison battery. (See our advertisement pages to-day.)

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price Mar 5.	Fortnight's inc or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	"	£52	...
a Bisulphide of Carbon	"	...	...
a Borax	"	£25	...
a Copper Sulphate	"	£25 10s.	...
a Potash, Chlorate	per lb.	8½d. to 4d.	...
a " Perchlorate	"	5½d.	...
a Shellac	per cwt.	£18 10s.	...
a Sulphur, Commercial	"	£11	...
a " Roll	"	£11	...
a Soda, Chlorate	per lb.	3d.	...
a " Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	3½d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£95 to £100	...
b " Wire	per lb.	1/1 to 1/9	...
b " Sheet	"	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metal—			
Grade I	per ton net.	£200	£3 dec.
Grade II	" "	£139	£2 dec.
Grade III	" "	£75	£1 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	11½d.	½d. inc.
c " Tubes (solid drawn)	"	1/1½ to 1/1½d.	½d. inc.
c " Wire, basis	"	11⅜d.	½d. inc.
c Copper Tubes (solid drawn) ...	"	1/3½	½d. inc.
c " Bars (best selected) ...	per ton.	£116	£8 inc.
c " Sheet	"	£116	£8 inc.
c " Rod	"	£116	£8 inc.
d " (Electrolytic) Bars ...	"	£91 10s.	£7 inc.
d " " Sheets ...	"	£143 10s.	...
d " " Wire Rods	"	£101 10s.	£7 inc.
d " " H.C. Wire	per lb.	1/0 1/16	1/16d. inc.
f Ebonite Rod	"	2/3 to 2/6	...
f " Sheet	"	2/3 to 2/6	...
n German Silver Wire	"	2/2	...
h Gutta-percha, fine	"	nom.	...
h India-rubber, Para fine	"	1/1½	½d. inc.
l Iron Pig (Cleveland No. 3.) ...	per ton.	80/-	...
l " Wire, galv. No. 8, P.O. qual.	"	£21	...
g Lead, English pig	"	£25	10/- inc.
g Mercury	per bot.	£22 2s. 6d. to £22 5s.	...
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e " " medium	"	4/- to 8/-	...
e " " large ...	"	10/- to 20/- & up	...
p Phosphor Bronze, plane castings	"	1/3½	...
p " " drawn bars & rods	"	1/3¾	...
p " " rolled strip & sheet	"	1/3½	...
p " " wire...	"	1/6	¾d. inc.
o Platinum	per oz.	£18 17s. 6d.	...
d Silicium Bronze Wire	per lb.	1/1	...
r Steel, Magnet, in bars	"	7½d.	...
n Tin, Block (English)	per ton.	£219 10s. to £220	£3 dec.
n " Wire, Nos. 1 to 16	per lb.	8/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on March 2nd, Messrs. James Forster & Co. stated that the feature of the lead market had been extensive covering of sales of Mexican lead for delivery this month. But for this prices would probably have been lower, as the demand from home consumers has quietened down considerably this week, while the Continent has again done little. The position of supply and demand appears to be very well balanced but for the moment prices seem high enough, though no appreciable set-back should be seen.

The South African-German Trade Treaty.

On March 1st the South African House of Assembly approved the conclusion of a commercial treaty between the Union and Germany by 62 votes to 51. General Hertzog, in reply to protests from the Opposition, said that it was unnecessary to transmit the motion to the Senate for approval; the lower House alone was competent to ratify the treaty.

Belgian Enterprise in Central Europe.

It is reported in Brussels that the recently-established Belgian electrical trust, "Elektrobel," has been negotiating successfully for participation in certain Czecho-Slovakian supply organisations. The "Hydrofina" is extending its operations in Rumania and proposes to develop the Argesu water power resources.

New German Company.

With the title of the Westdeutsche Elektricitätswirthschaft Gesellschaft, a company has been formed in Frankfurt-am-Main with a capital of £50,000. The undertaking has been formed by a number of the principal electricity supply companies in west and south-west Germany with the object of centralising the sale of power through a single concern.

New Belgian Company.

Among the companies recently formed in Belgium is the Compagnie Italo-Belge pour Entreprises d'Electricité et d'Utilité Publique, Brussels, capital 5 million francs, to engage in electricity supply enterprises in Italy.

Polish Foreign Electrical Trade.

The *Board of Trade Journal* shows that during December last Poland imported "apparatus, conductors and other electro-technical materials" valued at 7,319,000 zloty (about £1,0,000). Polish exports of this class of goods had a value of 44,000 zloty (about £1,000).

Lighting and Power Notes.

Australia.—Launceston (Tasmania).—The report of the city electrical engineer (Mr. R. J. Strike) on the working of the electricity undertaking for the year ended June 30th last records a total income of £76,830, as compared with £69,193 in the preceding year. Working expenses amounted to £48,564, as against £47,766, leaving a gross profit of £28,266 (£21,427). After providing for capital charges there was a net surplus of £4,481, as compared with a loss of £7,712 in 1926-27. The electrical energy sold totalled 9,119,707 kWh, an increase of 1,377,328 kWh, and the maximum load recorded 3,952 kW, an increase of 475 kW.

Canada.—Electrical Development.—The Hydro-Electric Power Commission of Ontario has approved the duplication of the 220-kV transmission line, from the Toronto Leaside transformer station to the Ottawa River at a cost of approximately $3,000,000. The work will be carried out as previously by the Commission's own construction staff. The Commission plans to proceed with the westerly half of the line during the coming summer, with towers of similar design to the existing towers, with the expectation of having this half available to connect with the present line for the second increment of Gatineau power. The construction of the easterly half of the line will follow, so that the entire new line will be available by the autumn of 1930, when the third increment of power from the Gatineau will be supplied. Last year the Commission authorised the connection of a double-circuit 110-kV transmission line from Pelham Junction to St. Thomas transformer station. Authority has now been given to connect the terminus of this line, which is at present under construction, for 10 miles in an easterly direction, at an estimated cost of $180,000.

The Gatineau Power Company, controlled by the Canadian Hydro-Electric Corporation, Limited, a subsidiary of the International Paper and Power Company, has started up additional generators in its Farmers and Chelsea hydro-electric plants on the Gatineau River. The two new generators with a combined capacity of 58,000 h.p., raise the total installed capacity of the Farmers and Chelsea plants to 232,000 h.p. The total capacity of the plants of Gatineau Power Company is now 562,600 h.p. installed and in process of installation. Of this, 439,000 h.p. is on the Gatineau River, and the balance is in the hydro-electric developments of the company on the Ottawa River and its other tributaries. In 1928, the company produced 1,286,000,000 kWh.

Continental.—Czecho-Slovakia.—The West Moravian Electric Power Supply Co. is establishing a new steam-operated electric power station at Brunn which will be equipped with two 4,500-kW high-pressure turbines and two low-pressure sets—one of 9,000 kW and one of 6,000 kW capacity. The

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high-pressure sets will operate with steam at a pressure of 65 atmospheres superheated to 450 deg. C. The plant will be interesting in that the exhaust steam from these machines will be conveyed by piping for the operation of engines and for heating purposes in the local textile mills.

GERMANY.—Statistics published in *Wirtschaft und Statistik* show that the production of electricity in Germany during 1927 amounted to 25,100 million kWh, an increase of 3,900 millions, as compared with the preceding year, representing an increase by 52 to 392 kWh per head of the population. New plant installed during the year raised the capacity to 10,000,000 kW. The energy derived from solid fuel was 72 per cent. of the total production, and water power accounted for 15 per cent., a decrease of 1 per cent.

Dover.—LOAN.—The Corporation Electricity Committee has recommended that application be made for sanction to a further loan of £3,000 for services.

Guatemala.—NEW POWER STATION.—An electrical plant, known as Santa Maria, and one of the largest in Guatemala, is about to be opened to supply power to the Ferrocarril Los Altos (San Felipe-Quezaltenango), which will use 9,000 of the 10,000 h.p. generated, the rest being used at Quezaltenango, 60 miles away. A second plant has been completed at Huehuetenango, 75 miles from Quezaltenango.—*Reuter's Trade Service* (Guatemala City).

Guildford.—EXTENSION OF SUPPLY.—At a recent meeting of the Corporation Electricity Committee, the borough electrical engineer reported that there was a large number of residents in the Shamley Green, Lords Hill, Blackheath, and Chilworth districts waiting for supplies of electricity. Before supplies could be given it would be necessary to erect transformer kiosks and lay l.p. cables at a cost of £4,954. He estimated the return on the completion of the extensions at £1,400 per annum. The extensions were approved.

Hull.—BULK SUPPLY TO TRAMWAYS.—The Corporation Electricity Committee has authorised the borough electrical engineer to take steps to supply electricity in bulk to the tramway undertaking. The estimated cost of the scheme is £35,000, and it has been approved by the Tramways Committee in preference to renewing the plant at the tramway power station, which would cost £42,000.

Lancaster.—NEW PLANT.—The Town Council has approved of a recommendation to extend the Caton Road generating station by installing a battery, booster, and switchgear at an estimated cost of £7,000. This plant is required to work the auxiliary engines for lighting.

Leicester.—INSTITUTION SUPPLY.—The Corporation Health Committee reports that at the present time electricity for the isolation hospital and sanatorium is obtained from the Corporation mains, and the cost to the Committee for electricity during the past year has been over £1,000. The Committee has been advised that it is possible to generate electricity at the hospital from the waste heat from the various reducing valves at a cost of 0.366d. per kWh, as against that paid of 2.303d. per kWh. With this in view, the Committee intends to install two 75-kW generating sets, together with the necessary switchgear, &c., at an estimated cost of £1,802. This will meet all present demands, and also allow for some proposed extensions.

Liverpool.—NEW POWER STATION.—The Corporation has set up a special committee to take in hand the construction of the Clarence Dock power station, which it is estimated will cost £1,764,000. This station will include plant with a capacity of 100,000 kW in two 50,000-kW sets. Contracts are to be invited for the buildings and plant.

Llanidloes.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council a letter was received from the Llanidloes Electric Light Co. stating that circumstances had arisen which made it necessary for the company to remove its generating plant to some other premises, and it inquired whether the Corporation desired to acquire the undertaking. The matter was referred to the Lighting Committee for consideration.

London.—BATTERSEA.—The Borough Council Electricity Committee is to extend mains from Park Road, Battersea Bridge Road, to the premises of Hovis, Ltd., Anhalt Road, and provide transformers and switchgear at a cost of £3,737. The Committee has decided to convert lamps in further streets from gas to electricity, at a cost of £1,468.

HAMMERSMITH.—The Borough Council Electricity Committee has recommended the following reductions in the charges for electricity:—General lighting: ordinary meters—maximum price, from 4d. to 3½d. per kWh; pre-payment meters—from 4½d. to 3¾d. per kWh. General power: from 1½d. to 1¼d. per kWh. Tariff (A): from 1½d. to 1½d. per kWh. Tariff (B): from 1.15d. and 0.9d. to 1.05d. and 0.85d. per kWh. Tariff (C): from 1d. and 0.75d. to 0.98d. and 0.73d. per kWh. Tariff (D): Ratable value charge from 10 per cent. to 7½ per cent., kW charge from £8 to £6, and "unit" charge from 1d. to ¾d. Tariff (E): electricity consumed between 9 p.m. and 6 a.m.—from ¾d. to ½d. per kWh. The reductions are equivalent to an estimated revenue of £22,572.

Northern Ireland.—PORTRUSH.—The Urban District Council is to apply to the Electricity Commissioners for sanction to borrow £4,200 to meet expenditure on additional plant.

Palestine.—THE RUTENBERG SCHEME.—*The Times* reports that another eight months should see the completion of the work on the dams, canal and bridges of the Rutenberg scheme for harnessing the Jordan for the electrification and irrigation of Palestine, work on which was commenced early in 1928. By the beginning of this year, the Yarmuk dam was nearly completed, and the head-race canal had been excavated and filled, so that it only waits for the rainy season to be lined with concrete. The excavation of the Jordan-Yarmuk canal is proceeding, and the building of the dam across the Jordan will begin soon. At the end of the eight months Haifa should be supplied with hydro-electric power from the Jordan. Soon after power will be carried by h.p. lines to Jaffa and district. Then all but Jerusalem will be supplied with electricity from the Jordan. A British company has the rights of a pre-War concession for the lighting of the latter city. The Jordan power house will consist of three 8,000-h.p. turbo-generators at first, and a fourth is to be added later, when definite data on the amount of water available have been obtained. This power house will at first use the unregulated waters of the River Yarmuk, supplementing them, especially in summer, by required amounts of the Jordan water stored in Lake Tiberias. The second power house at Abadieh will be erected when the demand for power rises to the maximum capacity of the first. Both will then be using all the waters of the Jordan and Yarmuk, drawn together through Lake Tiberias. If necessary a third power house will be built to the north of Lake Tiberias, utilising the fall of 200 metres in the Jordan between Lakes Meron and Tiberias.

Perth.—ELECTRICITY IN BULK.—The Corporation Electricity Committee has considered correspondence with the Grampian Electricity Supply Company with regard to obtaining a bulk supply of electricity from the company, and a sub-committee is to inquire and report.

Prestatyn.—LOAN.—The Urban District Council is applying for sanction to a loan of £10,000 for mains, services, and meters.

South Africa.—JOHANNESBURG.—Satisfactory progress is being maintained in connection with the installation of the 10,000-kW turbo-generator at the new power station of the City Council. The main building has been completed, and the transformers, switchgear, and cooling towers have been installed. The coal-handling plant and railway siding are almost finished. Four new boilers are to be installed, and the total cost is expected to exceed £500,000.

PIETERSBURG.—The Municipal Council has adopted a report from its consulting engineer (Mr. A. E. Val Davies) regarding the further development of the electricity undertaking. The Council is to erect a new power station which will contain two boilers operating at 200 lb. and 550 deg. F., together with an economiser and two new 150-kW alternators, and one 150-kW set to be transferred from the existing station. The total cost of the scheme, including cables and sub-stations and the changing of the voltage to 220/380 is estimated at £24,765.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Electric Supply Corporation, Ltd., authorising the transfer of the undertaking authorised by the Exmouth Electricity Special Order, 1923, and the powers granted under this Order to a company registered or to be registered; the West Hampshire Electricity Co., Ltd., to supply electricity in the rural districts of Alresford and Droxford, and part of the rural district of Winchester; the Mersey Power Co., Ltd., to supply in part of the parish of Weston; and Colne Corporation, to supply electricity in the urban district of Trawden.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Electricity Company of Macclesfield, Ltd., to supply electricity in the urban district of Bollington and part of the rural district of Macclesfield.

The following Special Orders made by the Commissioners have been confirmed by the Minister of Transport: Glaslyn and Deudraeth Rural Districts Electricity Special Order, 1929 (undertakers: Gwynedd Trust, Ltd.); Tonbridge Electricity (Extension) Special Order (Tonbridge Urban District Council); North Somerset Electricity (Extension) Special Order (North Somerset Electric Supply Co., Ltd.); and Brentwood and District Electricity (Extension, &c.) Special Order (Brentwood and District Electric Co., Ltd.).

Stoke-on-Trent. — LOANS SANCTIONED. — The Corporation Electricity Committee has received sanction to loans of £13,000 for overhead lines and £5,000 for transformer, switchgear, and metering equipment.

Torquay.—INQUIRY DECISION.—At a meeting of the Electricity Committee, the town clerk reported that the Electricity Commissioners, after careful consideration of the evidence given at the inquiry held at Torquay, had decided to refuse the application of the Teignmouth Electric Lighting Company, Ltd., and to grant the application of the Corporation on the following terms and conditions, *viz.*, the necessary steps to be taken by the Corporation to include the parish of Widecombe-in-the-Moor within the proposed area of supply; the non-statutory undertaking in the urban district of Buckfastleigh to be purchased from the Teignmouth Company on terms to be agreed between the parties or failing agreement to be determined by arbitration; and the maximum price scheduled to the Torquay order to be reduced from 1s. to 10d. per kWh with minimum quarterly charges on the usual basis.

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Trowbridge.—Overhead Lines.—As an outcome of an inquiry held in January last, the Ministry of Transport has allowed the appeal of the West Wilts Electric Light & Power Co. against the decision of the Urban District Council requiring the use of steel poles for the overhead lines in Gloucester Road and Wesley Road. The company will therefore be empowered to use wooden poles.

Wing.—Electricity Supply.—The Rural District Council has decided to approach the Luton Town Council with the object of obtaining a supply of electricity for the Ivinghoe district from the h.p. transmission line to be erected between Cheddington and Ivinghoe to Aylesbury.

Tramway and Railway Notes.

Acton.—Tramway Scheme.—The Middlesex County Council has reported that it obtained powers in 1925 to construct a connecting link of tramway to enable the Metropolitan Electric Tramways to connect up with the London United Tramways at Horn Lane, Acton. The proposed route of the connecting link is The Steyne and Rectory Road, Acton, and negotiations have been conducted with the Metropolitan Electric Tramways Co., with the object of ascertaining whether it is prepared to include this new tramway link in the system. The company has intimated that before agreeing to operate the new tramway, it desires to know whether it is the County Council's intention to charge against the tramway undertaking the expenditure which will be incurred in the necessary road widenings. The Council is of opinion that no charge in respect of acquisitions should be debited to the cost of the tramway scheme.

Australia.—Launceston (Tasmania).—The report on the working of the city tramway undertaking (superintendent: Mr. R. J. Strike) for the year ended June 30th last shows a total revenue of £49,946, and working expenses of £35,979, leaving a gross profit of £13,967. The figures for the preceding year were: Income, £51,342; working expenses, £39,648; gross profit, £11,694. Capital charges absorbed £8,922, and there was a net surplus of £5,045, as compared with £2,608 in the previous year. The number of passengers carried increased by 224,879 to 4,720,083, and the car-miles run by 3,265 to 472,970. The revenue per car-mile rose from 22.372d. to 22.668d.

Blackburn.—Penny Fares.—The Corporation has again approved penny fares on several routes in the borough. The system was given an experimental trial some time ago and discontinued on account of loss of revenue.

Croydon.—Tramcar Improvements.—Having regard to the increased receipts from top-covered tramcars the Corporation Tramways Committee has recommended the reconditioning and covering of nine further cars at a cost of £4,000.

Japan.—Electric Railways.—The survey of the Koriyama-Yumoto electric railway has been completed and application has been made for permission to commence the work of construction. The railway will be constructed between Koriyama station on the Government North-Eastern Line and Yumoto-machi, a distance of approximately 27 miles.

The Hankyu, Hanshin and Keihan Electric Railway Co., has in hand a scheme for the construction of a rapid transit electric railway between Osaka and Miyazu, a distance of 67 miles. The distance will be covered in about two hours, as compared with 2½ hours now taken by the Government service.

Lincoln.—Abandonment of Tramway.—The Corporation tramway service was abandoned on March 4th, and motor-omnibuses have been introduced.

Mexico.—Railway Electrification.—The Mexican Railway Co. has electrified a further 30 km. of its line between Cordoba and Paso del Macho, making a total of 103 km. electrically operated. A second sub-station with two 1,500-kVA synchronous motor-generators has been installed at Potrero.

Rothesay.—Abandonment of Tramway.—Application has been made to the Secretary of State for Scotland by the Rothesay Tramways Co., Ltd., for an Order enabling it to make provision for a temporary discontinuance, and ultimately the abandonment of its tramway. The company proposes to substitute motor omnibuses for the existing tramway service.

South Africa.—Railway Electrification Cost.—The *South African Engineer* reports that the Auditor-General gives the following figures regarding the cost of electrifying the Glencoe-Maritzburg section of the Natal railway system. Excluding the cost of electric locomotives, the total expenditure on the electrification of the 170 miles, including the Howick branch, to March 31st, 1928, was £4,473,811. Adding £1,160,959 as the expenditure on the electric locomotives to the same date, the total cost was £5,634,771. Further expenditure has to be incurred owing to damage by electrolysis to the concrete mast foundations. This, the Audtor-General states, is estimated at £20,350, of which £10,350 will be spent on preventive measures.

Southern Railway.—Progress During 1928.—The report of the Southern Railway Co., for the past year, states that the colour light signalling already introduced in the London area has proved very efficient and the system has been installed on the lines between London Bridge station and Bricklayers' Arms Junction. In March last a further stage of the electrification scheme, comprising the equipment of the lines from London Bridge to Tattenham Corner and Caterham and the line from Sydenham to Norwood Junction *via* Crystal Palace was completed. Another section from London Bridge to Sutton and Epsom Downs, Victoria to Peckham Rye, Tulse Hill to Crystal Palace and Streatham Hill, was brought into use in June last. A further stage was expected to be ready for use in March, comprising the following lines: Victoria to Mitcham Junction, Sutton and Epsom; Herne Hill to Tulse Hill; Streatham to Wimbledon; and Crystal Palace to Beckenham Junction. (Electrified services on these routes were put into operation on March 3rd and 4th.) It is anticipated that by the end of this year the a.c. system adopted on the L.B. & S.C. lines in 1909, will be entirely superseded by the system of d.c. working, thereby standardising the method of traction throughout the company's electrified area. The capital expenditure during the year amounted to £1,079,145, of which £8,900 was for electrification of suburban lines, and £106,118 for electrical equipment of trains. Estimates of further capital expenditure include £215,000 for electrification of suburban lines, and £60,000 for electrical equipment of trains.

Swansea.—Mumbles Railway.—The electrification of the Mumbles Railway has been completed, and a service of electric trains commenced on March 2nd. Power for the railway is supplied from Swansea Corporation power station, and a sub-station has been erected at Blackpill for this purpose.

Tottenham.—Tramway Scheme.—The Middlesex County Council Highways Committee, reporting upon the present position of the scheme for widening and reconstructing Broad Lane and Ferry Lane, Tottenham, and also upon the proposal for the construction of a new light railway, states that steps should now be taken for the necessary powers. The Metropolitan Electric Tramways, Ltd., has agreed to take over a new lease of this light railway at an annual rental of £4,000 provided the County Council refunds the amount already expended by the company (approximately £36,000) for the purposes of the light railways authorised by the Tottenham and Walthamstow Light Railways Order, 1906.

Telegraph and Telephone Notes.

Canada.—Wireless Communication.—The terms of the agreement between Canada, the United States, Newfoundland, and other North American countries in connection with the assignment of frequencies in order to control the wireless band throughout the Continent have been announced, the agreement being the result of the International Conference held at Ottawa in January last. The part of the agreement dealing with commercial wireless services gives Canada and Newfoundland 103 general communication channels, compared with 146 for the United States, 20 for Cuba, and 24 for other North American countries. The agreement came into force on March 2nd for three years. The division of wireless channels between Canada and the United States is satisfactory to the Canadian authorities.—*Reuter* (Ottawa).

Czecho-Slovakia.—Radio Station.—The Czecho-Slovakian telegraph authorities have recently placed a contract with the Telefunken Gesellschaft, of Berlin, for the establishment and equipment of a short-wave wireless telegraphy station at Podeprady, near Prague.

Sardinia.—Telephone Communication.—It is reported from Milan (Italy) that the Minister of Communications has ordered preparations to be made for the laying of a submarine telephone cable to Sardinia. Wireless telephone communication is also to be established with the island.—*Reuter's Trade Service* (Milan).

South Africa.—Railway Telephone Development.—In his annual report for 1928 the general manager of the South African Railways and Harbours stated that a comprehensive telephone construction programme had been adopted to improve communication over the system. A sum of £200,000 is to be spent during the next three years, and the work provided for in the first year's programme is in hand.

The Telephone Service.—North Wales.—The annual progress report for 1928 relative to the Chester, North Wales and Hanley district (superintending engineer: Mr. R. A. Weaver, M.I.E.E.) indicates that the net addition to the number of telephones was 2,584, or 7.5 per cent., the total number being 37,187. In rural areas 6 exchanges were opened, and 7 others are to be opened; 3 automatic exchanges were

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opened, and others are in course of construction, while one new manual exchange was inaugurated and the extension of others added 1,965 subscribers' lines. During the year 1,262 miles of wire was brought into use for trunks and telegraphs, and 14,523 miles for subscribers' telephones, making a grand total of 124,295 miles of underground wires. Overhead wires for trunk and local services amounted to 2,041 miles, bringing the total up to 65,501 miles, an increase of 3.2 per cent.; the increase in underground wires was 1,262 miles for main lines and 14,523 for subscribers. Public kiosks increased by 43 to 82. The number of effective trunk calls increased to 3,898,971, an increase of 5.4 per cent. Telegrams passed over the telephone lines totalled 315,124, an increase of 6.3 per cent. The total local and junction calls originated was 15,670,278, an increase of 3.3 per cent.

NEW LONDON EXCHANGES.—Nine new exchanges were added to the Greater London telephone area last week, a "record." Archway Exchange took over subscribers in the Highgate district, Emberbrook relieved the pressure in the rapidly-growing Kingston area, Flaxman took over part of Kensington, and Hillside part of Finchley; Metropolitan received its first subscribers by a transfer from London Wall, and National was brought into existence to cope with the ever-growing traffic in the City. These six new exchanges, together with Pollards in Norbury, and Valentine in Ilford, are at present being operated as manual exchanges, but Archway will be transferred to the automatic system on March 9th. The ninth new exchange is Temple Bar, which was opened on March 2nd, and is automatic. The total number of exchanges in Greater London is now 138, as compared with 120 a year ago. In the same period the number of telephones in the Greater London area has increased from 555,592 at the end of January, 1928, to 604,349, the latest official figure available.

FIRE.—The Post Office Telephone Department accomplished in 48 hours the task of installing at Llandudno complete manual telephone plant as a temporary substitute for the automatic system which was recently put out of action by fire.

Transatlantic Telephony.—PROPOSED CABLE.—So greatly has the use of the transatlantic wireless telephone service increased and so overloaded are the present facilities that the American Telephone and Telegraph Company has decided to spend much money on laying a special submarine telephone cable across the Atlantic Ocean. This fact emerges from the annual report of the company issued on March 1st, which states that the stockholders number over half a million, while approximately 20,000,000 telephones are now in use in the United States. Last year the company spent 400,000,000 dollars on extending its services and on reconstruction work.—*Reuter's* (New York).

United States.—FORD RADIO STATIONS.—The Radio Commission has refused the application of the Ford Company for construction permits and commercial licences for six stations by means of which it desires to establish communication between its plant at Dearborn, near Detroit, and its rubber plantations in Brazil.—*Reuter* (Washington).

Radio Notes.

B.B.C. Problems.—REPRODUCTION.—Some problems of broadcasting were touched upon by Mr. David Curd, engineer-in-charge of the Plymouth station of the B.B.C., in an address before the Plymouth Rotary Club on February 22nd. The handling of frequencies was one of the most important things in broadcasting. The results were transmitted quite true, and they gave listeners the various harmonics of a person's voice. They put those tones on the line, but most of them were cut off and sometimes all the little harmonics lost by the receiver at the other end. He deplored the fact that the correction, or "tone sauce," supplied by the engineer often lost its effect owing to listeners' sets. They could never persuade the public that they did transmit pure music, and he argued that in all large towns there ought to be a salon, or some sort of parlour, where people could be taken to listen to radio broadcasting as it really was. Mr. Curd advised listeners who were seriously concerned with the reception of music to study the improvement of the acoustics of their rooms. Little re-arrangements like hanging a curtain, or taking one down, or shifting some of the furniture, very often made a tremendous improvement in reception. If listeners, instead of trying to get anything from long-distant foreign stations, would concentrate upon true production from their nearest station, they would get more enjoyment for their money.

International Radio-telephony.—GENEVA PRINCIPLES.—The Juridical Committee of the International Union of Radiophony has laid down a number of guiding principles regarding the relations to be established between radiophonic societies, and the compilation of statistics regarding the procedure followed in each country.

RELAYS.—The Relay Committee has had under consideration the practical development of international relays, and the Council has decided that the International Union shall meet in Lausanne at the end of May next to discuss legal questions and problems of inadmissible propaganda, the extension of existing services, the control of wave-lengths, and other cognate matters.—*Reuter* (Geneva).

Italy.—NEW STATIONS.—The E.I.A.R.A. has acquired a large piece of land near the Piazza Mazzini, Rome, where a building is to be erected to contain a number of studios, as well as the equipment required for transmission, and administrative offices. The largest studio will be approximately 72 by 45 by 36 ft. in size; there will be four smaller studios, two of which will be reserved for talks and lectures. Sanction has also been given for the construction of a new station near Rome, about 25 km. from the city, to have a power of 50 kW (aerial). It will be put into operation this year, says *World-Radio*, and provision is also being made for a short-wave station near Rome; with an aerial power of 12 kW, it will be designed for frequencies between 12,000 and 3,750 kH (25 and 80 m.) and it will transmit normally on two wave-lengths with two aerials; the higher wave-length to be used for medium distances, and the lower for long distances, for instance, to the Italian colonies in East Africa.

Short-wave Signals.—ECHO PHENOMENON.—At the Academy of Science at Oslo on March 2nd Professor Stoermer lectured on the much discussed echo phenomena in connection with short-wave signals from the wireless station at Eindhoven, Holland, which were observed last October. A close watch was kept from Norway to Spitsbergen, but no further echoes were heard until the latter half of February, when they were heard in Norway, England, and Eindhoven. The time between the dispatch of a signal and the echo varied from eight to twenty-five seconds, and it is taken for granted that whatever the explanation may be the phenomenon is genuine and not imaginary. Professor Stoermer some time ago dealt with the occurrence in a British scientific journal, and predicted that there would be a recurrence of the echoes in the middle of February.—*Reuter* (Oslo).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—March 15th. Victorian Railways. Armoured telephone cable. (B.X. 5126.)*

Beckenham.—Electricity Department. L.p. feeder pillars. (See this issue.)

Belgium.—ANTWERP.—March 22nd. Municipal Council. Electrical cable and accessories. (B.X. 5124.)*

Cardiff.—March 19th. Electricity Department. E.h.p. and l.p. cables, and one natural draught cooling tower. (March 1st.)

Dundee.—March 13th. Electricity Department. L.p. cable. (March 1st.)

Edinburgh.—March 18th. Electricity Supply Committee. H.p. sub-station switchgear. (See this issue.)

March 25th. Electricity Supply Department. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuse-boards, electricity supply meters. (February 15th.)

Earby.—March 20th. Urban District Council. Complete electricity distribution scheme. (See this issue.)

March 15th. One 1,500-kW motor convertor. (February 22nd.)

Fort William.—March 12th. North British Aluminium Co., Ltd. Material required for the electric power and lighting distribution system at the works near Fort William. (February 22nd.)

Gloucester.—March 25th. Electricity Department. Two 1,000-kW motor-generators. (See this issue.)

Harrogate.—March 23rd. Electricity Department. Cables, joint boxes, joint box compound, service meters, cut-outs and transformers for 12 months. (See this issue.)

Hull.—March 21st. Electricity Committee. Electrically-driven circulating water pump, motor, motor-starter, &c. (March 1st.)

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March 21st. Electricity Committee. Three 1,500-kW motor-convertors. (See this issue.)

Ilford.—March 25th. Electricity Department. Supply of paper-insulated cables. (See this issue.)

Lancaster.—March 18th. Electricity Department. Two water-tube boilers (36,000 lb. per hour), with mechanical stokers, economisers, air heaters, steel chimney and fans. (February 22nd.)

London.—Central Electricity Board.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

Metropolitan Asylums Board.—March 20th. Installation of automatic telephone system at the North-Western Fever Hospital, Lawn Road, Hampstead. (March 1st.)

Bethnal Green.—March 25th. Borough Council. Electric lighting installation at seven blocks of tenement buildings in Bethnal Green. (See this issue.)

Manchester.—March 18th. Central Purchase Committee. Incandescent electric lamps for 12 months. (See this issue.)

New Zealand.—Wellington.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Oldham.—March 11th. Board of Guardians. Electric lamps and fittings. Form of tender from Mr. F. W. Fletcher, clerk to the Guardians, Union Offices.

Pentre, Rhondda.—March 30th. U.D.C. Electricity Department. A.c. ordinary and prepayment meters, mains and house service material. (March 1st.)

Perth.—March 11th. Corporation. Electric lighting installation for the housing scheme. Schedules (deposit £1) from T. McLaren, burgh surveyor.

Sheffield.—March 14th. Electricity Supply Department. Buildings and civil engineering works and constructional steelwork, transformers, pipework and valves, e.h.p. switchgear, battery shunting locomotive and accessories. (February 22nd.)

South Africa.—Johannesburg.—March 21st. Town Council. 65,500 porcelain insulators. (B.X. 5114.)* Weatherproof wire. (B.X. 5113.)*

Stourbridge.—March 21st. Board of Guardians. Electric lamps, shades, &c., for six months. G. F. James, clerk, 12, Hagley Road.

Warrington.—March 11th. Electricity and Tramways Committee. Motors and transformers. (February 22nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—Electric Supply Committee. Accepted:—
Rotary converter for Belchers Lane sub-station.—Harland Engineering Co., Ltd.
Transformers for sub-stations.—Hackbridge Electric Construction Co., Ltd.
Works in connection with installation of grit collectors at Prince's power station, Nechells.—Thomas Piggott and Co., Ltd.
Constructional steel work for extensions at Water Street and at Chester Street sub-stations.—E. C. & J. Keay, Ltd.
Overhead cranes.—Herbert Morris, Ltd.
Vacuum dust-extracting plant at Summer Lane power station.—British Vacuum Cleaner and Engineering Co., Ltd.
Mental Deficiency Act Committee. Accepted:—
Installation of apparatus for electric lighting at Coleshall Hall Mental Home.—T. Glover.
Overhead equipment and underground cables.—Callender's Cable and Construction Co., Ltd.
Education Committee. Accepted:—
Electric generating plant and electric lighting installation for Boys' Camp School, Clent, and installation of apparatus for electric lighting at Dolphin Lane School.—Reynolds & Bradwell.
Installation of apparatus for electric lighting.—At Colmore Road School, Baxter & Impey; at Birches Green School, R. H. Newton; at King's Norton Secondary School, Ray Electrical Co.
Cleansing Committee. Accepted:—
Three electric vehicles.—Electricars, Ltd. One ditto.—General Vehicle Co., Ltd.

Black Notley.—Essex County Council. Accepted:—
Work in connection with electrical installation at new sanatorium (£1,879).—Christie Bros. & Co., Ltd.

Brentwood.—Essex County Council. Recommended:—
Electric wiring and installation of motors at Mental Hospital (£9,675).—Power Contracts, Ltd.

Brighton.—Lighting Committee. Recommended:—
Works at Southwick power station.
C.i. pipes, &c. (£1,791), Staveley Coal and Iron Co., Ltd.; valves, penstocks, &c. (£1,825), Blakeborough & Sons, Ltd.; centrifugal pumps (£2,936), Worthington-Simpson, Ltd.; grid screens, platforms, &c. (£880), Ledward & Beckett, Ltd.
Two boilers (each of 75,000 lb. evaporation), £46,130.—Yarrow & Co., Ltd.
Extension to circulating water system at Southwick (£16,445).—Cochrane & Sons.

Chelmsford.—Essex County Council. Recommended:—
Two electric lifts at new county offices (£1,379).—Waygood-Otis, Ltd.

Cheltenham.—Stores Committee. Recommended:—
Electric light fittings.—Sharpe & Fisher, Ltd.

Chesterfield.—Electricity Committee. Accepted:—
Spare armatures for turbo condenser motors (£182).—English Electric Co., Ltd.
Governing control gear (£168).—Metropolitan-Vickers Electrical Co., Ltd.

Eastbourne.—Electricity Committee. Accepted:—
Assisted wiring scheme (16s. 6d. per point).—Blaine and Parris.

Guildford.—Electricity Committee. Accepted:—
Equipment in connection with supply to Clandon Park:—
25-kVA kiosk (£100), Ferguson Pailin, Ltd.; 10-kVA kiosk (£35), W. Lucy & Co., Ltd.

Herne Bay.—Pier Committee. Accepted:—
New armoured cable from pier entrance to Grand Pier Pavilion (£120).—Herne Bay and District Electricity Co., Ltd.

Ilford.—Tramways Committee. Recommended:—
Rail grinder (£330).—Equipment and Engineering Co., Ltd.

Irish Free State.—Dublin.—City Commissioners. Recommended:—
Electric wiring of houses on the Emmet Road (Extension) Area (£5,271).—Hall & Srinson, Ltd.

Lamp Contracts.—The following contracts for electric lamps have been placed recently:—
Islington Borough Council.—Nelson Electric Co., Ltd.
Cheadle and Gatley Urban District Council.—Edison Swan Electric Co., Ltd.
London, Midland and Scottish Railway Co.—Siemens Electric Lamps and Supplies, Ltd.; Edison Swan Electric Co., Ltd.
Government of Northern Ireland.—Edison Swan Electric Co., Ltd.
Camberwell.—Public Service Committee.—General Electric Co., Ltd.

London. — Battersea. — Electricity Committee. Recommended:—
Two 500-kVA transformers (£467); British Electric Transformer Co., Ltd.; switchgear (£1,167), Bertram Thomas.
Earthing resistance system at power station (£204).—Metropolitan-Vickers Electrical Co., Ltd.
Health Committee. Accepted:—
Lamps and apparatus for Solarium at Southlands (£187).—Watson & Sons (Electro-Medical), Ltd.
Hammersmith.—Electricity Committee. Annual contracts. Recommended:—
Stoneware conduit.—Doulton & Co.
Insulating compound.—Dussek Bitumen Co., Ltd.
Cables.—Connollys (Blackley), Ltd.
Insulated wires.—W. Geipel, Ltd.
House service and joint boxes.—W. Lucy & Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd., and Metropolitan-Vickers Electrical Co., Ltd.
Meter boards.—W. T. Henley's Telegraph Works Co., Ltd.
Metropolitan Asylums Board.—Works Committee. Installation of electric light at the Southwark Casual Ward:—

H. Lewis & Co. (Recommended.)	£105
A. Hawkins & Sons	160
Alpha Manufacturing & Electrical Co., Ltd. ...	160
S. Reed & Sons	161
Hall's Longitudinal Lighting Co., Ltd.	171
Read & Partners, Ltd.	178
Toy & Winslow	193
J. Briggs, Electrical Contractors, Ltd.	197
Harden & Chinery	219.
J. Nicoll & Sons	284

London County Council.—Education Committee.
Electrical installation at Beaufoy Institute:—

Stegman & Co. (Recommended)	£390
Electrical Installations, Ltd.	435
Buchanan & Curwen	510
Smethurst & Co. (London), Ltd.	515
W. H. Gaze & Sons, Ltd.	558

Highways Committee. Cables, reactors and control battery in connection with the new switchgear for Greenwich power station:—
Cables and reactors:—

General Electric Co., Ltd.	£2,075
Standard Telephones & Cables, Ltd.	2,242
British Thomson-Houston Co., Ltd.	2,278
Callender's Cable & Construction Co., Ltd. ...	2,340
Siemens Bros. & Co., Ltd.	2,342
W. T. Glover & Co., Ltd.	2,343
Macintosh Cable Co., Ltd.	2,372
Johnson & Phillips, Ltd.	2,405
British Insulated Cables, Ltd.	2,399

The Committee reported that an examination of the various tenders showed that it would be to the Council's advantage

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to divide the work. The lowest offer for the reactors was that of the General Electric Company, Ltd. (£802, including provisional sum), and for the remaining items that submitted by Standard Telephones and Cables, Ltd. (£1,234, including provisional sum); and, it having been ascertained that these two companies would be prepared to enter into contracts for part only of the items of the section, the Committee has accepted the tender of the former company so far as it relates to reactors and that of the latter company so far as it relates to the remaining items.

Control battery :—

EDISON SWAN ELECTRIC CO., LTD. (Accepted.) ...	£452
Alton Battery Co., Ltd.	562
Tungstone Accumulator Co., Ltd.	628
Fuller Accumulator Co. (1926), Ltd.	647
D.P. Battery Co., Ltd.	672
Pritchett & Gold and E.P.S. Co., Ltd.	672
Chloride Electrical Storage Co., Ltd.	679
Premier Accumulator Co. (1921), Ltd.	679
Hart Accumulator Co. (1926), Ltd.	684
British Thomson-Houston Co., Ltd.	690
Tudor Accumulator Co., Ltd.	695
Siemens Bros. & Co., Ltd.	746

Maidenhead.—Town Council. Accepted :—
Two additional 100-kVA transformers, with tapping switches (£244).—Hackbridge Electric Construction Co., Ltd.

Newbury.—Main Drainage Committee. Accepted :—
Electrically-driven pumping plant at sewage works (£899).—Hathorn, Davey & Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted :—
Steam, water piping, valves, &c., in connection with central power house extensions (£11,939).—Aiton and Co., Ltd.
Supply of cables and laying mains for 12 months.—Callender's Cable and Construction Co., Ltd.
Sub-station switchgear.—Metropolitan-Vickers Electrical Co., Ltd.
Sub-station transformers: 200 kVA, British Thomson-Houston Co., Ltd.; 800 kVA, Metropolitan-Vickers Electrical Co., Ltd..
Overhead wiring and services for 170 houses at Hanford estate (£477).—Barnett & Soans.
Watch Committee. Accepted :—
Electric lighting installation at Stoke Police Station (£96).—Painter & Madew.

Wimbledon.—Electricity Committee. Accepted :—
One 2,000-kVA Transformer (£635).—Metropolitan-Vickers Electrical Co., Ltd.
L.p. switchgear (£2,065).—George Ellison.
H.p. switchgear (£1,259).—English Electric Co., Ltd.
Extra-h.p. switchgear (£2,922).—A. Reyrolle & Co.

York.—Education Committee. Accepted :—
Electric lighting installation at Clifford Street Technical Institute (£490).—Corporation Electricity Department.
Watch Committee. Accepted :—
Installation of cables to police boxes (£158); supply of lighters and heaters (£54).—Corporation Electricity Department.

Forthcoming Events.

Physical Society.—Friday, March 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Royal Institution of Great Britain.—Saturdays, March 9th and 16th. 21, Albemarle Street, W. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford, P.R.S.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, March 12th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "The Design of Feeder Pillars, Cable End Boxes, &c." Mr. P. Dunsheath.

(Manchester Local Group).—Thursday, March 14th. Geographical Hall, Manchester. 7.45 p.m. "Modern Switchgear Practice." Mr. G. Cluley.

Electroplaters' and Depositors' Technical Society.—Wednesday, March 13th. Northampton Polytechnic Institute, E.C. 8.15 p.m. "Electroplating Plant." Mr. J. W. Perring.

Institution of Engineers-in-Charge.—Wednesday, March 13th. St. Bride Institute, E.C. 7.30 p.m. "Recent Developments in Superheating." Mr. J. S. Evenden.

Royal Society of Arts.—Wednesday, March 13th. John Street, Adelphi, W.C. 8 p.m. "Loud Speakers." Mr. R. P. G. Denman.

British Electrical Development Association. — Thursday, March 14th. Piccadilly Hotel. 7 for 7.30 p.m. Annual dinner.

Friday, March 15th. Royal Society of Arts, John Street, Adelphi. 7.30 p.m. "Water Heating Development."

Institution of Electrical Engineers.—Thursday, March 14th. Institution, London, W.C. 6 p.m. "Electrical Insulating Papers for the Manufacture of Power Cables." Messrs. T. N. Riley and T. R. Scott. "The Prevention of Ionisation in Impregnated Paper Dielectrics." Messrs. S. G. Brown and P. A. Sporing.

(North-Eastern Centre).—Monday, March 11th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Faraday Lecture, "How Electricity Does Things." Mr. Ll. B. Atkinson.

(Scottish Centre).—Friday, March 8th. Cowdray Hall, Aberdeen. Faraday Lecture, "How Electricity Does Things." Mr. Ll. B. Atkinson.

Tuesday, March 12th. North British Station Hotel, Edinburgh. 7 p.m. "The Construction of the Grid Transmission System in Great Britain." Messrs. J. Wright and C. W. Marshall.

(Western Centre).—Monday, March 11th. Bristol. 6 p.m. "Electricity in Agriculture, with special reference to Electro-culture." Mr. W. Phœnix.

(North Midland Centre).—Tuesday, March 12th. Hotel Metropole, Leeds. 7 p.m. Annual dinner.

(Dundee Sub-Centre).—Thursday, March 14th. University College, Dundee. 7.30 p.m. "Overhead Electric Lines." Mr. W. B. Woodhouse; "Distribution," Mr. W. Woodiwiss.

(North-Eastern Students' Section). — Wednesday, March 13th. Joint meeting with the North-East Coast Institution of Engineers and Shipbuilders, Graduate Section. Bolbec Hall, Newcastle-on-Tyne. 7.15 p.m. "The Problem of High Voltage Measurement." Mr. M. Waters.

(London Students' Section).—Friday, March 15th. Institution, London, W.C. 6.15 p.m. "Wave-Form Analysis." Mr. C. F. J. Morgan.

British Institute of Radiology (incorporated with the Röntgen Society).—Thursday, March 14th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

Association of Mining Electrical Engineers (Western Sub-Branch).—Saturday, March 16th. 60, Wind Street, Swansea. Informal discussion of the report of H.M. Electrical Inspector of Mines for 1927.

Notes.

The E.P.E.A. (Western Section) Dinner.

The ninth annual dinner of the London Western Section of the Electrical Power Engineers' Association was served at St. Ermin's Hotel, Westminster, on March 2nd, Mr. E. F. Hall presiding over a gathering of some 100 members and guests, and their ladies.

Mr. P. E. RYCROFT, M.B.E., M.I.E.E., following the loyal toast, proposed "The Association," enumerating its virtues and achievements; no scheme it had proposed had ever proved to be otherwise than of practical benefit. They all wanted to get on, and wished the world to appreciate the importance of the engineer; the E.P.E.A. would continue to raise his status if it were given the support it deserved.

Mr. A. E. RICKETTS (junior vice-president of the E.P.E.A.) responded.

Mr. W. J. OSWALD, A.M.I.E.E., toasted the ladies, but the Mayoress of Hammersmith (Councillor Mrs. B. J. Samuels), who was to have replied, was prevented by indisposition from being present.

Mr. J. F. SARVENT proposed "Our Section and Our Chairman," and Mr. E. F. HALL briefly replied.

A musical entertainment contributed materially to the enjoyment of a successful function.

Educational.

The Scottish Education Department has issued a circular (Rules 4) describing the arrangements and conditions for the award of the national certificates and diplomas of the Institution of Electrical Engineers in conjunction with the Department. Copies of the circular may be obtained at H.M. Stationery Office, for 2d. net.

Appointments Vacant.

Third class electrical engineering draughtsman (temporary) (£165) for the Metropolitan Asylums Board. Switchboard attendant for the Basingstoke Corporation Electricity Department. System control engineer (450 taels per month), assistant charge engineers (350 taels per month) (tael=2s. 7d.) for the Shanghai Municipal Electricity Department. Lecturer in electrical engineering for the Rugby College of Technology and Arts. Linesman jointer for the Milford Haven Urban District Council. Plumber jointer for the Willesden District Council Electricity Department. Three consumers' accounts clerks (£135); assistant constructional (electrical) engineer (£416), for the Manchester Corporation Electricity Department. Assistant engineer in the Electrical Department of the Buenos Ayres and Pacific Railway, Argentina (£418). (See our advertisement pages to-day.)

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E.A.W. Activities.

On February 12th the Birmingham and Midlands Branch of the Electrical Association for Women held an "Outlet Campaign" meeting, at which Mrs. L. A. Wilson, M.B.E., spoke on "House Problems from the Women's Point of View." Mr. T. R. Martin spoke on the "Red Seal" Campaign in Canada, and Mr. Forrest, M.I.E.E., spoke from the supply engineer's point of view.

The North Wales Branch of the Association had an enjoyable visit to the Sunlight Soap Works at Port Sunlight on February 5th. Mr. Price F. White, borough electrical engineer, Bangor, gave a lecture on "Domestic Appliances" at Llanfairfechan on February 22nd, and at Pennaenmawr on February 28th.

King's College Centenary Appeal.

In connection with the centenary commemoration this year of the establishment of King's College, University of London, an appeal is being made for £350,000 to meet requirements for buildings and endowments. The College is now, with the approval of the Senate, acquiring a 200 years' lease of an area of nearly 5,000 sq. ft. above the Aldwych station. Plans have been prepared for the erection on this area of a new building to accommodate several departments which are now inadequately housed. The attention of our readers is drawn to the special arrangements which are being made to secure endowments for the Chair of Physics, now occupied by Prof. E. V. Appleton, F.R.S., and the Chair of Electrical Engineering which, since the untimely death of Prof. J. Hopkinson, F.R.S., in 1898, has been held by Prof. Ernest Wilson, Wh.Sch. The discoveries and inventions which have been made in the laboratories of the College, the promise of new developments contained in the original investigations which are now being carried on, and the continuous supply of personnel trained in these two departments, are of immense value to the electrical and allied industries, and it is hoped that the firms to whose benefit the College contributes in so many ways will generously support the ambition to place the two chairs in the position of dignity and financial security which their importance deserves.

Some of the discoveries, inventions and investigations made in the laboratories of the College during the last hundred years are: electric telegraph, Prof. Sir Charles Wheatstone, F.R.S., and W. F. Cooke; invention of Daniell cell, J. F. Daniell, F.R.S.; discovery of existence of electromagnetic waves, Prof. James Clerk Maxwell, F.R.S.; quantitative basis of the design of the filament of the thermionic valve, Prof. O. W. Richardson, F.R.S.; investigations on wave form of atmospherics and the effects of thunderstorms on radio-telegraph receivers, measurements of the height and investigations on the influence of the Heaviside Layer in causing signal fading, Prof. E. V. Appleton, F.R.S.; properties of selenium now utilised in selenium cells, Prof. W. Gryll-Adams, F.R.S.; invention of continuous-current dynamo and invention of shunt-wound dynamo, Prof. Sir Charles Wheatstone, F.R.S.; theory of parallel running of alternators, differential method of testing dynamo electrical machines and invention of three-wire system, Prof. John Hopkinson, F.R.S.; and investigations into the corrosion of metals for overhead wires, Prof. Ernest Wilson, Wh.Sch., M.Inst.C.E., M.I.E.E.

The above summary indicates the extent of the indebtedness of the electrical and allied industries to the departments of physics and electrical engineering in King's College during the past hundred years. To-day the two departments are anually supplying trained workers to meet the demands of modern industry, while in addition to their work of teaching, all members of the staff are actively engaged in the prosecution of research. For example, among the subjects now being investigated in the Wheatstone Laboratories, under the general supervision of Prof. O. W. Richardson, F.R.S., and Prof. E. V. Appleton, F.R.S., are:—wireless wave propagation, investigations on soft X-rays, and generation of electrical oscillations by gas discharges.

The similar investigations now being carried on in the Siemens Electrical Laboratory, under the direction of Professor Wilson, include such subjects as spark potential, a.c. commutator motor, moving-coil telephones, properties of magnetic oxides, and atmospheric corrosion of electrical conductors.

Donations in response to the appeal may be sent to one of the treasurers—The Rt. Hon. Reginald McKenna, or Sir Edward Troup, K.C.B.—at the College; or they may be sent to the college bankers—Messrs. Coutts & Co., at 440, Strand, W.C.2, for the credit of King's College centenary appeal account for the physics and/or electrical engineering endowment fund.

Local Societies.

At a meeting of the Paisley Association of Electrical Engineers recently, Mr. James Orr described the electrical equipment at "Paisley Abbey."

Speaking at the annual dinner of the electrical staff of the Doncaster Collieries' Association (Limited) and the Associated Collieries at Doncaster on March 2nd, Mr. C. C. Bleach, chief electrical engineer to the Doncaster Collieries' Association, said that in 1928 the Association generated 31¾ million units of electricity, as against 16¼ million units in 1922. Outside undertakings last year took seven million units, an increase for the year of a million units.

A Reconstructed "Underground" Station.

The reconstruction of Charing Cross underground station is now practically completed. Work was commenced in 1926, and has been carried out gradually in order to cause as little inconvenience to traffic as possible. The need for construction became apparent when the new Morden tube increased the number of passengers through the station exchanges by 26,000 a day, and the new station is capable of dealing with at least 50,000,000 per year. The work commenced with the construction of a new circulating area beneath the District Railway at a point where passengers could conveniently change between that railway and the Bakerloo and Hampstead tubes below. This was followed by the installation of two escalators which linked up the intermediate hall with the new south-bound platform of the Hampstead tube, and two escalators which ran from the street level to the intermediate landing. The latter two were the first escalators to be installed at a District Railway station. The final stage was the construction of a new booking hall to replace the inadequate arcade booking office. The new hall is three times as large as the old one and has an area of 10,000 sq. ft. Automatic machines are to be installed, and in addition there will be a booking office for the issue of long-distance tickets, change-giving kiosks, and a special office for the issue of season tickets. The station fronts on Villiers Street and the Embankment are floodlighted, and the booking hall is illuminated by means of a system of lights situated outside the windows of the clerestory roof. The question of directing passengers using the station subways has been considered, and a new scheme of coloured route signs has been adopted. In the subway leading to the west-bound platform of the District Railway from which trains proceed to Victoria, green lamps have been installed at distances of about 15 ft. Similarly, the subway to the Bakerloo north-bound platform for Piccadilly Circus has red guide lights, and the subway to the Hampstead south-bound platform for Waterloo or Morden, blue lights. This scheme is only of an experimental nature at present. Another experiment is that of employing small station names on the walls opposite the platforms. It is thought that by having several small signs, the difficulty experienced by passengers, when the trains are full, to see the regular station name-plates, will be overcome.

The Batti-Wallahs' Society.

A very well attended luncheon of the Batti-Wallahs' Society was held at the Hotel Cecil, on Wednesday, February 27th, the chief guest being Lt.-Col. K. Edgcumbe, R.E. (T.), president, Institution of Electrical Engineers.

The president, Mr. R. W. Hughman, who occupied the chair, introduced Col. Edgcumbe in an exceedingly amusing speech, the main theme of which was the relative importance of the Batti Wallahs Society and the institution itself.

Col. Edgcumbe, who addressed the gathering on the subject of "Prosperity," suggested that a fair measure of prosperity could be taken as being represented by the number of good things which a fair day's work could provide for the individual. He stressed the enormous variation between the wealth of individuals in such countries as Austria and the United States. He thought that the only way in which we could increase our own prosperity was to increase the quantity of commodities which we all produce. The people of the United States had realised very clearly as a nation that a large output per individual was the surest road to wealth. Without discussing the relative merits of Free Trade and Protection, he believed that it could hardly be disputed that there was something wrong when we continued to import goods which we could readily produce at home at a period when the country was suffering so disastrously from unemployment. Government action could not help us and he hoped that we might be preserved from visionaries who desired to re-make the world on some fanciful scheme of their own without any study of the economic factors which had been brought about by centuries of slow growth. He took a rather hopeful view of the coal, iron and steel industries, and believed that considerable improvement could be looked for during 1929. Success could be said to be due to constancy of purpose, and he trusted that our purpose in the future would be to increase the home output by every possible means and for our people to buy British goods.

Mr. Snow Huddleston in a short speech thanked the president for the pleasure which his presence and his address had given the society.

Among those present were:—Col. R. E. Crompton, Mr. Arch. Page, Mr. A. A. Campbell Swinton, Mr. Ll. B. Atkinson, Mr. Roger T. Smith, Sir George Sutton, Sir Montague Hughman, Sir Robert Donald, and Messrs. A. H. Dykes, L. L. Robinson, J. Christie, P. V. Hunter, H. V. Couzens, W. E. Highfield, W. McClelland, H. J. S. Mackay and E. Reeves.

On Friday, March 1st, the Society held its twenty-third annual dinner and dance at the Hotel Cecil, London. Mr. Ll. B. Atkinson, in proposing the toast of the Society and its president, Mr. R. W. Hughman, said the Society was doing excellent work for the industry. After dinner the evening was spent in dancing: picturesque head-dresses and favours were provided for the ladies, and "brass hats" for the gentlemen, the officials sporting admirals' cocked hats. The evening was voted an enormous success by the huge company present, and the biggest hall at the Hotel Cecil has already been booked for next year's dance, on Friday, March 21st, 1930.

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Wandsworth Electricity Charges.

Wandsworth Borough Council on February 26th decided to ask the Electricity Commissioners to reopen an inquiry into prices charged in Wandsworth by the County of London Electricity Supply Co. Alderman A. W. Mathias said that the whole borough was groaning under "the excessive charges." Under the company's multi-part tariff only a few people benefited, while the vast majority did not. Fourpence a unit was the top price which the public should pay. The company had not offered the more fair and generous terms which might have been expected.—*The Times.*

The Co-ordination of Societies.

The seventh annual corporate meeting of the Institution of Chemical Engineers on March 20th will be held at Grosvenor House, Park Lane, London, W.1, under the chairmanship of the president, Sir Alexander Gibb. Non-members are invited to attend the delivery of Sir Alexander's address at 12.15 p.m. He has on various occasions spoken on the desirability of closer union between the many engineering institutions, and is taking this opportunity to develop the theme under the title of "The Co-ordination of Engineering Institutions and Societies"; members of other engineering bodies will no doubt find therein matter for consideration.

London Electrical Engineers (T.A.).

The parade of the detachment of the 27th A.A. Battalion, R.E. (London Electrical Engineers) of the Territorial Army, commanding officer, Lt.-Col. C. H. S. Evans, O.B.E., going to Easter camp will be in the Drill Hall at 10 a.m. on March 29th.

Heat Transmission in Buildings.

The Department of Scientific and Industrial Research has published Building Research Special Report No. 11 on Heat Transmission, the first portion of which contains the values of the thermal resistances of various types of walls and building materials. They will, it is thought, be found more convenient in practice than thermal conductivities. In addition, an alignment chart is given for the derivation of an approximate overall "air-to-air" transmission coefficient, so much used by heating and ventilating engineers, under different conditions of exposure. The second part of the report is a résumé of the phenomena affecting heat transmission through the fabric of buildings and the laws governing the transfer. Special attention is paid to the effect of various factors on overall coefficients of conductivity.

Notes from Switzerland.

The annual statistics concerning the output of electrical energy in Switzerland are now to hand for the past year, and it appears that the total may be divided as follows:—Energy produced in stations fed by natural waterfalls or rivers, 3,622 million kWh; energy produced in stations fed by seasonal reservoirs, 457 million kWh; energy produced in stations fed by thermal installations, 2 million kWh; energy imported and used in Switzerland, 16 million kWh, making a grand total of 4,097 million kWh. Out of this amount 2,276 million kWh has been employed in the country itself, and the remainder has been exported, to the great profit of the Confederation and electrical societies in general. The different uses to which this energy has been put may be indicated by a few figures showing how some of it has been employed. Energy employed for electric traction other than the Swiss Federal Railways, 192 million kWh; energy employed for electro-chemistry and metallurgy (not including that produced by private power stations belonging to such works), 494 million kWh; energy employed for general usage, 1,590 million kWh. The stations belonging to the Swiss Federal Railways, the Swiss Centrals, and private stations have produced 5 million kWh.

The Société Romande d'Electricité has just celebrated the twenty-fifth anniversary of its foundation by the distribution of 8,000 francs amongst the various hospitals, orphanages, almshouses, and anti-tuberculous societies of the region, and other charities. Over and above the said sum, the S.R.E. has granted another eight thousand francs to aid research; five thousand of this amount goes to the fund for old pupils of the Ecole d'Ingénieurs at Lausanne, and the rest to the laboratories of the University of Lausanne and of the Collèges of Vevey, Montreux, and Aigle.

An Automatic Rectifier Sub-station in Germany.

The inter-urban railway between Haspe, Vorde and Breckenfeld, in Germany, was recently electrified on the 1,200-volt direct-current system, which comparatively high voltage was chosen in order to feed from one point the 11½-miles section negotiated by rolling stock up to a total weight of 152 tons. The necessary energy is supplied at 10,000 volts, 50 cycles, three-phase, and is transformed to 1,200 volts d.c. by two mercury-arc rectifiers at the Schutzenhof sub-station near Haspe, the plant being so designed as to work automatically and quite independently of attendants. Each rectifier has a continuous capacity of 450 kW, and is capable of carrying peak loads of 650 kW for ten minutes and of 850 kW for two minutes. Ordinarily, only one is in service, the second being used more or less as a stand-by for the peak-load hours; it is eventually intended that the two rectifiers shall work in parallel and a third be installed as a stand-by.

Each rectifier set is protected against overload on the h.p. side by oil circuit breakers fitted with time-limit releases.

The cathodes of the rectifiers are connected to the rails, so that no dangerous voltages can occur at the rectifier vessels. The anodes are at a high potential to earth and are protected from contact by a wire guard. The main vacuum chamber within the cylindrically-shaped rectifiers is water-jacketed. The chamber is elliptically-shaped and supports the anodes from six flanges in its roof, below the cathode. The evacuation of the rectifier is effected in the usual manner by a three-stage mercury-vapour pump and a two-stage oil pump, to which it is connected, *via* the pre-vacuum chamber. All switching processes are effected by relays in the correct sequence, and the station automatically adjusts itself to the fluctuating demand on the d.c. network, *i.e.*, the individual transformers and rectifiers are automatically switched in and out as the load increases and decreases. The d.c. feeder network is also under automatic control: on the occurrence of a short-circuit, or overload, the line beaker disconnects the section affected and only re-connects it when the cause of the disturbance has been eliminated. If the demand of the railway exceeds the maximum capacity of the station, the entire plant is automatically shut down, but the station is not entirely switched out of service, because, after disconnection, the rectifiers are again switched on to the bus-bars and the automatic line breakers continually test whether there is an excessive demand on their respective feeder circuits before closing them. Should an excessive load be evident on any particular feeder, it is even then not finally disconnected, but continues to be tested at short intervals before the line breaker is opened definitely after a elapse of time, and signals are sent to the main control station that a fault which requires immediate removal has occurred. The station can be put into service either by push-button control or by time switches.

The automatic equipment of the sub-station was carried out by the A.E.G., of Berlin, and has fully satisfied expectations from the standpoint of both economy and technical efficiency. Indeed, it is claimed that the station operates more reliably and gives rise to less disturbances due to faulty switching operations than hand-operated plant does.

Electricity and Traffic Control.

Some interesting comments are given in the *Yorkshire Observer* on the application of electric colour signals to the control of traffic. The system has made rapid progress and met with marked success, not only in America, but on the Continent. It is less than a year ago that steps were taken to test this method of traffic control in this country. The original signals were installed in Leeds, at the Bond Street and Park Row crossing, and the success with which they have worked has led to the general consideration of their use by many other road authorities in Great Britain. Within a period of 11 months some 20 authorities have adopted the use of the signals, and the number in use in Leeds has increased to seven.

It is found that road users speedily become acquainted with the signal implications, and that within a few days the usual traffic policeman may be withdrawn. So far the use of signals in this country have been confined to busy thoroughfares in towns, but the signals should be equally successful at important road intersections or dangerous crossings in the country. The rapid growth of the electric supply industry within the last few years and the extension of electric mains into urban and rural districts has made possible the installation of these signals on high roads outside the towns.

As it was recently stated that £20,000 was being spent on traffic control annually in the area administered by the West Riding police, the call for a wider adoption of electric traffic control seems justified on an economy basis alone. The maximum initial cost of installing a complete set of signals is less than a year's salary for a constable, while the annual running costs are approximately one-twelfth.

Electric Lifts.

In a general review of the above subject brought before the Junior Institution of Engineers by Mr. L. S. Atkinson on March 1st, the author said that the immense height of many buildings in America necessitated the rapid travel of elevators, and many of these were now operating at speeds of 800 ft. per min. and over, but in England the greatest speed was probably not more than 450 ft. per min. The hydraulic lift of the direct-acting type was practically obsolete, and the indirect or suspended type nearly so, one of their chief disadvantages being the difficulty of efficient counterbalancing, due to the necessity for such lifts being heavy enough, when unloaded, to drive the water out of the cylinder at a rate which would give the lift a reasonable speed of descent. Assuming that an electric lift had to raise a load of 2,000 lb., 40 per cent. of the load could be counterbalanced; whereas an hydraulic lift would have to raise that load plus the weight of the car and a negative balance as above—a total possibly of 5,000 lb. The evolution of the electric lift had been rapid, the traction type being the latest and most efficient, and particularly suitable for high buildings and for working at high speeds; it also permitted of a greater measure of standardisation, and consequently decreased manufacturing costs. It had beside the advantage of an important safety feature, the impossibility of overwinding. In this type of lift one end of the sus-

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pension ropes were fastened to the lift and the other to the balance weight and they passed over a grooved traction sheave driven by the motor, and imparting motion to the lift, the friction between the ropes and sheave being depended upon to transmit the driving force from the motor to the car and balance weight, speed reduction being effected by worm gear. A gearless traction machine used for high car speeds of over 400 ft. per min. had the traction sheave mounted directly on the motor shaft. Braking was done by springs which were compressed electromagnetically and released the brake shoes while the motor was running. The operation of micro floor levelling gear was described, together with the various methods of control, announcing signals, and so on.

American Notes.

During the year 1928 the production of electricity by water power in the United States of America totalled 34,747,188,000 kWh, or 39.6 per cent. of the total output. The production of electricity by fuels totalled 53,103,932,000 kWh. Of this amount, 365,623,000 kWh was produced by burning wood, leaving a balance of 52,738,309,000 kWh generated by means of the combustion of coal, oil and gas. Evaluating the oil and gas into equivalent tons of coal, a total of 46,348,846 tons of coal (or its equivalent) was used, or an average figure of 1.76 lb. per kWh. This compares with an average of 1.84 lb. in 1927, and represents an average gain in plant efficiency of nearly 4½ per cent. during the year. It stands in striking contrast with the 3.2 lb. required by the average plant in 1919.

The effects of centralisation of ownership or control and the absorption of independent generating stations accompanying the extension of transmission lines is shown by the most recent State summaries released by the United States Bureau of the Census. The number of individual generating stations in the various States has either remained stationary or else has shown a considerable decrease during the five-year period, 1922-27. A great many of the smaller enterprises have been superseded by co-ordinated systems whose current is supplied by large, centrally-located plants, whose greater size and more effective operation of machinery are evident in the remarkable increase in the average horse-power per engine and in the increase in output per kW of capacity which the Census figures show.

In Colorado the total number of undertakings decreased from 79 in 1922 to 72 in 1927. The number of power houses has increased from 69, with a total capacity of 112,530 kW, to 86, with a total capacity of 198,919. In Louisiana a tremendous growth in electricity output is evident, although the number of stations has only increased slightly, and the number of undertakings has shown a decrease from 81 in 1922 to 51 in 1927. The total number of undertakings in Maine has decreased from 82 in 1922 to 70 in 1927. The number of power houses has remained the same, but their capacity has doubled during this five-year period.

In Massachusetts the total number of undertakings has grown slightly, from 117 in 1922 to 123 in 1927, while the number of power houses has remained practically the same, being 90 in 1927, as against 87 in 1922. The total number of undertakings in Minnesota declined by 25 per cent. during the same period. In 1922 this total stood at 254; in 1927 it had dropped to 190. The number of generating plants shows a similar rate of shrinkage, although their capacity has grown by nearly two-thirds during those five years.

In Missouri the continued absorption of small isolated undertakings into larger co-ordinated systems seems to have taken place with unprecedented rapidity. In 1922 the total number was 240; in 1927 it had dropped to 122. The number of generating stations also shows a large shrinkage, although their capacity has grown by more than half as much again during those five years. Electric service has steadily increased in New Hampshire during the five-year period. The installation of generating machinery and the output of electricity has more than doubled, while the number of customers has grown from 64,158 at the end of 1922 to 106,249 at the end of 1927.

In Oregon there has been a marked decrease in the number of undertakings. A shrinkage of 22 is noted in the number of companies, representing the net result of a gain of 9 and a loss of 31, while two municipal enterprises have been absorbed into private systems. The most striking fact that the Census figures reveal is, however, the relative growth of steam generation in a State supposedly blessed with considerable undeveloped water-power resources. Steam engines and turbines aggregated 37,680 h.p. at the end of 1922; at the end of 1927 these totalled 136,905.

In Washington a large increase in hydro-electric development is noted, chiefly because of the completion during the same period of the first Skagit plant of Seattle, the first installation of the Lake Cushman plant of Tacoma, the Baker River plant of the Puget Sound Power and Light Company, the Chelan plant of the Washington Water Power Company, and numerous other (though smaller) installations. Water wheels and turbines have grown from 388,024 h.p. capacity in 1922 to 698,729 h.p. in 1927.

The total number of watt-hour meters employed on the system of the New York Edison Company and associated electric companies serving the metropolitan area last year was 2,119,636, as compared with 1,985,250 meters at the end of 1927. In 1928 the companies comprising the system tested a total of 518,974 meters. Of these, 507,482, or 97.78 per cent., were found to be correct, according to Public Service Commission standards, and only 1,330 meters, or twenty-six one hundredths of 1 per cent., were found fast. Those recording slow numbered 10,172, or 1.96 per cent. The percentage found correct increased from 97.33 per cent. in 1927 to 97.78 per cent. in 1928. Of the 518,974 tests made throughout the system in 1928, 12,724 were complaint and Public Service Commission tests, made on complaint of customers that their meters were fast, and of these only 78 were found fast, while 554 were found to be slow. The remainder, 12,092, were recording according to Public Service Commission standards.

Institution Note.

American Institute of Electrical Engineers.

Lamme Medal Awarded.—The Lamme Medal Committee of the Institute has awarded the first (1928) medal to Mr. Allan Bertram Field "for the mathematical and experimental investigation of eddy-current losses in large slot-wound conductors in electrical machinery." The Lamme Medal was founded as a result of a bequest of the late Benjamin G. Lamme, chief engineer of the Westinghouse Electric and Manufacturing Company, who died on July 8th, 1924, to provide for the award by the Institute of a gold medal (together with a bronze replica thereof) annually to a member of the A.I.E.E. "who has shown meritorious achievement in the development of electrical apparatus or machinery," and for the award of two such medals in some years if the accumulation from the funds warrants.

Mr. A. B. Field has been associated for some years past in the capacity of consulting engineer with the Metropolitan-Vickers Electrical Co., Ltd., and the work for which the distinction has been conferred is well known to designers of large electrical machinery. The investigation, the results of which were embodied in a paper presented to the A.I.E.E. in 1905, constituted the first thorough analysis of the subject, and provided for the first time a system by means of which the eddy-current losses for any given design of large machine could be predetermined. The importance and completeness of the work are indicated by the fact that the system, to which little has been added by later investigators, remain still the acknowledged basis for the calculation of eddy-current losses in turbo-alternators and other machines which are being built in ever-increasing capacities. The first award of the Lamme Medal to an engineer of British birth and training, of British and American experience, and now of British residence, is an honour to be proud of indeed.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The New Year Honours.

Particulars appear in our leaderette pages to-day of the honours that His Majesty has conferred upon certain well-known electrical gentlemen. Accompanying the present notes we are able to give photographs of the two new electrical knights—Sir J. A. Fleming, F.R.S., and Sir T. F. Purves, M.I.E.E.

The following are the main advances of the Post Office system of electrical communications that have taken place during Col. Sir T. F. Purves's period of office as engineer-in-chief:—

The provision of a complete network of underground trunk telephone cables connecting together all the important towns of Great Britain, and involving the construction of many thousands of telephone repeaters, equipped with valve amplifiers, which have made it possible to transmit speech satisfactorily, without any limit of distance. The rapid extension of telephone communication between Great Britain and the other countries of Europe, to an extent which already includes all the principal

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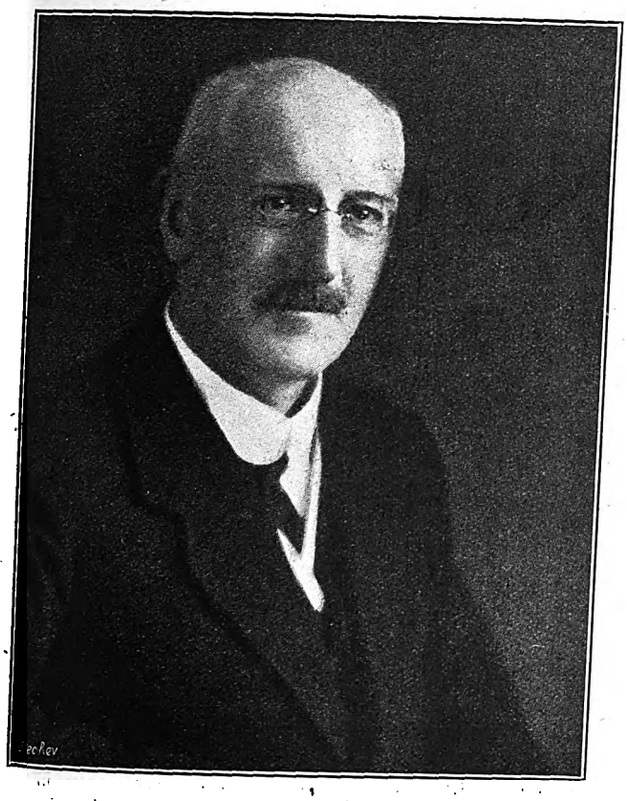
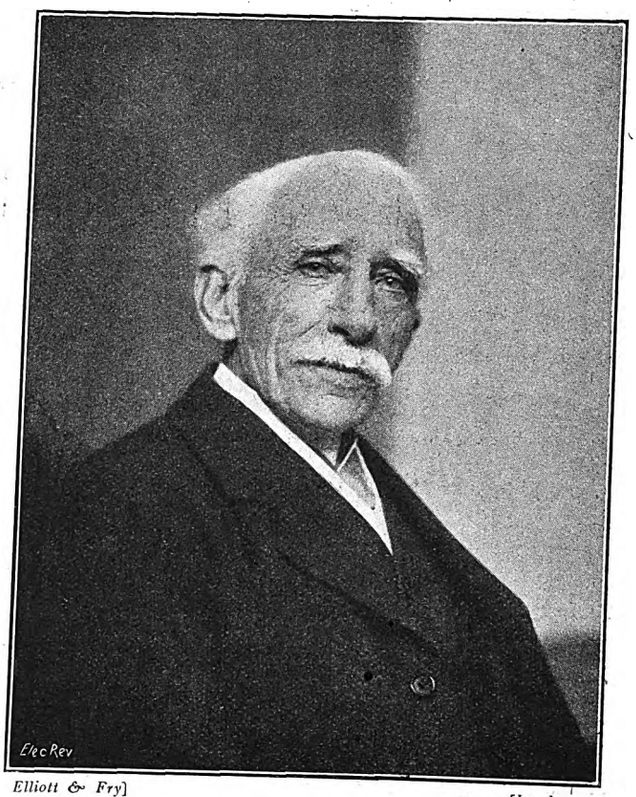
nations. The establishment of public radio-telephone services between Great Britain and the United States, and the extension of these Anglo-American radio links to the telephone systems of most of the countries of Europe on this side, and to practically the whole of the American Continent on the other side. The establishment of the Imperial radio-telegraph services to Canada, South Africa, Australia, and India. The design and introduction of an automatic telephone system for London, and the rapid extension of the automatic telephone system throughout the other cities and towns of Great Britain. Col. Sir Thomas Purves served during the Great War as major in the Corps of Royal Engineers, and was in charge of the design and supply of new forms of technical equipment for military communications. He has since been colonel of the 44th (London Home Counties) Division of the Royal Corps of Signals. As Engineer-in-Chief of the Post Office he is the head of an engineering staff of about 35,000 men, and is responsible for an expenditure approaching £20,000,000 per annum. He has represented the British Government abroad on many special commissions, and was head of the British Delegation to the world radio conference held at Washington, 1927, under the presidency of Mr. Hoover, for the purpose of establishing international regulations governing radio communication. He has for some years acted as President of the international commission on the development and unification of telephone engineering, which meets annually in Paris.



Sir T. F. Purves, M.I.E.E.



Elliott & Fry] [London.

Sir J. A. Fleming, F.R.S.

The Two New Knights.

Alderman J. W. LONGLEY, consulting electrical engineer, and recently-elected chairman of the Bradford Corporation Electricity Committee, has been elected chairman of the West Riding Conference of Local Authorities in connection with the co-ordination of electricity supply in the Aire and Calder Electricity District.

Mr. L. W. BARNEY, who has for the past five years been chief electrical engineer with Messrs. Pearson & Dorman Long, Ltd., who are engaged in the development of the Kent coalfield, has been appointed local manager and engineer to the South-East Kent Electric Power Co., Ltd.

Mr. J. W. FAWCETT, electrical engineer to the Holmfirth Urban Council, who has been appointed resident engineer at Withernsea with the South-East Yorkshire Electric Light and Power Co., has been presented by the staff of the electricity department with a smoking cabinet.

At a recent meeting of the Southend Electric Lighting Committee a resolution was passed expressing appreciation of Mr. R. BIRKETT's services as tramway manager during the last 14 years. The tramways and electricity supply departments at Southend have recently been separated, Mr. Birkett remaining borough electrical engineer.

The Reigate Town Council has increased the salary of the borough electrical engineer by £25 per annum.

The Rt. Hon. Lord CONGLETON, director of G. D. Peters and Co., Ltd., Slough, has joined the board of the Park Royal Engineering Co., Ltd.

The Stoke-on-Trent Electricity Committee has considered an application from its engineer for an increase in his salary, and has recommended that it be advanced from £1,125 to £1,200, this being the maximum fixed according to scale.

Mr. V. BINGHAM has resigned his appointment as publicity manager to Messrs. Crompton Parkinson, Ltd., and is taking up a similar position in the North of England.

Mr. H. C. SPENCE, assistant maintenance engineer of the Yorkshire Electric Power Co., has been appointed engineer and manager to the Holmfirth Urban District Council electricity department. There were 66 applicants for the post.

Alderman H. J. GALLIERS, J.P., and Mrs. Galliers, the Mayor and Mayoress of Brighton, were presented with a grandmother clock as a token of good wishes on the commemoration of their silver wedding on February 24th.

In recognition of his services as hon. secretary of the Preston Corporation Electricity Sports Club, Mr. THOMAS PARKER, of the Ribble power station, who, on Saturday next, March 9th, sails for India to take up an electrical appointment at Calcutta, was entertained by the members of the club and presented with a case of electrical instruments, a gold wristlet watch, and a travelling trunk. The presentations were made by Mr. S. Wood, the power station superintendent, who was supported by Mr. R. Dickinson, deputy superintendent, and Mr. Lucas, Blackpool transmission cable superintendent.

Mr. PHILIP H. GODDARD, who has completed 25 years' service in the supply department of the British Thomson-Houston Co., Ltd., at Rugby has been presented by his colleagues and the staff and members of the branch offices with a silver salver. The presentation was made at the eleventh annual dinner of the department by the manager, Mr. J. S. Ramsden.

As a mark of appreciation of his work in connection with the development of steam turbines, the authorities of the Technical High School of Karlsruhe have awarded the degree of Hon. Dr. Engineer to Herr Gottlob Fassnacht, of Mulheim (Ruhr).

Mr. COLIN E. PROCKTER has resigned his position with the Norwich Corporation Electricity Department (Thorpe power station) to take up an appointment as electrical and mechanical engineer to the Imperial Tobacco Co. (Great Britain and Ireland), Ltd., at its works at Limbe, Nyasaland. He will sail early in April.

The Manchester Corporation Electricity Committee has appointed Mr. A. WILLIAMS, at present assistant resident engineer at Stuart Street station, to the position of assistant resident engineer at the Barton power station. Mr. C. D. MILSOM, at present engineer-in-charge, takes Mr. Williams's place at Stuart Street station.

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M. Milon, chief of the French Telephone Department, has recently been appointed a Commander of the French Legion of Honour.

Obituary.—Mr. R. P. Abel.—The death occurred at Letchworth, Herts., on February 26th, of Mr. Robert Philip Abel, who, shortly before the war, joined the staff of the Union Electric Co., in London. He became assistant manager, but had to relinquish his position when the war broke out. He was sent to Russia in connection with electrical work, but succeeded in leaving that country the day before the revolution. Returning to England, he joined the firm of Kryn and Lahy, of Letchworth, and became a director. He was 41 years of age.

Mr. J. Harrison.—The death occurred suddenly on February 20th of Mr. John Harrison, who has been in business for about 17 years, as an electrical engineer and radio engineer at Lord Street, Earlestown, near Warrington. He was 42 years of age.

Mr. W. R. Spaven.—We regret to record the death of Mr. W. R. Spaven, which occurred on March 1st, at Portsmouth. Mr. Spaven retired two years ago from the post of manager of the Portsmouth Corporation tramways, which he had held for 24 years.

Dr. L. Kohlfurst.—The death is announced from Kaplitz, Bohemia, at the age of 80 years, of Dr. Ludwig Kohlfurst. The deceased was a well-known Austrian authority on railway electrification and telegraphy.

Mr. C. Dorman.—The death occurred at Middlesbrough, on February 28th, at the age of 54, of Mr. Charles Dorman, heir to Sir Arthur Dorman, Bart., and a director of Dorman, Long & Co., Ltd.

Mr. C. E. Crocker.—We regret to learn that cable advice has been received in London to the effect that Mr. C. E. Crocker, general manager of the Perth (W.A.) City Council Electricity and Gas Department, was killed in a motor accident on Monday last.

Mr. A. Brown.—Mr. Albert Brown, of Brown Bros., Ltd., passed away on March 4th after a brief illness.

Wills.—The late Sir Charles H. T. Metcalfe, Bart., who was prominently associated with many South African railway and other undertakings as an engineer, and was a director of the Victoria Falls and Transvaal Power Co., left £118,015.

Mr. J. Ferguson, M.B.E., general manager of the Perak River Hydro-Electric Power Co., Ltd., left £4,412 gross and £4,069 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

G. F. Billing & Co., Ltd.—Private company. Registered February 28th. Capital, £100 in 1s. shares. Objects: To carry on the business of electricians, mechanical and wireless engineers, &c. The subscribers (each with one share) are:—J. Bannister, 59, Chalsey Road, Brockley, S.E.4, articled clerk; R. Walter, 7, Curzon Street, N.1, clerk. Registered office: 41, Cheapside, E.C.2.

Bellfrey, Ltd.—Private company. Registered February 26th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical, telegraphic, telephonic and wireless instruments, appliances or energy, drawn wire, electric cables and lamps, and all parts and articles used in connection therewith, &c. The first directors are:—F. J. Humphrey, 15, Crescent Wood Road, Sydenham Hill, S.E.22, electrical engineer; G. C. Bell, 37, East Dulwich Road, S.E.22, electrical engineer; C. J. Laker, "St. Hilaire," 4, Blunt Road, South Croydon, chartered secretary. Registered office: 9, Brunswick Place, City Road, N.1.

Loughborough Motor Units, Ltd. — Private company. Registered February 23rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of an automotive electrical engineer carried on by A. R. Faulkner at The Rushes, Loughborough, Leics., as "Loughborough Motor Units." The first directors are:—A. R. Faulkner, 3, Cumberland Road, Loughborough, electrical engineer (managing director); F. A. Parkinson, "Woodlands," Steedman Avenue, Mapperley Plains, Nottingham, traveller (both permanent). Registered office: The Rushes, Loughborough.

Lege Reet & Co., Ltd.—Private company. Registered February 25th. Capital, £8,000 in £1 shares. Objects: To acquire inventions and patents, and to carry on the business of mechanical, electrical and general engineers, manufacturers of and dealers in locomotive engines, motors, &c. The directors are:—Sir John T. Prestige, Kt., 43, Montpelier Square, S.W.7, engineer; B. W. Preston, 74, Drayton Gardens, Fulham Road, S.W.10, engineer; H. Bissell, Drayton Lodge, Frithwood Avenue, Northwood, Middlesex (director of Iron and Nickel Battery Co., Ltd.). Secretary: S. G. Nevard, 11, Aspinall Road, S.E.4. Registered office: 27, College Street, E.C.4.

Kolster-Brandes, Ltd.—Public company. Registered February 26th. Capital, £1,300,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in any equipment, apparatus or device used in connection with any process of transmitting, receiving, producing, recording or reproducing by electrical or any other means any matter, whether consisting of sounds, images, signals, impulses or otherwise, founders, manufacturers of and dealers in machinery, metal workers, electricians, electrical and mechanical engineers, dealers in electric motors, dynamos and electrical machinery, &c. The directors are:—R. Spreckels, Burlingame, California (director and chairman, Kolster Radio Corporation); E. W. Stone, 1016, Fifth Avenue, New York City (director and president of the above Corporation); W. A. Bartlett, Romford Manor, Pembury, Kent (managing director of Brandes, Ltd.); S. W. Cole, The Turret, Sidcup (director of Brandes, Ltd.). Registered office: Cray Works, Sidcup, Kent.

Official Returns of Electrical Companies.

Worcester Electric Traction Co., Ltd.—Satisfaction in full of debentures or a charge dated March 29th, 1906, securing £15,000. (Notice filed February 22nd, 1929.)

J. L. Maughan & Co., Ltd.—Debenture dated February 18th, 1929, to secure all moneys not exceeding £3,000, charged on the company's undertaking and property, including uncalled capital (if any). Holders: Stella Conduit Co., Ltd., Highfield Works, Bilston, Staffs.

Rushden and District Electric Supply Co., Ltd.—Issue on January 8th, of £550, and on February 1st, 1929, of £450 debentures, parts of a series already registered.

Thalberg Halstead, Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1929. All shares taken up. £630 paid. £370 considered as paid. Mortgages and charges, nil.

Berkeley & Young, Ltd.—Capital, £22,000 in £1 shares (subdivision not stated) Return dated April 19th, 1928 (filed February 13th, 1929). 6,276 preference and 11,520 ordinary shares taken up. £7,786 paid on 6,276 preference and 1,510 ordinary shares. £10,010 considered as paid on 10,010 ordinary shares. Mortgages and charges, nil.

Halifax and Bermudas Cable Co., Ltd.—Capital, £50,000 in £5 shares. Return dated January 2nd, 1929. All shares taken up. £50,000 considered as paid. Mortgages and charges, nil.

Power and Lighting Cables, Ltd.—Capital, £10,000 in £1 shares. Return dated November 21st, 1928. 1,100 shares taken up. £1,100 paid. Mortgages and charges, nil.

Fada Radio, Ltd.—Capital, £10,000 in £1 shares. Return dated January 11th, 1929. 5,000 shares taken up. £5,000 paid. Mortgages and charges, nil.

Helio Dynamo Co., Ltd.—Capital, £20,000 in 8,000 "A" and 12,000 "B" shares of £1 each. Return dated January 15th, 1929. 8,000 "A" and 5,062 "B" shares taken up. £3,062 paid on 3,062 "B" shares. £10,000 considered as paid on 8,000 "A" and 2,000 "B" shares. Mortgages and charges, nil.

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Hadden & Pearce, Ltd.—Capital, £5,000 in £1 shares. Return dated December 24th, 1928. 2,502 shares taken up. £2,002 paid. £500 considered as paid. Mortgages and charges, £1,800.

British General Manufacturing Co., Ltd.—Capital, £500 in £1 shares. Return dated November 12th, 1928. All shares taken up. £2 paid. £498 considered as paid. Mortgages and charges, nil.

Wallace Magneto Repairing Co., Ltd.—Capital, £2,000 in 800 preference shares of £1 each and 2,400 preference shares of 10s. each. Return dated October 20th, 1928. All shares taken up. £2,000 paid. Mortgages and charges, nil.

John Collier & Co. (Electrical Engineers), Ltd.—Capital, £20,000 in 12,000 "A" and 8,000 "B" shares of £1 each. Return dated November 19th, 1928. All shares taken up. £2 paid. £19,998 considered as paid. Mortgages and charges, nil.

Jersey Electric Lighting and Power Co., Ltd.—Capital, £65,000 in 51,000 preference and 14,000 ordinary shares of £1 each. Return dated August 16th, 1928. 12,257 preference and 14,000 ordinary shares taken up. £26,257 paid. Mortgages and charges, £12,000.

City Notes.

General Electric Co., Ltd.

An extraordinary meeting is called for Wednesday next, the 13th, for the purpose of considering resolutions providing for the creation of 1,600,000 new ordinary shares of £1 each, raising the company's capital to £7,600,000. It is proposed that these new shares shall be called "British ordinary shares," and shall be issued only subject to the condition that they shall not be registered in the name of, or transferable to, or held on behalf of, any foreigner, foreign corporation, or corporation under foreign control. In all other respects the shares will rank equally with the existing ordinary shares. The proposals involve a number of alterations to the company's articles of association. The notice convening the meeting was accompanied by a letter explaining that in September, 1931, the company has the option of redeeming the existing 7 per cent. debenture stock, the interest on which constitutes a heavy charge on the profits. In the directors' opinion the necessary finance can now be obtained on satisfactory terms to provide funds for this and for the general expansion of the business.

North Metropolitan Electric Power Supply Co.

Sir James Devonshire, K.B.E. (chairman) presided at the annual meeting on February 26th. In presenting the report and accounts (*vide* our last issue, p. 391), Sir James said that there had been a continuation of progress; the sales of energy had increased by 14 per cent., while the number of consumers had shown a rise of 17 per cent. At the end of the year the company had 1,294 miles of trunk and distributing mains served by 311 sub-stations. The increase in the profit appeared to be incommensurate with the growth of the business, but that was due to the further reductions in charges which had been made throughout the area; these reductions accounted for at least £40,000 during the year. Early in the current year 325,000 ordinary shares had been issued. Of these 6,250 had been reserved for subscription by members of the salaried staff. The proceeds had been devoted to paying off a bank loan. The operating results of the Brimsdown station had been satisfactory. Pulverised fuel firing was employed, and one of the two 25,000-kW turbines made by Messrs. C. A. Parsons & Co., Ltd., was believed to be the only machine of its size which generated at 33,000 V. They were making special efforts to stimulate the growth of domestic consumption of electricity. The number of consumers who had purchased their own electric cookers had more than doubled since 1926. "Electric cooking is becoming a public habit, and the rapid growth in this direction is largely due to the fact that those who have adopted electric cooking are so satisfied that, perhaps unconsciously, they become our best canvassers." There were also great advantages in electric water heating and in many other applications of electricity in the home. The company had built up an extensive organisation for the service of its consumers and for the furtherance of the matters which he had mentioned. Last year 228,000 separate accounts were rendered in connection with electricity supply, sales of electrical apparatus and for installation work carried out by the staff, representing a total revenue of over £1,000,000.

New Issues.

Kolster-Brandes, Ltd.—This company, particulars of which appear in our "New Companies" section to-day, made an issue on Monday last of 350,000 £1 ordinary shares at par. The company has acquired the business of Brandes, Ltd., and the exclusive right to exploit the inventions of the Kolster Radio Corporation (U.S.A.), and its subsidiaries, in the British Empire (except Canada) and Europe. The directors estimate that the sales for the first year will be £750,000, rising to £1,200,000 in the second year, with net profits equal to 7.3 per cent. and 13.7 per cent., respectively, on the nominal capital. It is not intended to distribute any dividends until a substantial reserve fund has been accumulated. The issue was not underwritten, the Kolster Radio Corporation having agreed to take up at par any part not subscribed.

Parent Coal Carbonisation Trust, Ltd.—On Tuesday last this company, whose nominal capital is £750,000, made an issue of 1,200,000 8 per cent. cumulative participating preference shares of 10s. each, and 1,200,000 deferred ordinary shares of 1s. each, at par. The chairman of the company is Lord Askwith, K.C.B., and the company is to exploit in this country the "Aicher" (German) process of low-temperature carbonisation of coal.

Sphinx Electric, Ltd.—The registration of this company was recorded in our issue of February 8th (p. 249). On Thursday last week the company offered for subscription at par 290,000 10 per cent. participating preference shares of 5s. each and 580,000 ordinary shares of 1s. each. The prospectus stated that the preference shares would participate to the extent of 25 per cent. of the surplus profits after the payment of 10 per cent. on the ordinary shares. The company is acquiring the businesses of Auto-Bulbs, Ltd., and Sphinx Electric Supplies (Ireland), Ltd., for £88,000 (£47,000 in cash and the balance in shares). It expects to have a working capital of £42,000, and is to manufacture automobile lamps, an accumulator-regenerating compound, a fog dispeller, &c. The gross profits of the two companies acquired (*i.e.*, excess of net sales over net purchases) have been as follows:—1924, £11,926; 1925, £13,205; 1926, £17,638; 1927, £22,135; 1928, £13,445. Although several of the London newspapers described the investment as speculative the lists were closed on Friday last owing to over-subscription.

Underground Electric Railways Co. of London, Ltd.

The accounts for the year ended December 31st record a total income of £1,153,798, an increase of £188,952 over the 1927 figure. The expenses amounted to £68,277 (£11,724 decrease), leaving net receipts of £1,085,521 (£200,676 increase). After meeting interest on the debentures and bonds, adding a net amount of £169,761 brought forward, and writing off £10,000 from commission, discount, &c., a balance of £709,401 (£286,196 increase) is carried to the balance sheet. The ordinary dividend (as already reported) is 7 per cent. for the year (against 5 per cent.), and £262,504 remains to be carried forward. During the year £4,000,000 of 5 per cent. first mortgage debenture stock was created and sold. The proceeds were used to repay bonds and loans, &c., and there was a balance enabling the company to widen the scope of its investments. The report reviews the operating results of the companies in which investments are held, and points out that during the year the operating companies spent £2,164,000 on various improvements and additions. Reference is made to the Bills for the co-ordination of London passenger transport services and to other Parliamentary measures. The report also records the retirement of Major-General Sir Frederick Sykes from the board and the appointment of Mr. F. Pick as a director. The meeting was to be held yesterday (Thursday).

Charing Cross Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1928, shows that the West End Undertakings had gross earnings amounting to £330,571, against £337,839 in 1927. The net earnings rose from £121,030 to £145,920. A net balance of £34,966 brought forward and interest and dividends of £57,608 are added, making £238,494. After providing for debenture interest, sinking fund, preference dividend and "standard" ordinary dividend, £79,706 remains to be carried forward. The total connected load is now 34,533 kW; the sales of energy during the past year totalled 28,599,840 kWh.

The City Undertaking's accounts show gross earnings of £345,939 (against £354,527), and a net income of £137,288 (£100,414). A net balance of £1,472 brought forward is added, together with rent in respect of Bow generating station, &c., £60,944, making £199,703. After providing for debenture interest, &c., and preference dividend, ordinary dividends of 10 per cent. on £380,000, and 7 per cent. on £200,000 are paid, leaving £18,227 to be carried forward. The connected load is now 41,332 kW, and the sales during the past year totalled 36,270,027 kWh. The meeting was held on Wednesday last.

Metropolitan Electric Cable and Construction Co., Ltd.

The second annual report (for the year ended December 31st last) showed a trading profit of £24,086. After providing for expenses, depreciation, income tax, &c., and adding £819 brought forward, there was an available balance of £6,726. A dividend of 7½ per cent., free of tax, is being paid, and £2,000 is set aside to form a general reserve, leaving £976 to be carried forward. The death of the chairman (Mr. D. D. Warren) is recorded. At the annual meeting on February 22nd, Mr. J. Miller occupied the chair, and, after referring to Mr. Warren's death, said that the directors were pursuing a conservative policy with regard to the profits. They expected the erection of the new building to be completed by the end of June. Certain plant had been ordered, but they were going very cautiously in the ordering of other plant, in order that they should have the latest type of machinery and the most up-to-date factory for production at lowest cost. The outlook for 1929 was very promising, and he felt sure that when the new factory was completed, and with the programme they had in hand for still further improvement of the type of cable that they intended making, they would soon realise the position which they had set out to achieve.

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London and Suburban Traction Co., Ltd.

The annual meeting was held on February 26th. Lord Ashfield (chairman), who presided, said that traffic had improved considerably, the number of passengers carried having increased by 12,000,000 to 193,000,000. Referring to the proposals submitted to Parliament by the London County Council and the Underground Group of companies for the co-ordination of the passenger transport facilities within the London Traffic Area, he said that neither by sectional measures nor by competitive methods could London be provided with adequate transport facilities at the lowest cost, which in other words was the lowest fare. Only by a common management capable of surveying and planning to cover the whole field of transport, and by a common fund capable of equalising the financial burdens and gains for all interests, could undivided attention be given to fulfilling the purposes of a transport system which was to meet the needs of the passengers; only by such means could a margin of resources be secured which would allow of the steady expansion of the facilities provided.

St. James' and Pall Mall Electric Light Co., Ltd.

The annual meeting was held on February 27th, Mr. G. W. Balfour (chairman) presiding. In presenting the report (*vide* Elec. Rev., February 15th, p. 296), Mr. Balfour said that the output of electrical energy in 1928 amounted to over 32 million kWh, against 28 millions in 1927, and the connections increased from 31,733 to 35,626 kW, an increase of 12.27 per cent. The initial charge for lighting supply was, from Midsummer last, reduced to 4d. per kWh, with a reduction to 3d. per kWh for any excess over a consumption of 4,000 kWh per annum. The power charge was also reduced to a flat rate of 1d. per kWh, and a special rate of ½d. per kWh was introduced for water heating during off-peak periods. The introduction of a rate of 2d. per kWh for shop-window lighting during certain hours had proved a success. Lord Wargrave was elected to the board to fill the vacancy caused by the death of Sir Alexander Kennedy. The report and accounts were adopted.

Mather & Platt, Ltd.

The annual meeting was held on February 27th, Mr. L. E. Mather (chairman) presiding. In presenting the report and accounts (*vide* our last issue, p. 392), the chairman said that it was satisfactory that the profit had shown a slight increase in view of the difficulties of the past year. They had continued to improve their production methods, and their research department and designers had produced increasingly good results. They had further developed the standardisation of their dynamos and motors, which had resulted in increased sales. In the pump department their improved designs had met with gratifying success. Pumping units for power-station work had been designed and manufactured for the highest pressure and largest capacity of any in Europe. The outlook both at home and abroad appeared to be brighter. He claimed that few engineering firms gave so much attention to the development of overseas trade as their company did.

Chatham and District Light Railways Co.

The revenue for 1928 was £67,025, as compared with £72,362 in 1927; the gross working balance was £8,548, against £13,722. After meeting rental and taxation and crediting interest received and £1,259 brought forward, there is a balance of £5,412, which it is proposed to carry forward. The directors state that the revenue during the past year again showed a decrease due to intense competition, and they regret that they are unable to pay a dividend on either the preference or the ordinary shares. Last year the ordinary dividend was 2½ per cent. As we have already reported, the company is applying for Parliamentary powers to substitute omnibuses for its tramway system. Meeting: March 11th.

Westminster Electric Supply Corporation, Ltd.

Speaking at the annual meeting on February 27th, the chairman (Lord Wargrave) said that the cost of electricity purchased was £7,000 higher, but this had been counterbalanced by an increase in output of 5½ million kWh, with an increase in revenue of £11,000. The change of the company's system of supply from d.c. to a.c. continued to make satisfactory progress, and the benefit was already being felt by an increase in efficiency during the year which resulted in a saving of 600,000 kWh. Referring to the electricity charges, he said that the standard prices applied to the figures for the years 1926, 1927 and 1928, showed that consumers had received benefits in these years totalling £188,787.

Celestion, Ltd.

This company on Monday this week published, for information only, a statement of its constitution and objects. It has a nominal capital of £400,000, of which £253,007 has been issued in the form of 103,007 7½ per cent. cumulative participating preferred ordinary shares of £1 each, and 600,000 deferred ordinary shares of 5s. each. The company was formed in December last to acquire the business of the Celestion Radio Co., and to manufacture radio and kindred apparatus. The purchase consideration was £54,000 in cash, 400,000 deferred ordinary shares and the payment of the Celestion Company's liabilities on November 16th, 1928.

Torquay Tramways Co., Ltd.

At the annual meeting on February 27th, Mr. H. T. Barnett (chairman), in moving the adoption of the report and accounts, referred to the question of the relationship of tramcars and 'buses with railways, and said that if the managers of railways and other transport services were allowed by the public to keep their heads, there would during the next few years be co-operation between the services to the immense advantage of travellers, as there was no doubt that one set of services was complementary and not antagonistic to the other.

Liverpool Overhead Railway Co.

The revenue account for 1928 shows total receipts of £97,493 (against £93,558) and an expenditure, including £4,400 to reserves, of £79,610 (against £83,200). The surplus was thus £17,883, as compared with £3,603 in 1927. After meeting debenture interest and crediting £534 brought forward, a dividend at the rate of 5 per cent. is to be paid on the preference shares, leaving £3,730 to be carried forward. The number of passengers carried rose from 7,328,176 to 7,511,559.

Lancashire United Transport and Power Co., Ltd.

In the course of his speech at the annual meeting on February 28th, Sir Arthur Stanley, G.B.E. (chairman), said that owing to short-time working at some of the cotton mills the sales of power had slightly decreased. Throughout the country tramway undertakings were being seriously affected by the bad state of trade. The company had also suffered from the competition of motor-omnibuses and the time had come when the renewal of the track had to be considered. The directors therefore considered it desirable to abandon the tramways and substitute either trackless trolley vehicles or omnibuses. A Bill was being promoted in the present session of Parliament to give effect to this arrangement.

Beauly Electric Supply Co., Ltd.

This company recently applied to the Ministry of Transport for a Special Order which would make it a statutory undertaking and prevent the Grampian Company coming into its area and competing with it. At the annual meeting of the company held on February 26th, Mr. E. J. Williams, M.I.E.E., presided. For the eighth year in succession a dividend at the rate of 10 per cent. was declared. The chairman intimated that as a result of the application for a Special Order the directors had received an offer from the Scottish Power Company, Ltd.—one of the Grampian group—for the whole of the £1 shares at 35s. per share. This offer the directors had carefully considered and the shareholders would be recommended to accept it.

Enfield Cable Works, Ltd.

The directors report a profit of £142,000 for the eighteen months ended December 31st last and recommend a final dividend of 10 per cent. on the ordinary shares, making 30 per cent. for the period. They also proposed to raise the company's authorised capital to £800,000 by the creation of 350,000 ordinary shares of £1 each. Of these 100,000 will be offered to the present shareholders at 40s. per share in the proportion of two to each five shares already held. Meeting: March 20th.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

West Gloucestershire Power Co., Ltd.—£50,000 5½ per cent. first mortgage sinking fund debenture stock.

Yorkshire Electric Power Co.—897,000 ordinary shares of £1 each fully paid, Nos. 1,603,001 to 2,500,000, and 20,000 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1,603,001 to 1,623,000.

North Wales Power Co., Ltd.

The resolution for the reduction of the company's capital from £1,000,000 to £808,058 10s. having been passed on February 22nd, a further extraordinary meeting is called for March 11th to approve the other proposed arrangements which were outlined in our issue of February 22nd (p. 344). These include the sub-division of the preference shares and their conversion into ordinary shares; and the restoration of the capital to £1,000,000 by the creation of 383,883 10s. ordinary shares.

Brown Bros., Ltd.

In the course of his speech at the annual meeting on February 26th, the chairman (Mr. E. Brown) said that the radio business was becoming more stabilised. They had suffered during the past year from all-round reductions of prices. The position with regard to design was now more settled, and the remarkable improvement and lower cost of receiving sets should lead to a largely-increased demand.

Wellingborough Electric Supply Co., Ltd.

The total revenue for the past year was £19,089, and after making provision for depreciation, debenture interest, &c., there was a profit of £1,874, to which was added £2,066 brought forward, making £3,940. It is proposed to pay a dividend of 5 per cent., leaving £1,690 to be carried forward. The sales of energy rose from 1,285,802 to 1,539,804 kWh.

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Chas. Clifford & Son, Ltd.

From the 1928 net profit of £14,326, plus £53,247 brought forward, the directors propose to pay a final ordinary dividend at the rate of 10 per cent. per annum and a bonus of 5 per cent., both free of tax. £12,000 is placed to the reserve for the renovation of plant, machinery, &c., and £44,773 is carried forward.

Bell Telephone Co. of Canada.

This company reports a net profit on last year's working equivalent to 10.14 per cent. on the capital stock, as compared with 9.69 per cent. for 1927. The surplus of the company is now $5,269,000, an increase during the year of $931,000.—*Reuter* (Montreal).

Wisbech Electric Light and Power Co., Ltd.

The gross profit for the past year was £7,636, and to this is added £1,782 brought forward, making £9,418. After providing for depreciation, renewals, reserve and preference dividend, the directors propose to pay 10 per cent. on the ordinary shares and to carry forward £2,585.

Marconi International Marine Communication Co., Ltd.

The gross revenue and receipts of the company for the year ended December 31st last amounted to £905,816, as compared with £912,640 in the preceding year; the net profit rose from £179,730 to £193,420. The directors recommend a final dividend of 7½ per cent., making 15 per cent. for the year, against 12½ per cent for 1927. A balance of £36,889 is carried forward, against £13,011 brought in. The report states that the investments, standing at £514,561, show a decrease of £99,943; this decrease is mainly offset by an increase of shares in a foreign associated company. During the year Mr. F. S. Hayburn was appointed a director. Meeting: March 11th.

Canadian Power Loan in New York.

The Power Corporation of Canada, Ltd., which controls a number of leading Canadian electric power companies, is raising a loan of $10,000,000 in New York by means of 4½ per cent. 30-year convertible debentures.

English Electric Co., Ltd.

The directors announce that the financial results of the past year do not admit of the payment of a dividend on the preference shares. The dividend on these shares is in arrear as from June 30th, 1926.

Calgary Power Co.

The gross operating earnings for 1928 were $949,422, against $494,408 in 1927, while the net income rose from $129,594 to $251,198. The preferred stock dividend absorbs $25,000, and the common stock dividend $102,500.

Vickers, Ltd.

The directors have declared the final dividends on the preferred stock, the preference shares, and the cumulative preference shares for the half year ended December 31st last, amounting to 2½ per cent. in each case, tax-free on the last class.

Crompton Parkinson, Ltd.

The interim dividend on the ordinary shares for the six months ended December 31st, 1928, is at the rate of 22½ per cent. per annum.

Telegraph Construction and Maintenance Co., Ltd.

The directors recommend a final dividend of 7½ per cent., free of tax, again making 10 per cent., tax free, for the year.

Western Telegraph Co., Ltd.

A dividend of 5s. per share, free of tax, has been declared in respect of the quarter ended December 31st, 1928.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The directors recommend a final ordinary dividend of 3½ per cent., making 6 per cent. for the year, as for 1927.

Stocks and Shares.

MONDAY EVENING.

STOCK EXCHANGE conditions have taken on a much quieter tone than has prevailed for some time past. For this, the principal reason is the money situation: first, in New York, and then on this side; while the second factor which looms largely in the situation is the shadow of the forthcoming General Election. It will be, unfortunately, needful to refer to both these factors for some time to come. Political considerations are bound to exert a good deal of influence in the stock markets. The fear is, of course, that Labour may secure a majority large enough to enable extremists in that party to launch schemes that may be regarded as predatory and fantastic, aimed at the security of capital, and devised for the purpose of increasing taxation upon companies, corporations and individuals who are even now taxed with sufficient heaviness. The main issue of the Election is expected to focus upon the tariff policies of the parties, though how these will appeal to the susceptible heart of the flapper-voter, eager to record her vote for the novelty of the experience, only the ballot-boxes can demonstrate.

Cable and Wireless.

One department in which weakness is somewhat marked is that for cable stocks and shares. Falls have taken place in Eastern Telegraph, Eastern Extensions, Westerns, Great Northerns, and Anglo-American deferred. The heaviness in the Eastern quartette was ascribed by some people to the new invention, claimed by the Beam system, of simultaneous telegraphic and telephonic communication between here and Canada. But it may well be doubted whether this consideration had anything to do with a heaviness that can be more properly attributed to the depressing effect of the money market. Stock Exchange members have been talking about the possibility of a 6½ per cent. Bank Rate, and maintaining that, if the rise does not come on the Thursday in this week, its advent is likely to prove merely postponed. Everything must depend, of course, upon the position of money in America, where the key to the present position rests for the moment.

Marconi shares have gone back to £4, and a sharp fall occurred in Marconi Marines, on the dividend announcement making only 15 per cent. for the year. Most people had been expecting some sort of bonus, and the declaration was followed by a fair amount of selling. Canadian Marconis, on the other hand, have strengthened to 34s., support coming from New York, as well as from Montreal. Burndepts are 6s. middle. International Telephone and Telegraph, after being 225, went back to 220. The American Telephone and Telegraph Company, in its annual report, mentions that plans have been made to lay a special telephone cable across the Atlantic.

Central Electricity Board Contracts.

Speculation in the shares of the London electricity supply companies has subsided, not even County of London being the object of any particular animation during the past week. The quotation is steady at 53s., but Bournemouth and Poole, upon the strength in whose shares the rise in County of London was partially based, have gone back to 69s. 6d. Electric Supply Corporations are a little lower at 56s. 3d. Amongst the profvincial shares, Midland Counties lost 1s. at 29s. 6d. The Chairman of the Central Electricity Board, speaking at the British Industries Fair, Birmingham, announced that the Board had already placed contracts for over three million pounds sterling, and that in the week following, the Board intended to place other contracts for a similar amount, all of them in this country. The money, he added, was not being spent light-heartedly, but with a feeling that it was absolutely necessary that the schemes they favoured should ultimately pay their way.

London Electric Shares on Offer.

It may be of service to mention that there are at the present time on offer 1,000 Brompton and Kensington Electric ordinary shares at 27s. These pay £6 7s. 9d. on the money, on the 8½ per cent. dividends at present declared, but the yield on the 7 per cent. basis, to which the shares will probably revert in 1931, is shown in our lists. There are also 1,000 City of London Electric Lighting ordinary shares obtainable at 33s. 6d., and paying £5 19s. 3d. until 1932, using as a basis the 10 per cent. dividend which the company is at present paying on these shares. The substantial line of 5,000 St. James' and Pall Mall Electric Lighting ordinary shares is on offer at 27s. 9d., cum dividend. The company is paying a trifle under 8 per cent. dividends until 1931, and on this figure the yield is £5 13s. 9d. per cent. on the money. A line of 5,000 Westminster ordinary can also be obtained, the price in this case being 27s., and the yield, until 1931, 6½ per cent., calculated on the 8.8 per cent. dividends paid annually during the past three years. A fair number of South London Electric ordinary at 27s. 6d. will give £6 3s. 6d., and Kensington and Knightsbridge at 27s. 6d. will pay £5 16s. 3d., with the same proviso in regard to the year 1931, when the new arrangement comes into force. There are 500 Chiswick Electric ordinary available at 67s., to pay 4¾ per cent.

Provincial Power and Supply.

In the provincial group, a couple of thousand Midland Counties ordinary at 29s. 3d. pay £4 8s. 9d., 5,000 Newcastle-on-Tyne ordinary at 26s. return £4 12s. 3d. per cent., and the same yield is available from 2,000 Northampton Electric Light and Power ordinary shares at 39s., all the last three named being cum the dividends which may be taken off the prices before these paragraphs appear. Two thousand Altrincham ordinary at 61s. 6d., yielding £6 16s. 6d., and the same number of deferred shares in this company at 18s. 6d., affording a return of £7 18s. per cent. on the money, can be obtained;

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and in Bournemouth and Poole, 500 shares are on offer at the time of writing at 71s. The Newcastle-on-Tyne Electric Supply Company has notified its dividend, making 6 per cent. for the year 1928. The report should be available next week, and is likely to show good figures. The Lancashire United Transport and Power Company proposes to substitute railless trolley cars for its present tramway system. The company's 6 per cent. first debenture stock is quoted at 97, and the ordinary shares stand at 10s.

The Undergrounds and Petrol.

Increase in the price of petrol led to an abrupt fall in Underground Electric Railways of London incomes, where the price of 115 is about 4½ points down, allowing for deduction of the half-yearly interest payment. The London General Omnibus Company is considered likely to be very unfavourably affected, and the question of increased fares is said to be under discussion. Underground shares fell 6d. to 25s. Districts remain unchanged at 80½. but Metropolitan consolidated at 63½ is 1½ lower. Traction and tramway shares of the British companies have undergone no change. London and Suburban Traction preference remain dull at 12s. British Electric Traction deferred stock holds its last week's gain of 100 points.

The Anglo-Argentine group is irregular, an eighth gain in the first preference shares being balanced by a loss of 2 points in the 5 per cent. debenture stock, lowering the latter to 75. Brazilian Traction common shares at 70½ are half a dollar down on the week.

Atlas and North Wales.

Atlas Light and Power ordinary shares strengthened to 30s. upon a rumour that the company had resolved to sell its Montevideo interests. The report lacked confirmation, but the shares remained in request from New York. There are a few thousand of the company's 7 per cent. preference shares on offer at 24s. These yield £5 16s. 8d. per cent. on the money, dividends being due in May and November. A meeting is to be held next Monday, March 11th, of the North Wales Power Company, for the passing of resolutions which arise out of the proposals to reorganise the capital. It is also announced that Messrs. Robert Benson & Co. have agreed to subscribe for the 859,177 shares of 10s. each which, previously, the firm was going to underwrite. The company's 4½ per cent. guaranteed debenture is a Trade Facilities Act stock, the price standing at 96. The ordinary shares change hands occasionally at about 12s.

Dollar Stocks.

Amongst the dollar stocks and shares on offer which are not quoted in our price lists may be mentioned British Columbia Power Corporation "A" shares of no par value, in receipt of 2 per cent. dividends, which at 58 yield £3 9s. per cent.; Calgary Power common shares of $100 each, receiving 5 per cent., and at 180 offering a return of 2¾ per cent. on the money. Canadian General Electric 7 per cent. preference are of $50 each, and at 61 yield 5¾ per cent. Columbia Gas and Electric shares (new) at 154 return 3¼ per cent. on the basis of the last-paid 5 per cent. dividend, and Consolidated Gas, Electric Light and Power of Baltimore common shares, in receipt of 3 per cent. dividends, return at 105—the current quotation—2¾ per cent. on the money. Middle West Electrics 7 per cent. prior lien shares at 135 give £5 18s. 6d. on the basis of the 8 per cent. dividend, and the common shares, which receive 7 per cent., stand at what looks to be the high price of 185, yielding 3¾ per cent. on the money. Montreal Light, Heat and Power Co. shares at 117 return a slender £2 2s. 3d. per cent., which is about 2d. more than the income derivable from Pennsylvania Water and Power common shares at the current level of 95. Compared with these returns, that of £2 4s. per cent. on Shawinigan Water and Power common shares looks quite good. This company also pays 2 per cent. dividends, the price of the shares being about 91.

Manufacturing Shares.

Amongst the manufacturing shares, Enfield Cables ordinary attracted attention by reason of a proposal, contained in the annual report, for the issuing of 100,000 new shares at 40s. in the proportion of two new shares for every five shares held. The company has declared a final dividend making 30 per cent. for the year, as compared with 20 per cent. for the previous twelve months. As the price of Enfield ordinary stands at 5½, there is a handsome bonus contained in the offer. Callenders have gone back to 4¼; International Automatic Telephones are easier at £2. Henleys are a little lower at 6, and General Electrics at 3¼. Siemens lost ⅛ at 27s. 6d. Ever-Ready shares, after being 24s. 6d., subsided to 23s. The Sphinx Electric offer of 290,000 preference shares of 5s. each at par, and 580.000 ordinary shares of 1s. each, was oversubscribed. In the iron, steel and engineering section, the general disposition was to put up prices on the impression that both the Unionists and the Labour Party are toying with the proposal to extend the principle of "safeguarding" as applied to some of the basic industries of the country. Vickers rose nearly 1s. to 12s. 3d., but eased off to 12s. Babcock and Wilcox are unchanged, and, in the depression which crept over the markets in consequence of the monetary situation, other improvements that had occurred were wiped out.

The rubber share market keeps steady, the price of the produce holding to a little over 1s. per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 4 1929.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14†	15	69/6	—⅛	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 8 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	53/-	—	2 16 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—9d.	3 18 3
Kensington Ordinary	1	8	8	27/-	—	5 8 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/6	—	5 1 10
Metropolitan	1	8	9	2¼	—	4 0 0
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	29/6	—1/-	4 8 8
Mid. Elec. Power	1	—	15	2 1/16	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	26/3	—	4 11 5
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	—	4 14 2
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	44/6	—	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/9	—	6 1 8
Yorkshire Elec.	1	8	8	36/-	—	4 9 0

†4% of which was tax free.

Home Rails.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price March 4 1929.	Rise or fall.	Yield. p.c.
Central London Ord. Assented ...	Stock	4	4	†2xd	—1	5 11 1
Metropolitan	"	8	8	63½	—1½	5 10 3
do. District	"	8½	4	80½	—	6 4 8
Underground Electric	£1	1½	5	25/-	—6d.	5 12 0
do. do. Income ...	Bonds	6	6	115xd	—4½	5 4 4

Telegraphs and Telephones.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price March 4 1929.	Rise or fall.	Yield. p.c.
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24¼	—¼	6 9 9
Automatic Telephone	1	10	10	2½	—	4 14 1
Eastern Extension	10	10	10	2 1/8	—¼	*3 16 7
Eastern Tel. Ord.	Stock	10	10	268½	—2	*3 16 0
Globe Tel. and T. Ord.	10	10	10	26⅝	—	*3 15 9
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	20	32½	—½	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	5	*10	4	—1/16	... ...
Marconi-Marine	1	8¾	12½	8⅝	—¼	4 8 9
Oriental Telephone Ord.	1	12	12	8	—1/16	... ...
Western Telegraph	10	10	10	25⅞	—½	3 17 2

*Interim.

Home and Foreign Trams, &c.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price March 4 1929.	Rise or fall.	Yield. p.c.
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅞	+⅛	7 1 11
do. do. 2nd. Pref. ...	5			8 13/16	+3/16	7 12 4
do. do. 5% Deb. ...	Stock	5	5	75	—2	6 13 4
British Electric Traction Def. Ord.	"	—	—	925	—	... ...
do. do. Pref. Ord.	"	8	8	128	—	6 5 0
Brazil Traction	100	6	7	70½	—½	2 17 8
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 8 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	82	—1½	5 15 0
Mexican Light Common	100	Nil	Nil	91	—1	... ...
do. 7% Pref.	100	Nil	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	80	+1	6 5 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price March 4 1929.	Rise or fall.	Yield. p.c.
Babcock & Wilcox	1	18	15	8½	—	*4 11 5
British Aluminium Ord.	1	10	10	46/3	—1/16	*4 6 7
British Elec. Transformer Pref....	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4¾	—	8 8 8
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4¼	—⅛	8 10 9
do 6½% Pref.	1	6½	6½	1¾	—	6 4 0
Crompton Parkinson Ord.... ...	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1 1/16	—⅛	7 1 2
Enfield Cable Ord.	1	20	20	5⅛	+⅛	5 9 1
English Electric	1	Nil	Nil	8/3	—6d.	... ...
do. do. Pref	1	8	Nil	9 6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	10	3¼	—1/16	8 1 6
Henley	1	25	25	6	—1/16	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	12½	10	1 15/16	—	5 8 1
Siemens Ord.	1	7½	7½	13	—⅛	5 9 1
Telegraph Construction	12	10	10	25¼	—	*4 15 8

*Dividends paid free of Income Tax.

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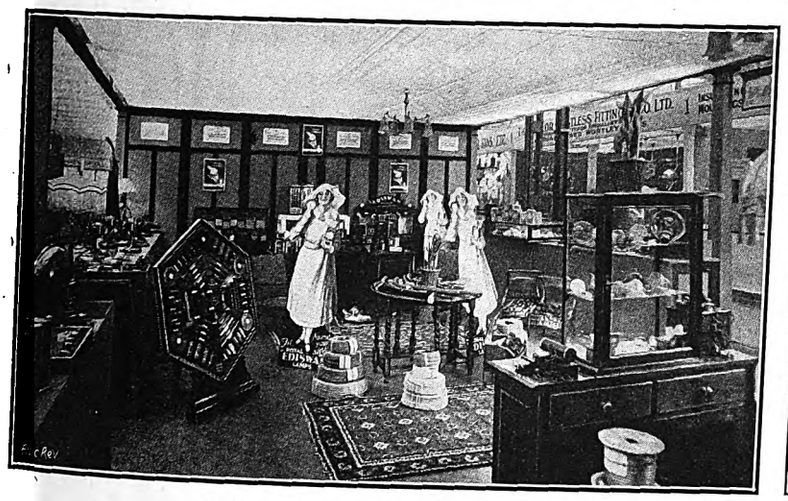
The British Industries Fair.—IV.

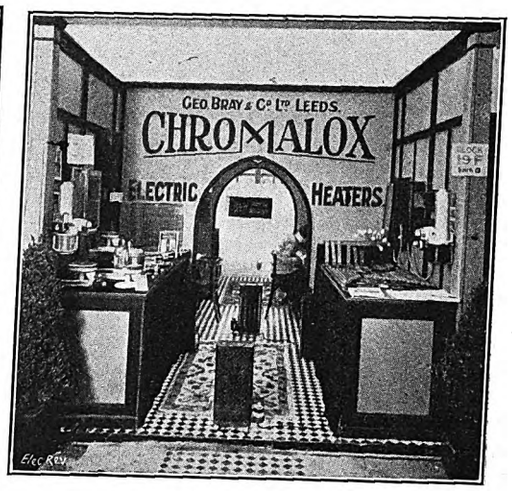
Functions and Exhibits in London and Birmingham.

When dealing with the British Industries Fair during the past few years we have always, with reason, laid greater stress upon the Birmingham Section for it is there that the electrical manufacturers are most in evidence. But gradually the London Section has assumed greater electrical importance and this year we have been compelled to give it more space than ever before. It may be that the Southward movement of industry has had an influence in this direction, but whatever the reason may be there is no doubt that the manufacturers of the smaller electrical apparatus and appliances were well represented at the White City this year.

The Fair closed on Friday last week, and by all accounts the business done was very gratifying. It always has to be borne in mind that the immediate results of such an exposition are by no means the *only* results. Shy or cautious buyers often prefer to make notes of what they have seen with a view to placing orders at a later date, so that the ultimate effect of the Fair is really incalculable. Another thing which has to be considered is the way in which such excellent shows enhance the prestige of British industry generally in the eyes of foreign and Dominion buyers.



Edison Swan Electric Co., Ltd.



George Bray & Co., Ltd.

Two of the Stands at Castle Bromwich, Birmingham.

The following statement on the achievements of the Birmingham Section of the Fair was made by Mr. R. C. Rodgers, president of the Birmingham Chamber of Commerce, which is responsible for the management of that section, at the close on Friday night: "I do not think it can be questioned that the Fair this year has been the most successful of the series. During the past eleven days I have been in close contact with a large number of exhibitors, and have obtained much information. Upon that information I have formed the definite opinion, which is confirmed by my colleagues on the Fair Management Committee, that the amount of actual business done has been entirely satisfactory, and that the number of trade inquiries has been largely in excess of last year. Already many of the exhibitors have applied for increased space for 1930, and everything points to the fact that the exhibition buildings must be still further extended. What the extent of the increased accommodation will need to be depends on the exhibitors themselves, but it is of the first importance that they should make their demands known at the earliest possible moment. The Chamber of Commerce has willingly faced extensions costing £30,000 in each of the last two years. The Chamber is prepared to make adequate provision for space in 1930, but I would point out that seven months in advance of this year's Fair in Birmingham every foot of space was let. For this Fair there were 300 manufacturers on the waiting list, all of whom had to be refused space. I am satisfied in my own mind that the Fair is well on its way to establishing itself as one of the greatest practical assets to British production that has ever been created. It is becoming recognised as the annual trade event which wholesale and retail distributors must take into account as the guiding factor in making their plans for the year. This view of the inevitable development of the British Industries Fair is confirmed by the official visit which I paid to the White City Section in London. The Fair, as a whole, has taken deep root. Both sections together form a complete exposition of the industries which make up our productive earning capacity as a nation. In 1930, we are all looking forward—exhibitors, buyers and management—to a still more remarkable record of business."

A director of one of the most prominent exhibitors of a specialised line of electrical apparatus informs us that his company never had fewer than 25 or 30 sound electrical men at its stand on any day of the Fair, and these came from all over the country. He is of the opinion that even in its present form the Fair is doing a great deal of good, but it could do enormously better if it were thoroughly representative of the industries of the country attracting foreign buyers, and if every detail of its organisation was as perfect as it might be.

The difficulty with regard to the Electrical Section is, as we pointed out last week, the immense variety of the productions of some of the leading manufacturers. Any attempt at strict classification would involve some companies in dozens of exhibits ranging from lamps to heavy machinery. At the same time it is probably true that the bulk of the firms exhibiting are more or less specialists in a particular direction, and so far as these are concerned some sort of co-ordination might well be tried.

We suppose that a large number of the buyers who visit the Fair are on the look-out for some individual appliance, accessory or apparatus, and it would certainly be more convenient to them and more conducive to business if they were able to find their particular class of product in a definite quarter.

No doubt this problem has already been placed before the management and will receive careful consideration.

In this issue we publish the concluding instalment of notes upon the stands at London and Birmingham.

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Electrical Organisations at Birmingham.

An Important Statement by Sir Andrew Duncan.

THE attendance at the Birmingham Section of the Fair on Friday last (the concluding day) was very satisfactory. Similarly to the preceding Friday it was an "electrical" day. Delegates were present at luncheon, as the guests of the Birmingham Chamber of Commerce, from the following bodies:—The Institution of Electrical Engineers, the Association of Consulting Engineers, the Association of Supervising Electrical Engineers, the Electrical Contractors' Association, the Electrical Contractors' Association of Scotland, the Electrical Wholesalers' Federation, the Electrical Merchants' and Manufacturers' Association, the Association of Mining Electrical Engineers, and the Illuminating Engineering Society.

Mr. G. N. Guest (chairman of the Fair Management Committee), who presided, stated that the Chamber of Commerce recognised that the electrical industry was the key to nearly all other industries. If this did not yet apply to all of them, it would be so when the "grid" arrived and then he hoped electricity would be much cheaper. Perhaps Sir Andrew Duncan would refer to that possibility if he dared (laughter). All present depended upon industry and the Fair was a big effort on the part of manufacturers to promote British trade and therefore British industry. He hoped, moreover, that the Fair would lead to increased business in the international markets. He trusted that with the growth of the Fair, which was inevitable, the Government would make a grant of much more than the £25,000 which it allowed at present, for advertising the two sections of the Fair.

Sir Andrew Duncan's Speech.

The toast "The Success of the Electrical Industry" was proposed by Sir Andrew Duncan, Chairman of the Central Electricity Board, who said that they all recognised that it was a far cry from the old time Fairs of the early craft fathers, who had their own exhibitions of their own handicraft in their isolated communities, to a great national Fair of British industry such as had been organised in Birmingham. The same stimulus to creative enterprise and the same enlargement of commercial vision arose to the nation from a Fair like that as arose to those small communities in olden times. It was fitting that the electrical industry should take such a leading part in that exhibition of British manufacturing strength. Many of our older industries had been going through a depressing time, and in spite of the superficial criticisms levelled against the internal disorders of industry that had arisen, or were supposed to have arisen from the superfluous and post-war booms, fundamentally the trouble had been that these industries which built up great facilities and led the world before the war, had had to-day too many facilities at hand for the market that was available. But the electrical industry had been like the younger brother in the family. Its strength was now growing rapidly in outlook and outlet; domestically and industrially the country was beginning to look more and more to this younger brother. It was, perhaps, natural that he should regard the electrical industry from the angle from which they of the Central Board must approach it. The trouble of the Act of 1926 had now died down and they were able to see things in a better perspective. Whether the expediency of cheapness would be realised or not the electrical industry ought, he thought, to be grateful to those politicians who, two years ago, gave the electrical industry better propaganda, if less truthful, than usual (laughter). It was better propaganda than the Electrical Development Association could have done in ten years, great as had been that Association's work. The public had been trained now to look to the electrical industry, and having launched their fifth scheme as a Board, and having visited almost every undertaking in five great areas, he was able to say of his own knowledge that there was a combined determination on the part of electrical engineers running power stations and distribution systems to expand to the greatest possible degree the use of electricity. And with a slight revival of British industry there would be unquestionably a growth of the use of electricity in this country that would more than surpass what they regarded as the very optimistic estimates made by gentlemen in London.

Further Central Board Contracts.

On the manufacturing side, too, both in the production of apparatus and of the larger type of machinery, the work that arose from the 1926 Act was now beginning to tell. Already the Central Board had placed contracts for over £3,000,000, and in the next week it intended to place contracts for another £3,000,000. All those contracts had been placed in this country, and those to be given out next week would also be placed in this country. He did not want anybody to say that they were spending that vast sum with a light heart. They were doing it with a great degree of responsibility, feeling that it was necessary for the schemes if they were ultimately to pay their own way. The view of the Central Board was that the electrical manufacturing industry had applied its energies in an equitable and fair manner from the monetary point of view to see that the requirements of the Central Board had been met on a basis that would ultimately make these paying schemes. There was an indirect reaction in this new experience of high-voltage transmission lines in the country. It was giving their own manufacturers a market at their own doors from which they would gain experience in the type of work which was world-wide now, and in world-wide competition they would be able to compete assisted by the knowledge gained at home. That he believed was regarded by the manufacturing industry of prime importance. He believed there were some important accessories which had always been manufactured abroad and imported into this country. We had already a movement for establishing factories here, not only for making them for our own market, but for the purpose of competing in foreign markets.

Engineers and Salesmanship.

Lieut.-Col. K. Edgcumbe (President of the Institution of Electrical Engineers), in responding, remarked that there were those who held that a technical institution like theirs should restrict itself to purely technical questions and pay no attention whatever to the industrial side. To his mind that was entirely wrong. The engineer was met at every turn with industrial questions. In fact, the success of the engineer depended more than anything else upon the price at which he could do his job. The Prince of Wales in his recent speech made some pertinent remarks on salesmanship. He believed a certain number of people thought that our salesmanship was not so black as it was painted. Be that as it might he thought they must agree with what the Prince said, that successful salesmanship depended largely upon personality and an intimate knowledge of the goods that were being sold. He felt that in a technical industry such as the electrical industry, it was quite impossible for the salesman to have the intimate knowledge, which was regarded as essential, of the goods which he was selling unless he really was an engineer. Sometimes they had felt at the Institution that the fact that the electrical engineer was now more intimately connected with the industrial side than with the purely designing side, was no bar to his candidature for the Institution, so long as he had the requisite training and could show that the post he held carried with it sufficient technical responsibility. There was a great opening for commercial engineers, and he thought that such men were just what the Prince of Wales had in mind when he said that we wanted men with personality and an intimate knowledge of what they were trying to sell. He thought it was particularly fitting that the Heavy Section of the Fair should be held in Birmingham—the world's recognised seat of engineering. The Birmingham Chamber of Commerce and the Corporation of Birmingham were heartily to be congratulated on the success of their labours. He thought that everyone would agree that at the present moment the most important thing, which they had to put in front of everything else, was "Buy British." It seemed that the state of employment was the best criterion as to whether or not we were importing too much in the way of manufactured goods. With unemployed to the extent of one and a third millions, it seemed that the ordinary stock arguments for or against protection or free trade entirely fell to the ground. The conditions were entirely different from the conditions which the old economists had in mind, and he did not think that anyone would dispute the fact that with the existing unemployment, it was "up to" everyone to buy all they could that was made in Great Britain. The question which should be asked was not only "How much does it cost?" but, above all, "Where was it made?"

Visit of the E.A.W.

Members of the Electrical Association for Women were entertained to tea in the afternoon. Mr. R. A. Chattock (city electrical engineer, Birmingham) presided. He said that what they wanted to impress upon everybody was the fact that everything they required could be made in England by ourselves, far better than anybody else could make it.

Lady Brooks pleaded for more art and more beauty in the design of electrical accessories.

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Some of the Exhibits.

A Further Instalment of Illustrated Notes.

Edison Swan Electric Co., Ltd.

This was a varied display of the company's products. It included the usual range of standard "Royal Ediswan" lamps, as well as "Pointolite" and "Kingolite" lamps. Among the electric lighting accessories shown was a selection of fuseboards and small switchgear, both ironclad and open type. Another section of the stand was devoted to domestic appliances and heating apparatus, such as vacuum cleaners, toasters, irons, kettles and fans, and there was a range of modern electric fires, including the "Vera" model and the 2- and 3-kW "Raymond" types. Representative samples of cables and wires manufactured at the Lydbrook Works, Glos., were on view,

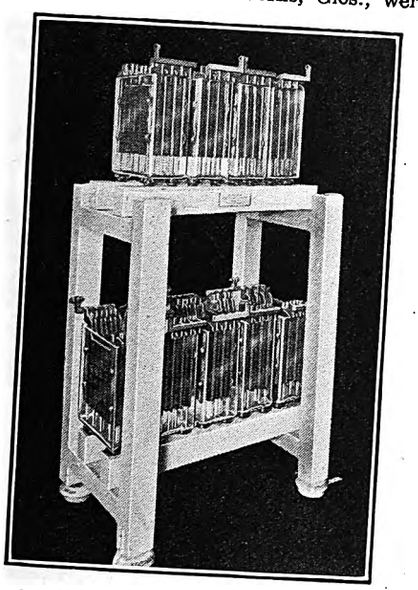

Fig. 33.—An "Ediswan" House-lighting Battery.

i.e., standard v.i.r. and c.t.s. cables, bitumen cables of all sizes, shot-firing cables and "Virite"—a special cable of compound insulation designed to resist the effects of very onerous conditions of service. The accumulator exhibit comprised a number of radio types ("Loten" and non-spillable), stationary type batteries, and motor car dry-charge starter batteries; in addition there were examples of the company's dry cells of various kinds. Several electricity meters were shown. Some Ediswan decorative fixtures were displayed in use for lighting the stand, and the latest designs of shades and standards appeared. The radio section embraced the well-known "Ediswan R.C. Threesome," mains h.t. units and receiving and transmitting valves. Our illustration (fig. 33) shows a house-lighting battery which is one of the exhibits.

W. H. Dorman & Co., Ltd.

This company's principal exhibits were "Flexstel" ball and socket and rotary joints, grey iron and aluminium sand castings, aluminium alloy, lead, tin and zinc base high-pressure machine die-castings, and pressure die-casting machines. Among the grey iron castings there was a selection of sole plates and clamps for electric irons of various sizes as well as sample castings for electric boiling plates and similar accessories.

Wm. Sanders & Co.

On this stand there were shown two sections of unit boards which instead of being mounted on angle-iron frames were solidly made with cast-iron busbar chambers and solid cast-iron legs to support them. Mounted on the sections were various switches, notably the new pattern of 400-A t.p. switch-fuse. All types of the company's "Superior" switches can be mounted on this type of board. The busbar chambers are made in various lengths to suit the switches which are mounted on them, and they have no sharp corners. The company also showed a number of knife switches, notably a 1,000-A switch with two blades mounted close together on one handle, providing a large contact surface and large carrying capacity. The fuseboards shown included 30-A teak boards which are made with up to 12 ways or more if required; and 15-A boards for domestic use, produced as switch-fuseboards or d.p. fuseboards. There was also a flush type teak fuseboard which is very useful for institutions where appearance is of prime importance. This consists of a cast-iron case with wooden front which is let into the brickwork or concrete, fitted with "Ideal" fuse elements on tilting battens for easy wiring.

Other exhibits were cooker control boards with main switch and separate small plug; samples of mining type "Superior" switch and switch-fuse gear, which hold the certificate of the Sheffield University; "Superior" switch-fuses, and "Presto" switches and switch-fuses; samples of all sizes of cut-outs and ironclad fuseboards, &c.

Fescol, Ltd.

The process by which this company deposits metals, particularly nickel and chromium, has already been described in the Electrical Review. The company's exhibit consisted of many examples of its work, mainly in the direction of building up worn parts. It is claimed that the deposit is unstrippable, cohesive and adhesive, forming an integral part of the base metal.

Wardle Engineering Co., Ltd.

This company's exhibit comprised a number of reflectors, lanterns and lighting fittings for industrial use, and street lighting equipment. The "One Piece" reflectors shown incorporate a patent easy-wiring cap and vibration-proof porcelain lampholder. Bruce "One Piece" copper lanterns, incorporating a dust-tight "Holophane" dome refractor with internal prisms have been produced for main street lighting.

Wardle glass units for offices, classrooms, and similar situations were displayed in adjoining stands. The glass is three ply, of pleasing appearance with minimum absorption coefficient. "Prismat" bulkhead fittings were also on view. These have been designed to secure definite control of the light rays in any required direction, and are intended to replace the bulkhead fitting of conventional design in tunnels, inspection pits, corridors, subways and similar situations.

Jackson Electric Stove Co., Ltd.

As usual, this company exhibited several examples of its cookers, fires, water-heating apparatus, &c. Among the cookers were the new "Jackson Junior" and the "Model No. 46," which we have recently described in our pages. Another interesting exhibit was the "No. 75" "Colonial" cooker, designed especially to meet the requirements of Empire markets. The cooker (fig. 34) has an oven with a cooking space measuring 13½ in. high, 13¾ in. wide, and 15½ in. deep, loaded to 1,650 W, and fitted with a drop-down door. The oven is surmounted by a hob fitted with a grill-boiling plate measuring 9 in. by 7½ in., loaded to 1,800 W, and two "No. 86" hot-

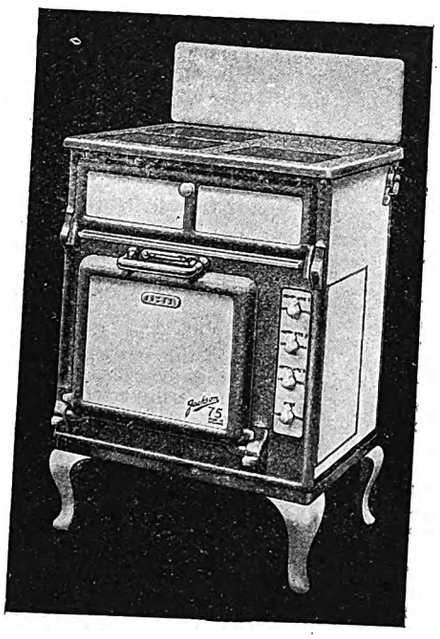

Fig. 34.—The Jackson "Colonial" Cooker.

plates measuring 8½ in. by 6 in., and loaded to 1,500 W each. All the units are arranged for 3-heat control by switches and fuses fitted in the control space on the side of the cooker. The space between the hob and the top of the oven is fitted with a drop-down door. Both the oven and hot cupboard are fitted with white panels mottled grey inside. The switch direction plate fitted is finished in white vitreous enamel with black lettering. The total height of the cooker is 36 in. It can be fitted with either a short splashplate or a standard plate-rack and splash plate. A thermometer is fitted to the cooker body (not to the oven door) and the oven is heavily lagged.

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Fox & Offord, Ltd.

This company exhibited at the Fair for the first time, and its display comprised direct-current meters, new patent prepayment meters, a patent electro-mechanical production and stock balance indicator, moulds for the production of "Bakelite" and other synthetic products, grinding spindles, jigs and fine tools, and pump conversion sets.

H. E. Ashdown, Ltd.

Messrs. Ashdown again had a display of various types of mouldings in "Bakelite" and synthetic resins. The company not only makes the mouldings, but it also produces and machines all metal parts, turning out a complete and finished article to specification.

Their latest development is a standard set of eight mouldings with which a wireman can assemble either a cord grip, screwed or batten type holder (with shade ring or skirt), or ceiling rose as required, thus eliminating delays when requiring an odd fitting. Another new accessory is an adjustable two-pin to b.c. adaptor, which is adjusted by a revolving and insulated ring on the body of the plug, thus guarding the user against shock. The cam action of the pins in relation to the thread motion is such that while the adjusting cap is easily revolved by hand, it will not do so whilst being transferred from one socket to another, thus altering the setting of pins. There is also a large and comprehensive range of general commercial mouldings.

Brantford Washing Machine Co., Ltd.

The British representatives of this Canadian company (the Sloan Electrical Co., Ltd.), had on view examples of the "Locomotive" washing machine which embodies a number of new features. The main part of this is a copper tank with a heavily-plated interior. This is equipped with small wheels running upon rails. By means of a crank on the shaft of the driving motor the tank is moved to and fro, and by reason of this and its shape the water is given a "figure of 8" motion and is swirled through the clothes. This obviates the use of a dolly or other moving device in the tank itself. There is a wringer which can be detached and packed neatly by the tank in the casing, the tank automatically locking into an end position when not in operation, and the whole of the equipment is mounted on castors for easy movement and covered in to form a table. Beneath the tank is fitted a 600-W heating element which can be switched on a reasonable time before washing is commenced to boil the water; as the tank when closed is airtight there is little heat loss. The wringer is provided with an ingenious release device which opens up the rollers immediately anything above a certain thickness gets between them. It is claimed that there is nothing in the whole equipment which can rust. The washer is well illustrated in the accompanying picture of the stand on which it was displayed (fig. 35). The model on the left of the illustration is fitted with a glass front for demonstration purposes. On the right the machine is shown disassembled.

Fig. 35.—The "Locomotive" Washing Machine.

J. H. Connor & Son, Ltd.

This was another washing machine company which exhibited in the Canadian section. The "Connor" electric washer is of the dolly type. Special attention is drawn to the container, the interior of which is of nickel-plated copper; there is an outer casing of sheet steel and between the two there is heat-insulating packing. The aluminium dolly has a reversing motion which is operated by a knob in the centre. The wringer is somewhat similar in design to that described above, the rollers springing well apart upon encountering any obstruction. The machines are equipped with British Thomson-Houston motors.

Moffats, Ltd.

This year the company was with its compatriots in the Canadian section, and it showed four examples of its "Gold Medal" cookers. The principal feature emphasised by the makers of these cookers is the porcelain enamel finish both within and without. One of the models on view was finished in a beautiful pale green; in the others the predominant colour was a kind of dove-grey. They would certainly brighten any kitchen considerably. Top and bottom elements are employed and from two to four boiling rings are provided. Each cooker has a thermometer fitted in the door, some of them having a compensated dial type.

Monarch Battery Manufacturing Co., Ltd.

This company also appeared in the Canadian section and showed a number of samples of its secondary batteries, most of which were fitted in ebonite cases.

Mudie's Electrical Co., Ltd.

Among the exhibits of this company were air-break free-handle circuit-breakers. This type cannot be held in against an overload—and the handle is used for both closing and opening the breaker. The moving contact is a laminated brush mounted on a rocker free to move on a spindle, which makes the brush self-aligning and equalises the pressure on both contacts. All parts are liberally rated to ensure cool running under rated load; and a noteworthy point is the long "wipe" which the brush makes on the contact blocks. The final break is between substantial carbon blocks, and a magnetic blow-out may be fitted. The breakers are supplied s.p., d.p., t.p., or 4-pole, and can also be supplied enclosed in sheet steel cases. The company also showed an oil-immersed wall-mounting ironclad circuit-breaker; an 11,000-V 3-phase oil switch for cubicle mounting fitted with self-contained anti-surging resistances, and hand-operated handle gear with t.p. overload and no-volt trip coils in a combined trip box; strip-type panel-mounting knife switches; h.p. and e.h.p. pole-operated isolating switches; current transformers of various types; a 3-phase ammeter switch; automatic electromagnetic battery switches; and cast brass switchboard labels.

Crosthwaite Engineering & Furnace Co., Ltd.

On this stand there was shown the Crosthwaite improved type of patent mechanical stoker and self-cleaning furnace which is claimed to give complete combustion of fuel, elimination of smoke without the need for admitting excess air, and easy and simple working, and to retain the advantages of hand firing without the disadvantages of mechanical stoking. There was also a Crosthwaite patent self-cleaning furnace especially designed for the economical burning of slurry and other waste fuels.

John Harper & Co., Ltd.

This exhibit comprised a full range of sand-blasted castings for all branches of the engineering and hardware industries, with examples of electrical instruments, meters, radiators, switchgear, motors, resistances, &c., adapted for machining by modern jig methods.

Rapid Magnetting Machine Co., Ltd.

New types of special electromagnetic equipment were shown by this company, and practical demonstrations of lifting magnets and seperating machines were given. In connection with pulverised fuel there was a new machine with jig shaker feed, which can be automatically regulated, embodying a recently-developed rotary separator which has special stationary magnets, about which the drum revolves. The drums are 24 in. in diameter and are listed in a range in multiples of approximately 6 in. in width up to 4 ft. A special motor blower for blowing dust from windings, &c., was another exhibit. This is a self-contained machine, mounted on a portable trolley complete with flexible hose and suitable starting switchgear. There was also a 20-in. diameter totally-enclosed magnetic clutch, for line shaft drive for power transmission and machine tool drives. Other exhibits were a new type of rotary separator used in connection with tea blending, and similar granular sifting machinery, for the extraction of iron, and a "chute" type. The high intensity electromagnetic chute is interconnected and interlocked with switchgear in such a way that in the event of the current failing, not only does a collapsible bridge divert the iron adhering to the poles, but the feed is automatically shut off, the switch is cut out, and an alarm bell rings. Another type of equipment recently developed is a special light electromagnet for use in conjunction with pickling and acid vats.

Dexine, Ltd.

Among a large collection of "Dexine" (rubber) and "Dexonite" (hard rubber) products for all purposes were a number of electrical components and accessories.

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Credenda Conduits Co., Ltd.

On this stand, which was a particularly large one (45 ft. by 20 ft.) was an excellent display of "Creda" electric heating and cooking apparatus. Examples of the latest types of "Creda" cookers in "standard" and "de luxe" finishes, occupied one end of the stand, the "deluxe" finish comprising all vitreous enamel, white and granite grey. For fine finish and workmanlike design and construction these cookers are in the front rank. At the other end of the stand were examples from the range of over 30 designs of electric fires made by the

Fig. 36.—A "Creda" Water Heater.

company, including imitation coal fires. Many other appliances were exhibited on the stand, including electric kettles, irons, toasters, grills, wash boilers, &c. The finely-finished automatic water heaters which were shown at the last Fair for the first time again appeared; the company says that since then a very big business has developed in them. They provide an absolutely automatic supply of boiling hot water for all domestic purposes, *i.e.*, baths, washing, &c., cheaply and economically. One of them is illustrated in fig. 36. Samples were also exhibited of "Credenda" conduits and conduit fittings, and the stand was illuminated by "Credalux" reflectors. A new line of "Credalux" streetlighting fittings was also exhibited.

F. Gilman (B.S.T.), Ltd.

This company showed, in operation, the various mechanical devices which it manufactures for carrying out every type of tube and surface scaling work. A flexible-shaft general-utility tool was shown. This can be fitted with drilling heads, emery wheels the "Skatoskalo", boiler-scaling chipper, and "Skatoskalo" rotary type heads for surface scaling, &c. The machine shown embodied a ½-h.p. electric motor, but various other arrangements are available.

Alfred Herbert, Ltd.

In addition to a large display of machine tools of various kinds, this company exhibited a typical "Atritor" coal-drying pulverising and firing machine. The use of this machine, which treats and fires the coal as required, obviates the storage of pulverised coal which presents difficulties and dangers.

Vitalite Co., Ltd.

Examples of "Vanalite" material and products were shown by this company. This composition although used for many kinds of mouldings, is particularly suitable for electrical work. Official tests have shown a break-down figure of about 20,000 V r.m.s. per millimetre thickness. It is non-inflammable and non-hygroscopic, and can be made in a great variety of colours. The "Vangard" pear switch which was also shown has several novel features. The case is made of "Vanalite" in a number of colours; the interior is of the best British vitreous china. Instead of plungers there are patented multifold spring contacts which produce high surface conductivity, smooth movement and definite action. The ends of the leads are kept entirely separate, and the cords are automatically gripped between the interior and the case. Every switch has a one-or two-way action, and it is claimed that the safe current carrying capacity is 3 A on a 250-V circuit. Miniature switches and lampholders embodying similar features were also shown.

Coventry Chain Co., Ltd.

Upon this stand were shown roller and inverted-tooth type chains for every class of industrial drive, chain couplings, speed-reduction and increase gear boxes, stud chains, pipe chains, balance chains and chains for elevating, conveying and a variety of special purposes. The central exhibit was a working model of a patent chain elevator.

Filtrators, Ltd.

This exhibit consisted of a complete plant for dealing with boiler-feed water, comprising a "Filtrator" and the "Filtrator" continuous blow-down and heat-recovery plant. The plant was shown with all connections made to a standard boiler. The company's system is non-chemical. By a physical process all scale-forming particles in boiler feed water are coated by colloidal starches extracted from linseed. They are prevented from adhering to each other and to the heating surfaces, and thus prevent the formation of hard scale. The sludge which is formed is removed by the continuous blow down. The heat which is lost by intermittent blowing down is returned to the feed water tank, a considerable portion of it as steam, the remainder in the form of clean water.

Langham Gears.

Motors with totally-enclosed reduction gearing were again shown by this firm, including triple-geared models capable of reducing the speed to 15 r.p.m. A number of applications of these motors were also shown.

Bulpitt & Sons, Ltd.

In addition to a very extensive display of aluminium ware, on stands in the hardware and electrical sections, this company exhibited a number of domestic electrical appliances, including kettles, percolators, urns, bowl fires, &c. A special exhibit was a hospital steriliser fitted with patent renewable immersion elements and a safety device.

B.K.B. Electric Motors, Ltd.

This company had a comprehensive exhibit of small electric motors, ranging from 1/100 h.p. to 5 h.p., of which 400 different ratings are available in fractional horse-power sizes alone, both for a.c. and for d.c. Special finishes are obtainable for high-grade instrument work, and there are designs applicable to every domestic or industrial purpose. The company also manufactures motor generators, "universal" motors, convertors, dynamos, static transformers, and high-tension generators for wireless and kindred purposes. A new line of universal motors with foot speed control for sewing machines and light dental work, &c., was exhibited.

Streetly Manufacturing Co., Ltd.

A variety of articles used in the motor, electrical and other industries, moulded from "Bakelite" and "Beetle" powders appeared on this stand. Hitherto, mouldings from synthetic resinous compounds have been largely limited to the darker shades, but the introduction of "Beetle" powders has made possible their manufacture in all colours—plain or mottled.

Bromford Tube Co., Ltd.

This exhibit comprised boiler tubes, steam mains, superheater tubes and elements, cable and telephone ducts, coils and manipulated tubing, &c. The company also exhibited seamless steel lighting standards and transmission poles, and has recently introduced new lighting standards with fluted columns. They are very attractive in appearance and are claimed to be superior to cast-iron in every way.

British Sangamo Co., Ltd.

A number of examples of high-grade instruments were on view on this company's stand. Among them were watt-hour and ampere-hour meters for a.c. and d.c., switchboard and house-service patterns.

Ruston & Hornsby, Ltd.

Included in this exhibit was a 20-b.h.p. cold-starting horizontal oil engine, designed to run on a wide range of cheap fuel oils. These engines are made in a range of sizes from 16 to 260 b.h.p. There was also a cold-starting vertical oil engine, 3-cylinder, rated at 100 b.h.p. This type is stated to be particularly well suited for generating electricity. A patented feature of the Ruston engine is the fuel distributor gear which ensures an equal distribution of fuel to all cylinders. The engines available cover sizes up to 1,000 b.h.p. Pumps and pumping plant and a "Thermax" vertical boiler were also shown. An exhibit which attracted a great deal of attention was a back-acting trenching machine weighing about 14 tons shown working.

National Gas Engine Co., Ltd.

The engine exhibit of this company included an "MHE" type engine and chain-driven dynamo rated at 7 kW maximum, 6¼ kW constant load. The engine is of the horizontal tube starting type, using cheap heavy oil as fuel. An ignition tube is incorporated in connection with the vaporiser. This tube is heated by means of a lamp, the time required not exceeding three minutes. The dynamo is of the Electric Construction Co.'s manufacture. There was also an "F" type gas engine and direct-coupled dynamo. The engine was of the horizontal totally-enclosed type, and the output of the set was 1 kW.

Pneulec, Ltd.

The "Pneulec Royer" sand-mixing machine for foundry use was shown by this company. This machine combs the sand and makes it easy to work. It is mounted on wheels and operated by an electric motor which, of course, is totally enclosed.

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Wolseley Sheep Shearing Machine Co., Ltd.

The sheep-shearing machines shown by this company included electrically-driven models. In addition to these there were shown petrol engines and electric generating sets. The latter included examples of the sets which the company makes in 1, 2 and 3-kW sizes, gear-belt or chain driven. The gear-driven and chain-driven models are specially constructed for economising floor space.

Micanite & Insulators Co., Ltd.

A comprehensive display of all classes of insulating materials including mica, micanite, paxolin ("Bakelite"), varnish-paper, empire cloths, tapes, papers, leatheroid, &c., appeared on this stand. A feature of the exhibit was a complete range of indoor and outdoor condenser-type terminals and bushings for transformers and switchgear including a 132-kV terminal designed to meet the requirements of the Central Electricity Board.

Henry Hope & Sons, Ltd.

An interesting exhibit on this stand was a typical factory "north-light" roof constructed with the company's patent glazing, and having a continuous opening light in the upper portion, extending the whole length, which could be opened and closed electrically by pressing a button.

Earle, Bourne & Co., Ltd.

This company had on view a comprehensive range of manufactures including cold-rolled brass, of various alloys, and copper; solid drawn brass and copper tubes for locomotives, condensers, &c.; brazed brass and copper tubes; angles, channels, and sections, &c.

Heyes & Co., Ltd.

This company exhibited an extensive range of "Wigan" flameproof and industrial type specialities, including mine signalling equipment, lamp fittings, prismatic bulkhead fittings, telephones, flameproof and watertight air-break switchgear, bells, keys, pushes, armour glands, &c. A modern type of luminous indicator for mine shaft signalling was shown in operation, together with suitable bells and keys. The switchgear included single units of the watertight and flameproof type, and pedestal type switch panels with various sizes of outgoing feeder switches.

Cellon (Richmond), Ltd.

The exhibits upon this stand comprised a range of various articles finished throughout with "Cerric" cellulose lacquers, including a number of electrical fittings, insulating slabs, &c.

Drayton Regulator & Instrument Co., Ltd.

Many types of temperature and pressure regulators and steam fittings were exhibited by this company.

May & Padmore, Ltd.

Among a large general display of its products, this company included a few examples of its "Maymore" electric fires, cooking apparatus, soldering irons, &c.

Braithwaite & Co. (Engineers), Ltd.

This company erected a steel transmission line tower in the grounds adjoining the Fair building. This was equipped with suspension and strain type insulators supporting a truck to demonstrate their strength. The insulators were produced by Steatite and Porcelain Products, Ltd.

R. M. Catterson-Smith.

Automatic-feed tube furnaces (electrically operated) for continuous processes were exemplified by this exhibit. There were also examples of other electric furnaces for ceramic work, &c.

E.A. Manufacturing Co., Ltd.

Among the exhibits on this stand were examples of the company's lampholders and ceiling plates fitted with an easily-manipulated cord grip.

Sperryn & Co.

This exhibit comprised samples of "Sperrynwood" switches, fuses and other electrical equipment.

Exhibits at the White City.

Doulton & Co., Ltd.

Included in a most attractive display of pottery, china, and earthenware, at this firm's stand was a series of electric table lamps consisting of a combination of wooden bases, artistic china, figures and groups, and silk shades. One of these is illustrated in fig. 37.

Fig. 37.—A Doulton Table Lamp.

British Celanese, Ltd.

"Celastoid," which is used for insulation as well as other purposes, was shown at this stand in a full range both of transparent and opaque colours. The material is non-inflammable, and among its uses is that of lamp shade manufacture. Specimens of "Celastine" moulding powders for producing insulating mouldings of all descriptions were also shown, together with specimens of moulded rods and sheets.

A. W. Beuttell, Ltd.

This firm had an artistically-arranged stand showing various applications of the "K-Ray" device for the lighting of shop facias, name boards, pictures, posters, &c. The illumination is effected by a single row of concealed lamps, either at the top or bottom, used in conjunction with a slightly concave glass window. The light from the lamp is thrown on the inner surface of the glass, which gathers up the light and transmits it evenly over the whole surface at once. The glass is slightly inclined, so as to meet the display at the bottom edge, and leave a narrow space at the top, through which the light is thrown on to the window at such an angle of incidence that it acts as a perfect, though invisible, reflector. The firm also displayed various examples of "Linolite" strip-lighting reflectors and "Little Giant" reflectors, in which standard lamps are used.

Dowsing Radiant Heat Co., Ltd.

A varied display was made by this concern. There were a range of "Solarium" sun baths in a variety of patterns, portable and pedestal massaging vibrators, ultra-violet ray lamps in standard and portable types, combined galvanic and Faraday current apparatus and other electromedical instruments. Another section of the stand was devoted to examples of radiant bowl fires, "Hotpoint" cookers, hot-plates, laundry and domestic irons, and a stand for electrically-heating irons. Electric kettles, saucepans, copper urns, sealing wax heaters, soldering irons, glue pots, and laundry machinery were also included in the display.

The Radio Section.

Although the Radio Section was not fully representative of the industry, it was on a larger scale than last year, the space occupied having increased from 6,400 sq. ft. to 8,500 sq. ft. Astom & Mander (1917), Ltd., who specialise in the manufacture of wooden cabinets for receiving sets, showed designs suitable for most of the instruments home-assembled from standard parts. The Brownie Wireless Co. (G.B.), Ltd., exhibited examples of its crystal and one- and three-valve receivers, together with a variety of accessories. The company has also a special department for the manufacture of insulated mouldings for radio purposes, many examples of which were displayed.

Devices designed to supply the necessary h.t. and l.t. current for radio-receiving sets direct from electric light circuits were displayed by E. K. Cole, Ltd. Trickle chargers were also shown, while the firm's latest introduction is the "Ekco Electric Straight Three" radio receiving set entirely operated by connection to a wall plug.

J. Dyson, Ltd., in addition to portable radio receivers and components, displayed a range of d.c. and a.c. eliminators. These are made in various sizes, including one with a range of from 40 to 200 V, for use with sets up to eight valves.

J. J. Eastick & Sons displayed a complete range of ter-

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minals and other accessories for radio use, together with examples of multiple connectors, special lightning protection switches, &c. At this stand a novel radio loud speaker, known as the "Conchophone," was also shown by A. J. Wright, Ltd., in which a natural shell is used in place of the usual cone or horn. A novel radio cabinet was shown by Hamiltons (Arundel), Ltd., the feature being that the sides are all hinged, so that they can be quickly dropped down to give ready access to the component parts of radio receiving sets. Another novelty was an indoor aerial, arranged to be used below, and in conjunction with, an ordinary telephone receiver and transmitter.

The principal exhibit of the Neophone Engineering Co. was a new seamless-cone diaphragm for loud speakers, made of vulcanite, for which maximum clarity and volume are claimed. The diaphragm is being supplied either separately or in complete cabinet loud speaker form. Among other concerns showing radio sets and components were C. Creswick Atkinson, Burgoyne Wireless, Ltd., Cliftophone & Records, Edison-Bell, Ltd., the Formo Co., Garnett, Whiteley and Co., Ltd., Graham Farish, Ltd., the Halcyon Wireless Co., Ltd., Henry W. King & Son, Langham Radio, Eric J. Lever (Trix), Ltd., Lissen, Ltd., the Loewe Radio Co., Ltd., "M.P.A." Wireless, Ltd., the Mic Wireless Co., Ormond Engineering Co., Ltd., Read Radio, Ltd., Rees-Mace Manufacturing Co., Ltd., Rialton Radio, the Ricarda Electric Co., the Savoy Radio Co., Selectors, Ltd., Steval, Ltd., Stratton & Co., Ltd., Triotone, Ltd., Truphonic Radio, Ltd., Wandle Radio Co., Watmel Wireless Co., Ltd., Whittingham, Smith & Co., and Wright & Weaire, Ltd.

A new feature of the display was the appearance for the first time of a number of combined radio receivers and electric gramophones, among the exhibitors of these being the Ambassador Talking Machine Co., Ltd., the Apollo Gramophone Co., Ltd., the British Homophone Co., Ltd., Celebritone, Ltd., Celebrity Gramophones, Ltd., Cook's Wireless Co., Ltd., Edison-Bell, Ltd., Gradiophone (Cabinets), Ltd., Langham Radio, Lissen, Ltd., Ormond Engineering Co., Ltd., Phantestra (Renns), Gramophone & Wireless, Ltd., Radio-Tri-Phone, Ltd., Rialton Radio, the Wandle Radio Co., and the Watmel Wireless Co., Ltd.

M.L. Magneto Syndicate, Ltd.

A prominent position was given on this stand to "M.L." rotary transformers for use in connection with radio transmission and reception, these being made in sizes, ranging from 12 V for accumulators, up to 200 V for mains supply, with outputs varying from 15 mA at 120 V up to 200 mA at 500 V, including a type for 12 V input, giving 50 mA at 1,000 V. A range of anode convertors was also shown, these being adapted to be operated either from 6- or 12-V accumulators, or from 100- or 200-V mains. Combined motor-generator sets were displayed ranging in output from 15 to 170 W. A small but interesting machine was a hand-driven generator

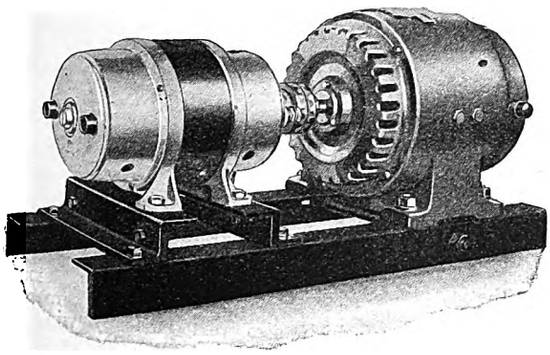

Fig. 38.—An "M.L." Motor-generator.

of a type largely used in connection with aeroplanes; it can supply either h.t. or l.t. current to a radio transmitter, an automatic signalling device being also provided to enable messages to be transmitted by an unskilled operator. The machine, which consists essentially of a permanent-magnet field generator, the armature of which is provided with two windings insulated from one another, and two commutators, has an output of 40 W. Gearing of 28 : 1 ratio is fitted between the armature shaft and the driving handle. The M.L. Co. also displayed moulded radio components. One of the company's motor-generator sets is illustrated in fig. 38.

Dubilier Condenser Co. (1925), Ltd., and Isenthal and Co., Ltd.

In addition to various specialities for radio use the Dubilier Co. showed examples of static condenser for power factor improvement, for power transmission line protection, and for laboratory use. Condenser blocks for use in conjunction with radio battery eliminators were also shown. Part of the stand was occupied by Isenthal & Co., Ltd., who had on view examples of mercury switches and relays, automatic voltage regulators, h.p. air-break switches, electromagnetic relays, remote control switches and tubular sliding rheostats.

Westinghouse Brake & Saxby Signal Co., Ltd.

Examples of the complete range of Westinghouse metal rectifiers for all purposes were shown on this company's stand, including instruments not only for radio use, but also for alternator excitation, battery-charging, lift-gate control, electro-plating and electro-medical apparatus. Special attention was drawn to a 1,000-V rectifier for radio transmission purposes and to a small rectifier adapted to obtain a direct supply from a.c. mains for feeding the pot-magnet windings

Fig. 39.—A Westinghouse Battery Charger.

of moving coil loud speakers. Other Westinghouse productions displayed included moving coil d.c. volt- and ammeters, portable a.c. testing voltmeters and a new four-circuit battery charging set specially designed for the charging of accumulators in motor garages and service stations (fig. 39). The four circuits provided are: 0.25 A, 150 V for h.t. cells; 0.5 A and 1.5 A, 150 V for low-capacity accumulators; and 5 A, 30 V for engine starter batteries. All the circuits are variable by means of tapping switches with final adjustment by sliding resistances.

Birkbys, Ltd.

The principal exhibit on this stand was the "Elo" synthetic resin product comprising mouldings, moulding powders, and insulating varnish. Among the samples of mouldings shown were armature and commutator parts, instrument covers, fuse blocks and cases, switch handles, magneto parts, meter cases, and radio components.

British Motor Sign Co.

An ingenious moving sign was shown at this stand. It consists of a small electrical projector and a film containing any message up to a maximum of 170 words. The film is driven by a fractional h.p. electric motor, and can be projected to a distance of 150 ft.

Ever Ready Co. (Great Britain), Ltd.

Dry batteries of all sizes and shapes to meet every possible requirement were again displayed by this company, special attention being drawn to those suitable for radio purposes. Samples of l.t. accumulators, portable electric lamps, and motor vehicle lighting accessories were also shown. A similar exhibit was staged at Birmingham.

Ferranti, Ltd.

Audio-frequency transformers were prominently displayed by this company, together with loud speakers, trickle chargers, h.t. supply units, and measuring instruments. The exhibit also included a high-power amplifier employed to convey the radio programmes from the London broadcasting station to loud speakers on each of the stands of the principal exhibitors of radio receiving sets.

Franco-British Electrical Co., Ltd.

This concern specialises in electrically-illuminated signs for all purposes. Special features of the exhibit were a new form of letter for shop signs, illuminated by reflected light from an electric lamp fitted in its centre, and a seven-switch flashing sign, the controller of which is driven by a ⅛-h.p. motor.

Sign Construction Co., Ltd.

At this stand was shown in operation one of the electric newspaper signs described and illustrated in our issue of April 8th, 1927. The installation comprises a long frame enclosing a very large number of compactly-arranged electric lamps, connected by leads to a special electrically-operated contact maker over which a perforated strip operates.

Freezone, Ltd.

Several examples of electrically-operated refrigerators for household, hotel and club use were shown by this company. The freezing unit, which is separate from the cabinet, is driven by a small motor, a thermostat being incorporated to control the temperature.

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Indurite Agency.

This concern specialises on the production and supply of a moulding powder known as "Indurite," and insulating mouldings made therefrom for a variety of purposes, including electrical and radio work, were shown.

Igranic Electric Co., Ltd.

A new device shown by this company was a screened-grid short-wave valve receiver. Another interesting exhibit was the "Phonovox" electrical reproducing equipment for use in connection with gramophones, this embodying an electrically-operated turntable, a special amplifier unit and a power supply unit for working off a.c. lighting circuits. The company also demonstrated its transverse current microphones and control units for use in broadcasting stations, public halls, &c.

K.F.M. Engineering Co., Ltd.

This firm specialises in the production of tubular lamp holders and reflectors for the lighting of shop windows, showcases, pictures, &c. Tubular lamps of 20- and 30-W capacity, 8¾ in. or 11 3/16 in. in length, are used, these being held between end blocks, which obviate the use of flexible conductors between the ends of the lamp. Three types—wide, narrow, and case-light—are made, these being available in lengths from 11 in. up to 12 ft.

Automatic Sun-Blind Co., Ltd.

One of the novelties of the Fair was this company's electrically-operated shop blind, which was described in our issue of December 21st, 1928 (p. 1091). It comprises an enclosed ¼-h.p. motor mounted within the blind roller. The latter is driven through a reduction gear running in oil and a coil spring, a special coupling being provided between the reduction gear and the driving plate.

Axuel Time Switches, Ltd.

In addition to the "Axuel" radio programme selector, by means of which radio receiving sets can be automatically switched on and off at any predetermined times, this firm displayed a new "four-in-one" radio valve made by the Quadruple Valve Co., Ltd., Northampton, which combines in one valve the functions of h.f. amplifier, detector, and first and second l.f. amplifiers.

Fraser & Glass.

Mouldings in "Omnite" were among the leading exhibits of this firm, many examples in various colours for electrical and radio purposes being displayed. Mouldings from Bakelite powders were also shown.

Belling & Lee, Ltd.

Indicating terminals for electrical and radio use are the main product of this firm, the range including terminals with markings in a number of European languages, as well as with American markings. A new line shown was an all-insulated plug and socket combination.

Beetle Products Co., Ltd., and British Cyanide Co., Ltd.

Another interesting section of the Fair comprised numerous exhibits of powders for producing non-inflammable high dielectric mouldings and of components made from such preparations. Among the exhibitors in this section was a joint one by the two concerns named above, who showed "Beetle" moulding powders in a variety of colours and "Beetle" synthetic resins, together with examples of moulded parts, such as switch covers, brackets, and electric table lamps.

H. Clarke & Co. (Manchester), Ltd.

This firm specialises in mains units for use with radio receiving sets. A new short-wave coil was seen among the range of coils displayed, while resistance coupling units, fixed condensers, and "Pirtoid" tubing were all on view. Electrical insulating materials are an important branch of the firm's activities, among those shown being vulcanised fibre, presspahn, and mica. The firm has introduced a new accumulator charging set with Westinghouse rectifier, and arranged for an output of from 1 to 5 A, the control being effected by a five-point switch.

S. G. Brown, Ltd.

In addition to a range of its latest moving-coil radio loud speakers, this company displayed examples of radio transformers, gyro compasses, and electro-megaphones.

Thomas De La Rue & Co., Ltd.

This firm showed examples of sixty grades of "Telenduron" insulated mouldings ranging from small radio components to large insulating links capable of withstanding considerable strain. Specimens of accumulator boxes were also shown, together with specimens of mouldings with metal inserts.

London Metal Warehouses, Ltd.

Plain and enamelled copper, phosphor bronze and aluminium wires for use for aerials and other radio purposes were on view. A large range of "Lunmet" insulated terminals was also displayed.

Bakelite, Ltd.

This company displayed a wide range of mouldings made from "Bakelite." Special attention was also drawn to a new flaked fabric material recently introduced by means of which, owing to the introduction of small flakes of fabric, mouldings with a higher shock resistance can be produced. Other exhibits included "Bakelite" cement, lacquer, and varnish—the latter being used for the insulation of coils, windings, &c.—and "Damarda" lacquer for colouring electric lamp bulbs.

Spauldings, Ltd.

Mouldings made of vulcanite, fibre and "Bakelite" are among the specialities of this concern, which exhibited a wide range of moulded parts for the electrical and radio trades. The mouldings can be supplied in various colours.

Mullard Wireless Service Co., Ltd.

Examples of the wide range of "Mullard" radio valves were to be seen at this stand, including the latest screened-grid and "Pentone" valves. Other exhibits were loud speakers, battery eliminators, wire-wound resistances, resistance-capacity coupling units and combined grid leak and condenser units on moulded bases.

Solaflex Amalgamated, Ltd.

At this stand were to be seen several patterns of Berry's "Magicoal" and "Newberry" electric fires and "Kangaroo" heaters. The greater part of the stand was, however, devoted to a range of day and night advertising signs, including the "Berrylite" and the "Luna."

Solidite and Synthetic Mouldings, Ltd.

This concern displayed many examples of "Bakelite" mouldings, for the electrical and radio trades, in a variety of colours, and made to very fine limits.

Telegraph Condenser Co., Ltd.

This concern displayed a variety of condensers for use in connection with radio and h.p. cable work. Particular attention was drawn to a mica transmitting condenser with a capacity of 0.003 mfd., the mica being immersed in oil in a sheet-metal case, it being intended to carry 30 A at 100 kilocycles. Smoothing condensers designed for a maximum working pressure of 2,500 V in various capacities were also displayed.

Advertising and Illuminated Signs.

Electrically-illuminated advertising signs were shown by quite a number of concerns, to which, however, only a brief reference can be made. Marathon, Ltd., exhibited an ingenious running sign which can display any message up to 27 ft. in length; detachable letters are used, and the outfit is operated by a 1/40-h.p. motor. The Power Engineering Co. introduced a new type of changing-colour sign, in which the different colours are gradually blended into each other by means of a special belt-driven commutator. Other exhibitors in this section included the Anglo-Scandia Co., Ltd., the Allan Manufacturing Co., the "Attracta" Electrical Co., Thos. Digby Illuminating Engineering Co., Ltd., the Glow-Activa Sign Co. (1928), Ltd., and United Signs, Ltd.

Electric Lighting Fittings.

Among the exhibitors of electric floor and table standards were J. Pope, who showed them finished in attractive colours of "Nacrolacque," shades of the same material to match being provided. Those displayed by Goodworks, Ltd., were notable in that they were made of ivory and choice colours of synthetic resins. The table lamps shown by Henry W. King & Son were of interest; the glass bowls were painted on the inside, to which also real butterfly wings were attached. The Shoreditch Wood Turning Co., Ltd., specialises in the production of wooden floor and table standards finished in Chinese lacquer. In the glass section electric table lamps and shades made of cut glass were shown by Stevens & Williams, Ltd., John Walsh, Ltd., and F. Wilkinson & Co. Artistic electric light fittings were displayed by the Birmingham Guild, Ltd., and the Pearson Page Co., Ltd.

One of the most striking features of the Fair was the extensive and artistic displays of electric lamp shades. These are being made in almost every possible material, ranging from glass to nacrolacque, not excluding ramie and imitation pigskin. Among the exhibitors in this section were Albion Shades, Ltd., who displayed, among others, shades made of "Velskin," a non-inflammable material made by a cellulose process to imitate real vellum. Artistic Lampshade Manufacturers showed both electric lamp standards and shades finished in fancy colours of nacrolaque. A novelty at this stand was a combined table lamp and radio loud speaker, the latter, of the cone type, being incorporated with the top of the shade.

Miscellaneous.

In addition to the exhibitors mentioned there were many lamp shades and other lighting fittings displayed, as well as electrical novelties of various kinds. One or two firms showed apparatus for the assistance of the deaf, including "Oravox" equipment, which is compact and light. The makers (Oravox, Ltd.) have designed a special equipment for use in churches.

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The Ideal Home Exhibition.—I.

A Review of the Electrical Features.

THE electrical aspect of the *Daily Mail* Ideal Home Exhibition, the twenty-first of which was opened at Olympia on February 26th and will continue until March 23rd, becomes increasingiy important as time goes on. Practically every new development affecting the domestic side of the industry is represented at the Exhibition and is being practically demonstrated to the many thousands of visitors. As usual, a large number of the leading electrical manufacturers are represented, showing improved appliances for electric lighting, heating, cooking, ventilation, and so on.

A spectacular feature of the Exhibition is the large "Mazdalux" electric fountain, fig. 1, which has been erected in the main hall by the British Thomson-Houston Co., Ltd. Electrically illuminated fountains are, of course, not new, for they formed a feature of the Inventions Exhibition at South Kensington as long ago as 1885, but the present apparatus, which weighs approximately 50 tons, is of a quite different form and much more beautiful than anything previously achieved in this country. A lower basin, measuring 30 ft. across, is mounted on a steel supporting structure at a height of 14 ft. above the ground level. In the centre of the pool is a tower supporting an upper basin 16 ft. in diameter. In the latter are five banks of nozzles from which spring huge jets of water, the heights of which are controlled and varied automatically. With the rapidly-changing colour effects produced by means of a battery of 30 B.T.H. floodlight projectors, concealed beneath the water in the upper basin, the fountain provides a noteworthy spectacle. When in operation there are no fewer than seventy-two different combined water and colour effects every eight minutes. Further spectacular effects are provided by the illumination, in a variety of changing colours, of the water flowing over the weir from the upper to the lower basin; this is achieved by means of 120 "Mazda" colour-sprayed lamps concealed under the rim of the upper basin, in conjunction with flashing devices.

All the apparatus for operating the fountain, consisting of a motor-driven centrifugal pump for producing the necessary water pressure, the electric flashing devices for controlling

Fig. 1.—"Electric" Fountain in the Main Hall.

the colour and water effects, electrically-operated water valves, and switchgear for controlling the floodlights, is housed in the central tower, the whole being remotely-controlled from a push-button station situated in the supporting structure. The electrical and water connections were carried out by Messrs. Grierson, Ltd., while the tank work was provided by Messrs. Silas-Hyde.

On the B.T.-H. stand prominence is given to the company's automatic electric refrigerator, numerous examples of which are shown in operation. This apparatus, fig. 2, is noticeable for its simplicity of construction and quietness of operation. Plugged into any electric-light point it will, it is claimed, keep food under ideal conditions for a year at a cost of a few pence per week. There are no exposed working parts, all the mechanism being hermetically sealed in a steel casing on the top of the cabinet. Permanent lubrication is provided by a specially compounded oil. The B.T.-H. refrigerators are supplied in eight models suitable for the home, with capacities varying from 2¼ to 18 cu. ft., and shelf areas from 5½ to 29½ sq. ft. The models are supplied in various finishes of porcelain and lacquer. In addition to the refrigerators, there are many other interesting exhibits on this stand, especially in electric lighting equipment, a variety of B.T.-H. fittings being employed for the dual purpose of illuminating

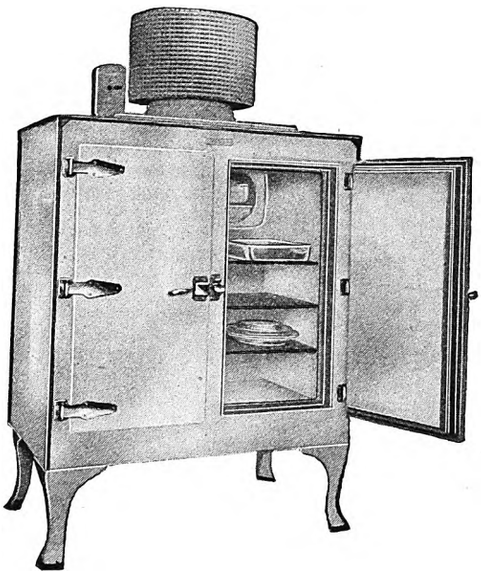

Fig. 2.—B.T.H. Refrigerator.

the stand and demonstration purposes. Finally, it may be mentioned that a corner of the exhibit is occupied by a large life-like tableau of the "Pearl Mazda" lamp showcard—"Beauty Enriched by Light."

The stand of British Vacuum Cleaner and Engineering Co., Ltd., is devoted to a display of various types of electric and non-electric vacuum cleaners. The popular electrically-operated machine is the "Goblin"; it is of the horizontal cylindrical pattern with an enclosed dust bag, two small wheels being provided at one end to enable the apparatus to be readily moved about. The motor, which drives a special high-speed suction turbine fan, is fitted with grease-filled ball bearings, and is claimed to be able to run continuously for six hours on a consumption of 1 kWh. It is supplied with 21 ft. of electric cable and 8 ft. of suction hose, together with attachments for four different cleaning operations. A range of more powerful machines is seen in the B.V.C. "Turbine" cleaners, which are made in three sizes—a domestic machine with a ⅛th-h.p. motor for home use, a ⅜th-h.p. apparatus intended for department stores, kinemas, hotels, and so on, and a ¾-h.p. machine for factories and other buildings where small refuse is intermingled with the dust.

Since the last Exhibition, Hoover, Ltd., has placed on the market a new heavy-duty vacuum cleaner for use in large residences, clubs, and hotels. The popular household models are also displayed, two varieties being available. Both embody the deep-breathing principle, and with them can be used the Hoover floor polisher in place of the detachable agitator.

The exhibit of Petters, Ltd., is largely confined to a range of self-contained electric generating sets for country house lighting, with or without batteries. The smallest plant is capable of providing current for the average house or bungalow, with anything from six to eight lamps. One of the most interesting exhibits is the Auto-Petter-Light, without accumulators, this being automatically controlled so that there is no need to go near the actual installation itself to start or stop the engine.

Rotapex, Ltd., is also showing electrically-operated domestic appliances. The "Apex" gyrator machine is adapted for both clothes washing and drying, being also equipped with a small hydro-extractor. A less expensive machine is the "Rotarex" washer with a power-driven wringer. Other "Rotapex" exhibits include both single- and double-roll ironing machines, refrigerating cabinets, two types of "Apex" vacuum cleaners, one known as the "Rotarex," and the "Econo" horizontal three-stage cleaner and blower.

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Transmission-line Poles.

Notes on Timber Preservation by the Creosoting and "Cobra" Processes.

A MEETING of the Overhead Lines Association was held at the Institution of Electrical Engineers, London, on February 20th, when Mr. W. Fennell (President) took the chair.

The President announced with sincere regret the death of Mr. A. H. Allen, late Technical Editor of the Electrical Review. Mr. Allen, he pointed out, had been largely instrumental in getting the Association formed, and was its first and only honorary member. At the request of the President those present stood in silence for a few moments.

Two papers, which are referred to below, were then read on timber preservation.

The "Cobra" Process.

By R. H. Herford.

(*Abstract.*)

The object of the "Cobra" method is to introduce strong fungicidal material into the cells of the wood, where it can be caught by the rising moisture drawn from the ground during growth and distributed throughout the timber. The fungicidal material must have strong antiseptic properties, not only to kill any organism that may be present when inoculation and diffusion takes place, but also to guard against future action. The material must also be stable, so that it does not disintegrate or disappear in time, and, further, must so fix itself in the fibre of the wood that it does not leak out. Another important quality demanded is high osmotic pressure, or power of diffusion in water. There is perhaps no substance which contains all these desirable qualities, but there is a simple compound of two substances which contains them in a high degree; the two elements are sodium fluoride and dinitrophenol. The first has high osmotic pressure and diffuses readily, whilst the second has pronounced stability. When mixed with water to the consistency of a thin paste and introduced into timber by means of a hollow needle, the sodium fluoride moves quickly, and soon establishes complete protection: the dinitrophenol follows on and consolidates the position. When required to combat the attack of insects, 20 per cent. of the sodium fluoride is replaced by arsenic.

The inoculation is carried out by what might be described as a large hollow flattened needle, similar to that of a hypodermic syringe. The needle acts first as a narrow wedge, separating the wood fibres, and, secondly, as it is withdrawn, it ejects two jets of preservative into the split originally made. The length of the needle and the consequent depth of penetration of the preservative ranges from 4 to 8 cm. The poles are inoculated along a length of about 3 ft., of which a portion is underground, and the inoculation splits are ranged all round the post in longitudinal, transverse and spiral lines. New poles, when treated, should be freshly felled, or, at least, they should not be fully seasoned, and the bark must be removed before treatment. Standing poles may also be treated, in which case the earth is removed from around the bottom to a depth of 2 ft., or thereabouts, so that the portion of the pole below the ground level may also be treated. A feature of the process is that the preservative will penetrate the heartwood of spruce poles, whereas creosoting will not.

The process is also recommended for inoculating the top portions of poles where the supports for wires are fixed, and also for partly decayed poles. In the latter case, the decayed wood on the surface is removed before inoculation takes place, the whole afterwards being painted with a solution which contains some tar oil. All poles, new or otherwise, are treated in this way after inoculation.

The Creosoting Process.

By Christopher Wade, A.M.I.E.E.

(*Abstract.*)

CREOSOTING under pressure has been used and found satisfactory in this country since 1838, when Mr. John Bethell obtained his original patent for the injection of hot creosote oil or dead oil of tar into the wood to be preserved. Timber so treated is still in use after 30 years, and examples are in existence after 50 years and more, in a perfect state of preservation.

My oldest customers in the North a year or two ago had every pole of some thousands examined and bored into, after being up about 25 years, and found only about 10 doubtful ones; some they took down and re-erected again in other places, as perfectly good for further service. A section of my firm—Messrs. English Bros., of Wisbech—states that the creosoted wooden piling put in the River Nene, at Wisbech, in 1854 to 1856, is perfectly sound now, after 70 years' service. The above facts show quite definitely the value of creosoted timber, and though many processes have been invented and tried in the last hundred years, creosote is the only one which has stood the test of time, and is used almost universally.

The German Ruping process of creosoting now prevails, by means of which the surplus oil is drawn off and the timber is left practically dry to handle. In this process the poles are placed in a cylinder. A vacuum is created, in the first place, to extract any moisture, and then compressed air is applied at a pressure of 60 or 80 lb. per sq. in., which opens up the pores of the wood, and the creosote oil is pumped in on the top of this pressure, up to, say, 150 lb. When this pressure is taken off the compressed air in the cells of the timber expels any surplus oil, leaving in about 5 or 6 lb. per cu. ft.

Whitewood, such as spruce or larch, will not absorb creosote, owing to the pores or grains of the wood being closed up. Larch also has a tendency to split and twist. Penetration cannot be obtained in the heartwood of any wood, even redwood, owing to the cells of the heartwood being sealed up. This fact does not seem to be generally appreciated or understood; but as most decay commences from the outside, this is of little account.

Any preparing, such as arm slots, &c., should be done before creosoting, as otherwise untreated timber may be exposed, so letting in rotting agents, or fungi, which are carried by the wind. The main point of decay is undoubtedly between "wind and water" at ground line, where all the three necessary factors of decay are present—namely, moisture, air and warmth. Some poles have been found hollow owing to the moisture entering at the top and percolating down the poles.

Molesworth's diary gives the following tensile strengths for timber: redwood, 12,000 or 14,000; larch, 8,900 or 10,200; spruce, 10,100; and whitewood, 8,700 or 11,000. I am not quite sure what the alternative figures are for, but in any case redwood is the strongest.

Discussion.

Mr. S. G. Bartholomew (General Post Office) exhibited two samples from poles which had been impregnated on the old Bethell system, one of which had been put into service in 1870, and the other in 1880; both were in splendid condition. The Post Office authorities, he said, had investigated all kinds of processes for impregnating telegraph and telephone poles, other than ordinary creosoting, but they had all been turned down. The later Ruping process had the advantage that poles could be painted after treatment, and that often satisfied local authorities, although he could not say that the painting was altogether satisfactory, after a short time. After the Bethell process creosote always oozed out, and it was impossible to paint afterwards. The Post Office experience with larch poles had not been satisfactory, and Scotch fir poles were best, but it was only possible to get 5 or 6 per cent. of the Post Office requirements of 100,000 poles per annum supplied by Scotch fir. As regarded the Cobra process, time would be the only test, and it would be interesting to know if the process was doing what was claimed for it after a period of years.

Mr. W. A. Turnbull (Aylesbury) said he had always understood that it was impossible to inject creosote into the heart wood, but some of the illustrations shown by Mr. Wade indicated that the creosote had penetrated the heart wood. Did Mr. Wade consider it detrimental to poles to have climbing irons fitted, and would it be necessary to go back to the ladder. Similarly, was it a serious offence from the point of view of the pole to fix "swan necks" for insulators? Again, how far did the creosote penetrate from the ends of the poles, and was it likely to do damage if a 2-in. nail was driven into the end when fixing the top to the pole? What was the cost of a gallon of the liquid used in the Cobra process, and did it require a skilled staff to do the work? He was specially interested in the new method because he could obtain larch poles in his district at 5s. each, and if by the new method it were possible to treat the poles on the spot it would be a great advantage.

The President said the first thing that had struck him was why the Cobra process did not use creosote. He thought that if creosote could be used it would make the process a little less frightening. There was a process called Burnetising, and he had some poles treated by that method which had stood up well. As to the prospects of the Cobra process making home-grown timber available for pole lines, in his district there was the Delaware Forest where there was any amount of timber in all stages which was being grown by the Department of Woods and Forests, and, like Mr. Turnbull, it would be a great convenience to him if some of this could be made available by the use of such a process as the Cobra process.

Mr. Bartholomew said that Burnetising was a process of impregnating with zinc chloride, and a pole so treated could be painted. The process was the alternative to the Bethell process before the Ruping process came in.

Mr. Wade, replying to the discussion, said it did not matter if nails were driven into the tops of creosoted poles for putting the cap on, as the creosote would have penetrated sufficiently for that purpose. It was immaterial whether

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the creosote penetrated the heart wood, as that did not decay. He also saw no objection to using climbing irons. If cuts in poles, after the original creosoting had taken place, were painted with a mixture of tar and creosote, it would be found satisfactory. More home-grown timber would be used if it could be obtained; he believed that in the next generation there would be an enormous quantity available. Although he had had no experience of the Cobra process, he felt that creosoting had been so satisfactory that there was no object in changing. The cost of white wood, which, it was suggested, the Cobra process would make available, was not much less than the cost of red wood, and the cost of the process seemed to be quite as much, or even more, than creosoting. He could confirm Mr. Bartholomew's experience with regard to larch, and mentioned that many such poles put up during the war had had to be replaced since.

Mr. Herford also replied, and said the trouble with larch was the large splits which occurred; at the Forest Products Research Laboratories, at Princes Risborough, an effort was being made to prevent large splits by making a number of small ones. He did not condemn creosoting, but it had serious limitations. At the same time, it was questionable whether a life of 50 or 60 years was really wanted from a pole, and, therefore, a process which would permit the use of timber not now regarded as suitable, even though its life might be shorter, was worthy of consideration. The records of the Cobra process went back 8 or 10 years on the Continent, and it had been used for from 50,000 to 60,000 new poles and 130,000 standing poles a year in Germany. The Austrian Telegraph Department used the process for treating 20,000 poles a year, and several departments of the Russian Government were also using it. The whole question was bound up with the economics of the supply of poles. On the Continent they had their forests and had to import creosote, and that, of course, made a difference in favour of the process. He quite realised that he had not an easy task in this country against creosote, but he believed, nevertheless, that the process had a field here. The preservative used was in the form of a yellow powder, and cost 2s. 3d. per lb. That quantity was sufficient to treat three standing poles, with a small machine, and, using the large machine, one pole would take 1¼ lb. of preservative.

Electricity Meter Bearings.

A review of the author's experimental and statistical data relative to the leading problem in maintenance, namely, that of worn rotor bearings.

By W. LAWSON. M.I.E.E.

(*Extracts from a Paper read before the* Meter Section *of the* Institution of Electrical Engineers.)

Attention is drawn to the necessity for improving the reliability of meters in service in consequence of the vast number to be dealt with under modern conditions. The period of sustained accuracy needs to be extended in order to reduce the work of periodically exchanging meters, which is becoming increasingly difficult to contend with. It is submitted that the solution lies in increasing the durability of the bearings, particularly the combination of bottom jewel and pivot which constitutes the footstep bearing. If the rotor had unrestricted freedom of movement it would not make a simple rotary motion, but would tend to move bodily in the direction of drive; when the driving force is applied there is a lateral movement of the rotor which tends to localise the pivots away from the dead centres of the bearings. Observation confirms this, particularly in the bottom bearing, which affords more freedom of movement than does the top bearing, and as the load on the meter increases more side pressure is exerted at the point of the pivot against the curved surface of the jewel, and this in turn produces an upward displacement of the rotor, which, though exceedingly small in the case of a.c. meters, is readily discernible in d.c. meters. The attention of the author was first specially directed to these movements through observing that the worn surface of jewels is not always located

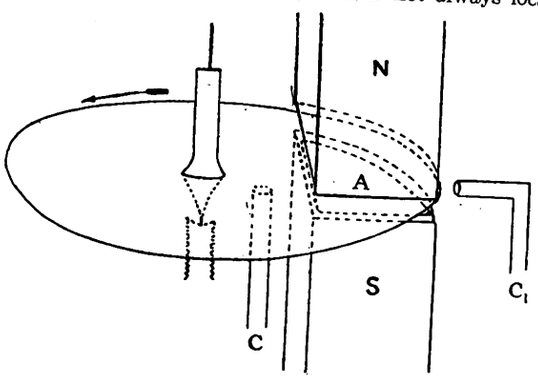

Fig. 1.—Arrangement of Damping Plate.

at the centre of the cup, and they were subsequently usefully employed in devising a means of compensating for the effect of fluid friction in mercury motor meters.

An explanation of the development of the author's ideas in this connection may not be out of place. Fig. 1 shows that the armature, magnet poles and conductors C C_1 conform to the usual arrangement, with the exception that the pole-faces are of sector instead of circular shape, and are so situated as to enable the working flux to embrace as much as possible of the area of the disk near the periphery. The effect of this modification is a considerable increase in speed, due partly to increased torque, but largely to decreased braking consequent on the cutting off of the Foucault currents generated in the disk. In order to reduce speed and so improve the characteristics, a damping plate A consisting of thin amalgamated copper sheet is placed below the armature and parallel to it, in the magnetic field. It has the effect of short-circuiting the e.m.f. generated in the disk and enormously increases the braking effect. It is essential that the under-surface of the armature should be amalgamated. The action that takes place is as follows:—

The eddy currents generated by the rotation, which ordinarily are almost all dissipated in the disk, find a path of low resistance by the proximity of the damping plate. As the speed increases, there is an upward movement of the disk (as

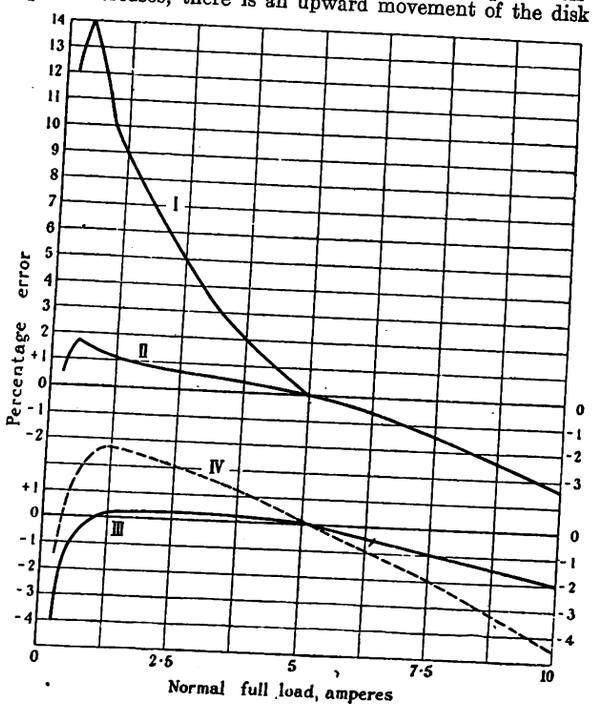

Fig. 2.—Effects of Damping Plate.

already described) which gradually increases the distance between the armature and the damping-plate (the greater the speed the greater the distance between the armature and the plate) obviously introducing more resistance in the path of the eddy currents and thereby reducing the brake torque. Compensation for fluid friction is thereby automatically achieved. No provision is necessary for any more displacement of the armature than takes place in any other meter of this type.

Curve I (full-load speed, 95 r.p.m.), fig. 2, shows the characteristic of a meter without damping plate, curve II (52 r.p.m.) shows the characteristic with a damping plate of medium area, curve III (41 r.p.m.) shows the characteristic with a damping plate of large area, while curve IV (21 r.p.m.) shows the characteristic of a low-speed mercury meter without any form of correction for fluid friction. The damping plate not only helps to compensate for fluid friction, but also tends to

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smooth out the hump at the lower loads. The position of the damping plate relative to the magnet pole-face also influences the shape of the curve; fig. 3 demonstrates this.

If the damping plate A, or a portion of it, is made movable, the speed of the meter can be altered at will. The same principle can be applied to the improvement of the overload accuracy of a.c. meters. In this case the position of the brake magnet must be such that the lateral displacement of the rotor reduces the distance between the centre of the rotor and the brake magnet, to reduce the brake torque and so result in speeding-up the meter. To obtain marked results the rotor displacement has to be accentuated by the use of a bottom jewel having a specially wide and shallow cup. Better methods than this are employed to improve the overload characteristics of a.c. meters; it is referred to merely further to illustrate the lateral movement of the rotor.

It is not claimed that a general solution of the bearing problem has been found, or is in sight, and it is recognised that few definite conclusions can be arrived at from the experience and observational and experimental work detailed in the paper. Some advantages may, however, be gained in an endeavour to sum up the situation, and to that end the author formulates his views in the following paragraphs:—

(1) When the cost of a diamond bearing represents a small item of the total cost of the metering equipment, it offers a complete solution of the bearing problem. With low-priced meters its use from a financial point of view is debatable, but might be justified in the long run. Users of meters should seriously consider the adoption of diamond jewels in all meters of, say, 50 kW and over, and manufacturers should assist by placing themselves in a position to supply them.

(2) In a.c. meters vibration contributes to the wearing of the jewel and becomes more destructive with increased working forces in the meter (compare tests of agate pivots in polyphase and single-phase meters). Care should be taken not to overload meters heavily, even if they are designed for accurate performance under such conditions.

(3) Oil-immersion extends the life of the jewel and reduces the effect of wear on the accuracy, but is subject to physical changes and cannot be trusted for sufficiently long periods.

(4) The agate pivot provides a possible means of solving bearing troubles in mercury motor meters which would be subject to very light action and be free from the possibility of damage in transit.

(5) Given bearings of the durability of the diamond, reasonably protected against dust accumulation, with the pivots of all moving parts made of rustless material and no oil being used, there is no reason why the modern a.c. meter period of exchange should not be extended to 10 years, or even longer.

(6) Durability tests of jewels, if carried out, as they should be, under normal working conditions, necessarily extend over long periods of years and consequently do not constitute a sufficiently rapid means of obtaining results. Further, they offer no prospects of determining the root cause of wear upon the discovery of which depends the whole solution of the problem of producing bearings of uniformly high durability from the cheaper stones.

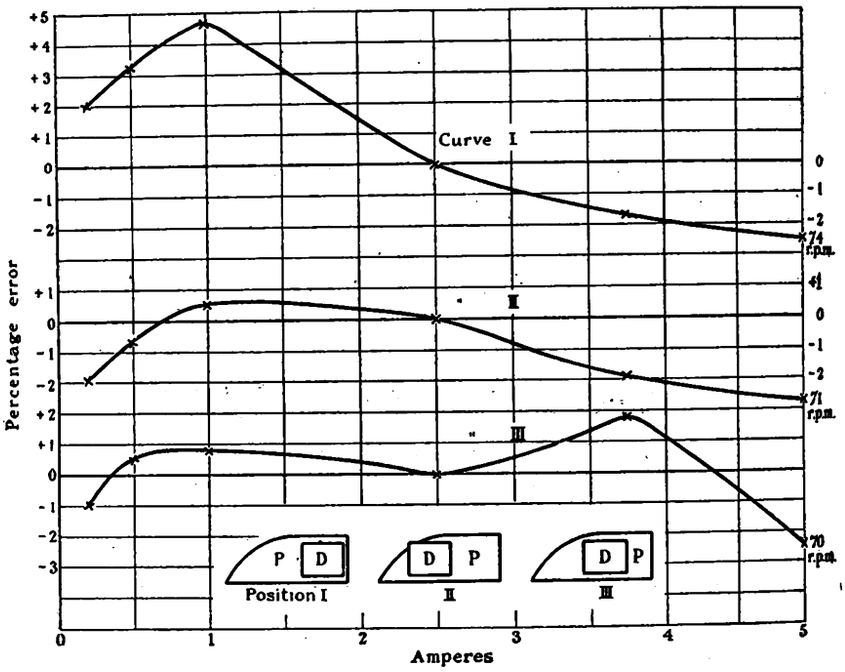

Fig. 3.—Influence of Position of Damping Plate.

The solution of the problem will come from the scientific research laboratory rather than from the maintenance side, but co-operation of the workers in both fields of inquiry would be a step in the right direction.

The author thanks Mr. R. A. Chattock, city electrical engineer of Birmingham, for permission to carry out the investigations and publish the results.

Refrigeration on Shipboard.

Some Features of Electrically-driven Compressor Plant.

By H. J. WARD, M.A.

(*Extracts from a Paper read before the* Institution of Mechanical Engineers.)

Of the various types of modern refrigerating machines, such as carbon dioxide (CO_2), ammonia (NH_3) compression, ammonia absorption, dense air, and water-vapour machines, only the two first named have met with any lasting success on board ship. Analysis of the lists published in the latest issue of Lloyds' Register of Shipping shows that by far the greater proportion of the refrigerating machines installed for cargo purposes operate upon the gas-compression system. Of the total 80 per cent. uses carbon dioxide as the working medium; 18 per cent. uses ammonia, air-compression now accounts for only 0.8 per cent., and other systems for 1.2 per cent.

Within the last few years the use of oil-engines for main propulsion and the increasing practice of driving auxiliaries electrically have led to the adoption of higher compressor speeds. The motors drive through gearing, or directly through a slightly flexible coupling, at speeds up to 150 r.p.m. for compressors with open motion work. As a further step in the direction of economy compressors may be mounted vertically on totally-enclosed frames with the motion parts oiled by forced lubrication; in this case the motor is directly coupled and may run at a speed of 350 r.p.m., or thereabouts. Such machines effect considerable saving of space and attention, and by eliminating gearing almost noiseless running is obtained, a very important consideration when passengers are carried. In a recent example of a vessel driven by oil-engines through twin screws, the CO_2 refrigerating machinery, in two electrically-driven units, affords complete facilities for temperature regulation, according to the distribution of a mixed cargo of fruit, dairy produce, and meat, by means of fan circulation on a new system. Rather too much is sometimes expected of the ship's refrigerating plant, which should not, strictly speaking, be called upon to do much more than maintain temperatures. Quite recently the practice of installing small electrically-driven compressors has been growing. They work with a low-pressure gas, such as methyl chloride, and cool individual cupboards at points too remote from the main plant to be conveniently connected to it. Cooling is effected by direct expansion and automatic starting and stopping of the plant is controlled by a thermostat.

All the larger naval vessels are equipped with electrically-driven refrigerating plant, usually on the CO_2 compression system, and embodying a number of units of moderate size. These are employed for cooling the gun charges, thereby maintaining their ballistic properties, and for the preservation of food for the crew. Certain classes of submarines intended for service in hot waters have been fitted with specially designed and very compact CO_2 machines for the main purpose of keeping the storage batteries at temperatures low enough to retain their capacity and to extend their life, which otherwise is short in the tropics. Advantage is taken of the presence of the plant, as an alternative duty, to cool and dry the air used for ventilation, thereby rendering the con-

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ditions more tolerable for the crew. A small cold store is also provided for provisions.

Horizontal machines driven by electric motors through double-helical reduction gear, with a ratio of about 5 to 1, have been used for some large passenger steamers in the Australian trade. Although the intervention of gearing enables the motor to be run at a speed more appropriate to the power transmitted than in cases of the drive being direct, it is impossible to avoid a certain amount of noise from the transmission. With open motion work and gravity lubrication, crankshaft speeds above 150 r.p.m. are generally undesirable for large units. To approach the economical speed of the electric motor while avoiding gearing, totally enclosed motion work becomes necessary, and full speed can be raised to 350 or 400 r.p.m. A type of machine which has been introduced lately for vessels wherein slightly greater headroom can be provided has a pair of single-acting CO_2 compressors mounted on a totally-enclosed frame, with ample doors for access to the glands and motion work, and has forced lubrication to all bearings by means of a pump fitted at the end of the crankshaft. The bearing surfaces are specially liberal so as to allow the use of refrigerator oil for general lubrication as well as for the compressor glands, thereby avoiding the necessity of carrying two classes of oil.

Legal.

Marconi Radio Patent Royalties.

In the Chancery Division, on February 27th, Mr. Justice Luxmoore had before him an appeal by Marconi's Wireless Telegraph Co., Ltd., from a decision of the Comptroller-General of Patents on an application by the Brownie Wireless Co., of Great Britain, Ltd., with regard to the amount of royalties to be paid by the Brownie Co. in respect of licences under patents held by the Marconi Co. There was another case in the list in which the respondents were the Loewe Radio Co., Ltd., but it was stated that the two cases would have to be dealt with separately.

Mr. Whitehead, K.C., for the Marconi Co., said that the appeal raised questions of great importance from the general standpoint of patentees. The Brownie Co. applied for compulsory licences under two patents; the first related to high-frequency reactance and the second to the grid leak invention. The Marconi Co. owned or controlled these two, and about a dozen other radio patents, and had granted over 2,000 licences. These licences had not all been in quite the same form. Five other companies—the British Thomson-Houston Co., Ltd., the Metropolitan Vickers Co., Ltd., the General Electric Co., Ltd., the Western Electric Co., and Radio Communication Co.—in consideration of the fact that they had shared the original risks, were granted licences involving the payment of only 10s. per valveholder, instead of the 12s. 6d. which was charged to other licensees. Also, in the case of licensees whose payments had been upwards of £5,000 or £10,000 there had been a reduction in the rates of royalty. The Marconi Co. offered the Brownie Co. licences on the same terms as the other general licensees, with the exception of the companies mentioned above. This offer was refused by the Brownie Co., who asked for special terms, and, upon being refused these, they asked for a compulsory licence under the provisions of Section 27 of the Patents Act. The Brownie Co. complained that "by reason of the refusal of the patentee to grant licences upon reasonable terms . . . it was in the public interest that a licence should be granted" (by the Comptroller). The Comptroller held that there had been an abuse of the monopoly rights, coming within the terms of the relevant paragraph of the Act. There was also a finding that the applicant was prejudiced by the non-granting of the licence. Counsel suggested that a result of the decision would be, if it were upheld, that holders of licences on the regular terms could claim that they wished to change, and if the patentees refused to grant licences on revised and lower terms it would be, on the ground of that finding, an abuse of monopoly rights. The question might arise whether the terms of the licence offered to the Brownie Co. were not, in the circumstances, reasonable. He would further submit that there had been no abuse of the monopoly rights. In the rules of procedure it was stated that all orders of the Comptroller-General under the section in question should be made subject to appeal to the Court. But in the present case there was no order to appeal from. There had been a "decision" which covered various points, but the Comptroller had suggested that the applicant and the patentee should confer and decide on the terms of the proposed licence. He had, in fact, never made an order.

The Judge said he did not see how they could go on in the absence of a formal order.

A conference too place between counsel, and there was an adjournment in order that the Attorney-General might be consulted. Upon the resumption of the case, Sir T. Inskip, K.C., the Attorney-General, said the Comptroller felt that he would have great difficulty in drawing up an order without the assistance of all parties. There were two courses open. One was for the two parties to assume that the decision of the Comptroller was right and that his Lordship had affirmed it, and then on that footing help the Comptroller to make an order in accordance with the decision; or the Comptroller could make an order substituting what he thought were reasonable conditions for those in the licence offered by the Marconi Company, which he thought unreasonable.

The Judge said that the best course would be for the case to stand over so that the Comptroller might call on the parties, if he so desired, to help him with regard to the licence. An order would then be made, and the appeal could be put in the list. He gave liberty to apply, and also gave liberty to the Marconi Company to amend its petition in any manner that might be necessary when the order was made.

Counsel for all the parties interested said they were willing to assist the Comptroller in every way possible so that the matter might be proceeded with.

The case with regard to the Brownie Company accordingly stood over, and the same course was taken with the other case.

Mr. Justice Luxmoore said he hoped it would be possible to get the order drawn up in the next week or so. He would give every facility he could.

An Electricity Supply Dispute.

At the Tavistock County Court on February 21st, Mrs. Alice Ghey, of Crapstone, Yelverton, Devon, sued Mr. C. T. Melhuish, trading as the Crapstone Electricity Supply, for £30 16s. damages for breach of contract, the defendant having cut off the electricity supply to her premises without reasonable notice.

A solicitor for the plaintiff said that when his client complained about failures of the supply, the defendant was rude to her and finally sent an assistant to cut off the supply from outside her house. She denied that she had given instructions for the supply to be discontinued.

The defendant said that in the course of installing a new switchboard at the works it became necessary to disconnect the supply for certain periods. During one period Mrs. Ghey telephoned and said that if the supply could not be restored at once it might be disconnected altogether, and later Mr. Ghey confirmed this.

His Honour Judge Higgins found for the defendant, on legal grounds, and awarded him his costs. A stay of execution was granted.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Electricity Measurement.

As manufacturers of friction compensated d.c. ampere-hour meters, we object to the deprecating remarks contained in the abstract of the paper by Mr. J. L. Carr, read before the Meter Section of the I.E.E. They were obviously based on information given by a competitor and, as such, can have no value (except to prove the reverse). We sell both compensated and non-compensated d.c. ampere-hour meters at the same price, and claim that they are equally reliable.

A.E.G. Electric Co., Ltd.,
H. Horwood.

London, S.W.1., *February 25th*, 1929.

Hydro-electric Power in India.

It has been said that you cannot hurry the East. Mr. G. O. McLean tells us in your issue of March 1st that "It has been estimated that India has available in water-power more than five million h.p., of which only about half is developed at present." That, according to this year's Ready Reckoner, gives India 2,500,000 developed h.p. On looking up my report on the Hydro-electric Survey, I find that in 1922 only 139,000 h.p. of plant was installed, so someone must have been hustling a bit since then; or did Mr. McLean forget to verify his facts?

J. W. Meares.

Guildford, *March 1st*, 1929.

Service and Co-operation.

Your wise remarks on page 364 of your issue dated the 1st instant deserve more than casual reading, and I venture to ask you to again bring the great value of co-operation before your large and influential circle of readers.

May I endorse your remarks regarding the unique opportunities of those who "serve" electricity to co-operate in spreading the good news of electric service, and may I add that those

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who receive the benefit of such service, *viz.*, the consumers, may be induced to also co-operate to extend the amount of electricity supply and so add to the common benefit.

You state that the idea is not untried, and, with your permission, I should like to draw attention to the scheme adopted by East Anglian Electricity, Ltd., which was a useful and profitable company. The co-operation was secured by the issue to the employés of "workers'" shares, limited in number, but which carried the right to double the dividend declared on "ordinary" shares, also the shares to consumers which carried a right to a reduction in cost of electricity. Unfortunately the "powers that be," who unfortunately are opposed to electrical development, were able to stop the good work of this company in such directions.

The value of an electric service for power and other purposes is of such importance to the welfare of this country, and especially to rural industries, that any aid towards its advancement is worth noting and adopting.

Napier Prentice.

London, *March 2nd*, 1929.

The Kennedy Memorial.

That there should be a permanent and lasting memorial of affection and esteem for the late Sir Alexander Kennedy is a feeling common to all who knew him or his work.

He was a pioneer in engineering education, for, during his tenure of the Chair of Mechanical and Civil Engineering (1874-1889) at University College, London, he was largely responsible for the lines and methods which higher education in engineering has adopted. As an engineer in practice, his wide knowledge of mechanical and electrical engineering was always available for the service of the country.

In connection with the Centenary Celebrations of University College, a movement was inaugurated to endow the Department over which he long presided with such distinction; and some time ago he had consented to the Chair in the Department being called by his name. Towards the sum of £30,000 required for this endowment, a sum of £18,035 has already been subscribed, leaving the amount of £11,965 still to be raised.

We are in hearty sympathy with this project and feel that no more suitable memorial of Kennedy's great work could be established. We invite all those who knew Kennedy to associate themselves with this memorial. Subscriptions should be sent to the Right Hon. Lord Meston, chairman of the Centenary Fund, at University College, London.

E. Rutherford,
President,
Royal Society.

Brodie Henderson,
President,
Institution of Civil Engineers.

R. W. Allen,
President,
Institution of Mechanical Engineers

K. Edgcumbe,
President,
Institution of Electrical Engineers.

Gregory Foster,
Provost,
University College, London.

University College,
London, *February*, 1929.

Service Boxes.

The correspondence on service boxes should prove interesting and instructive, as so many engineers are inclined to treat low-voltage jointing with a certain amount of contempt, yet most of their mains faults are on their low-voltage networks. Obviously, it should be our aim to restore a paper-insulated, lead-sheathed cable as nearly as possible to its original state; therefore, a pressed-lead service box, or one made up by the jointer out of sheet lead, should be used. If the cores are well insulated with tape boiled in resin oil compound, and the box filled with a high-grade compound, preferably with a resin base, little or no trouble should ever be experienced.

Regarding protection, I prefer an iron box with armour clamps, but many use creosoted wood boxes and tiles. If one waits for plumber-jointers to answer advertisements, one will always experience a shortage of really good men. The obvious remedy is to train them yourself; one way is to get improver plumbers as jointer's mates, and in twelve months an intelligent mate should be satisfactory for low-voltage joints.

Compound will not resist the penetration of moisture indefinitely, and practically every iron box joint made could be topped up next day if the hole could be left open, as shrinkage must occur, and a vacuum is created within the box which will surely suck in moisture in time.

Regarding time taken, I suggest that plumbed work takes no longer, as with iron boxes the jointer should allow two or three hours for cooling and shrinkage of compound, whilst this question is not quite so important with lead boxes, especially if a semi-fluid compound is used when the ratio of pouring temperature to setting temperature is quite low.

To Mr. L. Robbins I would say, let your plumber-jointers always use lead tees, even if those men represent only a small number of all your jointers, as by so doing the number of eventual faults will be reduced.

H. Payn,
Engineer and Manager,
Boston and District Electric Supply Co., Ltd.

Boston, Lincs., *February 25th*, 1929.

Hire-purchase Selling.

In your issue dated the 22nd instant an article on the above subject appeared on pages 326-328, and I would like to make the following comments.

The effect of the interest charge in the example is stated as about 7½ per cent. for the year, but, as the real measure of the accommodation given to the purchaser is of course based on the amounts outstanding from month to month, the interest charge results in a return of nearly 14 per cent. per annum, or, if calculated on the capital involved, assuming this to be the high figure of 75 per cent. of the cost price, 20 per cent. per annum.

E. B.

February 27th, 1929.

Replying to the above letter, I may say that in my article the charges made by finance corporations are given as percentages of the amount advanced. This fact is clearly shown in the example worked out on page 327.

Since the advance and finance charge are paid back in equal monthly instalments, the average balance outstanding over the period is approximately half of the total sum. The rate of interest charged is thus in the neighbourhood of 15 per cent. per annum. This is the actual rate on the amount borrowed, and the size of the initial payment does not of itself affect this figure. The charge can scarcely be considered too high in view of the fact that it covers the preparation of the legal forms, credit investigation, collection of monthly instalments, and insurance.

To base calculations on the actual rate of interest charged would considerably complicate the calculation, because of the effect of compound interest. For this reason the finance corporations almost invariably figure their charge as a percentage of the initial advance.

Ecos.

March 1st, 1929.

Collecting Money from Prepayment Meters.

With reference to the letter in your issue of February 8th regarding the above subject, I have pleasure in giving your correspondent some information on the subject.

We have now connected to our mains over 16,000 prepayment meters, and in the summer time employ five collectors. In the winter months, when the collections are much heavier, that number is increased to eight collectors. These men read the different circuit books alternately, that is to say, no collector reads the same meter twice consecutively. By this method any discrepancy made by one collector will be discovered by the collector who takes the next reading, unless there is collaboration between all the collectors, which is unlikely. We do not find any necessity for two men going together, but occasionally a clerk from the borough treasurer's office accompanies the collector for a day or so from time to time.

With regard to collecting money during the day from collectors with a barrow, or other vehicle, this will depend largely upon local conditions. This town is fairly well self-contained, and all parts are adequately served by the electric car service, and consequently the use of a vehicle to collect monies is not considered necessary. The collectors deliver their collections at noon and 5 p.m. daily to the office, the circuit books being checked with monies delivered by the collectors the following day. The money taken from penny-in-the-slot meters is made up by the collectors in 5s. copper bags; the name of the Department is printed on the bags, and on being handed in at the office, they are stamped with the date and the collector's number. The bags are sent to the bank daily in cardboard boxes, each containing £5 in copper, the boxes being conveyed in a motor vehicle. The collectors commence duty at 9 a.m., are allowed 1½ hours for dinner, and finish at 5.30 p.m.; whilst on duty they are required to wear a uniform provided by the Department.

James Edgar,
Borough Electrical Engineer.

South Shields, *February 25th*, 1929.

I was interested to read in your correspondence columns the letter of "Prepayment," but don't you consider it rather a strange way to stop this systematic fraud to publish these means? It seems to me that you would be acting as an information bureau to awaken the collectors of money from prepayment meters to the system to be used against them, or, in other words, assisting them to ward off detection.

It is a technical job to stop these frauds, and should be left to, or given to, a technical man who knows a meter and

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who is paid to know his job. It is the mechanical side of the meter that will stop it; it cannot be stopped by the pen. Consult your meter superintendent.

Regarding the reading of, and collecting of money from, meters, the majority of business houses are well alive by 8 a.m., the same as the villa, and a meter reader should find little difficulty in obtaining admittance at, or about, that time.

Meter Engineer.

February 23rd, 1929.

London Trunk Power Cables.

With reference to the article by Mr. K. Bell, which appeared in your issue of February 8th on the protection of unarmoured cables by slabs of concrete placed above them, it may be of interest to your readers that I happen to know of three cases during the last two or three weeks in which iron bars 1 in. by 1 in. have been put into the ground in search for escaping gas, one of which went right through the concrete covering, and then right through the heart of a 33,000-volt cable; so it would seem that in certain cases even a concrete cover is of no protection, though in cases of excavation by the gas and water companies it should, presumably, save the situation.

"Interested."

March 2nd, 1929.

With reference to the letter which appeared in your columns from "Resident Engineer," has not your correspondent totally overlooked the fact that the discussion is about 66,000-volt single-core cables, and that to put these in triangular formation at a distance apart of 15 inches would be to invite eddy currents of the most alarming nature in the lead sheaths?

A. M. Taylor,
Major, S.O.2.

Birmingham, *March 2nd*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be numbered and abridged, and all subsequent proceedings will be taken.

1927.

20,334. "Alternating-current motors." Maatschappij Tot Vervaardiging Van Snijmachines Volgens Van Berkel's Patent en Van Andere Werktuigen. July 30th, 1926. (275,264.)

20,447. "Electric storage batteries." R. Bosch Akt. Ges. January 11th, 1927. (283,490.)

20,796 "Tuning system for electric circuits carrying high-frequency currents." H. F. Elliott. August 6th, 1927. (305,600.)

21,019. "Manufacture of inductance coils and the like." M. Y. A. Serruys. August 9th, 1927. (305,683.)

22,774. "Means for the production of high-frequency currents." P. R. Coursey and Dubilier Condenser Co. (1925), Ltd. August 30th, 1927. (305,508.)

23,804. "Electrical gasfilled discharge device." F. Meyer and H. J. Spanner. September 9th, 1926. (Addition to 275,552.) (277,364.)

26,678. "Electric protective arrangements." British Thomson-Houston Co., Ltd., S. H. Petch, and F. J. Lane. October 8th, 1927. (Cognate application, 2908/28.) (305,687.)

27,478. "Lampholders for electric lamps." J. B. Taunton. July 25th, 1928. (305,283.)

29,130. "Electric heating devices." Hotpoint Electric Apliance Co., Ltd., and W. J. Sims. November 1st, 1927. (305,500.)

29,296. "Telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky). November 2nd, 1927. (305,691.)

29,372. "Manufacture of electrical condensers and materials therefor." E. W. Jodrey. November 3rd 1927. (Cognate application, 3129/28.) (305,515.)

29,919. "Methods of enamelling, and apparatus therefor." W. E. Beatty (Bell Telephones Laboratories, Inc.) November 8th, 1927. (305,611.)

29,925. "Dynamo-electric machines." J. Stone & Co, Ltd., and A. A. Mead. November 8th, 1927. (305,612.)

29,940. "Sound-reproducing apparatus." C. C. De C. de la Bourdonnais Prince de Mahe. November 8th, 1927. (305,614.)

29,961. "Simultaneous reproduction of sounds and pictures." B. E. G. Mittell and Gramophone Co., Ltd. November 8th, 1927. (305,617.)

29,964. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. November 8th, 1927. (305,618.)

30,015. "Electric protective systems." A. Reyrolle and B. H. Leeson. November 9th, 1927. (305,696.)

30,084. "Electric inductance coils." J. H. Nichols. November 9th, 1927. (305,702.)

30,089. "Radio and the like high-frequency receiving systems." G. A. Mathieu. November 9th, 1927. (305,703.)

30,174. "Electric protective devices." British Thomson-Houston Co., Ltd., and H. S. Petch. November 10th, 1927. (305,708.)

30,234. "Telephone systems." Associated Telephone and Telegraph Co. November 10th, 1926. (280,576.)

30,273. "Electric geyser or water-heater." A. W. Newland and J. Sabel. November 11th, 1927. (305,713.)

30,510. "Lamps for motor vehicles." British Thomson-Houston Co., Ltd., and C. J. Morton. November 14th, 1927. (305,496.)

30,567. "Apparatus for applying material to cores, particularly applicable to the insulation of cable conductors." W. E. Beatty (Bell Telephone Laboratories, Inc.). November 14th, 1927. (305,688.)

30,793. "Telephonic systems." A. Graham & Co., Ltd., and W. J. Rickets. November 16th, 1927. (Cognate application, 30,794/27.) (305,730.)

30,809. "Telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. November 17th, 1927. (305,731.)

31,067 "Aerial systems for wireless signalling." T. L. Eckersley. November 16th, 1927. (305,733.)

31,350 "Electric secondary batteries or accumulators." H. F. Joel, sen. September 21st, 1928. (305,738.)

32,406. "Automatic switches for telephone exchanges and remote-control systems." H. Baron C. Aldendorff December 1st, 1927. (305,747.)

32,649. "Loud-speakers." J. Wilson. December 3rd, 1927. (305,748.)

32,733. "Electric thermostats." B. R. Wingfield and B. T. Wingfield. December 5th, 1927. (305,749.)

33,386. "Apparatus for ultra-violet ray treatment." C. A. Cooper. December 9th, 1927. (305,758.)

34,794. "Electrical filters." R. E. H. Carpenter. December 22nd, 1927. (305,771.)

1928.

157. "Locking devices for electric incandescent lamps or the like." General Electric Co., Ltd., and R. J. Kaula. January 3rd, 1928. (305,781.)

1,106. "Apparatus for the production of heat, ultra-violet, and other radiation." L. G. Hawkins & Co., Ltd., and L. G. Hawkins. January 12th, 1928. (305,788.)

1,950. "Means for carrying and holding together a number of galvanic batteries." Oldham & Son, Ltd., and W. F. Wilde. November 10th, 1927. (Divided application on 30,194/27.) (305,724.)

2,319. "Electric heating element." J. Katunsky. January 24th, 1928. (305,799.)

2,770. "Manufacture of electric cables." W. S. Taylor. January 28th, 1928. (305,802.)

4,479. "Radiators heated by steam generated electrically." J. Vigneault. February 13th, 1928. (305,818.)

4,660. "Long-distance cable installations." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased), Suddeutsche Telefon-Apparate-Kabel-und-Drahtwerke Akt. Ges. February 14th, 1928. (305,822.)

5,645. "Incandescent cathode discharge tubes." C. H. F. Müller Akt. Ges. February 22nd, 1927. (285,843.)

7,155. "Electromagnetically or pneumatically-operated main current switch." C. Bruynis. March 7th, 1928. (305,847.)

7,354. "Talking motion picture apparatus." De Forest Phonofilms, Ltd. May 14th, 1927. (290,564.)

7,391. "Electric heating elements of the immersion type." W. W. Nobbs. March 9th, 1928. (305,849.)

9,633. "Electrodes for electron-discharge devices and the like." Westinghouse Lamps Co. March 30th, 1927. (287,937.)

10,517. "Electrical condensers." Telefunken Ges. für Drahtlose Telegraphie. April 9th, 1927. (288,518.)

10,961. "Insulating caps." Ramie Union. September 23rd, 1927. (297,447.)

11,185. "Method of and means for rectifying alternating currents." P. J. Maffey and J. B. L. Foot. April 16th, 1928. (305,875.)

13,701. "Lighting apparatus." Benjamin Electric, Ltd. May 19th, 1927. (290,667.)

14,789. "Insulation material for electric apparatus." H. D. Symons. May 19th, 1928. (305,887.)

15,477. "Electrode holders, for electric arc-welding." G. Haagen & Cie. May 27th, 1927. (291,114.)

17,717. "Electrolytic apparatus for refining aluminium and for like processes." Soc. Anon. Compagnie de Produits Chimiques et Electro-metallurgiques Alais, Froges, & Camargue. July 4th, 1927. (293,353.)

18,139. "Electric suspension insulators." M. Hentschel and F. Müller (trading as Porzellanfabrik Hentschel & Müller). June 22nd, 1928. (305,895.)

20,011. "Foot-operated controllers for electric motors." W. Fairweather (Singer Manufacturing Co.). July 10th, 1928. (305,903.)

21,368. "Counting apparatus." Telefonaktiebolaget L. M. Ericsson. August 3rd, 1927. (294,983.)

23,077. "Vacuum electric discharge tube devices." Westinghouse Electric and Manufacturing Co. August 13th, 1927. (295,580.)

29,357. "Apparatus for the manufacture of electric insulating tubes." P. Betz. October 11th, 1927. (298,578.)

35,228. "Electric induction furnaces." E. F. Northrup. September 8th, 1927. (Divided application on 301,954.) (305,620.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 27th :—

Edison. No. 493,476. Class 8. Electrical storage batteries (not for medical purposes).—Edison Storage Battery Co., New Jersey, U.S.A. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Indicta. No. 492,718. Class 8. Advertising signs and indicators either electrically illuminated or displayed by means of light reflectors.—J. McCread, 49, Whitechapel, Liverpool.

Electrographophone. No. 498,568. All goods in Class 8.—Columbia Graphophone Co., Ltd., 102-108, Clerkenwell Road, E.C.1.

Celestiona. No. 498,621. Class 8. Radio-telephonic apparatus and parts thereof.—C. French, Celestion Works, London Road, Kingston-on-Thames.

J.O.K. (lettering and design). No. 498,701. Class 8. Electrical accumulators and batteries (not for medical purposes).—J. Toubkin, 33, Long Millgate, Manchester.

Clix. No. 492,400. All goods in Class 13.—Lectro Linx, Ltd., 254, Vauxhall Bridge Road, S.W.1.

Steam Storage.

Dr. E. G. Ritchie, lecturing to the Junior Institution of Engineers recently, said it was a fact seldom appreciated that in the majority of industrial processes the first 20 odd days of the month were entirely absorbed in overtaking the cost of production, and, generally speaking, it was only in the last four or five days that profit was registered. Viewed from that standpoint, increased production was of the utmost importance, since, by crowding into a month the equivalent of one or two additional days, the economic balance sheet might be considerably affected. Every manufacturing process suffered from a "bottle-neck" somewhere or other. Boiler equipment could never meet peak-load conditions without loss of steam pressure, the load factor of the plant would be 50 per cent., and the full capacity of the steam raising sets would only be utilised for an extremely short period of time throughout the working day; but with a combination of boiler equipment and steam accumulator, the time rate of steam demand could adequately be met and all peak loads could be covered with energy which was instantaneously available. In a sugar refinery which he had recently investigated, steam-pressure fluctuations were responsible for reducing the output of the refinery by not less than 15 per cent.; with the installation of an accumulator pressure fluctuations would be entirely eliminated, with a gain in output of the order indicated. Apart from that, the saving in fuel and boiler operating and maintenance costs alone would be sufficient to pay off the capital cost of the accumulator installation in the course of about 18 months.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERGELE (North Wales).—Extension of sanatorium, for Manchester Corporation; city architect, Town Hall, Manchester.

AMERSHAM.—Housing scheme (34), for the R.D.C.; Kemp and How, architects, 4, Bloomsbury Square, London, W.C. (returnable deposit of £5).

BIRMINGHAM.—Students' Union establishment, University (£44,000); J. R. Deacon, builder, Lichfield.

BOURNEMOUTH.—Clinic and school house; borough engineer, Charminster School. Extensions, King's Park Pavilion (£6,000); borough engineer.

BRIGHTON.—Skating rink and restaurant, for Ice Rinks, Ltd.; S. Clough, architect, London. 208 houses, Whitehawk estate; Eadie Towers & Co., Wolverhampton. 36 houses, Crayford Road, 28 in Eastbourne Road, 36 in Hertford Road; Braybons, Ltd. Bathing pool (£175,000); borough engineer.

BURSLEM.—Extensions, pottery works, Nile Street; Doulton and Co.

CAMBRIDGE.—Extensions, Addenbrooke's Hospital (£90,000), for the Governors; clerk. Bazaar premises, Sidney Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

CASTLE DOUGLAS.—New school to accommodate 500 pupils, for Stewartry Education Authority; the clerk.

CHELMSFORD.—Municipal offices, library, &c., Rainsford House site; borough engineer.

CROYDON.—Billiard hall and shops, High Street and Friends Road; North, Robins & Wilsdon.

CULLOMPTON (Devon).—Residential hotel (£20,000), for a local syndicate; particulars from A. Martin Alford, Exeter.

DEVON.—Schools, Kentisbury, Kingsnympton, and Langtree, for Devon E.C.; county architect, 97, Heavitree Road, Exeter (returnable deposit of £1 1s.).

DOVER.—Extensions, Isolation Hospital (£8,300); J. F. Duthoit.

EARLSDON (Coventry).—New St. Barbara's Church (£6,000); incumbent.

EDWINSTOWE (Mansfield).—Re-erection (after fire) of the Dukeries Hotel (£10,000); H. Smith, licensee.

FARNHAM ROYAL (Bucks.).—Four-bay factory, Buckingham Avenue, for Slough Estates, Ltd.

GLASGOW.—Reconstruction, Calton area; city engineer and housing director. 756 houses, King's Park; Western Heritable Investment Co. Extensions at Wood's Hospital; S. Goddard & Sons.

GUILDFORD.—Extension, Nurses' Home, Royal Surrey County Hospital, Bray Road; Governors.

HERNE BAY.—Additions, Mortimer Street; Herne Bay Electricity Co., Ltd. New Council offices; U.D.C. Surveyor.

HIGH WYCOMBE.—Factory, Amersham Hill, for Lord Bros. Factory extensions, for W. F. Baker, Bellfield, and Bartlett & Co., Grafton Street.

HOVE.—Housing scheme (50), for the T.C.; borough surveyor.

HUTHWAITE.—Re-erection (after fire) of factory, electrically equipped, for the Crossley Hosiery Co., Lime Avenue.

IRISH FREE STATE (Ballinrobe, Co. Mayo).—Conversion of Creagh House into County Sanatorium (electric lighting), for the County Board of Health; T. T. Flanagan, County Surveyor, Courthouse, Castlebar.

(Drogheda, Co. Louth).—Installation of electric lighting in St. Peter's Church and Presbyteries, Presentation Convent, and St. Vincent's Convent; J. P. Tierney and Co., consulting engineers, 44, Kildare Street, Dublin.

(Kilkenny).—Installation of electric lighting at the City Hall; R. C. Murphy, borough surveyor.

KEARSLEY.—Housing scheme (80), Tasker's Lane site; E. Shaw, surveyor to the Council, Council Offices.

KETTERING.—Housing scheme (38), by direct labour; surveyor.

KINGS LYNN.—Extensions, West Norfolk and Lynn Hospital (£20,000), for the governors; secretary.

KNOTTINGLEY.—Housing scheme (48), for the U.D.C.; G. J. Laverick, surveyor.

LINCOLN.—School at Redbourne; Scorer, Gamble & Co., architects, Bank Street.

LITTLEBOROUGH.—Housing scheme (50); surveyor to U.D.C.

LONDON (Wood Green).—Extensions, Trinity School (£13,349); C. Miskin & Sons, Ltd., St. Albans.

(Ilford, E.).—113 houses, Otley Drive; F. Aldridge, for Suburban Developments (London), Ltd.

(Deptford, S.E.).—Remodelling pumping station (£62,616), for the Metropolitan Water Board; William Moss and Son, Ltd., contractors.

(Lewisham, S.E.).—Additions, Lewisham Hospital; Burnard and Pickett, Ltd.

(Aldwych, W.C.).—Buildings, vacant site, eastern wing; Bush House. Ltd.

MACCLESFIELD.—Conservative Club, with shops and offices; Burgess & Palmer, architects, Brock Street; Gorton & Wilson, builders, Elizabeth Street.

MAIDSTONE.—Houses (82), London Road, for Cox Bros.

MANCHESTER.—Extensions, Ancoats Hospital (£100,000); secretary.

MATFIELD (Kent).—Re-erection (after fire) of Beech House, residence of J. D. Hay (£3,000).

NAPSBURY.—Extensions, Mental Hospital; J. Laing & Son, Ltd., Mill Hill.

NEWHAVEN.—Development, Saltdean estate, 4,150 houses; Saltdean Estate Co., Ltd.

NORTHAMPTON.—School, St. James' (£29,800), for the Borough E.C.; Pullen & Son, builders, Bridge Street.

PORTSLADE-BY-SEA.—Housing scheme (91), for the U.D.C.; D. V. Howard, surveyor.

PORTSMOUTH.—31 houses, Carcombe Avenue; C. C. Coles.

RAMSBOTTOM.—Re-erection of Royal Picture Palace, for Blakeborough, Ltd. (£6,500).

ROTHERHAM.—Public library; borough surveyor.

SOLIHULL (Birmingham).—Housing scheme (50), for the R.D.C.; surveyor.

SOUTHBOROUGH.—Central school, Kent Education Committee.

SOUTHEND-ON-SEA.—Sanatorium extensions (£19,000), for the T.C.; borough surveyor.

SWANSCOMBE (Kent).—Re-erection (after fire) of the Cygnet Preserve Works, for John E. Gunn, Manor Farm.

SWANSEA.—Extensions, Technical College; borough architect.

TILBURY.—Maternity and child welfare centre, for the U.D.C.; A. W. Buckner, clerk (returnable deposit of £5).

TORQUAY.—Extensions, Grammar School, Oakhill Road; Governors.

TYNEMOUTH.—Alterations, Hay Hole Lead Works; Messrs. Cooksons.

UXBRIDGE.—Warehouse, Windsor Street; Yiewsley & West Drayton Co-operative Society.

WALTHAM ABBEY.—Drill hall for Essex Territorial Army Association; secretary, Chelmsford.

WELLINGBOROUGH.—Housing scheme (34), for the U.D.C.; surveyor.

WELWYN (Herts.).—Town hall (£10,000), for the R.D.C.; clerk.

WEST FIFE.—Extension of infectious diseases hospital (£21,000); West Fife Infectious Diseases Joint Hospital Board.

WEYMOUTH.—Maternity, Child Welfare, and Health Department centres (£5,000), for the T.C.; borough surveyor.

WIGAN.—Grammar school extensions (£40,000), for the borough E.C.; Dr. E. Davies, director of education.

WOLVERHAMPTON.—Additional 356 houses, for the T.C.; borough surveyor.

WORCESTER.—Extensions, with maternity home, for the Infirmary Committee; secretary.

WORKINGTON.—Block of business premises and central offices, for the Beehive Co-operative Society; H. Oldfield, architect.

YORK.—132 houses, Tang Hall; S. Higton & Sons, Sheffield. 31 houses, Fifth Avenue; J. Sawdon, Bridlington. Temporary mental hospital; Medical Officer of Health. Warehouse, Fishergate; Rankin Automatic Glass Feeder Co., Ltd. Additions, St. George's Hall, Castlegate; York Cinemas, Ltd. Senior school (360 places), Hewarth, for the City E.C.; director of education.

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The

Electrical Review

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Hydro-electric Power.

ELSEWHERE in this issue will be found an announcement of the holding of a sectional meeting of the World Power Conference on the complete utilisation of water-power resources at Barcelona, Spain, in May next. Organised by the Spanish National Committee with the approval of the International Executive Council of the W.P.C., with the official co-operation of the Spanish Government, the meeting will be followed by visits to places of interest in Spain. Apart from coinciding with the Barcelona Fair, which will be of considerable magnitude and include an engineering section that promises to be of some interest, the W.P.C. Sectional Meeting draws attention to the conditions under which water power has been harnessed in Western Europe during recent years.

The development of hydro-electric power in France is in reality a result of the 1914-18 European war, for it is doubtful if, in 1914, more than half a million kW was developed of the seven million kW which is estimated to be available. The power demanded for the manufacture of military and other requirements that were necessary for the defence of the nation, the need to reduce the importation of coal to the minimum, and the temporary loss of the French coalfields in the North, led to the exploitation of hydraulic resources which had previously been neglected, and would probably have remained undeveloped but for the dire exigency. Consequently, the numerous hydro-electric power stations built during the war period led to development which was particularly marked in the Pyrenees, but they were more or less isolated and of a purely local character; when the war ended, they were deprived of their *raison d'être*, and no normal market for their power existed.

The situation was remedied, though somewhat tardily, by an Act passed in July, 1922, which rendered it possible to construct lines for the transmission of power over long distances, and thus relieve districts overcharged by supplying other parts of the country where supplies of electricity were not available or were not sufficient. Thus, at the end of 1926, there was in operation 170,000 km. of transmission and distribution lines, of which 73,000 km. operated at from 250 to 600 volts, 90,000 km. at from 30,000 to 60,000 volts, and the rest at higher pressures; moreover, the lines are increasing by about 1,000 km. yearly.

However, although local over-production was thereby

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overcome to some extent, another danger of much greater gravity in both cause and effect asserted itself. France was faced with a financial crisis the effect of which on the hydro-electric industry was not only to arrest progress for a long period, but also to create a decided preference for steam-driven plant. Hydro-electric concessions which had been granted, and undertakings which had been started, fell into a state of paralysis, for hydraulic stations are more costly to construct than isolated steam equipment, and are less easy to adapt to increases in cost of labour and production. The effect was stagnation in the development of water power, both for industries as well as for transport, and many schemes and proposals for work of this character have consequently been held in abeyance.

The strengthening of French finance and the stabilisation of the franc, although the latter may be regarded as only the lesser of two evils, appear to be producing an effect. Relieved of the haunting fear that a quotation to-day will not be practicable to-morrow, industry and commerce seem to be showing signs of activity. According to the French Minister of Public Works, during 1928 alone hydro-electric plant producing 20,000 kW was put into operation in France, while during 1927 electricity was installed in more than 3,000 communes, partly in the hope of stemming the flow of labour to the towns and as an attempt to replace that which had already left the countryside, with the result that the total consumption of electricity in France amounted to 300 kWh per head of the population.

The French Government appears to realise the importance of developing national hydro-electric power, and thus reducing purchases of coal. Encouragement is being given by favourable concessions and by easier fiscal conditions, and it is safe to say that at present there are very few works and factories in the south-west of France which are entirely steam driven. Progress is also taking place in the Alps and River Rhone districts, and with a return of confidence in national finance, it is more than probable that the period of stagnation is nearing its end.

Rural Electrification.

Evidence of the interest that is being excited by the subject of rural electrification, or, as it may otherwise be termed, the facilitation of the provision in country districts of adequate supplies of electrical energy at such prices as will make its use economical for most power, heating, and lighting purposes outside urban areas, is the increasing frequency with which it forms the subject of discussion at conferences and meetings.

At the National Conference on Agriculture, which took place in London last month, it was resolved that immediate and widespread development of electricity supply in rural areas was essential to the economic reconstruction of rural England, and that co-operation was desirable between local branches of the National Farmers' Union and other agricultural organisations and the electricity supply undertakings, whose representatives should meet in conference to discuss the possibilities in each area; copies of the resolutions were sent to the electrical and agricultural authorities concerned. By far the most important announcement that has been made lately, however, was that of the Minister of Transport when he attended, with the chairman of the Electricity Commission, a recent meeting of the Parliamentary Conservative Party's Agricultural Committee. Amongst the suggestions which the Committee commended to them was the appointment of a representative of rural interests to the Electricity Commission and that a special section of the Commission should be devoted to the consideration of rural matters, and in reply thereto the Minister stated that the appointment of an official who would devote his time solely to the development of electricity supply in rural areas was receiving special consideration.

It would be uncharitable to assume that any significance is attached to the use of the word "official," though much will depend on the post being suitably filled, and the appointment, following the example of Sweden, must be welcomed as an indication of willingness to speed up progress.

The Ideal Home Exhibition.

Just twenty-one years ago the first of the series of Ideal Home Exhibitions was inaugurated at Olympia. Thus this season's show, which is now open to the public, celebrates the majority of what has hitherto been regarded as one of London's most largely attended exhibitions.

The visitor cannot fail to notice the large electrically-operated water fountain illuminated with constantly changing coloured electric light, and the large stands of a number of well-known manufacturers of electric cooking, heating, washing, cleaning, and refrigerating appliances for the home, not to mention the host of smaller domestic devices, form quite an impressive display in the main hall; in addition, a number of electrical companies are exhibiting in the Canadian section in the gallery. A feature of this year's show is the substantial improvement that has been achieved in the illumination of exhibitors' stands generally, whilst most of the sample household lighting fittings to be seen thereon are typical of the most modern ideas in that sphere; some of the glassware now being employed is capable of producing striking effects when utilised in the correct environment, and it is to be hoped that the public will profit by the lesson to be learned, particularly with respect to the value of coloured light appropriately used in the home.

It is to be regretted that the exhibition itself seems, as a whole, to be gradually losing its former essentially practical aspect, and to be tending towards what may be termed the luxurious.

The Gasfilled Lamp Patent.

Many rumours will be set at rest, and at the same time a great deal of speculation will be aroused, by the announcement which appeared in our advertisement pages last week of the intention of the British Thomson-Houston Co., Ltd., to apply for a five years' extension of its gasfilled lamp patent (No. 10,918 of 1913). Few inventions have led to so much litigation, and the proceedings will be watched with the greatest interest by lamp manufacturers, lamp importers, and the legal profession.

Change-Circuit Supply.

Those whose interest has been aroused by the merits of the Wilkinson change-circuit system of supplying electrical energy should profit by a further perusal of the subject as outlined on another page this week. The effect which the system promises to exercise upon a constant-pressure network in the form of economic influence on the load factor was not contemplated, or expected, and has revealed itself quite recently.

The author claims that it is, in itself, a full justification of his method, apart from the good effect of change-circuit arrangements in affording cheap and efficient supplies of energy for both water and apartment heating. At the risk of encouraging egotism on the author's part, little persuasion is needed to appreciate his suggestion as marking an advance in the electricity supply industry that would appear to be of no mean advantage to everyone concerned. It should be clearly apparent that the material economy indicated is not merely a reduction of the "unit" charge of a two-part tariff, which would obviously be a negligible gain; but that it represents a percentage on the whole charge without the aid of any further capital outlay, or other alteration of the operating conditions than the addition of a change-circuit load, which, besides its own separate revenue, economically affects the existing load conditions.

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A Hydro-electric Project.

A second development on the Stave River at Ruskin, near Vancouver, is designed to have a final capacity of 172,000 h.p.

By F. E. FULLERTON.

REPRESENTING an outlay of $7,250,000, the construction of another hydro-electric station on the Stave River at Ruskin, near Vancouver, is to be proceeded with at once. This additional development is planned in the belief that all previous estimates of Vancouver's growth will be exceeded. Completion of the first unit, which will develop 43,000 h.p. by means of one generator, is expected by the end of 1930, in time for the peak load of 1930-31. Foundations will be laid, however, for another generator of the same size, which can be put in at any time, and eventually the Ruskin plant may develop 172,000 h.p.

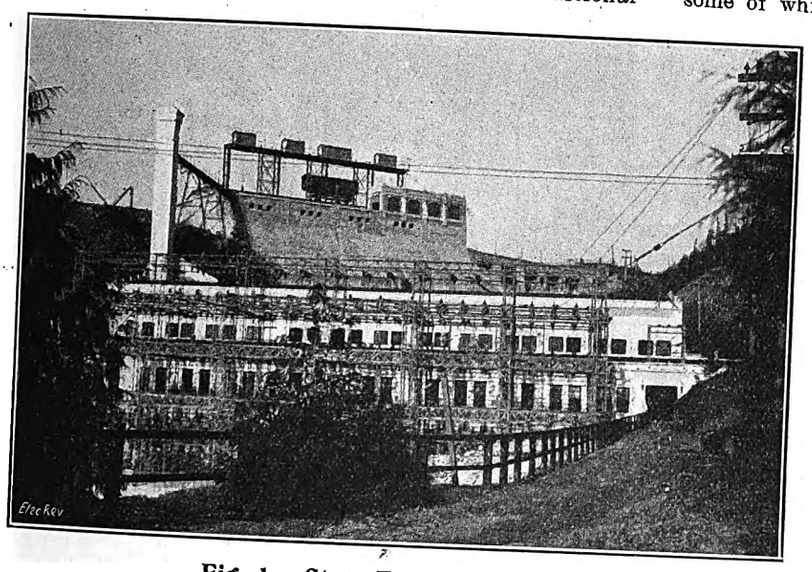

Fig. 1.—Stave Falls Power Station.

It is intended to call for tenders immediately for the first work in connection with the Ruskin development, and it is believed that the scheme starts with the industrial expansion of the British Columbia Power Corp., and that the abundant power available and the low rates which will be offered will attract industries in increasing numbers.

It is interesting to note that the Bridge River development of the B.C. Co. will also be increased, and this change in the plans may slightly delay the completion of the first stage. It had been intended ultimately to enlarge the tunnel at present being driven to twice the present size, and to increase the 165,000-V transmission line later to 220,000 V; it is now decided to enlarge the tunnel and make provision for transmission at 220,000 V immediately. It had also been intended to build a steam generating station as a stand-by in view of the length of the transmission line from Bridge River, but the decision has now been made that it will be better to develop the Ruskin site immediately, from which power will be transmitted over a comparatively short distance. The Ruskin plant will serve in a dual capacity because its comparatively short transmission line will not be so liable to breakdown. In any event, the mainland power system will, on the completion of the Bridge River and Ruskin plants, draw power from six independent sources, and there is small likelihood that all six will be out of commission at one time. The Ruskin station will eventually use all the water now passing through the Stave Falls plant, some of which also passes through the Alouette plant.

The first work will be to build a dam across the Stave River, at a point about three and a half miles below the Stave Falls plant. Tenders for this were to be called so that work could be started as soon as possible after February 1st. Two short tunnels will be driven through the rock, providing for the penstocks that will convey water to the generators.

The dam will be of concrete with a maximum height of 183 feet and a length of 325 feet at the crest. It will be necessary to make coffer dams of cribwork and sheet piling both above and below the site of the dam, after which excavation to the bedrock will take place. Provision for diverting the flow of the river will be made by means of a flume at the side of the canyon, which flume will pass through an opening in the dam and will not be closed until the dam is completed. In all, the dam will contain 90,000 cubic yards of concrete and will not be finished until August, 1930. It will be surmounted by seven regulating gates to control the flood over-flow.

An immediate start will also be made on excavating the power-house site. The foundations of the building will go 50 feet below the level of the tail race. To permit this work to proceed, a coffer dam will be necessary to keep the water from backing up into the workings. No steel penstocks will be visible in this plant, but a tunnel for each turbine and generator will convey water directly from the reservoir above the dam. The new plant will operate under a head of 125 feet, as compared with an average head of 115 feet at the Stave Falls plant. This head represents the entire fall of water from Stave Lake to the Fraser River, and when the new dam is built water will be actually backed up to the tail race of the Stave Falls plant.

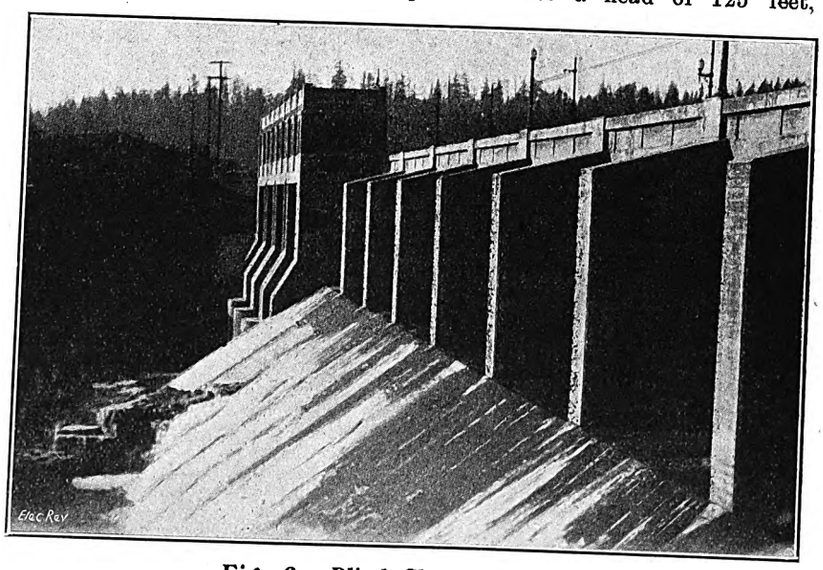

Fig. 2.—Blind Slough Dam.

The formation of this new lake will entail the re-

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building of the railway line from Ruskin to Stave Falls, the present tracks being within the area which will be flooded. At the site of the new development there will be a new railway bridge across the river to convey the heavy machinery to the generating station. Considerable roadwork will also be necessary in the vicinity to provide access to the site from the Dewdney trunk road and the valley above. A complete outdoor switching and transforming station will be built in connection with this new station, and electricity will be conveyed to the Horne-Payne receiving station, Vancouver, at 60,000 V.

It is estimated that the Ruskin plant, when fully developed, will be capable of supplying 328,000,000 kWh per year, as compared with 280,000,000 kWh by the Stave Falls station. The new installation, however, will be used as a peak-load plant, and therefore more generator capacity will be installed than would be the case were it to be used more or less continuously.

As the Ruskin plant will be able to draw water only as it passes through the Stave Falls, and to a certain extent through the Alouette plant, its operation will be governed to some extent by the operations of these former installations.

Fig. 1 is a view of the Stave Falls power station, and fig. 2 shows the Blind Slough dam at Stave Falls.

Agricultural Electric Machinery.—I.

A review of the 1929 Paris Agricultural Exhibition, depicting some selected items of special interest to electrical engineers.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

THIS annual exhibition, which is now in its eighth session, continues to grow in popularity and to attract an ever-increasing number of exhibitors, the total this year being 705; the standard of the exhibits is also being raised. For one thing, 28 applications for stands by "cheap-jacks," or men who sell small domestic appliances by sheer force of their personality, were refused. Next year it is proposed not to permit the exhibition of any washing machines or other similar domestic appliances, as, however useful they may be in the farmhouse, space is becoming so valuable that it is necessary to reserve it exclusively for machinery actually employed on the farm. The present exhibition space is about 21,000 sq. yd., divided over three halls, plus a considerable outdoor area. A new building is to be constructed during the next few years, with an area of 50,000 sq. yd., which will enable the whole show to be housed under one roof.

About 150,000 people pay for admission during the few days the exhibition is open, but a far larger number of visitors receive free invitations. About two million circulars are distributed throughout the country in advance.

While the French Government does not control the show in any way, the Ministry of Agriculture assists considerably by advertising it, and also it is well supported by the French Ministers. The general manager, Mr. A. Villard, is to be congratulated upon the excellent organisation that he has established. In one feature he probably does not gain the entire satisfaction of the exhibitors, for the show is very strictly classified, *i.e.*, all articles of one class must be shown in one section. This is of very great convenience to a visitor, as it so greatly facilitates comparison and inspection and, further, ensures that he does not overlook an exhibit of one of a particular class of machines; but, of course, it must be inconvenient for the exhibitor of several types of apparatus to have to establish several stands.

The catalogue this year was prepared in four languages, a much appreciated concession to the greatly increasing number of foreign visitors.

The exhibits may well be considered under the main groups in which they were arranged, namely, (1) thrashing and harvesting machinery and mechanical cultivators; (2) ploughs and implements; (3) barn machinery and equipment for the smaller agricultural industries, such as poultry keeping, and so on.

Thrashing Machines.—It is worthy of note that the finest examples were of British make (Ransomes, Sims and Jefferies, Ltd.) or of British design (Hoffer-Schrantz-Clayton-Shuttleworth, of Budapest). A considerable number of the thrashing machines were shown in operation, driven, of course, by electric motors. A criticism was made of the drives last year, that in many of them the electric motors were placed too high up on the machines, a practice not conducive to a reduction of the machine vibration. This year several makers placed the motor underneath. There were no directly-coupled drives, but it was noteworthy that practical experience is teaching the manufacturers that the belt drive must be as long as possible. While the aforementioned British machines are undoubtedly the best types for practical work, they are not satisfactory as complete units; hence the writer selected the Brouhot thrasher as being the best self-contained combination suitable for the average farmer. This machine has many excellent improvements, including a very neat electric drive, the motor

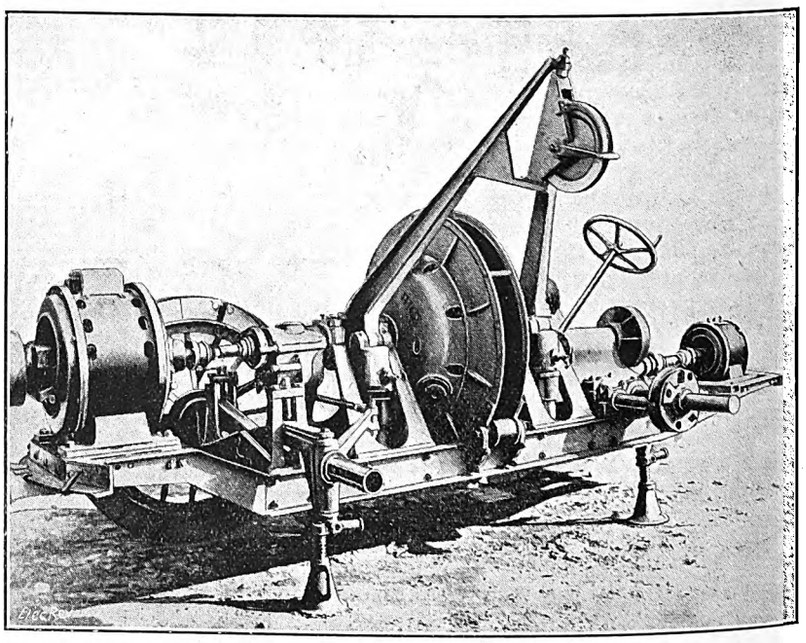

Fig. 1.—Estrade Plough with Casings and Wheels Removed.

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being placed underneath the frame. The motor is of the Dassenoy type, 3,000 r.p.m., which means a comparatively light motor. There were more motors of this make applied to thrashing machines than of any other make. The motor has a sliding armature which is held out of the field when at rest by means of a spring. It is started by an ordinary switch, and as the

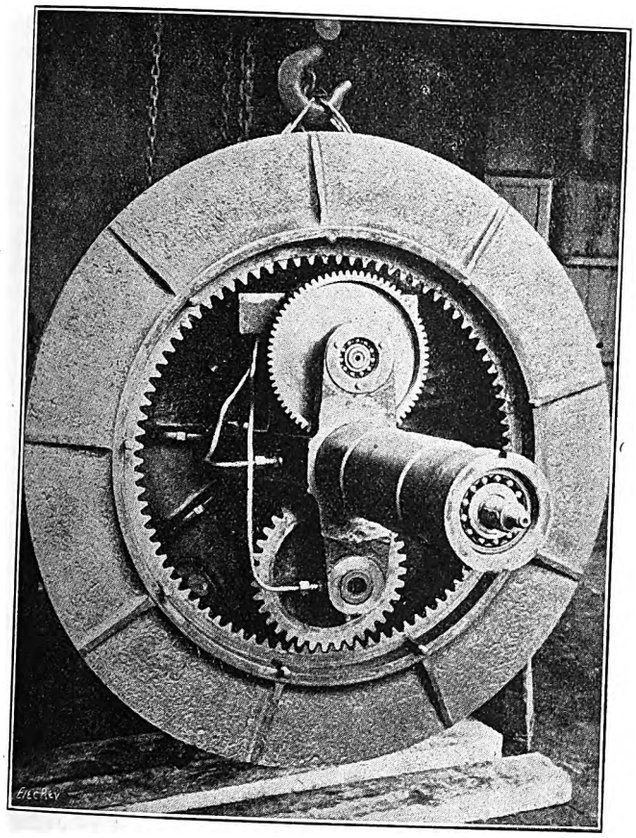

Fig. 2.—Estrade Plough Reduction Gear.

load comes on, the armature, as it attains its proper speed, is drawn into the field against the pressure of the spring.

There were no electrical applications to harvesting machines, though, as an item of mechanical interest, the complete, giant, combined machines for cutting the corn, thrashing, sorting and sacking it, and disposing of the sheaves of straw in bundles, all in one continuous operation on the field, are wonderful examples of modern ingenuity in high-speed work and labour-saving. One of these very interesting machines was tested out in Oxfordshire last year. There is no question as to their utility in hot, dry climates, but their application is a little more doubtful in damper countries, though even there it depends upon the nature of the corn that is grown.

Ploughs.—The typical French plough is an enormous vehicle capable of dealing with from fifteen to thirty acres per day, with a power ranging up to 150 h.p., so that manufacturers had only photographs and models on view. A recent development in electric ploughing is that the large French electricity supply companies are purchasing and operating ploughs themselves for the benefit of their farmer clients. This enterprise is partly due to the large amount of capital required and partly to the importance to the supply authorities of making sure that the plough is operated every possible working day. The manufacturers of farm oil tractors have now taken a leaf from the book of the electrical man, and have standardised powerful electric headlights fixed to their machines, supplied from a small motor-car type of generating set, so that the contractor can continue his operations far into the night. Electricity supply undertakings which are interesting themselves in electric ploughing are the Société Nord Lumière, Société Nord-Est Parisien, Société Ouest Lumière, Société Sud Lumière and Société Lorraine d'Electricité. The following Co-operative Societies are also operating electric ploughs:—La Co-opérative de Saclay, La Co-opérative du Vexin, La Co-opérative du Multien and La Société Générale Agricole. Many of the parts used in the construction of the larger ploughs come from England, where they are made by steam-plough manufacturers; the main framework and electrical gear is, naturally, of French manufacture. The switchgear does not seem to be quite substantial enough for the rough handling that it is likely to get in use. Last year, owing to the demand that is rapidly arising for smaller electric ploughs capable of handling from five to ten acres per day, several new designs were evolved.

A machine constructed by the Société Générale Agricole is of the double-winder type. Apparently a very successful 30-h.p. electric plough is that of the Société d'Electro Motocultur, of Carcassone. The pull of the rope hauling the plough is taken by a lever which extends from the side of the machine; and the inner end of this lever is supported on oil-filled cylinders which permit alteration of the angle of the lever, according to the strain put upon it. A practical result of this design is that full advantage is taken of transmitting as much of the pull as possible on to the ground, hence the haulage power of the machine is very considerably greater than would be anticipated from its dead-weight.

Fig. 1 shows an Estrade electric plough with the casings and the wheels removed; the transporting motor is at the right, and the 30-h.p. haulage motor is on the left. The reduction gearing of an Estrade plough is depicted in fig. 2.

Fig. 3 is an interesting illustration in that it shows the enormous boulders pulled out of the ground

Fig. 3.—Electric Plough Working under Severe Conditions.

by the plough. It is when a plough comes into contact with such obstacles that the advantage of having a power station behind the haulage gear becomes apparent. These boulders were pulled out of the ground during some electric ploughing trials at the School of Agriculture at Gryon, and, incidentally, it may be remarked that this was the only equipment which success-

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fully came through the very severe trials over such exceptionally difficult ground.

An entirely new 5-h.p. electric plough and garden cultivator was exhibited by the Société Générale Agricole. This is designed to meet the requirements of the market gardener, and is of the double-drum, single-haulage type, the rope passing around a pulley on a carriage at the far side of the ground to be worked. A water tank forms a part of the anchor pulley carriage as an easy means of adding sufficient weight. This equipment is intended for work over areas up to 160 ft. wide, and it will plough from 6 to 14 in. deep, with a maximum demand of 3 h.p. The haulage gear and the anchor wagon are both mounted on portable tram-rails, such as are very often used in French market gardens. The equipment is capable of ploughing from 1,500 to 3,000 sq. yd. per day, and the machine is, of course, intended to operate all forms of market garden implements in addition to ploughs. A direct drive is arranged on the motor, so that it may be employed for other purposes than cultivating, *e.g.*, the watering of gardens, the distribution of artificial manure, as a fire pump and as a sack elevator. A shaft with "Hooke" joints is also provided for operating barn machinery, such as circular saws.

For ploughing and other land work on a large scale, the 100-h.p. double-haulage S.G.A. sets should be selected. For medium work, the 30-h.p. Estrade equipment seemed to be the most attractive apparatus. For market gardens, the S.G.A. 5-h.p. apparatus should be considered, though undoubtedly it is at present in its early stages of development.

Electricity Supply in Australia.

The History and Progress of the Melbourne Electric Supply Co., Ltd.

By F. W. CLEMENTS, M.Inst.C.E., M.I.E.E. (Managing Director and Chief Engineer).

THE undertakings of the Melbourne Electric Supply Co., Ltd., in the State of Victoria, Australia, after thirty years of active development, will shortly pass into the control and ownership of the State Electricity Commission of Victoria. In view of the fact that it is by far the largest electricity supply undertaking in Australasia in private ownership and, in fact, second amongst all such undertakings as regards population and number of consumers served, it is thought that the following notes on the history of the company, which has undoubtedly made its mark on electricity supply in Australia, might be of interest.

The company was registered on August 17th, 1899, commencing business as the Electric Lighting and Traction Co. of Australia, Ltd., with an authorised capital of £300,000, and having its registered office in London. Its first Board included well-known members associated with the pioneering days of electricity supply, namely, Mr. J. B. Braithwaite, as chairman, and the late Mr. R. P. Sellon, as managing director. Mr. W. E. Lane was appointed secretary, and Mr. F. W. Clements (the company's present managing director and chief engineer), representative at the actual scene of operations in Australia. The company was formed for the purpose of acquiring the small undertakings of the New Australian Electric Co., Ltd., and the A.U. Alcock Electric Light and Motive Power Co., Ltd., each of which had been granted Parliamentary powers under the Victorian Electric Light and Power Act, 1896, for supplying electricity within the city and certain suburbs of Melbourne. The advent of the new company marked the first important attempt to build up a generating and distributing system over a wide area. The purchase of the two undertakings mentioned above was completed in January, 1901, and an extended Order-in-Council, covering the supply of electricity to some of the then most important suburbs of Melbourne, but not including the central area supplied by the Melbourne City Council, was granted to the new company for a period of twenty-five years, dating from November 13th, 1900. From that date onwards the company has steadily extended its mains throughout other municipal areas as the rapid growth of population required, and has made available a supply in bulk to a very considerable area in the extreme outer suburbs of the metropolis, where the local authorities decided to carry out their own distribution. The generation of electricity for the Melbourne area was concentrated at a central power station situated at Richmond, on the banks of the river Yarra, on the site of the partially-constructed station of the New Australian Co.'s undertaking, and orders for additional plant were immediately placed and the conversion and consolidation of the two different single-phase a.c. systems in use commenced.

A separate Order-in-Council was also acquired by the company, conferring the rights of supply to the City of Geelong and its environs (forty-eight miles from Melbourne), this order covering a period of thirty years, dating from February 20th, 1899, and a permanent supply of electricity from the company's newly constructed d.c. power house in that city was commenced in May, 1901, no supply having been available before that date. The company secured further Parliamentary powers for supplying in the neighbouring State of South Australia, the franchise being acquired with the purchase of the embryo undertaking of the South Australian Electric Light and Motive Power Co., Ltd. This purchase included a small station operating at Port Adelaide, nine miles from Adelaide City, but the company ultimately decided to cease generating there in favour of distribution by high-pressure mains from a new station which was opened in the capital City of Adelaide in November, 1901.

Progress during the early years was necessarily slow, owing to the enormous areas covered by Australian cities, which in the case of Melbourne were purely suburban areas, over which distribution had to be provided; nevertheless, the company pressed forward with development programmes involving capital expenditure far in advance of revenue returns, and results have more than justified this far-sighted policy. Had it not been for the courageous support of British capital and the shrewd foresight of the company's management during those early days, the progress of electrical development, in Victoria especially, must have been seriously retarded. In order to concentrate on the growing demands of the Melbourne and Geelong districts, the Adelaide interests were transferred in April, 1905, to the Adelaide Electric Supply Co., Ltd., in which the parent company retained a large holding in shares. This undertaking has likewise developed under its capable management to a remarkable degree, operating as it does not only within the large City of Adelaide, but, by means of an extended system of transmission lines, throughout a considerable portion of the State of South Australia.

The demands on the Melbourne and Geelong stations increased so steadily that it was necessary to adjust the company's finances in 1908, when the authorised capital

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was increased to £450,000, the title was changed to that of the Melbourne Electric Supply Co., Ltd., and a local board of directors was set up in Melbourne. The output of the two stations at that time is shown in the following table:—

1908.	Melbourne.	Geelong.
Number of consumers	1,727	586
Motors in rated horse-power ...	2,150	818
Total kWh sold	2,326,307	312,661

In 1910 the company's area was extended by the addition of three further Melbourne suburbs, and a contract was made for a supply of electric power from the Melbourne power house to the Prahran-Malvern Municipal Tramways. In the same year a system of electric tramways was commenced by the company at Geelong, the first portion of which was opened for traffic in March, 1912. A further extension of the company's Melbourne area was made in 1912 by an Order-in-Council covering supplies to three additional suburbs.

In 1914, after fifteen years' operations, the capital expenditure on the Melbourne and Geelong undertakings had passed the £1,000,000 mark, and in 1915, despite the adverse influences of war and drought, the continued expansion necessitated an increase of the authorised capital to £750,000. Progress at that time was so rapid that within the next two years the capital had to be doubled, an increase to £1,500,000 being made in 1917. That sum was further increased to £1,750,000 in 1921, in which year the board and general management were transferred from London to the actual seat of the company's operations in Melbourne. The members of the new board were the Hon. Agar Wynne, chairman, the Hon. W. L. Baillieu, and Messrs. J. S. Teulon and F. W. Clements, all of whom still continue in office. Mr. W. E. Lane was appointed London manager and secretary, and Mr. W. J. Mountain, who had been associated in a similar capacity with one of the undertakings originally acquired, was appointed secretary to the company.

The phenomenal development of the past ten years furnishes a complete justification for the faith of the company's founders in the development of a mainly suburban undertaking, the foresight of its management and the fortitude of those who supplied the necessary funds during the difficult early years. The following table shows the growth of capital expenditure in the development of the company's business during the last ten years:—

CAPITAL EXPENDITURE.

	£
Total to August, 1919	1,770,581
,, ,, 1920	1,982,043
,, ,, 1921	2,372,386
,, ,, 1922	2,817,058
,, ,, 1923	3,154,859
,, ,, 1924	3,471,860
,, ,, 1925	3,795,885
,, ,, 1926	4,110,919
,, ,, 1927	4,518,427
,, ,, 1928	4,940,806

The company has very completely developed its extensive districts in Melbourne and Geelong. Out of a total area of over 207 square miles, its distribution networks, both overhead and underground, cover 116 square miles, with a population of 580,000 inhabitants. Supply has been made available in 1,222 miles of streets, the number of consumers aggregating 130,503. That very full use of the supply is made by consumers of the residential class is evident from the fact that they number over 80 per cent. of the possible maximum number of consumers within the area, on the basis of four persons to a family. Saturation as regards the number of consumers is, therefore, within measurable distance; this is also the case in some of the more populated portions of the U.S.A. Hence increase in domestic consumption in the future will arise mainly out of the erection of new residences and also out of the more intensive electrification of the home; to the latter the company is devoting special attention, while the introduction two years ago of a two-part domestic tariff based on the number of rooms is having the expected effect in assisting towards this end. By especially fostering cheap power for industrial purposes, the company has played no small part in the development of the Geelong district, where unusual progress has been made during the past few years in the establishment of important new industrial undertakings, the connected industrial load per head of population being over twice that obtaining in the Melbourne area. Geelong, with its new system of three-phase supply and its modern highly efficient power house, seems destined to become an industrial centre of considerable importance within the State.

The following tables show the remarkable growth in demand during the ten years from 1919 to 1928:—

MELBOURNE.

Year ended	Number of Consumers.	Lighting, &c., in Kilowatts.	Motors in Rated h.p.	Total kWh Sold.
August 31st, 1919 ...	42,430	36,189	30,318	35,069,000
,, ,, 1920 ...	51,675	44,006	34,478	44,444,000
,, ,, 1921 ...	60,393	54,370	38,300	51,380,000
,, ,, 1922 ...	69,261	64,300	45,100	63,070,000
,, ,, 1923 ...	80,597	77,650	53,950	73,500,000
,, ,, 1924 ...	92,649	93,800	66,900	87,500,000
,, ,, 1925 ...	101,360	109,780	76,800	96,900,000
,, ,, 1926 ...	108,689	114,090	84,140	107,140,000
,, ,, 1927 ...	116,080	126,780	90,020	114,447,000
,, ,, 1928 ...	120,864	141,050	92,720	104,213,000

GEELONG.

Year ended	Number of Consumers.	Lighting, &c., in Kilowatts.	Motors in Rated h.p.	Total kWh Sold.
August 31st, 1919 ...	3,374	3,082	2,415	1,551,042
,, ,, 1920 ...	3,862	3,384	2,509	1,627,276
,, ,, 1921 ...	4,409	3,743	2,677	1,848,800
,, ,, 1922 ...	4,875	4,044	4,395	2,544,000
,, ,, 1923 ...	5,601	4,923	6,547	8,675,400
,, ,, 1924 ...	6,431	6,530	7,600	11,394,000
,, ,, 1925 ...	7,045	7,570	9,300	14,300,000
,, ,, 1926 ...	7,845	8,520	13,000	18,230,000
,, ,, 1927 ...	8,884	9,480	14,120	27,059,000
,, ,, 1928 ...	9,639	10,160	14,780	26,010,000

The company's original franchise for the Melbourne suburban area expired in November, 1925, and it is now operating under a special Act of Parliament (the Melbourne Electric Supply Company Act, 1924) which provides for extension to August 31st, 1935, on which date the State Electricity Commission will purchase all the company's undertakings, unless the Commission has previously exercised options to purchase at the intervening dates of August 31st, 1930, or February 28th, 1933.

With the expansion of the State Electricity Commission's activities the company has, during the past few years, made increasing use of the Commission's power supply, the company's Melbourne power house having actually ceased generating in 1926 and its consumers being now dependent for energy on bulk supplies from the Commission. Arrangements are in hand, however, to reactivate this power house for the purpose of supplementing the supply in the metropolitan area, and in this connection a new three-phase 15,000-kW turbo-alternator is being installed. The company's single-phase distributing system is in course of conversion to three-phase, and this work is now nearing completion. Its Geelong undertaking had already converted from continuous current to three-phase some nine years previously.

With the recent intensive development of country districts and the utilisation of the State's natural resources of lignite and hydraulic power by the State Electricity Commission, and with its large scheme of railway electrification, Victoria bids fair to become the most highly electrified State of the Australian Commonwealth; and the company can look back with satisfaction to the past thirty years in the knowledge that it is largely due to its own enterprise and pioneer work under initially difficult conditions that present-day developments have become possible.

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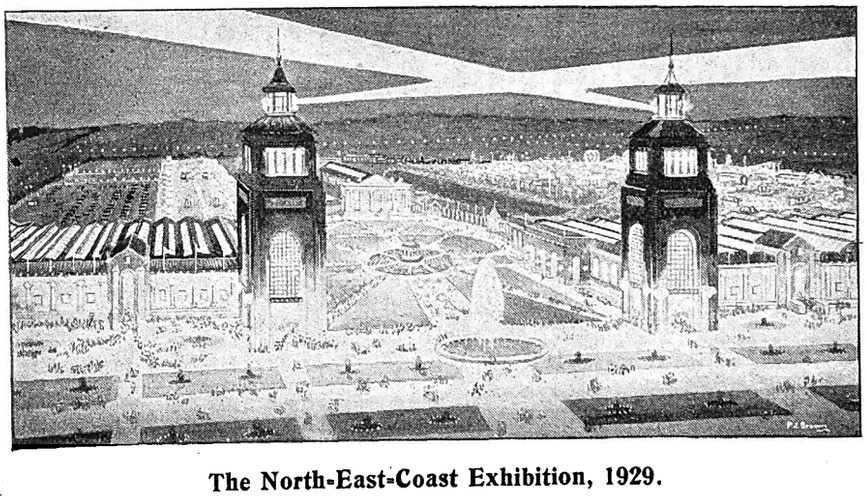
The North-East-Coast Exhibition.

A Big Effort to Revive Trade in an Important Industrial Area.

By R. E. ROBSON, M.I.E.E.

THE Exhibition which is to be held from May to October this year in Northumbria, now commonly known as the North-East Coast, is a huge undertaking at a time of great trade depression. The Exhibition is being organised mainly to revive industry and trade in that important area.

The North-East-Coast Area Committee of E.D.A. may take a considerable amount of credit for having sown a seed which eventually developed into an undertaking very much greater than ever anticipated. At one of the E.D.A. Committee meetings in Newcastle some two years ago the question of bringing new industries to the Tyne was discussed and means were suggested for advertising the district and sending information out giving particulars of the electrical facilities in the area. This matter was then referred to the Electrical Section of the Newcastle and Gateshead Chamber of Commerce, with Mr. H. W. Clothier as chairman, who soon took the matter up with great vigour and brought it before the notice of the Executive Committee of the Chamber, which from this scheme of advertising the area suggested that an exhibition should be held. The Lord Mayor of Newcastle and the mayors of all the principal towns in the Counties of Northumberland and Durham, and the Cleveland district of Yorkshire met and it was decided to promote an exhibition. A guarantee fund was put into operation and nearly £200,000 was guaranteed in a very short time.



The North-East-Coast Exhibition, 1929.

The Lord Mayor of Newcastle, Councillor Arthur Lambert, M.C., J.P., has taken great interest in the scheme, and owing to his untiring energy the undertaking has developed to gigantic proportions.

The Exhibition has had the hearty support of such large electrical undertakings as the Newcastle-upon-Tyne Electric Supply Co., Ltd., the Newcastle and District Electric Lighting Co., Ltd., Messrs. C. A. Parsons & Co., Ltd., Messrs. A. Reyrolle & Co., Ltd., Messrs. Clarke, Chapman & Co., Ltd., and many others which will have large exhibits in the show.

The Electrical Development Association is arranging a bureau and kinematograph room on its stall with many panels describing the applications of electricity. E.L.M.A. is to have a stand brilliantly illuminated by the most modern methods of panel and ceiling lighting with many thousands of lamps. The Newcastle Electric Supply Co., Ltd., is to have large stands both in the Palace of Engineering and the Palace of Industry, and is having them fitted up elaborately with the most modern methods of lighting and industrial heating.

The Exhibition covers the same ground as the great exhibition held in 1887, but is considerably larger. It is within one mile of the Central railway station, and on the Great North Road 276 miles from Charing Cross. Many conferences will be held during the period of the Exhibition promoted by various associations in the engineering world as well as in many other industries. The displays of E.L.M.A. and E.D.A. are the only exhibits which might be termed joint exhibits in the Electrical Section; the other electrical associations have allowed their individual members a free hand and they are exhibiting individually. Messrs. J. H. Holmes and Co., Ltd., who were exhibitors in the Exhibition of 1887, are to exhibit their "Castle" dynamos and motors.

The building of the Palace of Industry is absolutely complete and has been handed over by the contractors. The Palace of Engineering is nearly finished and so are most of the other pavilions. Special attention may be drawn to the pavilions to be erected by the Northcliffe Press and the Empire Marketing Board, which are huge affairs.

The asphalt paths and walks are practically complete, and even in the early days visitors will not find it so difficult to walk about in the grounds as they did at Wembley. There are two large towers in the Exhibition and each will be fitted with a powerful searchlight supplied by Messrs. C. A. Parsons & Co., Ltd., in conjunction with the London Electric Firm.

Messrs. Mountain, Wood & Maclean are the electrical consulting engineers for the Exhibition, and there is no question but that the undertaking will be a gigantic success. There can be only one thing to act detrimentally, and that is the weather.

The Exhibition will be opened on May 14th next by H.R.H. the Prince of Wales, H.M. the King is patron and the Duke of Northumberland, the Marquis of Londonderry, and Sir Hugh Bell, C.B., J.P., are local patrons. The president is Sir Charles A. Parsons, O.M.; the chairman is the Lord Mayor of Newcastle; and the general manager is Mr. C. P. Hainsworth, who has organised many exhibitions all over the world.

A full scheme of illumination for the buildings and grounds has been prepared by Messrs. Mountain, Wood and Maclean. The outside lighting includes the use of decorative pillars for the Main Avenue and Grand Court. In addition, there will be a scheme of flood-lighting for the whole of the walls of the Palace of Engineering, the Palace of Industries and the towers. There will also be an illuminated fountain in the middle of the Main Avenue, equipped with a very ingenious colour-changing scheme. For the general illumination of the buildings and for outside lighting, something like 10,000 lamps will be required. This does not take into account the very large number which will be used in the Amusement Park. The lamps in the grounds and pillars will be of many colours.

A view of the Exhibition prepared from the architect's drawings is reproduced herewith.

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Supplementary Change-circuit Supply.

An examination of the economics of electricity generation in relation to load factor, or the incidence of a supplementary change-circuit system with respect to constant-pressure supply costs.

By GEORGE WILKINSON, M.I.E.E., M.I.Mech.E., M.Cons.E.

A VIGOROUS national policy is now operating in the electricity supply business of this country. The main lines of that policy are directed towards placing a supply of energy within reach of every district, and to reducing the cost of generation and distribution by sweeping measures of co-ordination and large-scale development. Nevertheless, there is no indication that the general level of charges for electricity will be reduced by those measures to such an extent as will make electricity the generally adopted form of energy for all domestic purposes.

An enormous amount of technical skill is being expended upon the science of economic generation, and a large amount is also concentrated upon the problem of distribution: quite erroneously, the all-important

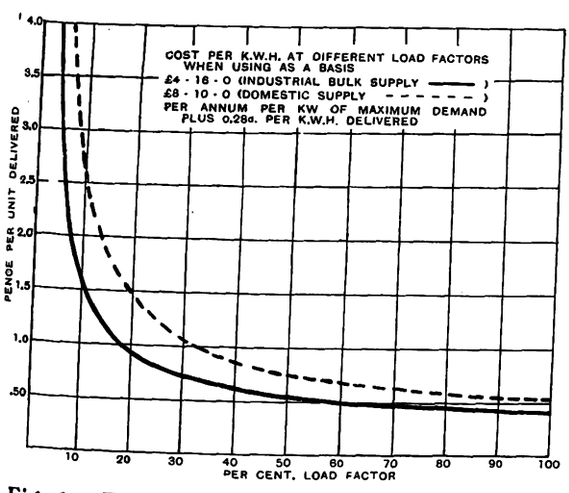

Fig. 1.—Effect of Load Factor on Energy Sold.

problem of a cheap supply has been assumed to be principally dependent upon these two considerations. It is certain that so long as the industry is content to find money to build expensive electricity generating plant, which is lucratively employed only during some six to eight hours out of every twenty-four, so long must electricity remain comparatively expensive.

One has only to glance at the charges at present in vogue to appreciate the true direction of development which must be encouraged. Fig. 1 has been plotted to show the effect of load factor on the cost per kWh delivered, taking as a basis the charge of £4 16s. per kW of maximum demand, plus 0.28d. per kWh delivered, which is a typical charge for a bulk supply to an industrial concern; the full-line curve shows that the total cost per kWh delivered may be 2.0d. at a 7.5 per cent. load factor, or 0.60d. at a 40 per cent. load factor, a ratio of more than three to one.

As is well understood, the maximum-demand charge is imposed to cover the capital cost of the plant installed and maintained to carry the maximum load, whilst the "unit" charge meets the running cost of the conversion of fuel energy into electrical energy. In the case of a domestic supply there is an increased cost of distribution which, on the same basis, would probably increase the standing charge to £8 10s. per annum for each kW of maximum demand, the "unit" charge remaining the same. It is seen from the dotted curve in fig. 1 why a purely lighting load with its extremely low load factor is comparatively costly per kWh, but with thermal storage to raise the load factor the inclusive overall charge may be 0.60d. per kWh.

Several articles in the technical Press, and the description of demonstration plant* at the Stafford works of the English Electric Co., Ltd., have dealt with the application of the change-circuit system to increase the load factor and provide a thermal-storage load during the off-peak periods. The main purpose of this article, however, is to examine the economics of electricity generation in relation to load factor.

We may consider the average guaranteed steam consumption of a modern 6,000-kW plant to be:—

11.13 lb. of steam per kWh at full load.
11.46 lb. of steam per kWh at $\frac{3}{4}$ load.
12.12 lb. of steam per kWh at $\frac{1}{2}$ load.
14.26 lb. of steam per kWh at $\frac{1}{4}$ load.

Assuming the unusually high load factor of approximately 40 per cent., such as is found in districts including chemical or cement works, we may consider that the plant operates for two hours at full load, for eight hours at half load, and for fourteen hours at quarter load, from which figures it may easily be calculated, on the basis of a 6,000-kW steam turbo-generator set, that 57,000 kWh would be generated daily at cost of 723,000 lb. of steam, or an average of 12.7 lb. of steam per kWh. Of that load 12,000 kWh will have been generated during the period of full load and 45,000 kWh during lighter-load periods.

If under those circumstances a change-circuit load had been employed which did not allow the load factor to fall below 75 per cent., the twenty-two hours of full load would have worked out at 11.46 lb. of steam per kWh, instead of the actual average of 13.12 lb. The same amount of coal, wages, salaries, interest, and sinking fund contribution would, therefore, have produced:—

$$45{,}000 \times 13.12/11.46 = 51{,}500 \text{ kWh},$$
or an increase of 14.4 per cent.

The two hours at full load would, of course, be unaffected. The total for twenty-four hours would be 63,500 kWh, or an increase of 11.4 per cent. In addition, credit must be added for the improved boiler efficiency secured by the larger and steadier loads, and for the freedom from the necessity of maintaining boilers under steam for emergency load. These boiler economies will add, as a conservative estimate, another 5 per cent. in energy for the same amount of fuel consumed without any increase of any kind in running or capital charges.

A comparison more closely approximating to the

* ELEC. REV., January 27th, 1928.

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average conditions met with to-day would be a load factor of 25 per cent. made up of, say:—

1 hour at full load,	6,000 kWh, using	66,708 lb. steam
4 hours at ½ load,	12,000 kWh, using	145,440 lb. steam
8 hours at ¼ load,	12,000 kWh, using	171,120 lb. steam
11 hours at light load,	6,000 kWh, using	96,000 lb. steam
	36,000 kWh	479,268 lb. steam

from which figures the average for the twenty-four hours is 13.33 lb. of steam per kWh, and the average for the twenty-three hours at reduced load is 13.75 lb. If this period had been kept up to 75 per cent. load factor by means of change-circuit thermal-storage load at a steam consumption of 11.46 lb., the energy generated by the 412,560 lb. of steam used in twenty-three hours would have been 36,000 kWh, or a 20 per cent. increase. Taking into account the long periods of light running, one can safely say that the higher boiler-plant efficiency

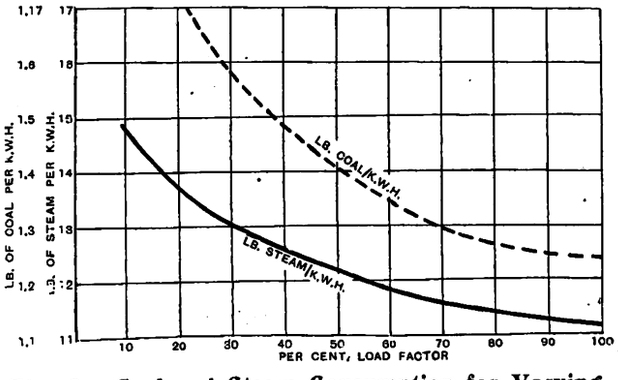

Fig. 2.—Coal and Steam Consumption for Varying Load Factor.

would add another 10 per cent. of energy for the same coal consumption, making an increase of at least 30 per cent. over the twenty-three hours during which the change-circuit system is carrying load.

It should be fully understood that the economies indicated are not a mere reduction on the "unit" charge of a two-part tariff, which would be a negligible gain; but they are a percentage on the whole charge without any further capital outlay, or any alteration in the conditions of working, except the addition of a change-circuit load which, in addition to its own separate revenue, has effected these economies in the existing load conditions.

Fig. 2 shows the steam consumption per kWh at differing load factors, using the turbo-generator figures quoted above; the dotted line shows the coal consumption per kWh, allowing 9 lb. of steam per lb. of coal consumed, with an allowance for reduced boiler-house efficiency when long periods of light-load running are experienced (up to 10 per cent. increased coal consumption, or 25 per cent. load factor).

These diagrams show graphically the tremendous importance of load factor to the economic generation and utilisation of electricity. From the diagram a concrete case may be worked out to show the present average and the possible earnings of the same generating plant under different conditions:—

Case 1—25 per cent. factor, 6,000-kW set:—
Energy generated per day = 36,000 kWh; coal consumption at 1.64 lb. = 59,000 lb.; revenue at 0.80d. = £120.

Case 2—Same coal consumption as above at constant pressure, maintained up to 75 per cent. load factor with change-circuit load:—
Energy generated per day, constant pressure = 46,300 kWh.
Energy generated per day, change circuit = 63,300 kWh.
Coal consumption at 1.275 lb. = 139,800 lb.
Revenue at 0.625d., constant pressure = £120.
Revenue at 0.33d., change circuit = £88.

Therefore the total revenue = £208,

or an increase of over 70 per cent, which shows a reduction of 22 per cent. in cost of electricity to the constant-pressure consumers *without any alteration whatever in the cost to the electricity supply authorities* and, *in addition*, a daily revenue of £88 for change-circuit supply charged at 0.33d. per kWh.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Post Office Affairs.

On March 4th, the House of Commons considered the Post Office Estimates.

Mr. Crawford strongly advocated a return to penny postage, which, he said, would benefit trade and industry. He also urged that broadcasting should be made use of during the coming General Election.

Mr. Lloyd George supported the suggestion that broadcasting should be used during the election.

Mr. Snowden said that if the penny post could be restored without loss to the Post Office it should be done, but he would not favour subsidising the Post Office out of the money of the taxpayers.

Other members criticised the working of the telephone service, and, in reply to the debate, Sir W. Mitchell-Thomson, Postmaster-General, compared broadcasting in this country with that in America, and pointed out that the congestion of the air did not affect America to the same extent as it did this country. America was not subjected to interruption in broadcasting as we were by the activities of our neighbours. We were so closely congested that we only had ten exclusive wave-lengths for our own use, and it was a matter of anxious consideration between the B.B.C. and himself how to make the best use of those wave-lengths. If broadcasting was entirely in the hands of the Government, it would open the way to charges that the Government was using it for its own party propaganda. It was better in the public interest to have the system controlled by a public corporation rather than by the State. The attempt to come to an agreement as to a fair allocation of the use of broadcasting between the respective political parties had broken down. A return to penny postage would cost between £6,000,000 and £6,250,000 in the first year. Those who advocated such a return must remember that the cost had got to be met somehow, either out of a Budget surplus or other revenue. As to telephone development, the number of telephones had increased by nearly 40 per cent. in the last four years. The capital expenditure on telephones during the past four years amounted to £44,000,000, every penny of which had to be paid out of revenue, both as to interest and depreciation. He did not see how more capital could be usefully spent on telephone development. We were now the third largest telephone-using country in the world. Five-sixths of the total telephone mileage was already underground, which was a larger percentage than in any other country in the world. While the increase in the general telephone service had been at the rate of 38 per cent. during the last four years, the increase in the rural areas during that period had been about twice that figure. Experiments had been in progress to ascertain whether small automatic exchanges could be provided, and that problem was in a fair way to solution. Two of those exchanges had now been started. Twenty more were in course of erection, and many others would be provided in the near future. The automatic system could be installed in a kiosk and gave a night as well as a day service. Another thing on which they had been experimenting, and which looked like coming to fruition, was the construction of a combined hand set telephone. They hoped to produce a set which would be an improvement on the latest American type. Arrangements had been made for the manufacture of a small number which would shortly be put on trial

Standard Voltages.

On March 5th, Sir R. Thomas asked the Minister of Transport if he would state how many and what standard voltages it was proposed to adopt for lighting in the Metropolitan area and in the provinces, as a result of the reforms undertaken by the Electricity Commission.

Colonel Ashley said he understood that the Electricity Commission hoped to see the eventual adoption throughout the country of a standard supply at 230 V for lighting purposes.

Overhead Lines in the Lake District.

On March 4th, Mr. Pethick-Lawrence asked the Minister of Transport whether he was aware that considerable public objection had been taken to the proposed electric power-line from Penrith to Whitehaven *via* Keswick; whether he was aware of any demand for it in Keswick; and whether, with a view to the preservation of the character of the Lakeland scenery, he would consider an alternative route passing to the north of Skiddaw.

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Colonel Ashley said that no application had yet been made by the Central Electricity Board for his consent, which was necessary before the line referred to could be erected. In the event of such an application being made the local authorities would be given an opportunity to be heard and careful consideration would be given to any representations which they might have to make.

Supply Companies' Bonus Shares.

On March 5th, Mr. Wellock asked the Minister of Transport whether he was aware that many electricity distributing companies which enjoyed monopoly powers, in addition to paying reasonable dividends, distributed large reserves in the form of bonus shares; and whether in view of the high cost of electricity in many areas, he would inquire into the matter.

Colonel Ashley said he was aware that certain electricity distributing companies had capitalised their undistributed profits. As regarded the last part of the question it was open to the local authority concerned or the consumers, if they were of opinion that a company's profits were excessive, to apply for a reduction in the maximum charges authorised by the Act or Order relating to the particular undertaking.

Telegraph Losses.

On March 5th, Sir J. Power asked the Postmaster-General if he could state the total loss on the telegraphs, on the basis of the commercial accounts, since they were nationalised; and which was the latest year in which a profit was earned.

Sir W. Mitchell-Thomson said that commercial accounts were not prepared before April 1st, 1912. It was estimated that during the period 1870 to 1912 the total loss amounted to approximately £21,800,000, of which interest charges accounted for about £12,500,000. From April, 1912, to April, 1928, the loss amounted to approximately £24,000,000, including about £5,000,000 for interest charges. The last year in which a surplus was shown was 1871, when the accounts were not on a commercial basis.

Central Board Capital.

On March 7th, Mr. Kelly asked the amount of capital raised by the Central Electricity Board under the Electricity (Supply) Act, 1926.

Col. Ashley said that the Board informed him that it had so far issued no loans under the Act referred to, but had met its requirements by temporary borrowing.

Rural Electrification.

Some Recent Suggestions and Recommendations.

For some time past the Parliamentary Conservative Party's Agricultural Committee has been considering the development of electricity supply in rural areas, and at its weekly meeting on March 5th at which the Minister of Transport, Lieut.-Col. W. Ashley, and the chairman of the Electricity Commission, Sir John F. C. Snell, attended, the Committee submitted the following suggestions for their consideration, namely, that (i) a further review of the Overhead Lines Regulations should be undertaken with a view to the reduction of the cost of such lines for serving sparsely populated areas; (ii) a standard form of wayleave agreement should be issued without further delay; (iii) different classes of construction should be authorised to meet the varying needs of rural districts; (iv) wayleave inquiries should be held promptly and inspectors empowered to announce decisions on the spot in cases governed by well-established precedents, otherwise decisions to be made known within 14 days; (v) when objections are lodged deposits should be made by both parties, forfeitable in the event of the objection being frivolous; (vi) the attention of local authorities and small-holding and road committees should be drawn to the need of avoiding delay in granting facilities for overhead line construction; (vii) steps should be taken to electrify on Continental lines a typical rural area experimentally at a cost not exceeding £250 per mile of overhead line; (viii) as in Sweden, a representative of rural interests should be appointed to the Electricity Commission and a special section of the latter devoted to the consideration of rural matters; (ix) they should consult bodies interested in the preservation of the amenities of the countryside.

Lieut.-Col. W. Ashley, in reply, stated that the steps recommended in (vii) were about to be taken, and suggestion (viii) was receiving special attention.

Sir John Snell answered technical questions.

At the National Conference on Agriculture held in London recently a resolution was carried which declared that the economic reconstruction of rural England necessitated immediate and widespread development of electricity supplies in rural areas, and that it was desirable for representatives of local branches of the National Farmers' Union, other agricultural organisations, and the electricity supply undertakings to meet in conference and discuss the possibilities of providing a supply in each of their particular areas. Copies of the resolution were forwarded to the Ministries of Transport and Agriculture, the Electricity Commissioners, the Central Electricity Board, the British Electrical Development Association, the National Farmers' Union, and other agricultural organisations concerned.

Mr. R. Borlase Matthews (Rural Reconstruction Society), in moving a resolution in support of the contention that an ample supply of electric power was of the utmost economic importance to agriculture, detailed the experience of small farmers who had saved labour and money by employing electricity, even when paying 4d. per kWh for it. In the case of a 70-acre farm which could hardly be described as all-electric, 755 kWh was consumed in 12 months at a cost of £11 15s. and the labour required to operate the electrically-driven machinery was £17 11s. 6d. Thus even with the minimum of equipment a gross profit of £26 16s. 6d. was made; the cost of the installation was about £121, so that after allowing for interest and depreciation charges at 15 per cent. there remained a net profit of about £8 15s.

At the Institution of Mechanical Engineers in London on March 8th Mr. R. Borlase Matthews exhibited a kinematograph film that illustrated the many uses to which electricity can be put on a general farm, the greater part of it having been photographed on his own 600-acre farm, which is all-electric.

Reviews.

The "All-Europe Three." By C. M. R. Balbi, A.M.I.E.E., A.C.G.I. Pp. 24; illustrated. With working drawings. London: Sir Isaac Pitman & Sons, Ltd. Price 6d. net.

The electrical engineer is often hard put to it to answer the question: "What set shall I make to obtain good loud-speaker reception over Europe?" Mr. Balbi gives him an easy answer: "Buy Pitman's sixpenny pamphlet and construct the All-Europe Three," and it is not only an easy answer, but a good one as well. The receiver consists of a high-frequency stage and a detector, followed by a low-frequency power valve. A screen grid valve is used in the high-frequency stage. The low-frequency amplifier is transformer coupled, and can be modified to take a pentode if desired. Two-wave coils are used for tuning, which saves coil changing. The set is, in fact, designed on up-to-date lines, and good components are specified throughout. Mr. Balbi has tested the set and finds that it will give good loud-speaker reception from twenty to thirty stations, that it will cut out the local station without difficulty, and, a most important item, that it will meet the requirements of the new regional scheme.

The make of every component, down to the terminals, is definitely specified, and this, we consider, is essential if results are to be guaranteed; but we think that Mr. Balbi might have been less dogmatic in giving his reasons for recommending some of the components, *e.g.*, such expressions as "as they are the best" savour somewhat of advertisement, though no doubt this is not intended.

Constructional pamphlets of this kind hardly ever give information of the cost of the set, and where every component is specified, as in this case, we think it would be a distinct advantage if prices were mentioned. After all, the cost of the set is of supreme importance to the constructor. In this pamphlet the makers of components have inserted advertisements, but the fact remains that there is no clear indication of the cost of the set.

Details of construction and operation are clearly described, and full-size working drawings are included.

Patent Law and Practice. By A. W. Griffiths. Pp. xxvii+174. London: Stevens & Sons. Price 7s. 6d. net.

This is an interesting and suggestive book. It contains much useful information, any part of which can easily be found by means of a good index. There are chapters on what may be the subject matter of a patent, what constitutes novelty, and what amount of inventiveness or ingenuity is enough. The chapter on "The Specification" explains how this will be construed by the Court, and what matters should be guarded against. Explanations are given as to the drawing out of claims, showing what should be put in and what left out. Further on in the book the rights of the patentee are considered, and what he can do in case of their infringement, what acts constitute infringement, and what defences there may be to a legal action of this kind. There are chapters on the amendment of the specification, and the revocation and restoration of a patent, and information on other points usually dealt with in books of this nature.

We cannot agree with everything in the book. On page 13 the author refers to the decision of Lord Shaw in British Thomson-Houston Co. *v.* Charlesworth Peebles & Co., as proof of his statement that a new body cannot be patented, but only the method of manufacturing it. Lord Shaw, when giving his decision in this case, expressed disagreement with "the view that if a new material had been discovered by no new means and by no new process of production that material itself would have been a patentable article." He went on to say, "a thing discovered in ordinary trade or adventure, with no novelty or invention of means employed is not patentable." But he did not say that if a thing had been discovered "by new means" and by a "new process of production"

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and "with novelty or invention of means employed," the thing would not be itself patentable. The case mentioned did not decide the point, nor has any other case decided it.

JOHN JOHNSTON.

Television. By ALFRED DINSDALE, A.M.I.R.E. (Second Edition.) Pp. xiii+180; plates 32; figs. 38. London: Television Press, Ltd. Price 5s. net.

The first edition of this book, published some two years ago, was written in a popular manner for the "man in the street," and this second edition is enlarged and purports to cover also the further progress to date and to give more technical information with the object of making the book useful to the amateur investigator.

Some early experiments with selenium cells (Chap. II) and later ones with photo-electric cells (Chap. III) are outlined and discussed, and some diagrammatic arrangements sketched, followed by a general survey (Chap. IV) of a few more recent forms of light-sensitive devices and some experiments made with them.

Chap. V briefly describes some not very recent television apparatus and components used abroad and then in Chap. VI reverts to some of the experiments with which Baird started in England.

The elaboration of lenses employed by Baird is explained in Chap. VII, together with the complexities of multiple channels experienced by him, and this is followed by a cursory account of their use by several others with a recount of an American demonstration of the light spot system (Chap. VIII). We are here told that the latter experimenters are amongst the latest to enter the field, but conceding that after working several years they succeeded two years ago in demonstrating satisfactorily, are we expected to believe, as we are told, that so elaborate was the system used at this limited demonstration "the services of nearly 1,000 men were required"? (page 96).

Some methods of attempted synchronisation (chiefly Baird's) are related in Chaps. IX and X—without, however, any mention of the stroboscopic method that appears to lend itself so well—and the restrictions at present imposed by speed limitations are discussed in Chap. XI.

Then follows a sudden diversion (Chap. XII) namely, first the introduction of "Phonovision" by an account of the sound effects derived from the train of signal impulses and their recording on wax records (without much relative useful value), and secondly, "Noctovision" (which has not the meaning the name would imply) by the use of infra-red rays giving the spectacular but rarely applicable effect of seeing in supposed total darkness.

Chap. XIII recounts the television experimental transmissions from London to New York, and from the former to the liner *Berengaria* in mid-Atlantic. A description of the successful accomplishment on a small experimental scale of television of persons in broad daylight and also of reproduction in colour by the well-known three-colour process is given in Chap. XIV, while the concluding Chap. XV similarly describes an attempt in stereoscopic relief by practically doubling the already highly elaborated apparatus.

The book as a whole deals mainly with some of the experimental work of Baird in England, and appears to support the pursuit of the glittering prizes of mere experimental achievement of one refinement after another, without deploring the apparent lack of endeavour first to consolidate each step as it is won, into a practical step forward, before passing on to still greater embellishments.

Little mention is made of the progress attained by several promising workers in the field abroad. The illustrations are good, but the diagrams are sketchy and essential data necessary to the serious investigator is almost completely absent. Mistakes occur, such as in the third paragraph page X, and the statement on page 174—and repeated on page 175—that the distance between two human eyes is approximately 4½ in.

The book furnishes good reading on an exceptionally interesting subject; the explanations are lucid and the expressions clear, and it is well worth perusing at leisure.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Central Electricity Board Contracts.

In our last issue we drew attention to an announcement by Sir Andrew Duncan at the British Industries Fair that the Central Electricity Board intended to place contracts to the value of £3,000,000 immediately. We have now received from the Board some details of these contracts, which are given below:—

South-East England Scheme.—(1) Contracts for 66-kV and other cables in the London area: British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; and the Pirelli-General Cable Works, Ltd.

(2) Contract for 66-kV switchgear in the London area: British Thomson-Houston Co., Ltd.

Central England Scheme.—(1) Contract for 132-kV overhead transmission lines: Balfour, Beatty & Co., Ltd.

(2) Contract for 132-kV outdoor switchgear: General Electric Co., Ltd.

North-West England and North Wales Scheme.—Contract for 132-kV overhead transmission lines: Foundation Co., Ltd.

In our advertisement columns to-day the Central Electricity Board invites tenders for the following:—Central Scotland Electricity Scheme, 1927—Supply, delivery and erection of electricity meters.

The Gasfilled Lamp Patent: Extension Application.

The BRITISH THOMSON-HOUSTON CO., LTD., has applied to the High Court for an extension of five years of the patent No. 10918, dated May 8th, 1913, granted to it in respect of an invention of "Improvements in Incandescent Electric Lamps." This is the gasfilled lamp, or, as it was known for many years (and still is), the "half-watt" lamp. The originating summons is to come before Mr. Justice Luxmoore on April 9th for directions as to the hearing. Persons desiring to be heard in opposition are required to give at least seven days' notice at Room No. 175, Royal Courts of Justice, and serve copies of their notice of opposition upon the Solicitor to the Board of Trade and upon Messrs. Bristows, Cooke and Carpmael, 1, Copthall Buildings, London, E.C.2.

Nottingham Electrical Contractors' Dinner.

The annual dinner of the Nottingham branch of the Electrical Contractors' Association was held at the Black Boy Hotel, Nottingham, on March 7th, under the chairmanship of Mr. E. A. Harvey. The principal guests were the Lord Mayor of the City (Alderman A. R. Atkey) and the Sheriff (Alderman W. Green). Both of these gentlemen urged the necessity for contractors to prevail upon those who were responsible for the building of new houses to make provision in all cases for electricity supply. Mr. E. G. Phillips, expressed regret that the proportion of members on the National Register in the Nottingham area was less than in any other part of the country, this being a matter which he suggested required very careful consideration. Mr. J. Orringe, chairman of the Midland Section of the Association, observed that their relations with trade unionists were very satisfactory. The Association was interested in the question of apprenticeship. In the Midlands every youth was indentured for five years and in that way they felt they were helping the trade unions; there were too many unqualified men doing electrical work. In Nottingham the heating and cooking charges were a penny per kWh and there was an enormous scope in that direction for business, it being the duty of contractors to obtain customers.

Unemployment in Germany.

The Berlin correspondent of *The Times* reports that the German unemployment returns for the first half of February gave the total number of persons in receipt of relief as 2,455,000, as compared with 2,350,000 on January 31st. This is a smaller increase than was recorded in the previous month. It is believed that the seasonal increase in unemployment, accelerated this year by the abnormal weather conditions, has reached its summit, and will now, with the return of milder weather, begin to decline.

American Electrical Goods in Germany.

In a recent article on the German market, *Commerce Reports* states that sales of American electrical equipment are somewhat limited by the licensing arrangements between German and American manufacturers, but there is, nevertheless, an increasing sale of American fractional h.p. motors, electrical refrigeration equipment, washing and ironing machines, and vacuum cleaners.

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The Easter Holidays.

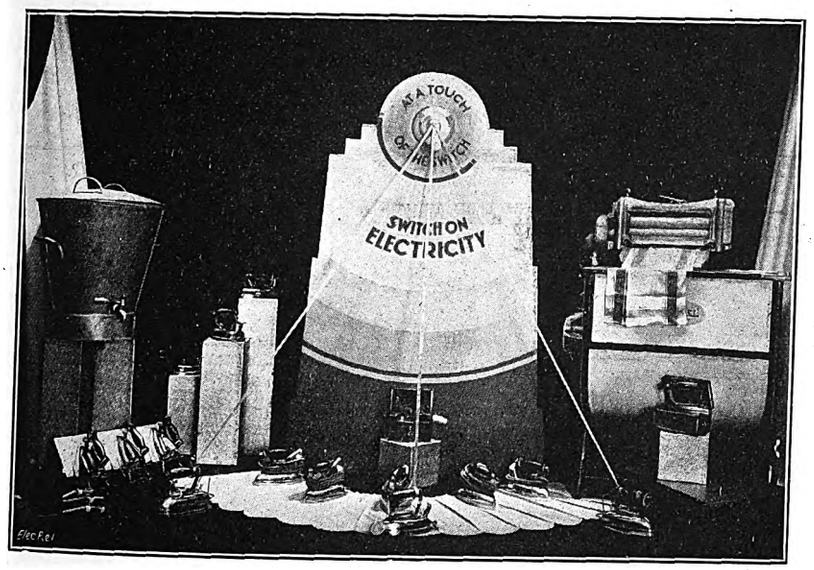
The Electrical Review for March 29th will be published on the morning of March 28th, owing to the following day being Good Friday. Our Advertisement Department announces that it will require new copy (with blocks) by Wednesday morning, March 20th. Official notices and small prepaid advertisements can be accepted up to 5 p.m. on Monday, March 25th.

The Business Delegation to Russia.

A further meeting in connection with the visit to Russia of representatives of British industrial firms was held in London last week. Mention was made of the friendly and businesslike reception of the proposal by the Russian Government, and Mr. L. E. Mather (Mather & Platt, Ltd.) proposed a resolution confirming the suggested visit, and said that definite arrangements had been made by the Anglo-Russian Committee for the delegation to leave London on March 25th. The resolution further expressed satisfaction with the attitude of approval taken up by certain of the largest British banks and financial houses. The resolution was passed unanimously

E.D.A. Activities.

During March the British Electrical Development Association's efforts are being directed mainly towards the popularisation of labour-saving devices. Following the usual practice, special advertisements are being inserted in numerous national newspapers and journals, while electros of three telling announcements are available to contractors and dealers for local newspaper advertising. An effective poster in seven



An E.D.A. Display for March.

colours can also be obtained at a low price, as well as lantern slides for lectures and demonstrations. Two special window displays have been prepared, both of which deal with electricity in the washing of clothes. One of these displays is illustrated herewith. In addition to all these special aids there are many appropriate E.D.A. pamphlets available for distribution. These are detailed in the Supplementary Programme for March which has been circulated.

Unemployment.

There was a decrease of 66,130 in the number of registered unemployed during the week ended February 25th. The total at that date was 1,391,900, as compared with 1,458,030 on February 18th and 1,108,676 on February 27th, 1928.

Philips's Activities in Germany.

It is announced from Amsterdam that the N.V. Philips Gloielampenfabrieken has acquired the majority of the shares in the J. Karger Fabrik für Werkzeug Maschinen, Berlin. As a result of the great extension of the Dutch company's activity at Eindhoven and the fact that it has an insufficient supply of trained mechanics it is no longer possible for the company itself to produce the many machines which are used in manufacturing; and it has also not been possible to obtain these machines in a satisfactory measure in Holland.

Industrial Conferences.

On Wednesday last week there was an informal discussion between Mr. Walter Citrine, secretary to the General Council of the Trades Union Congress, and representatives of the Federation of British Industries regarding the Federation's proposal that consultations should take place between the two bodies on questions affecting them both. It is expected that the first meeting will be held in a week or two.

At a meeting of the "Melchett-Turner" conference, held in London on Tuesday last, an interim report on unemployment was considered.

Recent Contracts.

An order has been received by the Hart Accumulator Co., Ltd., for a battery of 64 "JTPL" type cells, on behalf of the King of Hejaz.

The Brighton Corporation Electricity Department has ordered from Messrs. Yarrow & Co., Ltd., two boilers, each of 75,000 lb. per hour capacity and for 350 lb. per sq. in. working pressure. These boilers will be equipped with Yarrow superheaters, economisers, and airheaters. The Brighton undertaking is already employing two Yarrow boilers.

The English Electric Co., Ltd., has received an order from the Aberdeen Corporation Tramways for 56 "DK.108 C." 50-h.p. tramway motors, 56 controllers and circuit-breakers, twelve sets of cables, lightning arrestors and ampere-hour meters. This is the third repeat order from Aberdeen Corporation which the company has received for this type of tramway equipment.

A few months ago the Ashford (Kent) U.D.C. equipped its generating station with what was then the largest solid injection oil engine ever made in this country. This was an 8-cylinder "Paxman" cold-starting "spring injection" engine. The Ashford Council has now ordered from Messrs. Davey, Paxman & Co., Ltd., an even more powerful engine of the same type. This second engine will be almost identical to the 1,500-b.h.p. engine that the Basingtoke U.D.C. is about to install for the same purpose.

Trade Factors in Argentina.

Industrial electrical appliances are supplied to Argentina by every country in the world manufacturing such equipment, and the market is highly competitive. The greater part of the equipment now installed has been furnished by Germany, Great Britain, and the United States. Although the official import statistics do not classify industrial electrical machinery definitely enough to indicate the relative position of these countries, Germany is believed to be in the lead. American electrical machinery is considered favourably because of its quality, but large purchases of European equipment are made on the basis of price or nationalistic sentiment. Practically the only method feasible in the sale of this equipment in the Argentine market is through a factory branch or the established electrical-equipment supply houses in Buenos Aires, which have well-organised technical and sales staffs and branches or sub-dealers in other principal Argentine cities.—*Commerce Reports.*

According to the *Journal* of the British Chamber of Commerce in the Argentine Republic, there are wide margins of expansion open to services and industries in Argentina which already have a firmly established footing, the telephone service being one of the notable cases in point. "Telephones and electrical apparatus will undoubtedly figure very heavily in Argentina's import trade figures during the next ten years, and the factor of capital control over the services and enterprises operating in the corresponding spheres will play a very important part in the determination of the destination of the orders for the apparatus and material which will be required in increasing quantities." The value of imports of electrical materials during the first half of 1928 was, in tariff figures, 5,263,390 dollars gold as compared with 3,857,191 dollars in the first half of 1927.

The Companies Act, 1928, and Rationalisation.

On Friday last Sir Mark W. Jenkinson, K.B.E., finance director of Vickers-Armstrong, Ltd., gave an address on "The Companies Act, 1928, as it affects the Business Man" to members of the Rotherham Chamber of Commerce. In this address the main features of the new Act were admirably summarised, particular attention being drawn to the changes in company law which it introduced. The main headings were: "Directors," "Prospectuses and Offers of Shares for Sale," and "Balance Sheets and Accounting."

In the evening of the same day Sir Mark Jenkinson read a paper on "Some Aspects of Rationalisation" before a representative meeting of bankers and accountants at Sheffield. This dealt not only with the actual construction and financing of merger companies, but also with many of the effects of "rationalisation," including its influence upon the relations between capital and labour. The conclusion was reached that "Rationalisation of industry is the co-operative movement of those engaged in a particular industry to win back for that industry a paramount position in the world's trade, and by good will, good work and good brains success can be attained." These two addresses are published in booklet form by Gee and Co. (Publishers), Ltd., Kirby Street, E.C.1.

Rumoured Transatlantic Cable Merger.

Notwithstanding semi-official denials, Wall Street believes that the long-discussed merger between the Western Union Telegraph Co. and the Radio Corporation of America is approaching consummation. This combination would form one of the most extensive communication systems of the world. Recently negotiations were reported to have been postponed on

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account of fears that such a deal might violate the provisions of the White Act, which is designed to prevent mergers calculated to lessen competition. It is now thought possible that in order to complete the merger, the Western Union Telegraph Co. may create a new company or separate its cable business from its land-line operations.—*Reuter* (New York).

Registered Electrical Contractors.

The Executive Committee of the National Register of Electrical Installation Contractors, at its meeting on March 1st, accepted applications for registration from the following:—

Kay & Morris, Preston.
Graham & Zebedee, Belfast.
Young, N., Amble, Northumberland.
Ryan, L. R., Marlow, Bucks.
Ainley, J. R., Leeds.
Aspin, J. A., Colne, Lancs.
Smith, H. C., Leeds.
Engineering Works (Electrical & General), Ltd., London, E.C.2.
Collins & Sharp, Leeds.
Brown & Roberts, Barnsley.
Peat, H., Leeds.
Gray, James, & Son (Ironmongers & Electricians), Ltd., Edinburgh.
Yewdall, H., Leeds.
Taplin, H. C., & Sons, Southampton.
Pritchard, A., & Co., Lye, nr. Stourbridge.
Leonard, V., Belfast.
Chapman & Inman, Stockton-on-Tees.
Brentwood District Electric Installations, Ltd., Brentwood, Essex.
Lucas, A. W., & Co., Birmingham.

At the same meeting 14 applications were declined.

Italian Foreign Electrical Trade.

The appended table shows the Italian imports and exports of electrical machinery and apparatus during the past year, as compared with 1927. The values have been converted to sterling at an exchange rate of 92.70 lire to the £. It will be seen that while the imports show an increase of £541,905, there was a drop in exports of £4,074:—

	Imports.		Exports.	
	1927.	1928.	1927.	1928.
	£	£	£	£
Accumulators and parts ...	17,915	33,475	34,590	38,260
Incandescent lamp bulbs ...	23,073	33,172	24	27
Electrical measuring instruments	30,870	45,235	1,194	1,400
Electrical apparatus, miscellaneous	473,888	780,367	110,470	108,422
Telegraph, telephone and radio apparatus	737,162	894,342	45,874	28,650
Electric furnace carbons ...	176,438	159,140	17,355	5,748
Insu ated cables	28,192	31,308	150,745	188,039
Generators "without collectors"	222,033	224,194	11,980	13,623
Generators "with collectors"	216,622	240,8 '6	300,742	231,177
Glass and porcelain insulators	20,934	16 955	4,061	16,220
Arc lamps	1,357	586	—	—
Incandescent lamps	361 430	429,430	31,750	79,417
Static transformers	62,7 2	58,815	16,124	9,030
Insulating tubes	460	379	1,290	3,2:2
Electricity meters	160,322	12 ,576	8,380	3,160
Insulated wire	27,013	33,526	49,405	53,465
Totals ...	£2,560,421	£3,102,3 6	£783,984	£779,910

Bankruptcy Proceedings.

E. F. Lee (trading as Francis Newton), electrical engineer, &c., 340a, King's Road, Chelsea, S.W.—The first meeting of creditors was held last week at the London Bankruptcy Court, the debtor having filed his petition on February 22nd. He states that he commenced business in partnership with another person as builders and electrical engineers. The business proved very poor and was insufficient to carry two partners with the result that in July last the partnership was dissolved. The debtor took over all the assets and liabilities paying his partner £25 on retirement and had since traded alone. Owing to the pressure of creditors he closed the business on February 16th last. He attributes his failure to bad debts, heavy overhead expenses, and bad trade. The case was left with the Official Receiver as trustee, the debtor's statement of affairs showing liabilities of £372 and assets £60.

H. C. Buckley, electrician, 23, Asylum Road, Old Kent Road, S.E.—The public examination of this debtor was held at the London Bankruptcy Court last week before Mr. Registrar Warmington. The debtor failed last January with liabilities of £1,932 and assets "furniture, £6 10s." The Official Receiver reported that the debtor had failed to appear for purposes of investigation, and his statement of affairs required amendment. The examination was adjourned *sine die*.

S. Hall (E. Green & Co.), electric lamp dealer, 13, Caledonian Road, and 30, Leighton Lane, Leeds.—Receiving order made February 27th, on a creditor's petition.

T. C. Wheeler, electrician, 6, South Scarborough Street, West Hartlepool.—First meeting March 15th, at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. Public examination, April 11th, at the Court House, Stockton-on-Tees.

F. E. Care (F. E. Care & Son), dealer in electrical goods, &c., 40, Paradise Street, West Bromwich.—Receiving order made March 5th on debtor's own petition.

R. Horsfall (Harrison & Horsfall), electrical engineer, Midland Street, Barnsley.—First meeting, March 18th, at the Official Receiver's office, County Court Hall, Regent Street, Barnsley; public examination, April 25th, at the County Court Hall, Barnsley.

S. S. Kelly, electrical contractor, 59, North Road, Durham.—First and final dividend of 1s. 7½d. in the £, payable March 18th, at 2, Sackville Place, Newcastle-on-Tyne.

J. A. Davies, electrical contractor, Eureka, Church Street, Blaenau Festiniog.—First and final dividend of 3s. 5¾d. in the £, payable March 20th at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

Company Liquidations.

County Electrical & Wireless Stores, Ltd., Garrick Yard, St. Martin's Lane, E.C.—The first meetings of creditors and shareholders were held on March 8th at Carey Street, W.C. Mr. J. Barwick Thompson, Official Receiver, reported that the winding up order was made on January 28th upon the company's own petition. The company was registered as a private company in July, 1923, with a nominal capital of £1,000, increased in 1926 to £7,000, the object being to carry on business as dealers in wireless receiving sets and parts. He understood that the formation was at the instance of Burndept, Ltd., for the purpose of dealing in apparatus manufactured by that company because the rules of the trade association prevented manufacturers from retailing their own products. The original directors, Messrs. F. T. Lane, R. J. Frost, and S. E. Wadey were all nominees of the Burndept Co., and they, with Messrs. C. Stewart and J. G. Scott, resigned at different times. Although the nominal capital was increased in 1926, only 1,000 £1 shares had been issued and they were subscribed for cash. Premises were opened at Deal in 1923, other branches being subsequently established at Folkestone, Bournemouth, Gloucester and Hythe. Although in the first few months the company restricted its sales to Burndept products, it gradually traded in other apparatus. By February, 1927, the company was indebted to Burndept Wireless, Ltd., to the extent of £6,998, in respect of moneys advanced and goods supplied. In that month debentures were created and issued to Burndept Wireless, Ltd., to secure the debt, but in the following June, Burndept Wireless, Ltd., agreed to accept £1,250 in full discharge and an overdraft was obtained from the bank and guaranteed by Mr. Monins, a director. Thereafter the company purchased the bulk of its supplies from Hambling, Clapp and Co., Ltd., of which concern Messrs. Price & Monins were directors. The trading accounts showed that during the five and a half years of its existence the sales amounted to £36,499, and the gross profit was £7,130; there was a net loss of £10,691. Another company in which Mr. Monins was interested (E. K. Development Co., Ltd.) advanced £200, and another loan of £500 was obtained at the end of 1928 from the Ever Ready Co. (Great Britain), Ltd. Shortly before the presentation of the petition to wind up the company the landlords of the premises at Folkstone, Deal, Hythe and Bournemouth distrained for rent. No statement of affairs had yet been lodged, but the liabilities were estimated at £4,319 and the assets at £614, of which £500 represented book debts. The failure was attributed by the directors to insufficient working capital. In the opinion of the Official Receiver the failure was also due to mismanagement. The company ought to have been wound up at the end of the second year's trading, by which time the whole of the capital had gone. The result of the subsequent trading was merely to increase the liabilities year by year as a net annual loss had been sustained throughout. The liquidation was left in the hands of the Official Receiver.

Radiovisor, Ltd.—A meeting of members is called for April 9th at 26, Coventry Street, W., to hear an account of the winding-up from the liquidator, Mr. S. H. Master.

Dissolutions of Partnership.

Electrical Car Equipments, and Evans & Wheeler, automobile electrical engineers, 77, Market Street, and 22, Argyle Street, Birkenhead.—Mr. S. Evans and Mr. G. B. Wheeler have dissolved partnership. Mr. Evans will attend to debts and continue the businesses.

N. R. Phelp, wireless engineers, 54, Queen's Road, Brighton.—Mr. N. R. Phelp and Mr. W. R. Pallett have dissolved partnership. Mr. Phelp will attend to debts.

Manchester Magneto Co., magneto repairers, 51, Hardman Street, Manchester.—Mr. H. V. Barker and Mr. P. S. Clark have dissolved partnership. Mr. Barker will attend to debts and continue the business.

Roberts & Gouldthorpe, mechanical and electrical engineers, Crosland Moor Mills, Huddersfield.—Mr. J. E. Roberts and Mr. H. Goldthorpe have dissolved partnership. Mr. Roberts will attend to debts and continue the business.

Private Arrangements.

A. V. Creasey, electrical and wireless engineer, 54, High Street, Knaresborough, and 146, High Street, Bramley, Leeds. A meeting of creditors was held on March 7th, when a statement of affairs was submitted which had been prepared by Mr.

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C. H. Baker, of the Manufacturers' and Merchants' Protection Association, Leeds. The statement disclosed ranking liabilities of £2,373, of which £1,663 was due to the trade. The net assets were estimated at £969, leaving a deficiency of £1,404. Mr. Baker reported that before the war the debtor was a wireman, and on his demobilisation in 1918, he started trading on his own account at Leeds, with a capital of £200. In 1924 he commenced trading at Knaresborough, and for some little time following that date, his financial position was adversely affected. His position improved in 1926. The debtor also had a shop at Ripon but it was disposed of some little time ago. In 1926 the turnover was £4,000, and in the following year it increased to £4,100 and went up to £4,500 in 1928. The deficiency was accounted for by the depreciation written off the assets in the statement of affairs, loss on old stock £100, bad debts, losses on contracts, and depreciation of wireless stock. The debtor had recently been pressed, and a deed of assignment had been executed with Mr. Baker as trustee. The creditors confirmed the deed, and a committee of three of the creditors was appointed. Mr. Baker states that the business is being continued with a view to its sale as a going concern. The following are creditors :—

	£		£
Metro-Vick Supplies, Ltd.	71	Albion Electric Stores ...	206
E. G. S. Co., Ltd. ...	315	Ellison & Hillman	39
Morley, T. B., & Co., Ltd.	33	Lewtas, H. & G. O., Ltd.	38
Credenda Conduits, Ltd.	40	Dawson, Fred	110
Brown Bros., Ltd. ...	25	Major & Co., Ltd.	25
Baxendale & Co., Ltd. ...	150	"M.P.A." Wireless, Ltd.	27
Philips Lamps, Ltd. ...	32	Ward & Goldstone, Ltd.	99
Riddiough, Frank, & Son	79	Fuller Accumulator Co. (1926), Ltd.	21
Falk, Stadelmann & Co., Ltd.	42		

Reduction of Capital.

Sir W. G. Armstrong, Whitworth & Co., Ltd., & Reduced.—A petition has been presented to the High Court for the reduction of the capital of the above named company from £11,012,500 to £1,512,812, and will be heard in London on March 18th.

New Catalogues and Lists.

Holophane, Ltd., Elverton Street, Vincent Square, S.W.1.—A pamphlet, illustrated in colour, describing the company's colour-lighting schemes for kinemas. Also a copy of "Holophane Illumination" dealing in an interesting way with the arrangement of, and equipment for, colour lighting for stage and kinema.

British Insulated Cables, Ltd., Prescot, Lancs.—A bridge score pad, each leaf of which bears a picture of the company's works or products.

Messrs. Austin Walters & Son, Ltd., Gaythorn, Manchester.—A folder advertising the company's electric sky signs.

Messrs. J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham.—A priced and illustrated pamphlet dealing with the company's miniature cut-out (15 A at 250 V; 10 A at 500 V); and a folder containing illustrations and prices of numerous "Tucker" switchplates in metal and moulded "Telacite."

The Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex.—An illustrated booklet containing details and prices of the company's steam traps.

Messrs. W. Canning & Co., Ltd., 133-137, Great Hampton Street, Birmingham.—A pamphlet containing illustrations of chromium-plating equipment and examples of chromium-plated work, including electrical appliances.

The Enfield Cable Works, Ltd., Lincoln House, 296-302, High Holborn, W.C.1.—A blotter illustrating the method of packing small Enfield cables.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—A March calendar-blotter bearing an illustration of the company's "No. 46" cooking cabinet.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—A folder, illustrated in colour, dealing with "Eye-Restolite" and "Luxor" lighting fittings and silk shades. Priced. Pamphlets Nos. L.459 and L.460 dealing respectively with the company's equipment for industrial lighting and shop lighting. Also a descriptive pamphlet containing full details of the B.T.H. electric freezing unit.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—Leaflet No. 282 dealing with built-in control gear for individual drives, with illustrations of actual examples.

The Universal Manufacturing Co., 7c, St. George's Circus, S.E.1.—A card bearing examples of colours in which the company's lamp colouring preparations are produced.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—Three new showcards advertising in an attractive manner three "Marconiphone" receiving sets.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—Brochure No. 1002 E., illustrating and describing the company's centrifugal pumps.

The Eclipse Pump Co., 65-66, Queen's Buildings, 52, Queen Victoria Street, E.C.4.—A reprint of an article dealing with the "Eclipse" automatic force and sight feed oil pump.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 940 describing the company's oil-immersed starters for squirrel-cage motors.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—Catalogue No. 1324 illustrating and describing a number of industrial vacuum-cleaning installations employing Sturtevant equipment.

The Line Accessory Co., 59, Tennyson Road, Small Heath, Birmingham.—An illustrated price-list of "Linac" plugs and sockets of various patterns.

Giant's Causeway Tramway.

We have received a copy of a brochure dealing with the opening ceremony of one of the pioneer hydro-electric tramways of the world, the Giant's Causeway electric tramway, which was constructed by Mr. William A. Traill, and was opened in 1883. There is a forecast of an elevated, or overhead, electric railway by a model, 28 feet long, exhibited at the International Inventions Exhibition of 1885 in London, which received the award of a silver medal, embodying third-rail electric conductors as still used on the Metropolitan and Tube electric railways. Another forecast gave cross sections of the conduit system of street electric tramways, as described by Traill's patent of July, 1883, and used by the L.C.C. electric tramways of 1903.

Canadian Tariff Changes.

The *Board of Trade Journal* reports a number of alterations in the Canadian Customs tariff which took effect as from March 2nd. Among other things the duties on electrically operated rotary coal drills of a class not made in Canada, and coal-cutting machines are remitted. "Copper rods when imported by manufacturers for use in their factories in the manufacture of electrical conductors, the individual units of such electrical conductors not to exceed the area of No. 7/0 gauge conductor," are still to be admitted free of duty, but the Governor-in-Council is empowered to impose the following duties when he is satisfied that copper bars are being sold in the country of export at a lower price than for export to Canada :—Intermediate tariff ¼c. per lb.; general tariff ½c. per lb.

Social Events.

The annual dinner of the staff of the Bury Corporation Electricity Department was held on February 25th, under the presidency of the engineer and manager, Mr. J. G. Potts. Various toasts were honoured, including the health of Mr. T. Mahon, who was complimented on completing 33 years' service with the undertaking.

The annual fancy dress carnival, organised by the staff of the Sun Electrical Co., Ltd., was held at the Victory Hall, Leicester Square, on March 2nd, when nearly 200 of the staff and their friends attended. The costumes were, as usual, most original, the first prize being awarded to Mr. J. A. Johnstone whose characterisation of the results to be expected from a certain cheap type of tailor gave rise to uproarious hilarity. Among those present were Mr. A. G. Beaver (managing director) and Mrs. Beaver, Mr. D. M. Fraser (Leeds manager), Mr. J. K. Green (Newcastle manager), and several heads of departments. A raffle for a basket of fruit produced £5 for the Miners' Fund. The carnival was arranged by Mr. A. G. Owen.

The annual concert of the G.E.C. Choral Society was held in the Lecture Hall, Magnet House, on March 1st. A concert version of Gounod's *Faust* was rendered with fine effect. Much of the success was due to Mr. A. H. Spinks, the conductor, with Miss I. Page at the piano. The soloists were Mme. A. Glen Sidwell, L.R.A.M., Miss Hilda Burroughs, Mr. William Crowley, and Mr. Thomas Sack. The second part of the programme consisted of a number of well-rendered songs and choruses, the arrangements being in the hands of Mr. R. A. Hyde, the honorary secretary of the Society.

Continental Exhibitions.

It is stated that the thirteenth annual Swiss Industries Fair, which opens at Bâle for ten days on April 13th, shows a notable advance on previous years. Some 1,500 exhibitors have booked space. The electrical group comprises, in the main, exhibits illustrating the development of modern electro-technics. The exhibits include automatic telephone stations, batteries, radio apparatus, stage-lighting apparatus, household electrical appliances, scientific instruments, lifting plant, welding apparatus, medical and scientific electrical apparatus, automatic switches, transformers, and numerous other articles.

A dinner was given in London on March 7th to the Committee of Honour of the British Section of the Barcelona International Exhibition, which is being held from May to December. The Spanish Ambassador, who attended, described the exhibition as one of the greatest since the war, and said that it was within 26 hours of London. It provided a chance for British salesmen to "push" their goods, and in spite of the tariff wall there was always a way for high-class goods, and British goods were always that. Sir Edward Crowe (Department of Overseas Trade) said that British exporters had lost ground in Spain, and the Barcelona Exhibition presented a unique opportunity for the regaining it.

We have received from the Italian Chamber of Commerce in London, 10, Queen Street, E.C.4, some "literature" dealing with the Milan Sample Fair (April 12th to 27th). The illustrations show this to be a well laid out exhibition, in which the various classes of goods are separately housed.

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There is an "Electrotechnics Pavilion" covering an area of 5,000 sq. metres, as well as a "Mechanical Saloon" with a floor space of 12,000 sq. metres, said to be one of the largest in Europe. A combination of pleasure with business is suggested, and special tours have been arranged by the Italian State Railways.

In the coming autumn it is proposed (according to the *Daily Telegraph*) to hold an exhibition of British industrial products in Copenhagen. It is stated by the promoters, two newspaper proprietors, that although Danes prefer to buy British goods, the imports, owing to lack of propaganda, are rather small.

Book Notices.

"Publications of the U.S.A. Bureau of Standards.—Standards Year Book, 1929. Price one dollar.—The third issue of this annual publication is a reference book, summarising and bringing up to date current standardisation activities and accomplishments in the United States of American and elsewhere since the 1928 edition.

Circular No. 374, "X-Ray and Radium Protection" (5 cents); Research Paper No. 40, "Note on a Piezo Electric Generator for Audio-Frequencies" (5 cents); Miscellaneous Publication No. 86, "Tables of Spectral Energy Distribution and Luminosity for use in Computing Light Transmissions and Relative Brightnesses from Spectrophotometric Data" (10 cents).

"Electric Traction," by Capt. M. I. Williams-Ellis. Pp. xvi+40; 23 figs. Price 6d.—This booklet, being a reprint of a paper that was awarded the Maybury Gold Medal and a fellowship of the Institute of Quarrying, deals with the application of electric traction to quarries and mines, a subject on which little has been written.

"The Daylight Transmission of Wireless Waves over Sea Water," by R. O. Cherry. Pp. 6; figs. 3. Melbourne: Broadcasting Co. of Australia.—A pamphlet dealing with the results of signal intensity measurements of the ground wave.

"The Theory of the Gyroscopic Compass and its Deviations," by A. L. Rawlings. Pp. x+191; figs. 65. London: Macmillan and Co., Ltd. Price 10s. 6d. net.

Gramophone-Radio Merger.

It was announced last week that the Gramophone Co., Ltd. ("His Master's Voice") has acquired the Marconiphone Co., Ltd., one of the subsidiaries of Marconi's Wireless Telegraph Co., Ltd. The purchase carries with it the right to use the Marconi radio patents and the "Marconi" and "Marconiphone" trade marks. It is also understood that the radio interests of the Sterling Telephone and Electric Co., Ltd., are included in the transaction, leaving the company to carry on with its telephone business. The Marconi Company is to receive a cash payment and shares in the Gramophone Co. Commenting on the matter, the *Financial News* states.—"An important feature of the transaction is that the fusion of interests establishes control in British hands. It will be recalled that quite recently the Radio Corporation of America acquired control of the Victor Talking Machine Company, 95 per cent. of the stockholders of the latter agreeing to a share exchange. Victors hold all the 'B' ordinaries of H.M.V., and with them a controlling interest. By the issue of the new shares to the Marconi Company, to what extent has yet to be disclosed, it is understood that control will be swayed into British hands by the turn of the scale."

The Marking of Imported Rubber Goods.

The Standing Committee under the Merchandise Marks Act, 1926, has issued its report on the application made by the India-Rubber Manufacturers' Association, Ltd., for an Order requiring the marking of imported rubber manufactures. (Cmd. 3281, H.M. Stationery Office, 3d. net.) The application was in respect of many classes of goods, including sheet rubber, piping and tubing, rubber gloves, ebonite, vulcanite, and manufactures thereof, &c. An agreement was reached with regard to ebonite to the effect that sheets of the material of more than 3/16 in. in thickness and four sq. ft. in area should be marked by impression in one corner. It was also suggested that in the case of ebonite manufactures the containers should be marked, if supplied by the manufacturers; the Committee, however, considers this impracticable and inexpedient. With regard to rubber in sheets it is recommended that the seller should be allowed the option of marking them by stencilling or other non-injurious means. It is recommended that rubber hose should be marked by means of a securely-attached label. The suggested methods and positions of marking are given in an annex to the report.

German Meter Manufacturers' Association.

An association of German electricity meter manufacturers has recently been formed in Berlin with the object of protecting their interests in Germany and abroad.

Visit of Commercial Secretary in the United States.

The Department of Overseas Trade announces that Mr. A. J. Pack, the Commercial Secretary in the United States, will shortly visit this country on official business. Mr. Pack will attend the offices of the department for a few days commencing on March 18th, for the purpose of interviewing representatives of United Kingdom firms interested in the exportation of British goods to the United States. He will subsequently visit a few of the principal commercial centres in the United Kingdom. Applications for interviews in London should be addressed to the Comptroller-General Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference 12796/1.)

For Sale.

Birmingham Corporation Electricity Department has for disposal seven Babcock & Wilcox land type boilers with Underfeed stokers, &c., also two 175-b.h.p. Belliss & Morcom high-speed engines coupled to two 300-V. three-phase generators, one 15-h.p. Bryan Donkin & Clench steam engine, switchgear, piping, feed-water heater and purifier, and two 4-kW transformers. The receiver of the Chagford and Devon Electric Light Co., Ltd., invites offers for the freehold land, mill, or factory (with turbine) and buildings at Chagford, together with the goodwill of the business of electric light suppliers, including plant, &c. Exeter City Council Electricity Committee invite offers for two Babcock & Wilcox water-tube boilers with superheaters and chain grate stokers, and two Belliss and Morcom triple-expansion engines with jet condensers direct coupled to two 400-kW Westinghouse alternators. (See our advertisement pages to-day.)

Trade Announcements.

The Walsall Hardware Mfg. Co. has opened a new depôt at 39, Arundel Street, Sheffield (telephone 22844), under the management of Mr. E. P. Prior.

The business of A.F.A. Accumulators, Ltd., has been taken over by Pertrix, Ltd., 120, Tottenham Court Road, W.1. The latter company is equipping a factory at Redditch for the production of accumulators and dry batteries.

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, March 12th: No change in copper prices.

Messrs. James & Shakespeare report, March 12th: English pig lead £24 15s., 5s. dec.

Messrs. Edward Till & Co. report, March 12th: India-rubber, Para fine 1s. 1d., ½d. dec.

In their letter dated March 9th, Messrs. James Forster and Co. stated that the main support of the lead market last week came from America and to a certain extent from the troubles in Mexico, which, if prolonged, would result in production being interfered with. Demand in this country and on the Continent is still very quiet, while actual supplies are sufficient, and with heavy shipments from Australia during January and February, prospective supplies look like being in excess of requirements. Moreover, the revolution in Mexico seems to be on the eve of collapse, so that regular shipments should be resumed from that country before long.

We have received from Messrs. Lindsay & Williams, Ltd., Ardwick, Manchester, as usual, a set of curves showing the course of prices during 1928 of raw materials for cable manufacture, *viz.*, cotton, rubber, copper and lead.

Our Foreign Electrical Trade.

The following table shows the values of exports and imports of electrical goods and machinery during February:—

	Feb., 1929.	Inc. or dec. as compared with Feb., 1928.	2 months 1929. Inc. or dec.
Exports—	£	£	£
Electrical goods and apparatus	950,588	−41,426	− 36,175
Machinery	4,107,637	+35,750	+308,340
(Inc. electrical machinery)	511,777	+21,589	+ 83,948
Imports			
Electrical goods and apparatus	388,036	+47,888	+ 64,671
Machinery	1,234,671	+16,251	+299,054
(Inc. electrical machinery)	120,780	−19,596	− 11,038
Re-exports—			
Electrical goods and apparatus	12,776	− 125	− 3,146
Machinery	118,933	− 4,007	+ 460
(Inc. electrical machinery)	8,624	+ 751	+ 1,162

Lighting and Power Notes.

Accrington.—New Cables.—The Corporation Electricity Committee has approved schemes for the laying of cables to the Blackburn boundary at a cost of £1,148.

Australia.—New South Wales.—The N.S.W. Government has put in hand the construction of a dam on the Lachlan river at Wyangala, 30 miles above Cowra. According to the *Electrical Engineer of Australia and New Zealand*, this dam will impound water to be used for the development of mixed farming over a large area along the Condobolin to Broken Hill railway line, and will regulate the flow of the river so as to improve the water supply to properties along nearly 800 miles of river and creek frontage. The dam will be of concrete,

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with profile generally similar to that of the Barren Jack dam. It will impound 273,694 acre-ft. of water, to a maximum depth of 160 ft. It is proposed to build a hydro-electric station on the downstream side of the dam as part of the structure itself. This will house two 7,000-h.p. generating units and will supply energy for the surrounding towns and districts. The transmission system will link in with the Barren Jack system to the south and will also tie in, by means of a transmission line through Blayney, with the N.S.W. Railways Commissioners' steam power station at Lithgow. The Commissioners are already contemplating the construction of a line to supply Bathurst and Orange from Lithgow, and this will be used as part of the link. The tying-in of the Barren Jack and Wyangala hydro-electric stations with the Lithgow steam station will ensure reliability of supply.

Barnstaple.—New Plant.—The Town Council has decided to install another 300-kW Diesel set at the electricity works in the spring of 1930.

Bebington & Bromborough.—Street Lighting.—The Birkenhead Corporation Electricity Committee has arranged terms with the Urban District Council for street lighting in the district.

Caernarvonshire.—School Lighting.—The Clerk of Works of the County Education Committee has prepared a statement as to the cost of gas and electricity in one of the Council schools during a period of four years. For the four years when gas was used the cost was £55, and for the four years during which electric lighting was used the cost, including repairs, was £19. The Committee has decided that it is desirable that, wherever possible, schools in the county be lighted by electricity.

Canada.—Electrical Development.—A power development scheme on an exceptionally large scale is stated to be under consideration for the Abitibi River, north of Cochrane, Ontario. At the present time a preliminary survey is being made by Messrs. Morrow and Beatty, and the Abitibi Power and Paper Company, Ltd., it said to be interested in the plans. The site of the proposed development is close to Mile 70, on the James Bay branch of the Temiskaming and Northern Ontario Railway, in the vicinity of the Abitibi Canon, where four rapids provide a drop of 130 ft.

According to the *Financial News of Western Canada* the Power Corporation of Canada, Ltd., is shortly to undertake the construction of electrical utilities at Prince Rupert and Stewart costing between $2,500,000 and $3,000,000 during the current year. The municipal power plant at Prince Rupert, where 3,000 h.p. is at present developed, is likely to be acquired, the plant being extended in order to provide for the generation of 25,000 h.p. in anticipation of the development of new industries in the neighbourhood. Within 40 miles of the City are power sites on the Khatada, Oxtall and Brown's rivers.

Hydro-Electric Development.—In the House of Commons on March 8th, the Minister of Public Works, announced that the Government would sanction the application of the Beauharnois Power Company for approval of plans for a power canal seventeen miles in length on the St. Lawrence River above Montreal, involving the diversion of forty thousand cubic feet per second of the river flow sufficient for the initial development of 500,000 h.p., with a probable ultimate development of two million h.p. The company will immediately proceed with the development involving an initial expenditure of approximately 60 million dollars during the next three years, and also the contemporaneous establishment of many important new industries backed by Canadian, United States and British capital. The new industries will include electro-chemical and electro-metallurgical works in which British capital will be largely involved.—*Reuter* (Ottawa).

Colchester.—Plant Extensions.—The Corporation is to apply for sanction to the borrowing of £28,710 for the following extensions at the power station:—One 3,750-kW turbo-alternator with Lea recorder equipment, &c., £11,500; steel-cased cross-type marine boiler with accessories, £10,390; switchgear, £1,400; pipework and accessories, £2,500; foundations, &c., £1,550; engineer's fees, &c., £1,370. Subject to loan sanction, tenders have been accepted.

Continental.—Russia.—A committee appointed by the Central Electricity Department of the Soviet Government has reported in favour of the construction of a new power station to serve the industrial district of Leningrad. Recent extensions made to the existing stations have proved insufficient, and it is proposed to erect a station with a capacity of from 100,000 to 150,000 kW. The fuel used will be peat, of which there are ample supplies near Leningrad. Plans prepared by the technical expert, M. Speranski, provide for the erection of the new station at Malain-Vichera. Negotiations are said to be in progress with the American General Electric Co., for the work to be done at a cost of $25,000,000. The company will not only supply the plant but undertake part of the constructional work as well.

Dunoon.—New Undertaking.—The Town Council on March 5th approved the adjusted agreement between the Council and Messrs. Johnson & Phillips, Ltd., who are to establish an electricity undertaking in the town, costing £40,000.

Eastbourne.—New Sub-station Plant.—The borough electrical engineer has recommended to the Electricity Committee the erection of three new sub-stations at a cost of £2,184, and the installation of additional plant at five existing sub-stations at a cost of £1,505.

Loan.—The Committee is applying for sanction to a loan of £4,058 for mains extensions.

Epsom—Extensions or Bulk Supply.—At a recent meeting of the Urban District Council it was intimated that if sanction was not received soon for the installation of the second Fullager set, the electricity undertaking would not be able to cope with the demand for electricity in its area next winter. The Council had received an offer of a bulk supply from the London and Home Counties Joint Electricity Authority, but did not consider that that supply could be available in time to meet the fast-growing load.

Gloucester.—Loan.—The City Council has applied for sanction to a loan of £7,029 for a h.p. feeder and distributing cables to be laid in Stroud Road.

Grampians.—Amendment of Bill.—As a result of an important concession by the promoters of the Grampian electricity supply scheme, the joint opposition by Banffshire County Council and a number of the burghs in Banffshire, Aberdeenshire, and Kincardineshire may be withdrawn. The town clerk of Banff has been in consultation with the promoters in London, and they have agreed to add a clause to their Bill which requires them to submit their proposals to the Electricity Commissioners within three years, these proposals to be carried into effect within a time prescribed by the Electricity Commissioners. The Bill as it stood allowed five years for commencement and ten years for completion of the work. The town clerk adds that the promoters assured him that it was their hope and intention to supply electricity throughout the petitioners' areas considerably earlier than three years. They further indicated that they were prepared to be distributors of electricity to consumers direct, as well as suppliers of electricity in bulk, and that as such distributors they would supply at the price of 8d. per kWh as a maximum for lighting.

Guatemala.—Electrical Development.—It is proposed to augment the electrical plant at Coatepeque, Department of Quezaltenango, in order to serve Retaluleu and Ayutla, in the Department of San Marcos, close to the Mexican border. The bulk of the electricity provided at present is consumed by the owners, the International Railways of Central America, leaving an insufficient amount for general distribution.—*Reuter's Trade Service* (Guatemala City).

Hull.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to borrow £4,498 for works in connection with the supply of electricity to the Brough Aerodrome.

Irish Free State.—Cork.—At a recent meeting of the Council of the Cork Incorporated Chamber of Commerce, it was decided to ask the City Commissioner to make a request to the Electricity Supply Board to hold an inquiry regarding the charges for electricity made by the Cork Electric Supply Co., Ltd.

Killarney.—At a recent meeting of the Urban Council, the Town Clerk was directed to communicate with the Electricity Supply Board on the subject of the high price charged for electricity in the town, *viz.*, 10d. per kWh, and to request the Board to compel the Kerry Electric Supply Co. to reduce its present charges.

Shannon Scheme.—In Dail Eireann, on March 6th, the Parliamentary Secretary to the Ministry for Industry and Commerce, said that the total amount paid up to February 1st, 1929, to the contractors of the Shannon scheme was:—Civil constructional works, £2,140,557, and electrical and mechanical work, £1,428,904, making a total of £3,569,462. The amount which would accrue for payment on completion of the works could at present only be estimated. The sums would approximately be:—Civil constructional work, £2,897,000; electrical and mechanical work, £1,906,000; total, £4,803,000. This amount and the previous total made about £8,372,462 for the whole scheme.

Leyton.—Change-Over.—The Town Council is to change over the system of electricity supply from d.c. to a.c. in the Cann Hall area at a cost of £25,000, and has accepted the tender of the Power Lines Construction Co., Ltd.

Maidstone.—Loan.—The Town Council has applied for sanction to a loan of £3,000 for the provision of electrical apparatus to be let out on hire.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Beckenham.—"All-in" tariff: From 10 per cent. to 8 per cent. on the first £75 of ratable value, and from 4 per cent. to 3 per cent. on the ratable value above £75. Power: To consumers not using an electric cooker, from 1½d. to 1d. per kWh during the summer quarters, and to those using cookers, from 1d. to ¾d. per kWh.

Reigate.—Lighting: From 6d. to 5½d. per kWh. Heating: From 2d. to 1d. per kWh. Cooking and power: From 1½d. to 1d. per kWh.

Padiham.—In houses with a ratable value under £15, the rate of 6d. per kWh for lighting is reduced to 2d. per kWh for all electricity in excess of 60 kWh during the winter quarters, and 20 kWh in the summer quarters. The same reduction is to apply where the ratable value exceeds £15, but is under £25, for electricity in excess of 80 kWh in the winter quarters

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and 30 kWh in the summer quarters. Where the ratable value is over £25 the reduction will apply to electricity in excess of 140 kWh during the winter quarters, and 50 kWh during the summer quarters. Electricity for domestic heating and power is being reduced in similar ratio.

Wallasey.—Lighting: From 4½d. to 3¾d. per kWh, with a discount of 5 per cent. for prompt payment of accounts.

Cheadle and Gatley.—Ordinary lighting, within the district: From 6¾d. to 6d. per kWh; outside the district, from 7d. to 6½d. per kWh. "All in" rate: From 25 per cent. on the rateable value, with a minimum of £6, to 20 per cent., with a minimum of £4, plus 1d. per kWh. Slot meters: From 9d. to 8d. per kWh.

Preesall (Lancs.).—Assisted Wiring Scheme.—The Urban District Council has decided to embark upon a scheme to encourage electrical installations in private houses by means of a deferred payment system. The cost of the wiring installations will be met by a charge of 1s. per lamp per quarter until the capital outlay and interest are liquidated.

Rochdale.—Electrical Progress.—The Corporation Electricity Committee hopes to be able, at the end of this month, to report a surplus of £11,000 on the year's working of the electricity undertaking. One contributory factor has been the increase of about 65 per cent. in the use of electricity for domestic purposes. It is thought that the output for the year will be 80,000,000 kWh, representing an increase of 20 per cent. Of the estimated surplus, £5,000 will be put aside for new showrooms and stores.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by Messrs. Thomas Wilkinson (Arnside) Ltd., authorising them to supply electricity in the borough of Appleby, the urban districts of Kirby Lonsdale, Shap and Carnforth, the rural districts of East Westmorland and West Ward, and parts of the rural districts of South Westmorland, Lancaster, Lunesdale, and Sedbergh.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Liskeard Gas and Electricity Co., Ltd., to supply electricity in the borough of Liskeard, and Manchester Corporation to supply in part of the rural district of Bucklow.

Sheffield.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to borrow £49,897 in respect of feeder mains, and is to extend mains at a cost of £6,500.

Stamford.—Purchase of Undertaking.—The Town Council has decided to give notice to purchase the undertaking of the Urban Electricity Supply Co., Ltd., and to seek the permission of the Electricity Commissioners to carry this decision into effect.

Torquay.—Electrical Development.—At a meeting of the Town Council on March 5th, the Electricity Committee stated that the question of acquiring new premises for showrooms had been considered, but it had decided to proceed further with negotiations with the contractors before coming to any decision regarding the purchase of new premises. The cost of the showrooms was estimated at £15,000.

The Committee also submitted an assisted wiring scheme under which the work of installation would be let to contractors at a price to be fixed by the Council. Houses in streets where the cables were already laid would be dealt with first, and mains would be laid in other streets afterwards. The Committee recommended the Council to approve the principles of the scheme and stated that a further report and estimate would be presented in due course as to the sum required to set it in motion.

In connection with the purchase of the electricity undertaking at Buckfastleigh, the Teignmouth Electric Lighting Co., Ltd., has been requested to furnish more detailed particulars of the assets and financial position of the undertaking.

It was reported that from March 31st, 1928, to the end of January last, the electricity generated at the Council's works at Newton Abbot amounted to 14,232,036 kWh, an increase of 2,711,542 kWh, as compared with the corresponding period of the preceding year. The Committee's recommendations were adopted.

United States.—Electrical Development.—According to the *Electrical World*, construction of the James H. Reed 60,000-kW power station, to be built on Brunot Island, Pittsburgh, for the Duquesne Light Company, has been commenced, and orders for the major equipment, including three boilers, have been placed. The station will ultimately house another 60,000-kW generator and three more boilers. Construction work will continue through 1929, and the station will be completed in the summer of 1930.

Recommendations for the immediate expenditure of $2,950,000 for new equipment in the Kansas City (Kan.) municipal power station and expenditure of $7,600,000 by 1942 has been made to the City Commissioners in a report based on a survey made by Mr. A. L. Mullergren, consulting engineer, more than two years ago and recently revised. The programme would raise the capacity of the plant from 19,000 kW to 40,000 kW at first, and eventually to 100,000 kW.

Walsall.—Electricity Supply.—The Corporation Electricity Committee has authorised the expenditure of £17,000 for mains and sub-station extensions.

West Ham.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £19,081 by the Corporation for the extension of the generating station, as follows: Buildings, £2,000; switchgear, £7,575; cooling towers, foundations, &c., £2,323; superstructure and pipework, £7,163.

Tramway and Railway Notes.

Aberdeen.—Track Renewal.—The Corporation Tramway Committee has decided to spend about £19,600 on the renewal of the track in King Street and portions of the beach route.

Colchester.—Abandonment of Tramway.—The City Council is to apply to the Ministry of Transport for an Order authorising it to discontinue the tramway services from North Station Road to London Road, and from High Street to East Gates.

Continental.—Belgium.—The report of the Société des Tramways Bruxellois of Brussels for last year, which has just been issued, shows that the receipts from all sources amounted to £1,051,725, and the gross expenditure to £936,719, leaving a net profit of £115,006, as against £79,773 in 1927. Both the number of passengers carried and the number of car-miles run increased, and in order to provide for the growing traffic, the company has ordered 50 new motor-equipped and 200 large capacity trailer cars, which will be put into service during the present year. Several new lines were completed during 1928, and the company's reserve electricity stations have been connected up with the distribution mains of the other power stations in the Brussels area. The existing sub-stations have been modified, eleven mercury rectifiers are in course of installation, and about 20 miles of h.p. and 6¼ miles of l.p. feeders have been laid.

Switzerland.—The Swiss Federal Railways, at their last general meeting, passed the plans for the construction and electrification of a double section of line between Richterswil and Pfaeffikon, in the canton of Schwytz, and voted a credit of 4,638,000 fr. for the work in prospect. They also decided to purchase more rolling stock, and a sum of 17,900,000 fr. is to be set aside for this purpose.

Doncaster.—Railless Cars.—The Corporation has received permission from the Ministry of Transport to equip route No. 6 (Station Road, West Laith Gate, West Street, and St. Sepulchre Gate) and route No. 7 (Old Hexthorpe) for railless cars, on condition that the Corporation hold themselves solely responsible for the working of route No. 6, prior to it being authorised. The Ministry has also approved the plan of the proposed turning circle of route No. 7 at the junction of Urban Road and Greenfield Lane.

Ecuador.—New Tramway.—An executive decree has been issued granting the Quito Municipal Council authority to construct and operate a tramway system uniting Quito with other towns in the Canton. The 30-year concession will be transferred to the National Tramway Company, to which the exclusive right to operate the line will be ceded.—*Reuter's Trade Service* (Quito).

Glasgow.—Tramcar Improvements.—The Corporation Tramway Committee has approved the manager's suggestion that the top decks of 300 double-deck cars be enclosed at an approximate cost of £19,500.

London.—M.E.T. Developments.—Important additions to the tramway facilities in North and West London may be expected shortly. A decision has been reached to construct three links between the existing tramway systems, which will make possible new through services. The areas that will especially benefit are Park Royal, the districts between Golders Green and New Southgate, and Walthamstow.

One of these new links will be provided between the Metropolitan Electric Tramways in Horn Lane, Acton, and the London United Tramways system in the Uxbridge Road, and the two companies will, as a result, be able jointly to provide a direct service from Willesden, starting, perhaps, at Cricklewood, through Park Royal and Acton to Ealing. Another new link in the Metropolitan Electric Tramways system is about to be carried out near Tally Ho Corner, North Finchley. The Middlesex County Council has agreed to lay tracks directly connecting the services in Ballards Lane and Hilton Avenue, so that a through route can be operated from New Southgate to Golders Green, Cricklewood and Paddington. The third scheme for linking up the tramway system involves the construction of about a mile of double track connecting the Metropolitan Electric Tramways in Tottenham with the Walthamstow Tramways, by way of Ferry Lane. The Middlesex County Council has decided to ask for authority to lay this track, over which services will be worked by the Metropolitan Electric Tramways, giving through tramway connections from Epping Forest and Walthamstow to the Bruce Grove neighbourhood and Finsbury Park and thence on to the City.

Majorca.—Railway Electrification.—Work is in hand on the electrification of the railway between Palma and Port de Soller on the Island of Majorca a distance of 17½ miles. The trains will be operated at 1,200 V. d.c.

Siam.—Railway Electrification.—The Office National du Commerce Exterieur, reports that the Siamese State Railway authorities are considering the question of the electrification of the system.

York.—Tramcar Improvements.—The Corporation Tramway Committee has given instructions to the tramway manager to install upholstered leather seats in the tramcars as each car is brought into the workshop to be overhauled, the estimated cost being £40 per car.

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Telegraph and Telephone Notes.

Australia.—Photo-telegraphy.—The Postal Department has accepted a tender for the introduction of a service of telegraph transmission of pictures between Melbourne and Sydney. It is expected that the service will be available for public use in April or May. The contract has been let to the British General Electric Co., Ltd. The patent rights of the transmitting plant are owned by a German company, Siemens & Halske. The British General Electric Co. acted as agent for the German company. Two other tenders were received, one from an American telephone company, and the other from a Melbourne firm, which has been formed to experiment with and exploit the transmission of pictures.

France.—Telephone Call Metering.—A new experiment is to be made in certain Paris telephone exchanges of keeping subscribers' accounts by photographs. After two subscribers have been connected, the new apparatus photographs an instrument which records the number of minutes occupied by the conversation.

Greece.—Wireless Telegraphy.—The directors of the Greek Postal and Telegraph Administration have completed the programme for the extension of the postal network for wireless telegraphy. For coastal services, particularly with ships, four wireless stations will be established at Attika, Sitia (Crete), Salonica, and on the island of Zante, respectively. The internal radio network is to be extended by the establishment of three stations, which are shortly to be thrown open to competition for supply and erection. As a result of these developments the whole of Greece will be comprised within the domain of State telegraphy.

Radio-telephony.—Beam Circuit Tests.—Developments in radio-telephony were predicted on the occasion of a recent demonstration by Marconi's Wireless Telegraph Co., Ltd. The tests are being conducted between the short-wave beam radio stations at Bridgwater (Somerset, England) and Montreal (Canada), and it is claimed that the circuit has carried simultaneous telephony and telegraphy successfully.

Transatlantic Telegraphy.—Tariff Reduction.—The Postmaster-General announces that reduced rates per word for night letter telegrams and week-end letter telegrams to Canada have been introduced on both the Imperial cable and beam wireless routes. This follows an announcement by the Western Union Telegraph Co. of reduced rates for night and week-end letter telegrams to North America, the company's third reduction since January 1st.

The Telephone Service.—York.—Converted to Strowger automatic operation in 1924, the main network at York now boasts a Strowger satellite exchange at Dringhouses, the new equipment having been successfully cut over on February 16th. It was manufactured and installed to the order of the British Post Office by the Automatic Telephone Manufacturing Company, Ltd. Dringhouses is some 1½ miles to the south-west of York, and is the first outlying district to be separately equipped. The present equipment is for 200 lines, provision being made for ultimate expansion to 400. The system is 4-digit, with 4th-wire metering, discriminating selector repeaters being used, which absorb the first digit in the case of purely local calls.

New London Exchange.—The new exchange in the Norbury (London) area which was opened on the 27th of last month has a switchboard of the No. 10 type, with accommodation for 1,900 subscribers' lines, and was supplied by Siemens Bros. & Co., Ltd. It will serve the area until the new automatic director exchange to be called "Pollards" (which is to be installed in the same building) is completed.

Radio Notes.

Canadian Radio Commission.—Return to Canada.—The Canadian Royal Commission is returning to Canada this month to confer with the Provincial authorities. The Commission, which consists of Sir John Aird, as president, Mr. Charles Bowman, and Dr. August Frigon, spent a month in London in consultation with the B.B.C., and has visited the main Continental centres. The Commissioners are hopeful that, by the time a chain of powerful stations is built across Canada, it will be possible to arrange for a regular weekly programme of British broadcasting for Canadian listeners.

Continental Relays.—Extension.—Hungary will participate in future in the fortnightly exchange of programmes between the countries of Central Europe. International broadcasts have been given regularly by Germany, Austria, Czecho-Slovakia, and Poland since June 11th, 1928, when the first relay was made by Berlin to Vienna, Prague, and Warsaw.

Canada.—Station Changes.—The new list of radio stations issued by the Radio Branch, Department of Marine and Fisheries, at Ottawa shows two new stations. One is CJRX, 25.6 metres, 2 kW, short wave, which broadcasts simultaneously with another station owned by the same gram company at Fleming, Sask. (CJRW) on 296.9 metres. With the change of CKY, at Winnipeg, from 0.5 kW to 5 kW, CKX has been opened at Brandon, Man., with the old station that used to be CKY. The only other station broadcasting in the province is CNRW, which uses CKY, and has a Government-owned licence, that of the Canadian National Railways. There are now 78 broadcasting licences in the Dominion, not all of which are in use: sixteen are owned by firms, associations, and churches which have not their own broadcasting stations, but rent time from others in their cities. Station CFCF, at Montreal, now operates on a wavelength of 291.1 metres, 1,030 kilohertz. According to *World-Radio*, the Government is in receipt of more than a quarter of a million dollars as the contribution of listeners through the medium of the one dollar tax, which is applied to the improvement of the radio service.

Fultograph Picture Transmission.—Extension.—In view of improved processes in transmission, the B.B.C. has adjusted the times and stations allotted for picture transmissions outside programme hours as follows:—*Afternoon transmissions:* station 5XX from 2 to 2.25 p.m. on Tuesdays and Thursdays. *Night transmissions:* stations 2LO and 5XX from midnight to 12.15 a.m. on Mondays and Fridays; and station 5GB from 11.15 to 11.45 p.m. on Wednesdays and Saturdays.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Beckenham.—Electricity Department. L.p. feeder pillars. (March 8th.)

Blackpool.—March 27th. Town Council. Two electrically-driven sewage pumps. Specifications from F. Wood, borough engineer, Municipal Buildings, Town Hall Street.

Bolton.—March 18th. Board of Guardians. Electric lamps required during six months. Form of tender from H. I. Cooper, clerk to the Guardians, 28, Mawdsley Street, Bolton.

Bradford.—March 18th. Tramways Committee. Double-deck electric trolley vehicles. Form of tender from R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

March 18th. Dudley Hill Wesleyan Chapel. Wiring and fittings for chapel premises and classrooms, tenders with suggested lighting schemes to the Trustees, c/o The Caretaker, 11, Dudley Street, Bradford.

Bradfield.—March 18th. Rural District Council. Supply and installation of electric motors and switchgear, Pangbourne sewage works. C. H. Stafford, engineer, 209, King's Road, Reading.

Cardiff.—March 19th. Electricity Department. E.h.p. and l.p. cables, and one natural draught cooling tower. (March 1st.)

Chorley.—March 21st. Rural District Council. Two electrically-driven multi-stage centrifugal pumps, with switch and control gear, pipes, valves, &c. Specifications, &c. (deposit £2 2s.) from W. Cotterill, surveyor, High Street, Chorley.

Dartford.—March 21st. Electricity Department. 3,038 yd. e.h.p. cable. (See this issue.)

Earby.—March 20th. Urban District Council. Complete electricity distribution scheme. (March 8th.)

East Ham.—March 23rd. Electricity and Tramways Department. 5,750 yd. e.h.p. cable. (See this issue.)

Edinburgh.—March 18th. Electricity Supply Committee. H.p. sub-station switchgear. (March 8th.)

March 25th. Underground insulated cables, conduits, pave-

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ment and road box frames and covers, house-service fuse boxes and fuseboards, electricity supply meters. (February 15th.)

March 15th. One 1,500-kW motor convertor. (February 22nd.) (We regret that by a printer's error this item was placed under "Earby" in our last issue.)

Exminster.—March 21st. Committee of the Devon Mental Hospital. Supply for six months of electric lamps, &c. Forms of tender from the clerk, Mr. Cecil Masters.

Farnworth.—March 25th. Electricity Department. L.p. cables. (See this issue.)

Gloucester.—March 25th. Electricity Department. Two 1,000-kW motor-generators. (March 8th.)

Harrogate.—March 23rd. Electricity Department. Cables, joint boxes, joint box compound, service meters, cut-outs and transformers for 12 months. (March 8th.)

Hull.—March 21st. Electricity Committee. Electrically-driven circulating water pump, motor, motor-starter, &c. (March 1st.)

March 21st. Electricity Committee. Three 1,500-kW motor-convertors. (March 8th.)

Ilford.—March 25th. Electricity Department. Supply of paper-insulated cables. (March 8th.)

India.—New Delhi.—Indian Stores Department. March 26th. Oil engine generator set. (B.X. 5157.)*

Knottingley.—March 25th. Urban District Council. Wiring 48 houses in Weeland Road, and Womersley Road. Forms of tender from the Council's Surveyor, Town Hall.

Lancaster.—March 18th. Electricity Department. Two water-tube boilers (36,000 lb. per hour), with mechanical stokers, economisers, air heaters, steel chimney and fans. (February 22nd.)

London.—Central Electricity Board.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (See this issue.)

Metropolitan Asylums Board.—March 20th. Installation of automatic telephone system at the North-Western Fever Hospital, Lawn Road, Hampstead. (March 1st.)

Bethnal Green.—March 25th. Borough Council. Electric lighting installation at seven blocks of tenement buildings in Bethnal Green. (March 8th.)

Islington.—March 26th. Cleansing Committee. One new lead battery for Edison vehicle. (See this issue.)

Manchester.—March 18th. Central Purchase Committee. Incandescent electric lamps for 12 months. (March 8th.)

April 3rd. Electricity Committee. One 8,000-kVA air-cooled transformer. (See this issue.)

New Zealand.—Wellington.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Pentre, Rhondda.—March 30th. U.D.C. Electricity Department. A.c. ordinary and prepayment meters, mains and house service material. (March 1st.)

South Africa.—Johannesburg.—March 21st. Town Council. 65,500 porcelain insulators. (B.X. 5114.)* Weatherproof wire. (B.X. 5113.)*

Port Elizabeth.—March 28th. Municipal Council. 33,000-V cable, transformers, disconnecting boxes, oil switches, link switches, trifurcating boxes, and electricity meters. (B.X. 5146-7-8.)*

Umtali.—April 18th. Municipal Council. 1,000-kW turbo-alternator, spray cooling plant, switchgear, transformers, crane, &c. (B.X. 5142-5.)*

Stourbridge.—March 21st. Board of Guardians. Electric lamps, shades, &c., for six months. G. F. James, clerk, 12, Hagley Road.

Turton (Nr. Bolton).—March 20th. Urban District Council. Cable, meters, joint boxes, ironclad fuses, &c. Form of tender from Electrical Superintendent, Council Offices, Bromley Cross.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Brisbane.—City Council.

Turbo-alternator manufactured by the British Thomson-Houston Co., Ltd.; condenser, by Britons; and a condensate system by Mort's Dock (£67,427).—Australian General Electric Co., Ltd. (Accepted.)

Three boilers for the new power house at New Farm (£74,266).—Babcock & Wilcox, Ltd. (Recommended.)

Birkenhead.—Electricity Committee. Accepted:—

Cable (£1,434), W. T. Glover & Co., Ltd., and (£2,714), Hackbridge Cable Co., Ltd.

Bolton.—Watch Committee. Accepted:—

Experimental automatic traffic signals at Wheatsheaf Corner.—Forest City Electric Co., Ltd.

Bradford.—Electricity Committee.

C.i. sluice gates and frames for new cooling pond at Valley Road power station.—J. Blakeborough & Sons, Ltd.

Tramways Committee.

36 tramcar gear wheels, £216.—British Hele-Shaw Patent Clutch Co., Ltd.

Brentwood.—Mental Hospital. Internal wiring. The following tenders were received in connection with this scheme:—

Barrow & Co., Ltd.	£19,275
Ellis & Ward	13,827
W. E. Hutchinson	13,720
T. Clarke & Co., Ltd.	13,347
Malcolm & Allan (London), Ltd.	13,172
Tredegars, Ltd.	13,043
G. E. Taylor & Co., Ltd.	12,829
Electrical Installations, Ltd.	12,801
Rylands Electrical Co.	12,700
Gifkins & Co., Ltd.	12,601
Etna Lighting & Heating Co.	12,102
V. G. Middleton & Co., Ltd.	12,045
A. Higginbotham & Sons	11,699
Mann, Egerton & Co., Ltd.	11,152
Colston Electrical Co.	10,435
S. Dixon & Son, Ltd.	10,265
Power Contracts, Ltd. (Accepted.)	9,675
Read & Partners, Ltd.	9,240

Burton-on-Trent.—Electricity Committee. Accepted:—

Two 250-kVA transformers (£295).—Metropolitan-Vickers Electrical Co., Ltd.

Switchboard (£147).—Donovan & Co.

Canterbury.—City Council. Accepted:—

Steam and other pipes for the extension of plant at the electricity works, £910.—Babcock & Wilcox, Ltd.

Carlisle.—Electricity Committee. Accepted:—

One 15,000-kW turbo-alternator (£34,874).—British Thomson-Houston Co., Ltd.

One surface condenser (£10,052).—Mirrlees Watson Co., Ltd.

Colchester.—Town Council. Accepted:—

Plant for the extensions to the power station at Hythe:—

3,750-kW turbo-alternator, with Lea recorder equipment, &c. (£11,500).—W. H. Allen, Sons & Co., Ltd.

Marine boiler with accessories and soot blower (£10,390).—Babcock & Wilcox, Ltd.

500-kVA transformer (£242), switch cubicle (£137).—Crompton Parkinson, Ltd.

East Ham.—Electricity Committee. Recommended:—

2,200 yd. cables.—Enfield Cable Works, Ltd.

Egypt.—Egyptian State Railways.—The following tenders for the electrification of the Cairo-Heluan line were received:—

English Electric Co., Ltd.	£261,573
Brown, Boveri	261,706
Società Elec., Milano	274,993
Bergmann, Berlin	286,149
Siemens, Orient	287,974
Ganz	290,118
Groupe Français	302,836
Metropolitan-Vickers	307,551
A.E.G., Berlin	309,692
British Thomson-Houston Co., Ltd.	317,037
Skoda	319,648
Charleroi (A.C.E.C.)	369,995
Do. (alternative)	349,302
Soc. Nationale Serviliano	279,967
General Electric Co., Ltd.	353,225
Do. (alternative)	345,117
Elin, Vienna	308,235
Oerlikon	388,414

The shortest delivery period was that of the General Electric Co., Ltd. (11 months). The time quoted by the English Electric Co., Ltd., was 18 months, which was about the average.—*Reuter's Trade Service* (Cairo).

Erith.—Urban Council. Accepted:—

Installing electric light at the Sheridan Road site (£180).—Dickinson & Co.

Glasgow.—Improvements Committee. Accepted:—

Passenger lift at Glasgow Cross buildings.—A. & P. Steven, Ltd. (in lieu of the recommended tender of Waygood-Otis, Ltd.).

Baths Committee. Recommended:—

Electrical installation at Shettleston and Tollcross Baths (£971).—Haddow & Co., Ltd.

Hull.—Education Committee. Accepted:—

Installation of electric lighting at Francis Askew school extension (£1,000).—A. Shaw & Sons.

X-ray apparatus for East Hull clinic (£617); apparatus for light treatment and electrical therapy (£232).—Scholl and Son, Ltd.

Telephones Committee. Recommended:—

Table telephones and bell sets (£402).—Automatic Telephone Manufacturing Co., Ltd.

Bronze wire (£331).—F. Smith & Co.

Cable (£125), inside wire (£96).—W. F. Dennis & Co.

Electricity Committee. Accepted:—

E.h.p. pipe work (£8,605).—Aiton & Co., Ltd.

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Leeds.—Electricity Committee. Accepted :—
Cables.—(£2,565), W. T. Henley's Telegraph Works Co., Ltd.; (£1,808), Enfield Cable Works, Ltd.; (£1,194), Hackbridge Cable Co., Ltd.; and (£1,059), Greenwich Cable Works, Ltd.
Water Committee. Accepted :—
Automatic control gear for electric pump (£64).—Metropolitan-Vickers Electrical Co., Ltd.

London.—CENTRAL ELECTRICITY BOARD. Accepted :—
South-East England Scheme.—66-kV and other cables in the London area : British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Pirelli-General Cable Works, Ltd.
66-kV switchgear.—British Thomson-Houston Co., Ltd.
Central England Scheme.—132-kV overhead transmission line : Balfour, Beatty & Co., Ltd.
132-kV outdoor switchgear.—General Electric Co., Ltd.
North-West England and North Wales Scheme.—132-kV overhead transmission lines.—Foundation Co., Ltd.
(The value of the contracts is approximately £3,250,000.)
SHOREDITCH.—Lighting Committee. Accepted :—
2,000-kW mercury arc rectifiers (£9,643).—Hewittic Electric Co., Ltd.
LONDON COUNTY COUNCIL.—Education Committee. Recommended :—
Electric lighting installation at Webber Street School, Southwark (£185).—H. J. Cash & Co.
WANDSWORTH.—Board of Guardians. Accepted :—
Engineering reconstruction at the Swaffield Road Institute, electric generating plant and motors (£2,604).—Ashworth & Parker.
Wiring for electric lighting and power (£1,816).—Anderson, Angell & Co.
ADMIRALTY.
Switches.—Edison Swan Electric Co., Ltd.

Manchester.—Housing Committee. Accepted :—
Electrical installations at houses on the Barlow Moor estate.—R. H. Clampnett & Co. and Hall & Stinton, Ltd.
Waterworks Committee. Accepted :—
Electrical operating gear at Lostock booster station.—J. Blakeborough & Sons.
Tramways Committee. Accepted :—
Special trackwork.—Titan Trackwork Co., Ltd.
Electricity Committee. Accepted :—
Repairs to battery, Dickinson Street.—Tudor Accumulator Co., Ltd.
Oil purifier, Stuart Street sub-station.—Metropolitan-Vickers Electrical Co., Ltd.
Static transformers.—C. A. Parsons & Co., Ltd., and English Electric Co., Ltd.
Education Committee. Accepted :—
Electrical installations : Beaver Road school, Crumpsall open air school.—John Adams, Ltd.

Oldham.—Education Committee. Accepted :—
Two rotary convertors for electricity laboratory, Technical College.—J. P. Hall & Co., Ltd.
Electricity Committee. Accepted :—
Cable.—Union Cable Co., Ltd.

Orsett.—Board of Guardians. Accepted :—
Installing electric light at the Institution (£762).—Grays Electrical Co.

Reading.—Board of Guardians. Accepted :—
Installing electric light at Battle Infirmary.—Erlco, Ltd. (£723).

Rotherham.—Electricity Committee. Accepted :—
Two truck type switches (£256).—A. Reyrolle & Co., Ltd.
Cable (£1,659).—Callender's Cable and Construction Co., Ltd.
De-aerating plant (£656).—Hick, Hargreaves & Co., Ltd.

Salford.—Tramways Committee. Recommended :—
200 tons of steel rails (£2,023).—Cargo Fleet Iron Co., Ltd.

Stirling.—Town Council. Accepted :—
Installing electric light at the slaughter house.—W. & T. Marshall.
Electrical work for the new Police Buildings.—A. Brewster.

Stretford.—Electricity Committee. Accepted :—
Twenty 6,600-volt cubicles (£17,627), transformers (£23,050), 33,000-volt switchgear (£28,600).—Metropolitan-Vickers Electrical Co., Ltd.

Wrexham.—Rural Council. Accepted :—
Wiring 150 houses for electric lighting (£1,011).—Mr. L. Pritchard.

Forthcoming Events.

British Electrical Development Association.—Friday, March 15th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Water Heating Development."

Royal Institution of Great Britain.—Saturdays, March 16th and 23rd. 21, Albemarle Street, W. 3 p.m. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford, P.R.S.

Friday, March 22nd. 9 p.m. "Penetrating Radiations." Sir Ernest Rutherford, P.R.S.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, March 18th. Institution, London, W.C. 7 p.m. "Methods in Invention." Mr. C. Turnbull.

Thursday, March 21st. Institution, London, W.C. 6 p.m. "Direct Generation of Alternating Current at High Voltages." Sir Chas. A. Parsons, F.R.S., and Mr. J. Rosen. "Recent Developments in Turbo-Generators." Mr. J. A. Kuyser. (The papers will be preceded at 5.30 p.m. by a demonstration by Mr. R. T. Coe of a "Portable Electric Harmonic Analyser.")

(Mersey and North Wales (Liverpool) Centre).—Monday, March 18th. University, Liverpool. 7 p.m. "Radio Sets on the Mains." Mr. E. Y. Robinson.

(North-Western Centre).—Tuesday, March 19th. Engineers' Club, Manchester. 7 p.m. "Electrical Insulating Papers for the Manufacture of Power Cables." Messrs. T. N. Riley and T. R. Scott. "The Prevention of Ionisation in Impregnated Paper Dielectrics." Mr. S. G. Brown and Mr. P. A. Sporing.

(South Midland Centre).—Tuesday, March 19th. Joint meeting with the East Midland Sub-Centre. Town Hall, Loughborough. 6.45 p.m. Faraday Lecture. "How Electricity Does Things." Mr. Ll. B. Atkinson.

(South Midland Centre Students' Section).—Friday, March 15th. Grand Hotel, Birmingham. 7 p.m. Annual joint meeting with the Institutions of Civil and Mechanical Engineers. Graduates' and Students' Sections. Discussion on "A Hydro-Electric Power Station."

(Sheffield Sub-Centre).—Wednesday, March 20th. Mappin Hall, Sheffield. 7.30 p.m. "The Cause and Effect of Oscillation in Electrical and Mechanical Apparatus." Prof. W. Cramp.

(Tees-side Sub-Centre).—Wednesday, March 20th. Cleveland Technical Institute, Middlesbrough. 7 p.m. "Electric Supply in the Rural Districts of England." Mr. R. W. Gregory.

(London Students' Section).—Friday, March 15th. Institution, London, W.C. 6.15 p.m. "Wave-Form Analysis." Mr. C. F. J. Morgan.

Illuminating Engineering Society.—Tuesday, March 19th. Lighting Service Bureau, 15, Savoy Street, W.C. 6.30 p.m. "Architectural Lighting." Mr. W. Maitland.

Overhead Lines Association.—Wednesday, March 20th. Institution of Electrical Engineers, London, W.C. 5.30 p.m. "Notes on the Labours of the Ontario Hydro-Electric Commission." Mr. E. L. Stanton.

Institution of Civil Engineers (Midland Area).—Friday, March 22nd. Chamber of Commerce, Birmingham. 6 p.m. "Developments of the Generation and Distribution of Electrical Power in the British Isles." Mr. A. Page, chief engineer of the Central Electricity Board.

Physical Society.—Friday, March 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Annual general meeting. Presidential address by Dr. W. H. Eccles, F.R.S.

Birmingham Electric Club.—Friday, March 22nd. Grand Hotel, Birmingham. 7 p.m. Annual dinner.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 23rd. South Wales Institute of Engineers, Cardiff. 6 p.m. "Power Factor." Mr. C. L. James.

(London Branch).—Saturday, March 23rd. Visit to Gas, Light and Coke Company's Works at Beckton.

(Western Sub-Branch).—Saturday, March 16th. 60, Wind Street, Swansea. Informal discussion of the 1927 Report of H.M. Electrical Inspector of Mines.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

20-20 vacuum cleaners.
EVANS projectors.
DAISY vacuum cleaners.
PENTICON cookers.
A device for indicating a map route by means of small lamps which are switched on in rotation.

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Notes.

The British Association.

Dr. F. O. Bower, F.R.S., is to be nominated president of the British Association for the Advancement of Science for 1930, when the meeting is to be held in Bristol.

The Association has been invited by the City Corporation to hold its centenary meeting in 1931 in London, and the invitation has been accepted.

An invitation to members of the Association has been received from the French Association for the Advancement of Science to attend the latter's annual meeting at Havre in July. The B.A. has appointed a committee to make the necessary arrangements.

The Romance of Electricity.

In an interesting address by Mr. C. R. Spouge, at a recent luncheon of the Lincoln Rotary Club, Mr. Spouge said that the progress of electricity from the dawn of its inception to the final stage of application to the needs of modern life was one of the most interesting romances of civilisation. The Chinese and Greeks knew of the properties of the magnet and the electrical behaviour of amber under friction, but it was not until the middle of the 19th century that its potent forces were understood, harnessed, and transformed into the docile servant of man, which was only made possible by a new type of man with a new type of mind—a mind trained for scientific thinking. The simple fact that electricity had to be delivered by copper wires, instead of by carts or vans, had had a peculiar effect upon the whole trend of the electrical industry, and had made electrical development a more political problem than a scientific or engineering problem. To provide the infant industry with the "right" to lay its cables, legislation had to be invoked, and the complete history of electrical legislation made a particularly depressing story. In 1926 the most ambitious measure, the Electricity (Supply) Act, was sanctioned, and the only grave mistake in that Act was that it gave trading powers to municipal authorities.

Train Collision Report.

The report on the official inquiry into the circumstances of the accident which occurred on the Southern Railway, near London Bridge Station, on December 27th last, when a steam van train from New Cross Gate came into sidelong collision with an electric passenger train which was crossing the track of the van train, shows that the responsibility of the accident rests with the driver of the van train. He frankly admitted that he made a mistake in reading the signal of the up local line in error for the adjoining signal of his own up through line.

World Power (Sectional) Conference.

A sectional meeting of the World Power Conference on the complete utilisation of water-power resources will be held at Barcelona, Spain, between May 15th and 23rd, 1929, at the same time as the Barcelona Fair. It will be followed by official visits to places of interest in Spain from May 24th to June 4th, and it is being organised by the Spanish National Committee of the World Power Conference, with the official co-operation of the Spanish Government. The subjects dealt with are: (*a*) General hydrological problems; (*b*) technical problems of water-power utilisation; (*c*) economic and financial problems; (*d*) legal problems; (*e*) protective measures and defence works of undertakings. The fee for ordinary membership of the Conference is 30 pesetas, or one pound sterling, and copies of the technical programme (in English, Spanish, French and German) together with forms of application for membership may be obtained from the Secretary, International Executive Council, Central Office, World Power Conference, 63, Lincoln's Inn Fields, London, W.C.2.

The Whitefriars Lodge.

The Whitefriars Lodge, founded by members of the Kelvin and other Electrical Lodges, will be consecrated at Freemasons' Hall on April 19th. Those interested should apply for particulars to Mr. Arthur W. Cox, 4, Ludgate Hill, E.C.4.

A Large Lighting Fitting.

The massive central lighting electrolier installed in the Theatre Royal, Drury Lane, has so excited the admiration of a wealthy Chinese Towkay, of Kuala Lumpur, that he has ordered a replica of it for installation in his official residence in the Far East. The fitting is fashioned on classic Empire lines. The main band is 6 ft. in diameter, and around this there are eight 3-light arm clusters, supporting flambeau shades accommodating 60-W gasfilled "Osram" lamps, making a total spread of 8 feet to the centre of the lamps. The metal work is of cast-bronze, polished, and toned down to a dark colour, and it weighs over a ton. The bent glass panels and lower bowl are in satin finish, with clear cut relief. Sixteen inverted reflectors, each designed to house 500-W lamps, are also arranged inside the fitting, and these are supplemented by four 500-W and five 60-W lamps without reflectors. In addition, a number of other electric lighting fittings of an elaborate nature have been ordered, for which an initial contract exceeding £2,000 in value has been placed with the Kuala Lumpur Branch of the General Electric Co., Ltd.

Artificial Lightning.

Mr. F. W. Peck, a consultant, is reported to have described to a large gathering of electrical engineers in New York the recent artificial production in a laboratory of the General Electric Co., at Pittsfield, Mass., of a lightning flash 20 ft. long at a potential of 5,000,000 volts.

Royal Commission on Transport.

Following the meetings of the Royal Commission on Transport on January 31st and February 1st, at which evidence was given on behalf of municipal electric tramway authorities (Elec. Rev., February 15th, 1929), a meeting was held on February 15th at which Mr. C. J. Spencer, chairman of the Tramways and Light Railways Association, gave the views of his organisation. He said that restrictions under the Tramways Act prevented large profits from being made, and private tramway operation as a whole from being a remunerative business. Road maintenance had become a great burden since the advent of mechanical road vehicles. In the five years 1923 to 1927 privately owned tramway undertakings had spent over £2,000,000 on the repair and maintenance of permanent ways. Such indirect taxation was wrong in principle, and must ultimately be paid for by the passengers. The obvious remedy was to treat the tramway authorities in exactly the same way as the highway authorities. A tramway or light railway should be given the right to appeal against the granting of licences to outside parties, if it could be shown that it would injure the existing undertaking. Co-ordination with other and new forms of transport was desirable, and legislation was necessary in that connection.

Major H. E. Crawfurd, M.P., said that the tramway companies asked for protection, but what protection did they propose should be given to the public? He asked that question because, since the restrictions on omnibus services in London had been enforced, a great many fares had been increased.

Mr. Spencer said that he recognised that they could not have a monopoly unless they were controlled thoroughly.

At a further meeting of the Commission on March 8th, Col. R. E. B. Crompton, past president of the Institution of Electrical Engineers, gave evidence on behalf of the Electrical Vehicle Committee of Great Britain. He said, according to *The Times*, that the committee for which he stood represented many associations and individuals interested in the development of the electric vehicle. They included supply undertakings, manufacturers of electric vehicles and of electric accumulators, and the users of such vehicles. He contended that the only chance of doing away with horse-drawn vehicles, which were an impediment to the flow of modern street traffic, was to follow the example of Americans, who, by the extensive use of the electrically-propelled vehicle for the distribution of goods in their large cities, had practically abolished the horse. As the oldest chairman of electrical supply undertakings in Great Britain he was constantly asked by those who managed supply undertakings in America why they in England had done so little to encourage the use of the electric vehicle. Colonel Crompton said that the electric vehicle he had in mind would run up to 40 miles on a charge, although in certain cases it might be increased. He added that the average speed of the electric vehicle was probably about 15 m.p.h. Its acceleration was so great that it was the vehicle most easily controlled in traffic. It was therefore eminently suited for use in all towns where the traffic was heavy and congested. Electric vehicles had many other advantages. They were silent, gave off no fumes, and did not drop oil on the road surface. Other things being equal, electric vehicles represented the cheapest method by which the tradesman could deliver goods from door to door. So far as taxation was concerned, he held that the electric vehicle should be put on the same basis as horse transport. The public would obtain great advantage by the use of these cars in addition to the reduction of the cost of cleaning the streets and of damage to road surfaces. Many municipalities had already found this out, and their use for scavenging and municipal work was rapidly increasing.

The Ex-B.W.A. Association.

The eleventh annual reunion of the ex-British Westinghouse Association was held at the Hotel Cecil on March 8th, Mr. F. Massingberd Rogers presiding. Nearly 140 "old timers" turned up from all parts of the country. The chairman was inducted by the hon. treasurer, who preceded him to his place with the now famous "half crown" on the end of a long wand. Mr. B. P. Boyle gave the toast of "The Association," to which the chairman responded in reminiscent vein. The "Silent Toast" had a touch of sadness this year, as five members have died since the last reunion, Messrs. A. P. Ambler, J. A. Henderson, W. A. Hetherington, "Charlie" Parkes, and A. Simon. Letters of regret were received from all parts of the world, from members unable to attend; the toast "Absent Friends" was submitted with acclamation at 10 o'clock. The entertainment side of the evening was ably carried through by Mr. J. Gibson Young, himself a member of the Association, with Jacqueline and Imito. Among the usual informal toasts this year that of the "Grandfathers" provoked great merriment, the respondents being Messrs. Dyer, Seaman, Warrilow, and Sergt. McCully. The date of the next dinner will shortly be announced.

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Finsbury College Dinner.

The Finsbury Technical College Old Students' Association held its annual dinner at the Trocadero Restaurant, London, on March 1st. A delightful spirit of cameraderie lent a special charm to the function. In a humorous speech Mr. R. W. Paul (past president) proposed "The Guests," and Mr. L. St. L. Pendred (vice president) replied in an equally witty strain. "The Association" was proposed by Prof. C. R. Darling, F.I.C., and replied to by the president, Mr. E. W. Moss. A musical programme of merit under the direction of Mr. Chas. B. Nadaud, completed the enjoyment of the company. Old students of this College who are not members of the Association are earnestly invited to get in touch with Mr. F. R. C. Rouse, the honorary secretary, at 15, Clifton Gardens, Golders Green, London, N.W.11.

Birmingham Electric Club.

The eighteenth annual dinner of the Birmingham Electric Club was held at the Grand Hotel, Birmingham, on March 8th. Mr. Frank Forrest (president) presided, and was supported by the Lord Mayor (Alderman W. Byng Kenrick), Mr. R. A. Chattock (city electrical engineer), Mr. S. T. Allen (Central England engineer, Central Electricity Board), Mr. D. G. Mackintosh (president of the Birmingham Association of Mechanical Engineers), Mr. S. H. Holden (chairman, the Midland Centre of the Institution of Electrical Engineers), Mr. H. Hooper (honorary secretary of the Midland Centre), Mr. J. M. Dunkley (honorary treasurer, Birmingham Electric Club), Mr. E. A. Reynolds (chairman of the local section of the National Electrical Contractors' Trading Association), Mr. D. G. Brooks (senior vice-president, Birmingham Electric Club), and Mr. J. F. E. Brake (director and sales manager, Standard Telephones and Cables, Ltd.

The LORD MAYOR of Birmingham, in toasting "The Club," said it was the oldest of its kind in the United Kingdom.

The CHAIRMAN, in responding, pointed out that Birmingham was rightly regarded as one of the leading centres of the electrical industry in this country. The Club was founded 25 years ago by a small band of enthusiasts who had great faith in the future of the industry at a time when, electrically speaking, they were only just emerging from the dark ages. At that time only four million kWh of electricity was sold in Birmingham per annum; to-day the Corporation electricity supply undertaking was selling 300 million kWh per annum. There was a real need for such a club as theirs, and at no time in Birmingham and district was it so necessary for electrical engineers to pull together as the present. The putting into effect of the 1926 Act, including the change of frequency of supply from 25 to 50 periods per second, would add enormously to the work and responsibility of many of their members, and was a task not to be lightly regarded, but the work could be lightened by that spirit of co-operation which the Club endeavoured to foster. The rate of progress in Birmingham in time would catch up some of the cities abroad, especially if the suburban railways of Birmingham were electrified, which was very much overdue. It had often been said that a low tariff was the best selling agent: be that as it might, the price question must be followed up by the work of the Electrical Development Association, with the co-operation of manufacturers' and contractors' associations. Large numbers of people in this country did not miss the economy of electricity because they had never enjoyed the use of it. Those were the people whom they had to reach, and in this connection he paid tribute to the splendid service which was being rendered by the many showrooms in the country. Last year they added nearly 11,000 new customers to their lists in Birmingham, and everything pointed to the fact that the electrical industry, which had been so favourably placed with regard to employment, was going to be much busier in the near future.

The toast of "Our Guests" was proposed by MR. D. G. BROOKS, and MR. F. J. E. BRAKE replied and extended an invitation to the members to visit his company's cable works at North Woolwich in May.

Faraday House Dance.

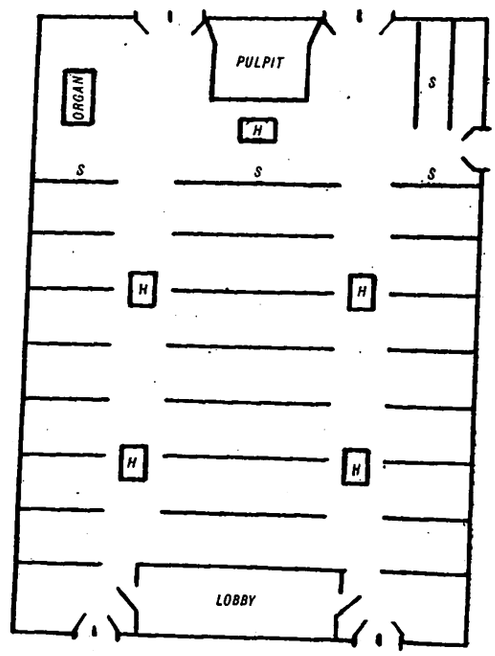
A successful carnival dance was held by the Faraday House Old Students' Association and its Rugby Club at the Victoria Halls, Southampton Row, on March 5th. As in previous years, this popular function was well attended, over 200 members and friends being present. The distribution of novelties added to the enjoyment of the evening and an exhibition of ballroom dancing by Mr. A. Milne and Miss N. Cave was a popular feature. Marius B. Winter's dance band provided the music. Among those present may be mentioned Messrs. F. E. Berry, R. C. Andersen, and F. G. G. A. Marraine, Major C. E. Prince, Major Flower, Dr. W. R. C. Coode-Adams, and the Rev. L. Van Vestraut (hon. secretary). Dr. A. Russell, F.R.S. who has been elected president of the Association this year in celebration of the 40th anniversay of the foundation of the College, was unable to be present through unavoidable circumstances.

Duty on "Imported" Electricity.

The Paris correspondent of the *Daily Telegraph* says that a curious case concerning invisible imports into France is occupying the attention of the correctional tribunal of Belfort. The Société Lorraine d'Electricité is being sued by the Customs authorities for having imported electricity without having made the necessary declarations. An expert who was charged to investigate the company's accounts reported that between January, 1925, and January, 1928, electricity of the value of 39,000,000 fr. (£312,000) was imported. The Nancy Court ruled against the Customs on the ground that electricity could not be considered as ordinary merchandise, and therefore could not be taxed, but the Court of Cassation took the opposite view. In arguments before the Belfort Court the Customs have entered a claim for double the value of the electricity imported without a declaration, that is, for nearly 80,000,000 fr. (£640,000). During a long debate their counsel declared that electricity was certainly merchandise, since it could be measured. The Court's decision has been reserved.

Small Chapel Heating Installation.

The accompanying illustrations depict how a space-difficulty problem in connection with the installation of electric heating in a small chapel in Gloucestershire was overcome, and it is

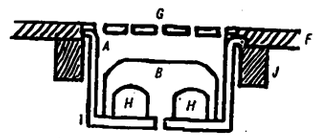


S, seats; H, heaters.

Disposition of Radiators in Chapel.

suggested that now that electricity is becoming available in rural districts there are probably many similar chapels which could be dealt with along the same lines.

The building in question is a small, nearly square, chapel, measuring about 35 ft. by 28 ft. by 20 ft. high. It is lined with a wood dado, and there is no space anywhere to fit radiators, as seats are against all the walls and the aisles are too narrow. It was decided that ten 1-kW electric radiators were necessary, and these are fitted in pairs in five positions below the floor. A hole has been cut in the flooring at each position in the gangways, and a sheet-iron box lined with cement-asbestos sheets sunk just below the level of the top of floor boards, a grating being placed over the box. The heaters are, of course, placed in the box. A square hole at the bottom of the box admits cold air *under* the heaters, and a baffle-plate of sheet-iron is placed *over* them. The



F, flooring; G, grating; I, iron box; H, heaters; A, asbestos lining; B, baffle plate; J, joists.

Section Through Radiator Chamber.

switching arrangements are such that the radiators are controlled in pairs, two of the pairs having each one radiator in each of a pair of boxes. The third pair is in the fifth and centrally-placed box. The installation is claimed to be giving entire satisfaction. The first of the above illustrations is a plan of the chapel, showing the disposition of the heaters, and the second represents a section through one of the radiator chambers.

Fatalities.

Private H. Brown, of the 2nd King's Shropshire Light Infantry, received a fatal electric shock on March 10th. He was cleaning a window at an officer's mess at Aldershot when he came into contact with a "live" wire.

An inquest was held at Manchester on March 6th, on the body of J. S. Hitch, 31, who received a fatal electric shock

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of 6,500 V. Deceased was employed at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., and the works superintendent stated that he believed that Hitch dropped a spanner into the tunnel which protected the high-voltage cable, and after going below to retrieve it, put his foot on the h.p. bars when returning.

An Inquisitive Rat.

A rat which entered a sub-station of the Willesden Urban District Council on March 6th caused a short circuit which deprived the whole of the district of electricity for two hours.

Appointments Vacant.

Two boiler house charge engineers (£588) for the Municipality of Singapore Electricity Department. Plumber-jointer electrician for the Barnoldswick U.D.C. Meter reader and fixer for the Borough of Reigate Electricity Department. Electrician (70s.) for the Edmonton Board of Guardians. General manager for the Bagdad Tramways and Electric Lighting Syndicate, Ltd. (1,400 rupees per month). Assistant electrical engineer (£1,000 to £1,200) for the Perak Hydro-Electric Power Co., Ltd., Malaya. (See our advertisement pages to-day.)

Institution Note.

Institution of Electrical Engineers.

Informal Meeting.—At the informal meeting of the Institution on March 4th, Mr. J. R. Bedford in the chair, Mr. L. J. Hunt opened a discussion on "Variable Speed A.C. Motors." He dealt with the various methods of speed variation by grouping the motors under the three standard types, pole-change, cascade, and commutator, all depending upon the development of the additional counter-e.m.f., and Mr. Hunt's remarks were mainly directed to the application of each type to its particular problem. He said the Scherbius method was an excellent solution of the problem, but the number of machines involved serious complications and, except for some requirements, a better solution was a single Schrage motor; the latter was, however, very expensive, and he thought the all-round advantages were with the cascade method, which was simple and robust, while the speed could be changed by switching the connections on the slip rings without opening the stator circuit.

Mr. W. A. Erlebach plotted the e.m.f. and counter-e.m.f. on change of speed.

Mr. F. V. Schulthess described a new system of Scherbius regulation with a double rotor which seemed to be a development of the Spinner motor. It was a commutator motor with voltage regulation producing variable speed and power-factor correction.

Mr. J. H. Johnson said if the user could manage with a pole-change he would be well advised to do so. The commutator motor had limitations of size and was expensive in cost and upkeep. He thought the advantages were often with a motor-generator in spite of the space factor.

Mr. A. F. Harmer said the cost of variable-speed machines was large because the demand was so small. He believed the future would show a more extended use of single-phase than was generally anticipated.

Messrs. H. D. Barlow, J. R. Bedford, G. B. Bryan, B.A., D.Sc., B. M. Burt, A. N. D. Kerr, C. D. King, N. Prentice, E. S. Ritter, D. M. Robinson, L. E. Squire, E. O. Taylor, and W. L. Wreford also spoke.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The report of the Engineering and Scientific Association of Ireland for the past year records the fact that Mr. Arthur E. Porte completed during the year 25 years' service as Honorary Secretary to the Association. The *Irish Electrician* reports that Mr. Porte's record as an engineer extends back another 25 years and more, for he was identified with the earliest work in Dublin, both in telephony and electricity supply.

The Birkenhead Corporation Electricity Committee has appointed Mr. G. W. Whitehouse, of Dudley, as motors and hiring superintendent.

Mr. Robert Roper, power station engineer with the South Wales Electrical Power Distribution Co. and chairman of the Electricity and Tramways Committee of the Pontypridd Urban District Council, has been appointed to the bench of magistrates for the county of Glamorgan.

Mr. J. N. Lindsay, boiler house charge engineer at the Hull electricity undertaking, has resigned to take up an appointment with the London Power Co., Ltd.

Owing to ill-health, Mr. Charles Erith has resigned his position of managing director of the Riley Stoker Co., Ltd., and has severed his connection with the company. Mr. J. O. Murgatroyd, the chairman, has taken over the management of the business.

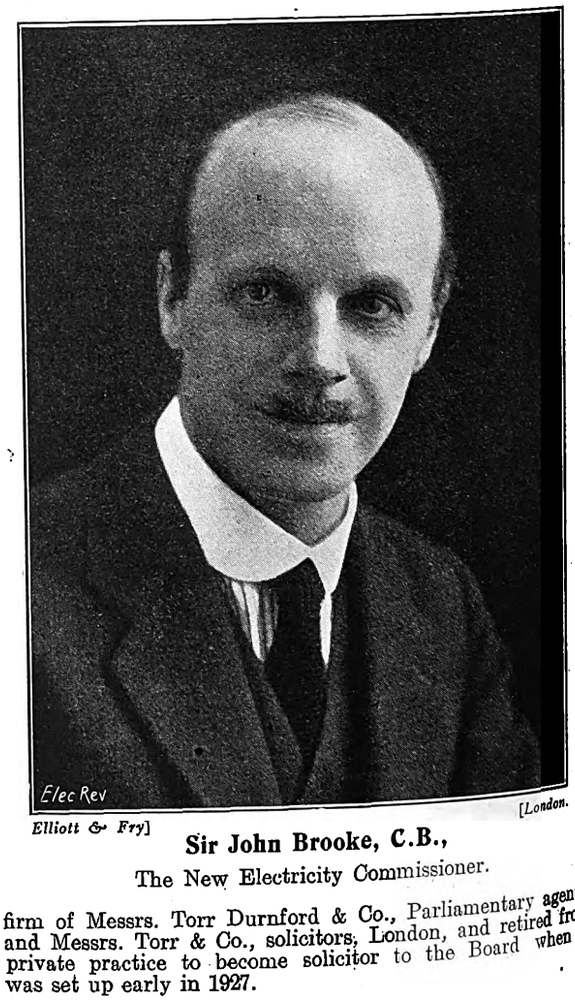
The Oldham Corporation Tramways Committee has recommended increasing the salary of Mr. C. Jackson, the general manager, from £750 to £825 per annum.

The Derby Town Council has increased the salary of the borough electrical engineer, Mr. G. H. Lake, from £1,100 to £1,200 per annum.

The Croydon Town Council has adopted a recommendation to increase the salary of the borough electrical engineer, Mr. A. C. Cramb, from £1,500 to £1,600 per annum.

On March 25th, Mr. W. Bolton Shaw, M.Sc., M.I.E.E., consulting engineer, is removing from 25, Market Street, Manchester, where he has been in practice for the last 18 years, to 1, New Brown Street.

The Minister of Transport has appointed Sir John Brooke, C.B., to be an Electricity Commissioner. Sir John Brooke, who has been Secretary to the Central Electricity Board since its formation, is resigning that post and will take up his new duties at once. Consequent on the resignation of the above position by Sir John Brooke, C.B., the Central Electricity Board has appointed Mr. Richard Hodding Fox, its present solicitor, to be secretary and solicitor to the Board. Sir John Brooke was formerly Secretary to the Ministry of Transport, a post which he occupied when the Ministry introduced into Parliament the Bill which ultimately became the Electricity (Supply) Act, 1926. This Act provided for the creation of the Central Electricity Board, and since the inception of the Board, Sir John Brooke has held the position of Secretary to the Board. Mr. Fox was for many years a partner in the firm of Messrs. Torr Durnford & Co., Parliamentary agents, and Messrs. Torr & Co., solicitors, London, and retired from private practice to become solicitor to the Board when it was set up early in 1927.



Elliott & Fry] [London.

Sir John Brooke, C.B.,

The New Electricity Commissioner.

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Mr. H. W. Bosworth, who has for the past 24 years been connected with the Lancashire Dynamo and Motor Co., Ltd., and for the last 12 years as director in charge of its London business, has been appointed joint managing director of the company, and is moving to Trafford Park, but he will be frequently visiting London.

Mr. A. C. Fenwick, engineer and general assistant to the tramway manager of Dundee, has been appointed general manager of the Bury Corporation tramways.

The Holmfirth Urban Council has confirmed the appointment of Mr. H. G. Spence, Ravensthorpe, Dewsbury, as electrical engineer, at a salary of £350 per annum.

Obituary.—Sir J. D. Denison-Pender.—We regret to record the death, which occurred on March 6th, at his residence in Grosvenor Crescent, S.W., of Sir John Denison Denison-Pender, third son of Sir John Pender, whose pioneering connection with trans-Atlantic submarine telegraphy made him famous. Sir John Denison-Pender was born in 1855, and was therefore 73 years of age. He commenced his definite relations with the Eastern group of cable companies, with which his father was so closely associated, in the year 1878. Three years later he became a director of the Eastern Company, and in 1893 a managing director. The honour of knighthood was conferred upon him by King Edward in recognition of his submarine cable service rendered during the South African war. When his father, Sir John, died in 1896, he became deputy chairman, and in 1917 chairman. His eldest son, Mr. J. Cuthbert Denison-Pender, was then appointed managing director, and he holds that office, as well as the vice-chairmanship, to-day. The great story of what was done by the great cable interests and their personnel in defeating our enemies in the Great War has never been written in detail, and probably never will be, but among those who placed themselves and their great organisations at the service of the Allies none played a worthier part than the late Sir John and his companies. Their contribution in the form of actual and wonderful achievements is known within submarine cable circles, and the honour of G.B.E. was conferred upon him in 1920. Two years later the Jubilee of the Eastern group took place in London, and one of the most interesting functions consisted of the presentation of a testimonial bearing the names of 8,000 members of the staffs in this and many other countries. *The Times*, in its appreciation of Sir John's distinguished service, mentions that in the recent negotiations for the merging of cables and wireless he played an important part, "and he lived long enough to be assured of the success of his diplomacy."

The funeral took place at Slaugham, Sussex, on Saturday. Those present included a large number of gentlemen of distinction from the boards and staffs of the companies over whose destinies Sir John exercised so large an influence, also prominent representatives of other cable, telegraph construction and wireless companies, and their staffs. At 12.15 p.m., Greenwich time, all circuits throughout the entire system of the Eastern Associated Companies observed a one-minute stoppage so that every member of the staff who was on duty could stand in silence as a tribute to their "head" at the time of the committal of the body to the grave in the village churchyard where Lady Pender was buried some years ago.

Mr. C. H. Cope.—The death has taken place, at the age of 84 years, of Mr. Clarence Hughes Cope, who was for over 35 years on the staff of Fraser & Chalmers, of Erith. Prior to joining that firm he spent many years in business on the Continent. He was an accomplished linguist.

Mr. C. Wood.—The death took place on March 6th, at his residence at Southborough, of Mr. Charles Wood. He was 83 years of age, and some 50 years ago he took charge of the first electric lighting plant at the emporium of Messrs. Charles Baker, of High Holborn, London. Subsequently he transferred his services to the installation at Broomhill, Tunbridge Wells, becoming engineer to the late Sir David Salomons, Bart. He held this position for 44 years.

Mr. T. B. Callard.—The death has taken place, at his residence at Chesham Bois, at the age of 82 years, of Mr. Thomas Black Callard, who was a director of James Keith and Blackman Co., Ltd., heating and lighting engineers.

Dr. M. Breslauer.—The death recently occurred in Berlin of Prof. Dr. Max Breslauer, of the Technical High School of Berlin. According to the *E.T.Z.*, about 1906 the deceased was for a time chief engineer of the Electric Plant Co., Ltd., of Alloa, Scotland.

Mr. F. Steven.—The death occurred on March 2nd of Mr. Fred Steven, electrical engineer, of St. Mary Street, Dumfries, where he commenced in business about five years ago.

Mr. T. F. Merseles.—A *Financial Times* dispatch reports the sudden death of Mr. T. F. Merseles, president of the Johns Manville Corporation, whilst travelling to California.

Mr. F. J. Santonna.—The death is announced at the age of 85 years of Mr. J. F. Santonna, of Sidbury, Worcester, who had attained the age of 85 years. He was in business in the city for nearly half a century, was a pioneer in electrical matters, and established an extensive business as an electrician. He installed electricity in the Shire Hall, The Guildhall, The Cathedral, and in numerous local factories and business premises.

Mr. T. Hartley.—The death took place on March 2nd, at the age of 65 years, of Mr. T. Hartley, traffic superintendent of the Huddersfield Corporation Tramways, a position which he had held since 1902, when the system was electrified.

Will.—The late Mr. Joseph F. Carlisle, formerly of the submarine cable service of the Eastern Telegraph Co., Ltd., left £5,680 gross and £4,436 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Autocar Electrical Co., Ltd.—Private company. Registered March 5th. Capital, £2,500 in £1 shares. Objects: To carry on the business of electricians, electric platers and battery chargers, and that of a general motor car, electrical and wireless service, &c. The directors are: A. R. Jones, 27, St. Michael's Square, Gloucester; N. G. Rabasch, 1, Station Road, Gloucester. The said A. R. Jones shall be permanent as long as he holds 250 shares. Secretary: A. R. Jones. Solicitor: H. H. Vowles, 65, Northgate Street, Gloucester.

Pandona, Ltd.—Private company. Registered March 7th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless receivers and instruments, electric or other advertising signs, refrigerators, vacuum cleaners, optical instruments, furniture, motor cars, &c. The directors are: W. F. Hutton, 33, Sandon Road, Edgbaston, Birmingham; F. Johns, Middleton Hall Road, Kings Norton, Birmingham. Qualification: 5 shares. Registered office: Empire House, 159, Great Charles Street, Birmingham.

Frank Wall & Co., Ltd.—Private company. Registered March 8th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical and electrical engineers, contractors, plumbers, suppliers of electricity, &c. The directors are:—F. Wall, 1, Hardy Street, Oldham, electrical engineer; J. H. Newton, 179, Grange Avenue, Oldham, electrical engineer. Registered office: 25, Union Street, Oldham.

Langham Radio, Ltd.—Private company. Registered March 2nd. Capital, £100 in 1s. shares. Objects: To carry on the business of manufacturers, assemblers, and constructors of all kinds of wireless and electrical instruments, machines and apparatus, cabinets, gramophones, &c. The subscribers (each with 20 shares) are: Winifred Roberts, Abbotswood, Crescent Road, Highgate, secretary; Alice E. Reynolds, Weycroft, Wey Lane, Chesham, Bucks., solicitor's clerk. The first directors are to be appointed by the subscribers. Registered office: Fitzalan House, Arundel Street, Strand, W.C.2.

South-East Yorkshire Light & Power Co., Ltd.—Registered as a public company, March 1st. Capital, £50,000 in £1 shares. Objects: To carry on the business of an electric light, heat and power supply company, and that of electrical, metallurgical, mechanical, and chemical engineers, electricians, and contractors, suppliers of electricity and electrical energy, manufacturers of electrical apparatus, &c. The first directors are: D. A. Evans, "Chelston," Gunnersbury Lane, W.3, consulting engineer; E. J. Guinness, 15, Basil Mansions, Basil Street, S.W.3 (director, the General Consolidated Investment Trust,

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Ltd.); F. Heppenstall, 226, Stanley Park Road, Carshalton, engineer; H. L. Howard, 27, Glenesk Road, Parkside, Eltham, S.E.9, engineer. Registered office: 53, Cornhill, E.C.

Sun-Ray Electric Lamp Co., Ltd.—Private company. Registered March 4th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric lamps, fuses and signs, agents for and dealers in all kinds of electrical and wireless apparatus, &c. The subscribers (each with 100 shares) are: A. E. Morter, T. Morter, and Mrs. M. Morter, all of The Nook, Wash Lane, Clacton-on-Sea. Secretary: T. Morter. Registered office: Wash Lane, Clacton-on-Sea.

Accumulator Co. of Scotland, Ltd.—Private company. Registered in Edinburgh on March 2nd. Capital, £100 in 5s. shares. Objects: To carry on the business of manufacturers and repairers of batteries and magnetos, &c. The subscribers (each with one share) are: R. G. Gammon, 100, York Drive, Hyndland, Glasgow, electrical engineer; J. S. Donaldson, 12, Greenlaw Avenue, Paisley, writer. R. G. Gammon is the first director. Registered office: 101, West Nile Street, Glasgow, C.1.

British Electrical Grid Co., Ltd.—Private company. Registered March 1st. Capital, £300 in £1 shares. Objects: To carry on the business of electricians, electrical, mechanical, and general engineers, &c. The directors are: M. A. Cohen, 13, Claremont Terrace, Sunderland; S. Cohen, 45-46, West Sunniside, Sunderland. Registered office: 45-46, West Sunniside, Sunderland.

Zirko, Ltd.—Private company. Registered March 2nd. Capital, £1,500 in £1 shares. Objects: To carry on the business of experimenters with, workers in, manufacturers of, and agents for vulcanite, ebonite, rubber, rubber substitutes, compositions, and insulating materials of all kinds, &c. The permanent directors are: A. W. Wright, "Melverne," Gorden Lane, Moor Park, Fazackerley; Mrs. Clarence M. Woodthorpe, 1, Chapel Avenue, Aintree; W. S. Roberts, "Newby," Ruff Lane, Ormskirk.

Eros (Dundee), Ltd.—Private company. Registered in Edinburgh on March 2nd. Capital, £2,000 in £1 shares. Objects: To carry on the business of electricians, electrical, mechanical, motor and radio engineers, contractors, manufacturers, &c. The directors are: A. J. Brinkler, "Hullavington," Beaumont Road, Orpington, Kent, merchant; W. Yuill, 17, Forthell Drive, Broughty Ferry, radio engineer. Secretary: Elizabeth R. Dargie. Registered office: 27, Crichton Street, Dundee.

Official Returns of Electrical Companies.

Montevideo Telephone Co., Ltd.—Capital, £220,000 in £1 shares. Return dated January 4th, 1929. 217,135 shares taken up. £217,135 considered as paid. Mortgages and charges, nil.

Allerton Electrical Supplies, Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1928. 1,500 shares taken up. £1,500 paid. Mortgages and charges: £1,400.

Nalder Bros. & Thompson, Ltd.—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. Return dated December 12th, 1928. 12,000 preference and 11,881 ordinary shares taken up. £13,881 paid, £10,000 considered as paid. Mortgages and charges, nil. Return of allotments made up to December 19th, 1928, shows a further 2,968 preference and 2,968 ordinary shares allotted, payable in cash, and fully called up.

Cymbal, Ltd.—Capital, £200 in 2s. shares. Return dated January 12th, 1929. All shares taken up. £200 paid. Mortgages and charges, nil.

William J. Hook & Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated December 17th, 1928. 400 preference and three ordinary shares taken up. £403 paid. Mortgages and charges, nil.

Horley & District Electricity Supply Co., Ltd.—Satisfaction in full on September 28th, 1928, of charge dated April 1st, 1927, securing £1,500. (Notice filed February 27th, 1929.)

Harrison & Searle, Ltd.—Debenture dated February 20th, 1929, to secure £1,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Tregellas, 955, Pershore Road, Selly Park, Birmingham.

Electrical Appliances (Blackpool), Ltd.—W. B. Haworth, 35, Cookson Street, Blackpool, was appointed receiver and manager on February 19th, 1929, under powers contained in debenture dated April 10th, 1928.

Cleveland and Durham Electric Power, Ltd.—Satisfaction to the extent of £13,400 on various dates between March 29th, 1928, and January 7th, 1929, of debentures secured by trust deed dated October 6th, 1913, and supplemental trust deed dated December 31st, 1918, securing £250,000.

Automatic Telephone Manufacturing Co., Ltd.—Satisfaction in full on January 1st, 1929, of first mortgage bonds secured by trust deed dated January 17th, 1921, securing £350,000.

City Notes.

General Electric Co., Ltd.

Last week the board issued the following statement with regard to the proposed creation of 1,600,000 new "British" ordinary shares (*vide* our last issue, p. 439):—"In view of misapprehensions which have apparently arisen with reference to the proposed increase of capital, the directors wish to make it clear that there is no intention of making an issue limited to existing shareholders only. They have now completed arrangements under which, subject to the sanction of the general meeting of the resolutions which have been submitted to their shareholders, an issue will be made to the British public generally."

The formation of a Committee to protect the interests of American shareholders was announced from New York last week, and at the week-end the board of the company received the following cablegram from the committee:—

"As a committee of holders of a substantial number of shares of your company, represented by the certificates issued by the Guaranty Trust Company of New York, we hereby protest against the proposed action to be taken at the extraordinary meeting of your corporation to be held on March 13th. We understand approximately forty per cent. of the outstanding stock of your company is represented by certificates issued by the Guaranty Trust Company. The proposed action, if consummated, will deprive the foreign holders of these certificates of a substantial property interest. The committee is cognisant that the corporation has limited the voting rights to British holders, but strongly objects to the announced plan, which substantially affects the property rights of foreign stockholders and, we believe, is opposed to British principles of equity. We understand that one of the purposes of the proposed action is to provide funds to retire the outstanding debentures of your company. On behalf of the American stockholders we respectfully request that the proposed action be modified so that the ordinary shares of the corporation be increased by one million six hundred thousand and that the additional shares be offered *pro rata* to all stockholders. This action will achieve the desired purpose, will recognise the rights of stockholders, and in view of the restriction of the voting power will preserve to English citizens the actual operation and control of the company. We propose to supplement this protest by appearing at the meeting through a representative. May we not suggest that should the action proposed by your company be consummated it will not only react most unfavourably on American sentiment with respect to your shares, but also as to other English shares traded in by the American public. The committee consists of Thomas L. Chadbourne, H. W. Croft, H. B. Baruch, Latham R. Reed, D. C. Dilworth. Chadbourne Stanchfield and Levy, counsel."

Sir Hugo Hirst, chairman and managing director of the company, sent the following reply:—

"We acknowledge receipt of your courteous telegram protesting against the proposals which are to be submitted to an extraordinary meeting of this company on Wednesday next. We believe your protest is due to a misunderstanding of our proposal. We understand you agree that our intention to redeem the debentures is sound, as when redeemed £60,000 additionally will be available for the benefit of ordinary shareholders, regardless of their nationality, calculated on last year's earning capacity and declared dividends. As regards confining the issue to the British public, we are sorry that you consider this an unfriendly action. We have the warmest regard for America and have no wish to disturb the traditional good relations between the two countries or between this company and its many good friends on your side. Trading as we do in most countries of the world, we have no narrow-minded conception. During recent months our shares have enjoyed such popularity in your country that at present approximately you hold 60 per cent. This may not matter if considered from the purely financial aspect, but it would have a seriously damaging effect from the trading point of view. As managing director of this company since its inception, I have had the experience that one of the pillars on which our success has been built has been the well-spread holding of our ordinary shares among the British public. This issue is intended to secure to us in continuity a certain percentage of British shareholders who are interested in the use of our products and the developments of our company at home. The benefits of that policy will come equally to all the proprietors, whatever their nationality. We trust this explanation removes from your mind any idea of intended unfairness against our American friends. As regards this issue price of £2 2s., you seem to consider this price as if it constituted a bonus issue. This is an error, as we have fixed this price after consultation with prominent British issuing houses, and are advised that this is a fair price compatible with the yield on industrial shares in this country of similar class and prospects. Any benefits such as possible increased dividends

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or capital bonuses will always belong to all proprietors without distinction. It is not proposed to offer rights to any section of existing shareholders on the register to subscribe for new capital and, subject to the resolution increasing capital being passed at the forthcoming meeting, 1,500,000 new shares have already been sold to London issuing house, imposing the obligation on them to distribute shares in the widest possible manner. In conclusion, the board has for some time viewed with grave alarm the diminution in the number of British shareholders on the register, and is convinced that its action is in the best interest of the proprietors and conducive to the earning of maximum profits. With much regret, if our proposed action should unnecessarily hurt feelings on your side, but the board must remain ultimate arbiter in guiding the company's affairs."

At the extraordinary meeting on Wednesday last the resolutions put forward were approved, with only two or three dissentients, after a lengthy discussion. Sir Hugo Hirst's speech and notes on the proceedings will appear in our next issue.

Midland Counties Electric Supply Co., Ltd.

The annual meeting was held on March 4th, when Mr. George Balfour (chairman), who presided, said that the electrical energy sold was 133,596,000 kWh, an increase of more than 29,000,000 kWh over the preceding year. The increase for the past two years amounted to approximately 60,000,000 kWh, which was almost exactly the total output from the company's power stations in 1925. The number of consumers connected had increased by 5,385 to 20,577, and the connected load by 19,676 kW to 105,300 kW. The maximum load recorded reached 42,910 kW, in addition to 2,000 kW purchased from other sources. The length of e.h.p. lines completed during the year was 105 miles, and of l.p. lines, 109 miles, making a total route length of h.p. and l.p. lines of 1,091 miles. The company was now supplying in three boroughs, 26 urban districts, and 134 parishes, and was giving bulk supplies to 10 local authorities and company undertakings. Four Special Orders were obtained for East Nottinghamshire, Mid-Warwickshire, Market Bosworth and district, and Fleckney Kibworth and district. At Spondon a 25,000-kW set was in course of erection, and four boilers had been brought into operation. Owing to the increased demand it was necessary to provide additional boiler plant at both stations. Referring to the Central England Electricity Scheme, Mr. Balfour said that all the company's generating stations had been classified as selected stations under the scheme. The traction business was still passing through a bad time, but by an Act of Parliament last year it was now possible to deal in a more elastic manner with this problem. Since the passing of this Act, there had been a considerable improvement in consequence of the reasonable degree of security which had been obtained. The report and accounts were adopted.

Metropolitan Electric Supply Co., Ltd.

The annual meeting was held on March 6th. Mr. G. Balfour (chairman), who presided, said that the introduction of a two part tariff had resulted in an average increase of 20 per cent. in consumption by consumers who had adopted this tariff. An additional bulk supply agreement had been entered into during the year with the Heston and Isleworth Urban District Council, and a Special Order extending the area of the Chesham Co., was sanctioned in August last. Transmission lines in the new area were being laid, and it was expected that a supply in Missenden and Goddesden would be available at an early date. The length of h.p. and l.p. cables laid now totalled 621 miles. The western area 22,000-V transmission system had been augmented by a new feeder between Willesden and Southfield Road, and additional sub-stations at Taplow and Beaconsfield were put into commission during the year. The output of electricity was 126 million kWh, as compared with 106½ millions for the preceding year, an increase of over 18 per cent. The total load connected was 151,569 kW, an increase of 20,106 kW, and the maximum demand reached 61,000 kW. During the year, apart from consumers connected by subsidiary companies, the company had connected 2,531 additional consumers, making the total 34,458. In addition, 3,049 consumers were connected to the mains of the subsidiary companies, making the total served by these companies 15,550, and the total number of consumers served by all the undertakings 50,008. The report and accounts were adopted.

Underground Electric Railways Co. of London, Ltd.

In the course of his speech at the annual meeting on March 7th, Lord Ashfield (chairman) said that the question of a combined meeting of all the companies of the group was being studied. The tramway undertakings had shown a definite improvement during the past year. Further increase in traffic could be anticipated now that measures had been taken to regulate the competitive services. They did not fear any slackening in the growth of London traffic, but when the question of expenses was considered the situation was not so certain. Wages represented 61 per cent. of the total operating costs. Although the cost of living index showed a fall during the past five years, they had increased wages. Their staff was in receipt of better wages than those paid by any other transport undertaking; if £3 a week was taken as a minimum standard, only 1,400 adults out of a total of 40,000 employed fell below that standard. The result had been contented and willing service and friendly relations. Referring to the rise in the price of petrol and to the heavy burden of rates and taxes, Lord Ashfield said that they could not both pay taxes and find money for the new tubes which had become necessary. In dealing with the subject of co-ordination of London traffic, the speaker pointed out that this was only following the examples of Paris and Berlin; the same matter was also being studied in New York and Chicago. After reviewing the accounts (ELEC. REV., March 8th, p. 439), Lord Ashfield said, in conclusion, that although the earnings so far this year had shown a decline on account of the severe weather, he was not inclined to take a pessimistic view of the future.

Electrical Distribution of Yorkshire, Ltd.

Presiding at the annual meeting on March 5th, the chairman (Mr. R. W. Wickham) said that there had been a large increase in the number of consumers and 15,248 new connections had been made in the last two years. The system of hire and hire-purchase of electrical apparatus which had been introduced was responsible for a distinct increase in the use of electricity for domestic purposes. During the year further agreements had been made for street lighting and 44 local authorities were now taking electricity for this purpose. Further agreements were already in negotiation. Application had been made for powers to supply in part of the rural district of Worksop. The Order had been made by the Electricity Commissioners and when confirmed by Parliament the company's area of supply would be increased to 1,197 sq. miles with a population of 744,000. Referring to the Central Electricity Board's schemes, Mr. Wickham said that there was a tendency to assume that the costs of generation which had been quoted in the Press were the prices at which electricity could be sold to the consumer. Generation was not all: the costs of distribution also had to be met, and when electricity was supplied in small quantities to users spread over a thinly-populated area it could not be expected that great reductions for small users would result from decreases in generation costs. The actual reduction of generation costs which the Commissioners estimated would be made in the first five years was only 1/20d. per kWh.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

West Gloucestershire Power Company.—£50,000 five and a-half per cent. first mortgage sinking fund debenture stock.

Yorkshire Electric Power Company.—897,000 ordinary shares of £1 each, fully paid, Nos. 1,603,001 to 2,500,000; and 20,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,603,001 to 1,623,000.

Adelaide Electric Supply Company.—250,000 6½ per cent. "C" cumulative preference shares of £1 each, fully paid, Nos. 750,001 to 1,000,000.

Dealings in the following have been allowed by the Committee under Rule 159:—

Sphinx Electric.—290,000 10 per cent. participating preference shares of 5s. each, partly-paid and fully-paid, Nos. 1 to 290,000. 10,000 10 per cent. participating preference shares of 5s. each, fully-paid, Nos. 290,001 to 300,000. 580,000 ordinary shares of 1s. each, fully-paid, Nos. 1 to 580,000. 770,000 ordinary shares of 1s. each, fully-paid, Nos. 580,001 to 1,350,000.

Underground Electric Railways Company of London.—9,523 new ordinary shares of £1 each, fully-paid, Nos. 7,064,654 to 7,074,176. (Ranking for dividend from January 1st, 1929.)

Chiswick Electricity Supply Corporation, Ltd.

Mr. H. Kahn (chairman) presided at the annual meeting on March 5th, and in presenting the report and accounts (*vide* our issue of March 1st, p. 392) said that further advance had been made, and there was every prospect of continued expansion during the current year. He warned the shareholders, however, that the rates both at Chiswick and Aberystwyth would be considerably heavier as their assessments had been practically doubled. At Chiswick, on the new assessment, the rates would work out at ¾d. per kWh. The balance sheet showed a very strong financial position. Although a sub-committee of the Chiswick District Council had recommended the Council to exercise the option of purchase which arose this year, the Council decided not to do so; the next opportunity would not occur until 1934. The company, in conjunction with other interested undertakings, had obtained an injunction against the London and Home Counties Joint Electricity Authority restraining it from proceeding with a Bill enabling it to acquire the purchase rights of local authorities in its area, and the Bill had now been withdrawn. The report and accounts were adopted.

Scottish Power Co., Ltd.

The trading profit for the year ended December 31st last of the undertakings owned and operated by this company, rose from £99,449 to £116,689. Of this £22,522 has been reserved in the companies' accounts and the balance has been paid over to the Power Co. After meeting expenses and adding £3,253 brought forward, there is an available balance of £85,840 (against £56,395). Debenture interest, &c., and preference dividend are paid, £4,446 is transferred to reserve

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(against £5,745), and it is proposed to pay a dividend at the rate of 8 per cent. per annum upon the old ordinary shares and instalments of new ordinary shares, of which 600,000 were issued during the year; a balance of £3,399 is carried forward. The proceeds of the issue mentioned are being utilised to redeem outstanding debenture stock, for extensions to plant and mains, and for expenditure on the development of the Grampian hydro-electric undertaking. The meeting was to be held on Wednesday this week.

Enfield Cable Works, Ltd.

The accounts for the eighteen months ended December 31st, 1928, show a profit of £162,317, as compared with £102,718 for the twelve months ended June 30th, 1927. After adding £26,083 brought forward and deducting directors' fees and depreciation there is an available balance of £169,150. The preference dividends are paid and a 10 per cent. final dividend is declared on the ordinary shares, making 30 per cent. for the period, as compared with 20 per cent. for the preceding year (the same rate). The reserve receives £40,000 again, making it £140,000, and a balance of £31,650 remains to be carried forward. The directors have decided to acquire interests in certain allied businesses and for this purpose propose to raise the capital to £800,000 by the creation of 350,000 ordinary shares of £1 each. If this is approved it is proposed to issue 100,000 shares immediately, offering them to the existing shareholders at £2 each in the proportion of two new shares to each five already held. Meeting: March 20th.

City of London Electric Lighting Co., Ltd.

The report for 1928 states that the directors are now able to deal with the unallocated balances. The Electricity Commissioners have fixed the standard prices, which will apply from January 1st, 1926, to December 31st, 1932, as follows:—For street lighting, after deducting expenditure specially relating thereto, 0.794d. per kWh; for supplies to private consumers, 3.069d. per kWh. The "consumers' benefit" figures for the past three years are set out as well as particulars of sums apportioned to the company's co-partnership scheme. The balance of net revenue for the past year is £253,341. After meeting the standard dividends (10 per cent. in the case of the ordinary shares), placing to reserve one-sixth of consumers' benefit (£45,990), and appropriating £31,695 for co-partners' benefit, a balance of £7,657 is carried forward. The price reductions made during the past three years are said to represent a relief to the consumers of £582,306, and during that period the consumption has risen by 37 per cent. Meeting: March 20th.

Ross-shire Electric Supply Co., Ltd.

At a meeting on March 15th, the company agreed to extend to the Grampian Electricity Company control of the management of the company in all matters apart from any proposal to liquidate. The promoters of the Grampian scheme become responsible for the present financial requirements of the company up to £20,000, on condition that the 7½ per cent. cumulative preference shares become non-cumulative preference shares with interest at 5 per cent., but participating with the ordinary shares up to 7 per cent. and that 9,000 deferred shares be transferred to the lenders by their present holders—who had agreed—and take rank with the ordinary shares, but with a voting power equal to seven votes for each share.

London Electric Supply Corporation, Ltd.

The directors report a profit of £178,880 for the year ended December 31st last, as compared with £251,214. To this are added £19,700 brought forward and interest on investments, and interest and sinking fund instalments are deducted, leaving an available balance of £181,206 (against £127,595). The final ordinary dividend is 5 per cent., making 9 per cent. for the year; £50,880 is transferred to ordinary shareholders' benefit (sliding scale) fund; and £25,437 is carried forward. The sales of energy increased by over 25 per cent. to 203,711,271 kWh, and the average receipts per kWh sold fell from 1.000d. to 0.816d. The meeting was to be held on Wednesday this week.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The report for the year ended December 31st last, which was to be presented at yesterday's annual meeting, shows a net profit of £33,659, as compared with £43,869 for 1927. To this is added £15,512 brought forward, making £49,082. Provision is made for the preference dividends and the "standard" ordinary dividends; £7,544 is transferred to "special reserve fund—ordinary shareholders' benefit under the 'sliding scale' for the years 1926, 1927, and 1928"; and a balance of £10,664 is carried forward. The connected load rose from 30,064 to 32,412 kW, and the sales of energy from 14,590,141 to 16,404,067 kWh.

Bruce Peebles & Co., Ltd.

The directors state that as the profits for the past year are insufficient to justify an extra dividend on the 7½ per cent. preference shares, only the fixed dividend will be paid. The ordinary dividend is reduced from 10 per cent. to 5 per cent., and £10,000 is taken from reserve.

Midland Electric Manufacturing Co., Ltd.

The net profit for the past year was £43,402, as compared with £39,360 for 1927. The addition of £5,251 from the sale of investments and £14,314 brought forward makes available £62,967. From this it is proposed to transfer £24,274 (against £10,000) to general reserve and to pay an ordinary dividend of 10 per cent., together with a bonus of 25 per cent., making 35 per cent. for the year, against 25 per cent. for 1927. A balance of £13,193 is carried forward. The directors propose to capitalise £37,500 of reserves and undivided profits.

Isle of Thanet Electric Supply Co., Ltd.

The total revenue for the year ended December 31st last was £171,863, as compared with £160,757. The gross profit rose from £72,554 to £73,416. From this debenture interest, taxation, &c., is met, and £30,000 is transferred to general reserve and depreciation account. After crediting interest and £4,535 brought forward, there is an available balance of £29,124. The preference dividend is paid and 4 per cent. is again to be paid on the ordinary shares, leaving £6,204 to be carried forward. At the annual meeting on Wednesday last it was proposed to submit an extraordinary resolution providing for the adoption of new and more up-to-date articles of association.

W. Canning & Co., Ltd.

The report for the year ended December 31st, 1928, records a net profit of £49,215 (as compared with £43,467 for 1927). To this is added £7,031 brought forward, making £56,246. A final dividend of 7½ per cent. is being paid (making 10 per cent. for the year), as well as a bonus of 1s. per share. The dividend was the same for 1927, but the bonus was only 6d. Of the balance, £10,000 is placed to reserve and £1,000 to the employés' benevolent trust fund, leaving £9,246 to be carried forward. The meeting was to be held on Wednesday last.

British Insulated Cables, Ltd.

The directors propose to pay a final ordinary dividend of 10 per cent., again making 15 per cent. for the year. The reserve receives £400,000 (against £300,000), and £250,000 (against £305,880) is carried forward. They also propose to distribute to the ordinary shareholders one new ordinary share for each four shares already held, and three "A" £1 preference shares (ranking after the existing preference shares) for each eight ordinary shares held.

Waygood-Otis, Ltd.

The net profit for the year ended December 31st, 1928, was £77,254, as compared with £68,115 for 1927. After reserving £30,000 for contingencies and £6,000 for pension fund, and adding £12,316 brought forward, there remains £104,320. From this a final dividend of 7½ per cent. is paid on the ordinary shares, making 10 per cent. for the year (against 20 per cent.), leaving £15,570 to be carried forward. Meeting: To-day (Friday).

English Electric Co., Ltd.

The accounts for the year ended December 31st last show a net profit of £86,292, as compared with a loss of £12,237 in the preceding year. After charging debenture interest and trustees' fees there is a loss of £33,617 (against £134,404 in 1927). The report records the deaths of two directors—Messrs. Claud T. Cayley and Bernard A. Firth. The meeting is to be held on March 18th.

Newmarket Electric Light Co., Ltd.

The balance on working for 1928 was £3,748, as compared with £2,516 for 1927. A balance of £720 brought forward is added, making £4,468. A dividend of 8 per cent., free of tax, is again to be paid, and £1,500 (against £500) is placed to reserve), leaving £844 to be carried forward.

Scottish Tube Co., Ltd.

While the preference dividends are to be paid, the directors are unable to recommend any distribution on the ordinary shares, which received 7 per cent. for 1927.

Peterborough Electric Traction Co., Ltd.

The accounts for the past year show a net profit of £4,309, against £5,464 in 1927. The dividend is maintained at 10 per cent., and £4,232 is carried forward, against £4,256 brought in.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

At an extraordinary meeting on March 6th the resolutions passed on February 19th providing for the reduction of the company's capital, &c., were confirmed.

Hoffman Manufacturing Co., Ltd.

From the 1928 profit of £96,994 (against £92,398) a final dividend of 6 per cent., making 10 per cent., free of tax, for the year is to be paid on the ordinary shares, as for 1927. The reserve again receives £10,000.

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Elgin Electric Supply Co., Ltd.

At the recent annual meeting a dividend of 5 per cent. was declared, and it was intimated that the price of electricity for lighting purposes would be reduced from 1s. to 10d. per kWh.

Davis & Timmins, Ltd.

The net profit rose from £6,629 in 1927 to £23,417 in 1928, and the ordinary dividend is raised from 8 per cent., tax free, to 20 per cent., less tax (final 16¼ per cent.) on a larger capital.

American Telephone and Telegraph Co.

It is reported that the company intends to create capital stock to the extent of $500,000,000 to provide for future stock issues. The nominal capital will thus be raised to $2,000,000,000.

Stewarts & Lloyds, Ltd.

The profits for 1928, including £133,000 surplus on the liquidation of the South African company, amounted to £582,000, against £440,740 in 1927. The preference and preferred ordinary dividends are paid, and it is again proposed to distribute 1s. per share to the deferred shares. The reserve receives £140,000 (against £175,000).

British Columbia Power Co.

A dividend of 50 cents per share has been declared on the Class "A" shares for the quarter ending March 31st.

Canadian General Electric Co.

The dividend has been declared on the 7 per cent. preference stock for the quarter ending March 31st.

Barcelona Traction, Light and Power Co.

A quarterly dividend of 1¾ per cent. has been declared on the non-cumulative participating preference shares.

Italian Companies.

Società Adriatica Elettricità.—The company is to increase its capital to 100 million lire; the new stock will be offered to the present shareholders. The question of constructing power stations in the Balkans and Spain is being further investigated.

It is reported from Milan that the *Pirelli Italiana* realised net profits of 21.4 million lire in 1928. A dividend of 11 per cent. is to be paid on the share capital of 155 million lire, as against 10 per cent. for 1927.

The *Financial Times* reports that the *Società Generale Italiana Edison* has decided to increase its dividend to 50 lire, as against 45 lire for the previous year. The par value of the shares is to be raised to 500 lire from 375 lire by capitalising reserves. Further, shareholders are given the right to subscribe for three new shares in respect of every 19 held at the price of 565 lire each.

Swiss Company.

The *Alioth Elektricitäts Gesellschaft*, Basle, has changed its title to the Holding Brown Boveri & Cie. Aktiengesellschaft.

German Company.

The report of *Brown, Boveri and Co.*, Mannheim, states that a considerable increase in the turnover took place in 1928 and an important stock of orders has been brought over into the new year. After allocating 1,810,000 marks to depreciation, as compared with 1,580,000 marks in 1927, the accounts show net profits of 1,960,000 marks, against 1,470,000 marks, and the dividend remains at 9 per cent.

Stocks and Shares.

Monday Evening.

Restraint on the part of investment, and disinclination on that of speculation to enter upon Stock Exchange engagements except in very modest measure, are features which make for pronounced weakness in prices, as well as contraction of business. The Stock Exchange member, passing through the markets, will see more men nowadays engaged upon crossword puzzles than has been the case for many months, possibly several years, past. In spite of the quietude of enterprise in business, new concerns continue to pour out their stocks and shares at a rate which arouses the perennial wonder as to where all the money can possibly come from which supports these fresh arrivals. The big borrowers are mostly conspicuous by their absence, owing, of course, to the continuance of a financial stringency that still looks for a possible rise to 6 or 6½ per cent. in the Bank Rate. Until the financial outlook in New York shows indications of a perceptible change, money is bound to remain tight. This leads to depression and to flatness in the Stock Exchange markets. It is obvious enough that the British Government and Treasury cannot regard the present minimum with any degree of favour, inasmuch as it lays a heavy hand upon industry, and postpones the efforts that are to be made to fund the nation's indebtedness into long-dated stock.

New Issues.

That all the new issues are not finding too ready a response may be seen by the fact that underwriters in one case last week were left with 92 per cent. of their liability. In another, they had to take 74 per cent. of the stock. Yet this present month promises to break records in the number of new companies whose shares are offered for public subscription. Last week's issue of Kolster-Brandes shares was overwhelmingly written for, and the lists opened only to close almost immediately.

The Late Sir John Denison-Pender.

The death of Sir John Denison-Pender, which occurred very suddenly, he having been in the City on the Friday before he succumbed to influenza and bronchitis a few days later, is greatly regretted amongst Stock Exchange men who knew and respected him. Sir John was regarded in a sense as being the head and front of the cable industry. Chairman of the Eastern Telegraph, Eastern Extension, Globe, Western and various other cable companies, he occupied a unique position in the cable world, and City men regarded him as being one of the soundest of the authorities on all questions relating to the industry with which his name will always be identified. The news of his death was followed by a slight weakening of prices in the stocks and shares of the companies connected with the industry, though it is taken for granted that arrangements have been made to prevent any large amount of stocks and shares coming on to the cable market as a result of his death. Declines in the leading stocks of the cable group are due to sympathy with the prevailing flatness elsewhere, and to dissatisfaction felt with the delay in making the announcement in regard to the Communications Company.

Marconi and Gramophone.

Activity developed in Marconis on the announcement that the company has entered into an arrangement with the Gramophone Co. (H.M.V.), which is to all intents and purposes a merger of certain interests with which both companies are closely connected. In the Gramophone Company, the Victor Talking Machine of America holds a majority of shares, and the latter company has joined forces with the Radio Corporation. Marconi shares, after being 78s., rallied to 81s. 3d., but reacted to £4, leaving the price without alteration on the week. Marconi Marines have further fallen to 3¼ on continued disappointment with the dividend of 15 per cent. Canadian Marconis rose 10 dollars in New York, and reflected this with a jump of 4s. 9d., to 38s. 9d. on this side.

The P.M.G. and Television.

The Postmaster-General is reported to have stated in the House of Commons that with regard to the wireless and cable merger, in so far as the Post Office was concerned, he believed the drafts were being considered by the associations interested. He did not think, according to this statement, that the Merger Company had yet been formed. The last statement aroused comment, and a wonder as to whether the Postmaster-General had been correctly reported. That same Minister was present at a demonstration of the Baird Television system, given recently, and afterwards an announcement was issued to the effect that the Postmaster-General would have to consider, and there is likely to be some considerable time before a statement can be made concerning the secret tests carried out in connection with the scheme. The price of Baird shares is dull at 5s. 9d.

Electric Lighting Shares.

County of London Electrics fell 3s. to 2¼, upon less exuberant dividend anticipations than were current last week. Bournemouth and Poole are 1/16 easier, at 68s. 3d. The City of London Electric Lighting repeats its previous distribution that makes 10 per cent. for the year, setting aside £45,989 to a special reserve out of the money which the company is entitled to retain under its sliding scale. The shares are unchanged at 32s. London Electrics are also without fluctuation at 27s. 6d.; the company is paying 9 per cent. for the past year, and transferring £50,880 to special reserve for the three years 1926-1928 inclusive. This fund is, of course, for the benefit of the ordinary shareholders. Midland Counties at 27s. 6d. ex dividend are about 1s. down, although the chairman at last week's meeting gave illuminating statistics of the company's expansion in sales and in the number of its customers. The company's tramway business presents difficulties, but an improvement in conditions was referred to in the chairman's speech. Isle of Thanet ordinary at 39s. and the preference at 29s., North Metropolitans at 49s., and Atlas Light and Power at 28s. 6d. have receded from the best prices recently reached. Newcastle-on-Tyne ordinary gave way to 25s., there having been an impression that the 1927 dividend of 6 per cent. might have been improved upon, whereas the same distribution is to be made in respect of 1928.

Mexican Revolution.

Revolution in Mexico is the latest news from that distressful country. The rebels, acting under a General Aguirre, were said to have taken the City of Vera Cruz. They claimed that eight States in Mexico favoured their cause, and a strict censorship in Mexico City has rendered it difficult to get authorita-

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tive news. The immediate effect in the Stock Exchange was to bring about a fall of 11 points in Mexican Light and Power common shares to 80, and to spread depression amongst the other utility issues of the Mexican group. Mexico Trams dropped to 52, and the company's first mortgage bonds to 77½.

The Shawinigan Water and Power Company reports a gross revenue for 1928 of 11½ million dollars, being more than two million dollars higher than that for 1927. The net revenue comes out at 4 million dollars. A new issue of capital is to be made to shareholders of 50 dollars per share, on the basis of one new share for every six shares held. Although, on this, the price of the old shares went back to 88½, the bonus is considerable. The company is paying quarterly dividends of 2 per cent. per annum. Montreal Light, Heat and Power shares eased off to 113.

Tubes and Traction.

Underground Electric Railways of London are again easier on account of the fears raised by the rise in petrol prices. Lord Ashfield made an optimistic speech at the meeting last week, but said that the extra price of petrol will cost the Underground Railways Company about £200,000 per annum. He remarked that whereas a mile of tube railway in London cost £850,000 and a mile of tramway £50,000, the equivalent for the omnibus system is £15,000. Underground shares are dull at 24s., and the incomes shed 5 points to 110. Metropolitan Consolidated and Districts, both ex dividend, are decidedly weak. No changes have occurred in London United Tramways or in London and Suburban Tractions.

Brazilian Tractions lost 4½ points, receding to 66. Further persistent buying of Anglo-Argentine Tramways second preference has lifted the price to 4, making a gain of 7s. 6d. on the fortnight. Para Electric Railway shares put on 2s., with an advance to 7s. 6d., and the company's first debenture stock at 73½ is 3 points up.

General Electrics.

The General Electric Co., Ltd., proposes, as mentioned on p. 439 of last week's ELECTRICAL REVIEW, to increase its capital from the present £6,000,000 to £7,600,000, by the creation of 1,600,000 new shares of £1 each. The money is to be raised partly with the idea of redeeming the existing seven per cent. debenture stock, and partly for purposes connected with the company's business. The new shares are to be called British Ordinary, and will be offered to the public. The meeting to sanction the issue is being held on the Wednesday of this week, and the price is to be 42s. per share. The existing shares have been moving up and down in erratic fashion, and on the week show a loss of 10s. at 2¾. A cable of protest from a committee of G.E.C. shareholders in America elicited a reply from Sir Hugo Hirst, chairman of the company, in which he defended the board in its determination to remain the "ultimate arbiter in guiding the company's affairs." It will come as a surprise to many people to learn from Sir Hugo Hirst's cable that Americans hold about 60 per cent. of the shares of the General Electric Co., Ltd.

British Insulated Bonus.

An issue of another kind, which will give satisfaction to the holders of the company's shares, is a bonus to be distributed by British Insulated Cables. Holders of the existing ordinary shares will receive one new ordinary share for every four shares held, together with three 5½ per cent. "A" preference for every eight ordinary shares held. The latter preference shares are to be created for the purpose of the bonus, and will rank behind the existing 6½ per cent. preference capital. The two new issues together add £833,331 to the company's capital. A final dividend of 10 per cent. makes 15 per cent. for the year, as before, and the appropriations have been generously dealt with. The effect of the announcement was to advance the price to nearly £5 a share, from which it reacted to 95s. Rumour has been suggesting for some time past that a bonus issue might be expected, and the present statement must be considered as good as anything for which optimism could have hoped. Enfields lost ⅛, failing to maintain their rise on the good report and melon-cutting already referred to here. Yorkshire Electrics are 6d. down at 35s. 6d. Probably the new issue of shares at 25s., three now being offered for every four shares held, will be out during the present week.

The Manufacturing Companies.

The English Electric Company reports a net loss on the past financial year of £33,000, the kindest thing about which can be said is that it is £100,000 less than the net loss of the previous twelve months. The debit balance is increased to £433,516. The ordinary shares are quoted at 8s. 3d., and the preference, upon which no dividend has been paid since June, 1926, at 9s. 6d. Electric Constructions weakened to £1. On the other hand, Telegraph Constructions changed hand at 26, and at 25½ are 5s. better on balance. Brush ordinary slipped back to 27s. 6d. Iron, coal and steel shares are fairly well maintained, considering the weakness that has over-spread most of the industrial sections. Rubber shares have gone back a trifle by reason of the produce reacting to a shade above a shilling per lb. Ever-Ready shares are dull at 22s. 6d., and the Trust Company's shares at 18s. 9d. are not a very lively market. Telephone Manufacturing at 5s. 9d. show a few pence decline.

Share List of Electrical Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 11 1929.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14†	15	68/3	—1/16	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/-xd	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 8 8
City of London	1	10	10	82/-	—	4 7 6
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	2½	—3/-	3 0 0
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—	3 18 3
Kensington Ordinary	1	8	8	27/-	—	5 8 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/6	—	5 1 10
Metropolitan	1	8	9	2 7/16xd	—	4 2 2
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	27/6xd	—1/-	4 8 8
Mid. Elec. Power	1	—	15	2 7/16	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	1½	—1/16	4 16 0
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10⅔	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	28/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27.6xd	+6d.	5 1 10
Scottish Power	1	8	8	32/6	—6d.	4 15 7
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	44/6	—	... ...
Westminster Ordinary	1	8⅝	8⅝	26.6xd	—	5 5 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/6	—	6 1 8
Yorkshire Elec.	1	8	8	35/3	- 6d.	4 10 2
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	12	—	5 11 1
Metropolitan	"	3	3	60xd	—1½	5 16 8
do. District	"	3½	4	76½xd	-2	6 10 9
Underground Electric	£1	1½	5	24/-	—1/-	5 16 8
do. do. Income ...	Bonds	6	6	110	—5	5 9
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	108	—	5 16 6
do. Def.	"	1½	1½	24½	—	6 3 9
Automatic Telephone	1	10	10	2⅛	—	4 14 1
Eastern Extension	10	10	10	25⅝	—½	*3 18 2
Eastern Tel. Ord.	Stock	10	10	260	—3½	*3 17 0
Globe Tel. and T. Ord.	10	10	10	26	—⅜	*3 15 9
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	20	32½	—	... ...
Indo-European	25	10	10	15½	—	*4 10 0
Marconi	10/-	5	*10	4	—	... ...
Marconi-Marine	1	8⅝	12½	8¼	—⅛	4 12 4
Oriental Telephone Ord.	1	12	12	3	—1/16	... ...
Western Telegraph	10	10	10	25⅝	—¼	3 18 2
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅞	—	7 1 11
do. do. 2nd. Pref. ...	5	6	6	4	+3/16	7 10 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	"	—	—	925	—	... ...
do. do. Pref. Ord.	"	8	8	128	—	6 5 0
Brazil Traction	100	6	7	66	—4½	3 0 8
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 8 7
Londen & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	82	—	5 15 0
Mexican Light Common	100	Nil	Nil	80	—11	... ...
do. 7% Pref.	100	Nil	7	76½	—1	9 3 0
do. 1st Bonds	—	5	5	79	—1	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	18	15	3½	—	*4 11 5
British Aluminium Ord.	1	10	10	46/3	—	*4 6 7
British Elec. Transformer Pref....	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅔	—	3 3 3
Brush Ord.	1	10	10	27/6	—1/16	7 5 6
Callenders	1	15	15	4¼	—	3 10 9
do 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.... ...	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—1/16	7 10 0
Enfield Cable Ord.	1	20	20	5⅝	—⅛	3 14 6
English Electric	1	Nil	Nil	8/3	—	... ...
do. do. Pref	1	8	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	10	2⅝	—⅛	3 12 9
Henley	1	25	25	6	—1/16	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	12½	10	1 15/16	—	5 8 1
Siemens Ord.	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction	12	10	10	25½	—	*4 14 8

†4% of which was tax free.

*Interim.

*Dividends paid free of Income Tax.

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The Brazilian Electrical Market.

An Official View of British Prospects.

IN a recent issue* the electrical markets of Argentina, Chile and Peru were surveyed. It is now possible to review business conditions in the Brazilian market, which is larger in actual area than either of those mentioned, but one where the prospects for British trade, if not definitely less promising, are at any rate more obscure than in the other countries. This information is contained in the recently-issued D.O.T. report on the financial, commercial and economic conditions in the republic by Mr. Stanley G. Irving, Commercial Secretary, at Rio de Janeiro (Stationery Office, price 3s. 6d. net).

Estimating the amount of foreign capital invested in Brazil at over £500,000,000, it is calculated that £300,000,000 of this came from Great Britain and Canada. On the theory that trade now follows finance, whereas formerly it followed the flag, the question arises: What benefits have accrued to British manufacturers and exporters from this investment of capital and from the risk and enterprise which it represents? Mr. Irving is doubtful whether the proportion of the total exports to Brazil representing orders from British controlled companies amounts to as much as 10 per cent. This statement, considered in conjunction with the growing movement on the part of American financial interests to acquire electricity supply undertakings hitherto under British control, gives rise to serious reflection. It is true that a condition of some of these acquisitions, *e.g.*, that of the Atlas concern, Light & Power Co., is that preference shall be given to British manufacturers for a certain period, but much will depend upon the interpretation of the term "preference." At the same time there has been a new development recently in connection with great financial concerns such as are likely to participate in electricity supply undertakings, *i.e.*, their very wide international ramifications. Of this feature, the Belgo-international "Sofina," with which Mr. Dudley Docker has recently become connected, is an outstanding example. In the case of control by a group representing virtually every manufacturing country, it is fair to assume that orders will be placed on merit alone.

The matter of securing a return on the investment of capital in its primary aspects, *viz.*, rate of interest and security, is also dealt with by the Commercial Secretary. He admits that the Brazilian Government has generally followed a farseeing policy with regard to the entry of foreign capital, but adds that the direct return to the original investors has been disappointing, in some cases owing to errors of judgment, in others to political causes. There are instances of foreign capital having been borrowed and spent without leaving any tangible asset in its place.

The long contemplated revision of the customs tariff is not yet complete. Certain textile duties have been raised and there has been a reduction of 10 per cent. in the rate on certain railway material. But it is highly desirable to remove the great number of *ad valorem* duties, of which unscrupulous competitors are able to take advantage in order to evade full payment by the use of fictitious invoices. Although nearly all articles are subject to a duty of over 50 per cent. upwards to as much as 200 per cent. of their value, the revenue from import duties at present amounts to only about 25 per cent. of the total value of the goods imported. "The revision of the tariff (says the Commercial Secretary) will provide an opportunity for the Brazilian Government to remove the opportunities for fraud offered by the *ad valorem* system, and so to protect the national interest."

Electrical Import Trade.

Summarising the general trend of the electrical import trade, more detailed statistics of which are appended, Mr. Irving remarks:—

The electrical machinery trade is largely dependent on the requirements of the Brazilian Traction Co. and the Electric Bond & Share Co., which is associated with the (American) General Electric Co. Imports of transformers increased from £170,000 in 1926 to £207,000 in 1927, Britain having become the chief supplier in front of Germany and the United States. In 1926 the United States supplied more than half the total. Electric motors increased from £242,000 to £250,000, the United States being the chief supplier in both years, Germany next and Great Britain third, losing ground. There is an appreciable trade in steam turbines for the larger industries in the northern States, Sta. Catharina and Rio Grande do Sul, in addition to the big plants in the Sao Paulo and Rio de Janeiro region.

Copper wire (insulated) in 1927 came chiefly from the United States and Germany in the proportions of 50 per cent. and 30 per cent. respectively out of a total of £85,000, a slight increase on 1926. The local production of copper wire is increasing. The largest item of copper products imported is cables, which amounted to 2,500 tons, valued at £188,340, in 1926, and to 2,940 tons, valued at £207,560, in 1927. Great Britain, after having held a good lead with 38 per cent. in 1926, fell back into second place with 27 per cent., close behind the United States. The biggest advance was shown by Germany, whose trade increased from £9,200 to £28,000. Belgium was fourth. The tonnage figures were: Great Britain 928 tons, United States 532 tons, and Germany 528 tons. The United States supplies most of the telephone cables and h.p. wires.

Electric lamp imports in 1927 amounted to £178,750, an increase of 32 per cent. over 1926. Nearly all the imported lamps come from Germany and Holland. There is a flourishing national factory of these goods under the control of the General Electric Co. of New York.

The following table shows Great Britain's position in relation to other important suppliers of electrical goods in 1913, 1926, and 1927:—

	1913.†	1926		1927.	
	Met. Tons.	Met. Tons.	Value in 1,000 £	Met. Tons.	Value in 1,000 £
Apparatus and appliances for electric lighting—					
Great Britain ...	1,510	670	195	759	173
United States ...	2,940	2,131	496	2,162	531
Germany ...	2,010	1,214	172	1,183	180
Others	600	694	123	1,113	179
Total	7,060 (£690)	4,709	£986	5,217	£1,063
Electric dynamos and generators—					
Great Britain ...	100	53	16	70	15
United States ...	370	461	73	610	97
Germany	170	476	52	373	29
Others	120	291	41	292	53
Total	760 (£61)	1,281	£182	1,345	£194
Electric motors—					
Great Britain ...	210	231	40	205	35
United States ...	465	346	70	494	93
Germany	480	583	54	379	30
Switzerland ...	165	102	15	108	18
Italy	85	151	15	121	15
Others	85	493	48	298	53
Total	1,490 (£123)	1,906	£242	1,605	£244
Transformers—					
Great Britain ...	40	114	16	261	37
United States ...	795	637	97	759	110
Germany	150	310	21	265	28
Others	25	256	31	241	22
Total	1,010 (£84)	1,317	£165	1,526	£207
Electric cables and wire (insulated)—					
Great Britain ...	1,287	1,345	95	951	59
United States ...	1,242	878	91	709	85
Germany	754	295	24	706	46
Italy	171	249	19	586	35
Others	171	430	40	590	47
Total	3,625 (£259)	3,197	£269	3,542	£272

Marketing Methods.

Mr. Irving has already formed strong opinions on the subject of marketing methods, and he tells the British manufacturer who contemplates establishing trade relations with Brazil that in order to have any chance of success he must be prepared to sacrifice preconceptions and approach the problem with an open mind. He starts, however, by endorsing the usual method employed by manufacturers, *viz.*, through merchant shippers in the United Kingdom having their own branch or agent in Brazil. After discussing this procedure in some detail he deals with certain other methods, *viz.*, selling through agents in Brazil directly representing the manufacturer; selling direct to local merchant firms; and selling to buying agents in Europe of large firms in Brazil. Among the points he makes are that unless the goods are well-known in Brazil or the agent has exceptionally good personal connections, stocks and advertising are essential if results are to be satisfactory, especially

* ELEC. REV. Feb. 8th, 1929, p. 253.

†Figures for 1913 show weight and total value (in brackets in 1,000's £) only.

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in heavy goods. The ordinary commission agent registered as such and paying an agent's licence only, cannot present tenders for Government contracts in public competition, unless holding his principal's power of attorney to represent fully. Otherwise he must employ a locally-established firm for the purpose.

It should be noted that the large Brazilian dealers prefer, as a rule, to buy from the local agents of European and North American manufacturers, a tendency which is increasing daily as the choice becomes greater; and, further, that representatives of most of the leading manufacturers of the world are now to be found in Rio, prepared to quote at a moment's notice. Consequently the need for keeping local stocks is becoming increasingly pronounced. When local contractors and engineers can conveniently buy at their own door, they will not go to the trouble of writing or cabling their requirements abroad, with the long delays involved and the troubles connected with bills of exchange and clearance through the Customs, to which is added, in many instances, the disadvantage of buying unseen and untried goods from a catalogue. The customer's reply to an agent who tries to sell to him from a catalogue is generally, "Can you show me one working here?" This applies especially to machinery, the selection of which may easily depend on the personal preference of a mechanic who is to work it.

Combined Selling Agencies.

In the circumstances the Commercial Secretary recommends the adoption of a scheme similar to that followed by Continental and United States manufacturers of non-competitive goods who have opened showrooms for their agents and have deposited goods on consignment in charge of capable men sent out to demonstrate them. The experts attached are prepared to furnish plans and information as to the working of new machinery or other products conditionally on receiving the order or preferential treatment. Mr. Irving says that a large amount of entirely unused British machinery has been thrown on the scrap heap because no one knew how to work it or even how to set it up. At the same time he commends the example of the British textile machinery makers, whose technical representatives visit the factories, suggest what machinery would be suitable and see that it is properly installed.

United States Activities.

Appended to the Commercial Secretary's report is one by the Consul-General at Sao Paulo and the Vice-Consul at Santos, in which there is given an interesting *résumé* of the operations of the Rio and the Sao Paulo Light and Power companies, now merged in one concern. After the drought of 1925, the principal companies doubled their capacities, for which purpose a considerable amount of capital had to be obtained from outside sources. The opportunity was not lost by American electrical manufacturers, who commenced to purchase the controlling interest in numerous undertakings. The combined Rio and Sao Paulo companies purchased controlling interests in most of the power undertakings operating between the city of Sao Paulo and that of Rio de Janeiro. It is found that the power undertakings purchased give an average net return of up to 12 per cent. on the capital invested, with prospects of a substantial increase as units come into operation and the demand increases. The prices charged for power in some areas are also low and will probably be increased as concessions are renewed. In addition there must be considered the substantial orders accruing to the manufacturers of electrical material through the expansion and re-organisation of such a large power network. To the Consular officers it seems essential for the development of British trade in Brazil that responsible directors should seize opportunities by personally studying the country and then giving more confidence to their local representatives. Americans and Germans have adopted this policy with great success.

The following striking example of the way in which American interests are spreading is given :—

In December last a concession was granted to the Sao Paulo Tramway, Light and Power Company, Ltd., for the development of a system of transport of goods between the capital of this State and the coast. This project, if materialised, will form a further outlet for the power which the company is developing at its huge station at Cubatao, which lies at the foot of the coastal hills near Santos. Two units of 40,000 h.p. each are already working and it is anticipated that a third unit will be installed within two years. Reservoirs already constructed for the storage of the flood waters in order to supply the power of the station at Cubatao will now serve a dual purpose in providing a waterway for the carriage of merchandise from the city to the edge of the coastal hills as well as furnishing the power. On September 19th the first half of the power plant (10,000 h.p.) of the Cia. Central Electrica de Icem at the Marimbondo Falls, on the north-west boundary of the State with Minas Geraes, was inaugurated. There is a fall of 19 metres and the plant has been planned to furnish 20,000 h.p. when completed. An area amounting to practically one-third of the area of the State is now served by companies belonging to the Empresas Electricas Brasileiras S.A., owned by an American corporation.

It may be added that from practically every business centre in Brazil comes the criticism that British firms are far behind their competitors in advertising and propaganda of every kind.

Developments and Prospects.

In Brazil great reserves of water power remain to be developed. The increasing needs of Rio de Janeiro, Sao Paulo, Santos, and the surrounding districts, are supplied by the well-known Canadian company to which so much of Brazil's progress is due. Eighty per cent. of the factories in the States of Rio de Janeiro and Sao Paulo are run by electricity. But power development ceased to depend solely on the Canadian company since it engaged the attention recently of powerful United States electrical interests, who have lost no time in establishing themselves. They have already taken in hand public services in Pernambuco, Bahia, Porto Alegre, Victoria, Nictheroy, and certain small towns in the State of Sao Paulo. All the principal cities of Brazil are in fact provided with electric lighting and tramway services, and there is one electric railway, the Paulista. Yet out of the total water power resources estimated at 25,000,000 h.p., only 500,000 h.p. has as yet been developed. Great as is the potential wealth and the area of the country, it is far from ripe for rapid development. Transport facilities are one great need. Another is to find additional export assets to coffee, on which at present the prosperity of Brazil depends too greatly. And without the former it is difficult to promote the more extended cultivation or marketing of maize, sugar, tobacco, cotton, rubber and animal products, all of which offer moderate possibilities.

Norwegian Imports.

IN the following statement are shown the imports during 1927 and 1926 of electrical and allied material into Norway, together with a note of increases or decreases in value. The countries of origin of certain groups of apparatus are given, but the official statistics, on which the statement is based, do not supply this information in many instances.

	1926. 1,000 Kroner.	1927. 1,000 Kroner.	Inc. or dec. 1,000 Kroner.
Internal combustion engines ...	2,292	1,579	−713
Electric motors valued each at—			
(1) less than 1,500 kr.	819	1,074	+255
(2) 1,500 kr. or more	1,151	967	−184
Total*	5,038	4,726	−312
From Sweden	1,713	1,182	−531
,, Denmark	417	289	−128
,, Germany	1,872	1,881	+ 9
,, United States	553	535	− 18
Electric generators—			
Transformers valued each at ...	776	1,106	+330
(1) less than 3,000 kr.	150	139	− 11
(2) 3,000 kr. or more	217	491	+274
Switchgear, &c.	177	222	+ 45
Convertors (rotary)	246	245	− 1
Other electrical machinery and apparatus of a kind not manufactured in Norway	1,308	979	−329
Lampholders with or without switches†	117	73	− 44
Switches, &c., for household purposes—			
Total	275	255	− 20
From Germany	228	221	− 7
Other electrical machinery and apparatus of a kind manufactured in Norway—			
Total	1,250	1,844	+594
From United States	121	137	+ 16
,, Sweden	574	718	+144
,, Denmark	128	115	− 13
,, Germany	356	741	+385
Carbon brushes—			
Total	86	104	+ 18
From Sweden	11	8	− 3
,, Germany	29	25	− 4
,, Great Britain	25	56	+ 31
,, France	8	8	—
Electric cable and wire—†			
(1) lead covered	1,407	1,257	−150
(2) other, insulated	555	453	−102
Total	1,962	1,710	−252
Accumulators and parts	636	717	+ 81
Batteries and parts	561	572	+ 11
Electric lamps	1,861	2,531	+670
Electrical apparatus (including telephone and telegraph)	1,529	1,886	+357
Electric meters	172	197	+ 25

* Includes generators.. † Mainly from Germany.

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Catalogues: A Reply.

The Point of View of the Compiler.

By R. J. WILLIS (Publicity Manager, Sun Electrical Co., Ltd.).

THE recent article by Mr. H. R. Taunton, dealing with the inconvenience of electrical trade catalogues (ELEC. REV., February 15th, p. 275) was so obviously written from the contractor's point of view that some details of the difficulties facing the compiler of one of these much-maligned volumes seems to be called for.

Of the thousands of electrical contractors who regularly receive catalogues, how many give a thought to the immense amount of work entailed in their compilation, the problems to be solved, the uncertainties to be overcome, before the finished article reaches their bookshelves—or their waste-paper basket? It is the sole concern of the publicity manager of the firm issuing the catalogue to make his catalogue as interesting and as convenient as possible to all electrical buyers. Unfortunately he cannot please everyone. What is to one an essentially simple lay-out, is obscure and irritating to another, and a complete mystery to the uninitiated. I am considering, of course, only fairly large catalogues in which there are a dozen or more different sections devoted to a wide range of material.

The first problem to be considered is external appearance, *i.e.*, size, colour and design, binding and division of sections. The colour is of paramount importance, for if the completed publication is deficient in "eye-value" it will suffer in comparison with its more attractive companions on the contractors' bookshelves and will not readily catch the hasty eye. If the colour is bright, a simple but dignified design must be adopted, otherwise a cover design sufficiently striking to make amends for a mediocre colour is necessary. An abbreviated title should always appear on the spine. As regards the binding, so long as it is stout enough to withstand rough usage and will allow the book to stand on end without support it is satisfactory. These problems scarcely affect the user; he may subconsciously note them, but he will only be aware of whether he is favourably impressed or not.

Size and Sections.

It is when he comes to consider size and division of sections that the compiler's real troubles begin. Is there a correct size for a catalogue? One has only to look at the uneven dressing of the volumes on an electrical buyer's shelves to realise the multiplicity of sizes possible. Presumably all these volumes are thought by their publishers to be convenient; yet some sizes must be easier to handle than others, and it naturally follows that those less easy to handle will be the less used. I consider that the ideal catalogue should not be too bulky to be carried about, but at the same time should be of sufficient size to maintain its place on the shelf among more pretentious lists. This is, of course, only a personal opinion, and what the compiler wants for guidance is not his own idea but the consensus of opinion among users.

Turning next to the division of sections we shall see that here the matter is not so much one of uncertainty as one of economy. The best method of sub-division is to use either a thumb index or projecting tabs. Both systems are, in the main, satisfactory, the only disadvantages from which they suffer being that where tabs are employed they are invariably used as levers to open the list with the result that eventually they become detached, while the constant insertion of the thumb in a "cut-away" index tends to obliterate the imprint and even to wear away the exposed portion of the pages entirely. Obviously, one can have specially stout tabs strongly affixed to a thick interleaved board—or even a glazed surface over the exposed portion of the thumb index—but the cost is absolutely prohibitive for a large catalogue. To have each section printed on paper of a different tint is a good method, but where there are 20 or more sections, it is almost impossible from an economical point of view, quite apart from the difficulty of finding a sufficient number of contrasting tints in the ranges of paper usually available. One other method remains, and that is to have the title page of each section printed on a thick board. This is not a costly method but, in practice, it is most unsatisfactory. It is not visible and the user will soon find that the thick boards prevent him from running rapidly through the list by letting the pages fly from under his thumb.

Faced on the one hand with the desirability of economy and on the other with the need for convenience to the user, the compiler's sole remaining resource is to leave as much white space as possible on each title page; to arrange each section so as to facilitate rapid reference; to refer on the outside cover to the contents page, giving the page numbers for each section, and finally to have a really effective alphabetical index.

The Problem of Sequence.

Having settled the external appearance of the catalogue there still remains the even more important matter of the arrangement of sequence. With a comprehensive list covering the whole range of electrical supplies from accessories and sundries to line material and plant, this is a matter of some difficulty. Decidedly the whole list cannot be laid out in alphabetical order. No one could seriously suggest that "tumbler switches" should be listed with "ironclad switchgear" or "lamps" with "line material." Nevertheless, since order must be maintained, the list can be divided up into sections and the sections themselves arranged in such a sequence as naturally to follow one another. Then the contents of each section must be arranged in some easily remembered order.

A further difficulty in the alphabetical arrangement of accessories is that one first of all has to determine under what initial letter the user would look for, say, "adjustable grid boxes" or "wall sockets and plugs." Even assuming that this problem could satisfactorily be solved there would then arise the question of keeping the illustrations to scale or at least approximately to scale. One has only to place scale illustrations of a screw and a switch-plug side by side to gain some idea of the resultant confusion and absurdity.

No matter how large a catalogue is, providing it is well sectionalised and there is no referring from one section to another to complete the price of an article, it is only a matter of seconds to find any required item. There are, unfortunately, some catalogues in which tumbler switches are listed in one section, finishes in another, and the appropriate flush plates in a third, with separate price sheets for all three. These are, however, the exception rather than the rule, and it is decidedly unfair to pillory some of the excellent lists issued by electrical manufacturers and wholesale distributors because of the eccentricities of the minority.

Prices and Discounts.

Coming next to page arrangement there are still more difficulties to be met. The subtraction of discounts is admittedly a nuisance, but unless a flat rate discount is allowed on the whole catalogue (an impossibility with a large list) one is forced to give a codified discount against each price or range of prices. So long as the code is simple and does not require constant reference to the explanation it will work admirably in practice, but if the code is too complicated it is worse than useless to the hurried estimator. The suggestion recently made in these columns that net prices should be inserted is an excellent one and would save endless fuss and bother both to the issuer and to the user. To the estimator, however, it would not be such a time saver as at first appears, since if he has not to subtract a discount he has at least to add one, and I fail to see that the addition of a percentage to a net price is any less difficult than the subtraction of a discount from a retail price. I suggest that this point was overlooked in the article referred to.

In addition, there is the retail price to consider. Most manufacturers insist on their retail prices being maintained, but if they were to print net figures in their catalogues they could scarcely persist in this attitude. All things considered, the retail price with a codified discount plainly marked is the best, and when it is remembered that the E.C.A. and other trade associations are definitely adverse to the issue of catalogues giving net figures it is obvious that any publisher of a catalogue who broke these rules would meet with a rather hostile reception.

Quite apart from the discount question there is the arrangement of tabular matter. Here there is only one sensible arrangement and that is with the tabular matter reading from left to right, preferably commencing with a reference number and concluding with a price, both of which should be printed in bold-face type, the other columns being light-face. As regards price corrections and revisions subsequent to the issue of the catalogue, no really satisfactory arrangement has yet been devised. The suggestion that the representatives of the firm publishing the catalogues should personally make the corrections is a good one, but in that case there would be some on the representative's ground who would not hear of a price revision for weeks.

The issue of the catalogue concludes the publicity manager's troubles and anxieties for a time, but he is still left in doubt as to what the user considers the best arrangement. With an eye to the next issue of his catalogue he is still puzzled to discover what the consensus of opinion regards as the ideal catalogue, and it would be interesting if some means could be devised whereby his perplexity could be removed.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Switchgear-Unit Panels.

Fig. 1 shows a "Simplex" standard unit panel, a recent introduction of Simplex Conduits, Ltd., Garrison Lane, Birmingham. These panels have been produced to enable the convenient use of "Simplex" standard switch and fuse gear at the "nerve-centre" of an installation—the main switch panel. All main or sub-main gear can, if desired, be grouped together on this principle, supervision and control being thus greatly facilitated. The panels consist of a stout angle-iron

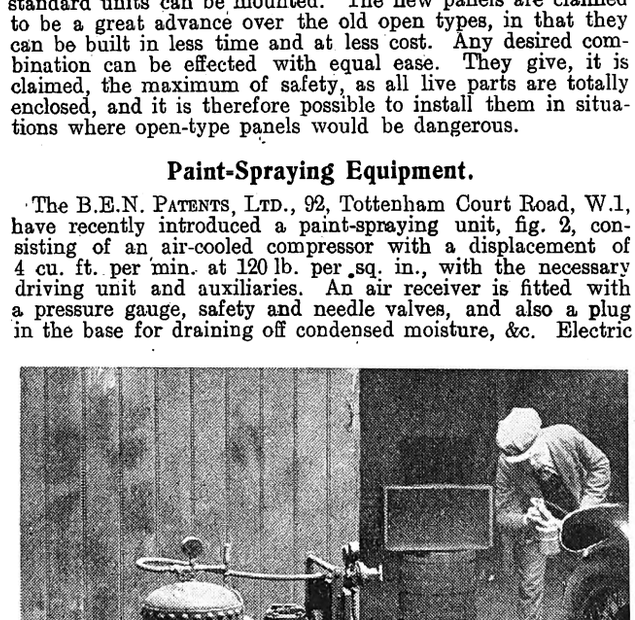

Fig. 1.—"Simplex" Standard Unit Panel.

framework, specially constructed to make erection or dismantling an easy matter, on which any arrangement of standard units can be mounted. The new panels are claimed to be a great advance over the old open types, in that they can be built in less time and at less cost. Any desired combination can be effected with equal ease. They give, it is claimed, the maximum of safety, as all live parts are totally enclosed, and it is therefore possible to install them in situations where open-type panels would be dangerous.

Paint-Spraying Equipment.

The B.E.N. Patents, Ltd., 92, Tottenham Court Road, W.1, have recently introduced a paint-spraying unit, fig. 2, consisting of an air-cooled compressor with a displacement of 4 cu. ft. per min. at 120 lb. per sq. in., with the necessary driving unit and auxiliaries. An air receiver is fitted with a pressure gauge, safety and needle valves, and also a plug in the base for draining off condensed moisture, &c. Electric

Fig. 2.—B.E.N. Paint-spraying Equipment.

driving is provided by a ¾-h.p. motor (compound-wound for d.c., or repulsion-induction for a.c.).

Automatic control is provided by means of an electro-pneumatic switch. This control maintains a constant tank pressure at all times, the motor cutting in when the pressure falls, and out when it rises again to the maximum. The spray gun used with the equipment utilises a new principle, requiring only 3½ cu. ft. of air per min. for good atomisation. It is claimed that the gun produces a perfectly smooth finish, free from pitting.

A New Lighting Fitting.

The latest production of British B.A.G., Ltd., 23, Farringdon Avenue, E.C.4, is the "Pearlite" diffuser, fig. 3. It is a totally-enclosed lighting unit of spherical shape, with a pleasing white matt finish, and with slightly projecting relief segments, although plain globes can also be supplied if required. The fitting can be supplied in either the ceiling or the pendant type; the latter is supplied with a suspension chain, or with flex alone. The brass ceiling plates, chains and galleries are specially solidly constructed and can be supplied in various finishes, such as matt brass and oxidised silver or copper. There are three sizes, 8-in. diameter for use with 60 to 110-W lamps, 10-in. for 100 to 150-W lamps, and 12 in. for 150 to 200-W

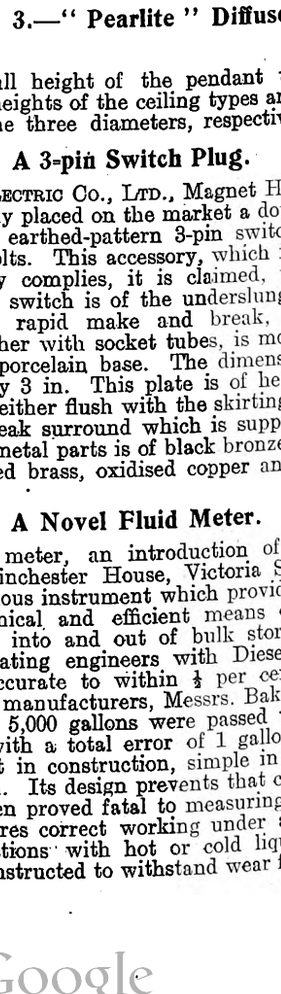

Fig. 3.—"Pearlite" Diffuser.

lamps. The overall height of the pendant types is 40 in., while the overall heights of the ceiling types are 9½ in., 11½ in., and 13½ in. for the three diameters, respectively.

A 3-pin Switch Plug.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has recently placed on the market a double-pole double-break interlocked earthed-pattern 3-pin switch-plug designed for 15 A at 250 volts. This accessory, which is of very robust construction, fully complies, it is claimed, with the I.E.E. Regulations. The switch is of the underslung type, having a long throw with rapid make and break, and the whole mechanism, together with socket tubes, is mounted in a solid English vitreous porcelain base. The dimensions of the face plate are 5 in. by 3 in. This plate is of heavy-gauge brass, and can be fitted either flush with the skirting board, or semi-recessed with a teak surround which is supplied as standard. The finish of the metal parts is of black bronze, but alternative finishes in polished brass, oxidised copper and oxidised silver are also available.

A Novel Fluid Meter.

The "Fluid" meter, an introduction of Messrs. Fluidmeters, Ltd., Winchester House, Victoria Square, Birmingham, is an ingenious instrument which provides, it is claimed, a simple, economical and efficient means of checking and registering fluids into and out of bulk storage; it is likely to interest generating engineers with Diesel plant. It is claimed to be accurate to within ½ per cent. In a recent test made by the manufacturers, Messrs. Baker Perkins, Ltd., of Peterborough, 5,000 gallons were passed through a No. 5 "Fluidmeter" with a total error of 1 gallon. The "Fluidmeter" is robust in construction, simple in design, and efficient in operation. Its design prevents that clogging of valves which has so often proved fatal to measuring equipment. Its construction assures correct working under any climatic conditions. It functions with hot or cold liquids equally efficiently, and is constructed to withstand wear for a long period.

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Single-wave Radio Broadcasting.

A consideration of the advantages to be derived from the operation of several radio-telephone broadcasting stations on one wave-length.

By CAPT. P. P. ECKERSLEY, M.I.E.E., and A. B. HOWE, M.Sc.

(*Extracts from a paper read before the* Wireless Section *of the* Institution of Electrical Engineers.)

THE number of wave-lengths available for broadcasting stations in any continental area is strictly limited, if their reception is to be free from interference, due to radiation from any aerial being composed, not only of rays parallel to, but also of rays at an angle to, the earth's surface. The latter radiation does not suffer attenuation as do the direct or ground rays. The indirect ray, travelling strongly until it strikes the upper electrified atmosphere, is bent again earthwards where its magnitude is comparable with the direct rays of other stations, even within their service areas. The geographical separation between stations, up to distances of 1,000 or 2,000 miles, makes little difference to the amount of mutual interference.

The best use of the available wave-lengths can be made in several ways, one of which is, first, to secure proper international agreement between nations as to the distribution of wave-lengths among all stations within 3,000 km of one another; secondly, to design the transmitting aerials of all stations so as to radiate, as far as possible, rays parallel to the earth's surface* and not at upward angles; thirdly, to use, in any territory, few high-power, instead of many low-power, transmitters; and, lastly, to share one wave-length between several stations, either in the same or in different countries.

The Union Internationale de Radiophonie is attempting to secure the required international agreement. It has been proved that something can be done to improve the service area for a given power by using very high transmitting aerials, which does not necessarily mean that interference with distant stations will be less. Most broadcasting authorities throughout the world are substituting for their present systems fewer stations of higher power (the British Broadcasting Corporation's regional scheme is largely based upon this principle). In 1924 Capt. P. P. Eckersley proposed, as a further method of attacking the limitation of the number of useful wave-lengths, the use of one wave-length for several stations. The original international plan for the allocation of wave-lengths to European countries was, on a suggestion by Capt. P. P. Eckersley, based on the use of "shared" or "common" wave-lengths. In 1925 the B.B.C. undertook experiments to find out the possibility of using one wave-length for several British stations (*i.e.*, the sharing of waves between stations in the same, in contradistinction to different, countries), and in consequence, during 1926, 1927 and 1928, four British relay stations shared one wave-length, and they were synchronised to an accuracy of 100-200 parts in a million. In 1926 and 1927, further experiments were undertaken to attempt to establish certain principles of single-wavelength working and, incidentally, to investigate methods of obtaining a practical system of very accurate synchronisation of carrier waves of stations. The result has been the conception of a scheme, begun in practice on January 13th, 1929, to share the one wave-length of 288.5 m between ten British low-power stations. In consequence of experiments, the German broadcasting authorities have decided immediately to work three of their stations on the same wave-length. American writers have forecast the solution of the problem of wave-length allocation for broadcasting stations by the use of single-wave-length working, *i.e.*, the working of several broadcasting stations on the same wave-length. As far as the authors are aware, two out of the 500 or 600 stations in the United States to-day repeat the same wave-length. Mr. Lemoine, head of the technical direction of Swedish broadcasting, has done a considerable amount of work on the subject and two Swedish stations exactly share the same wave-length.

The conclusion suggests that a part solution of the difficulty of giving satisfactory service to all listeners in a given continent, or nation, is the proper application of single-wavelength working, but it will be appreciated that many of the statements are based on theoretical calculations. The values of the indirect ray cannot be taken as exact, although they are remarkably confirmed by observations in two separate cases. The crucial experiment of single-wavelength working when the empirical factors for the relative field strength for good service conditions were determined, is wholly reliable. However, in general single-wavelength working is a practical proposition if means to carry it out can be found; even if there are large errors, shared waves between local low-power stations will be useful to cover large towns with good conditions of broadcasting if such towns happen to be outside the range of high-power regional stations.

Having outlined the theory of single-wavelength working in Section 1, Section 2 of the paper deals with the practical synchronisation of the stations involved. In general three methods as possible, as follows:—

(1) By arranging a continuous-wave transmitting station to emit a steady radiation of frequency f_d which is picked up at the broadcasting stations sharing a channel and is there multiplied n times to a frequency $nf_d = f_c$, the frequency of the wave to be used for single-wave working.

(2) By arranging a supply of sufficiently steady "low" frequency alternating-current, frequency f_l [which is $1/(n_l)$ of the frequency f], and distributing such currents by land line to the transmitters and, further, by connecting multipliers at the transmitters which multiply the low frequency f_l by n_l times until the required high frequency $f_c = f_l n_l$ results to drive the transmitters.

(3) By arranging for each of the transmitters "drives" which, although in no way interconnected, are so accurate and so carefully calibrated before installation that the desired measure of synchronisation is forthcoming without any common source of master frequency.

Variants of (1), (2) and (3) involve one, or two, or all, of these basic principles. Method (1) would involve a powerful long-wave transmitter (the more powerful the more scattered the broadcasting stations) and highly selective receivers at the stations.

Method (2) (interconnection by land line) is perfectly satisfactory; certain German stations use it, even using the land line for a control line (*i.e.*, for the passing of operating instructions, &c.) while the low frequency is passed over the same line.

Method (3) is merely a question of trying to find a frequency standard which can be maintained under ordinary engineering conditions to an accuracy which does not allow it to vary more than ten parts in 1½ millions, or one part in 150,000, but methods (1) and (2) both require some standard of frequency with a 1 in 100,000 order of accuracy, otherwise the frequency doublers will, particularly in the case of method (2), go out of adjustment; so the search for a highly accurate frequency standard is essential to all methods, if more vital in case (3). It is believed, however, that if precautions were taken an ordinary note oscillator would be sufficient for methods (1) and (2); we have two real alternatives for method (3), the tuning-fork and the crystal. While the interference situation in Britain was so serious, the B.B.C. in 1927 placed nine of its eleven relay stations and the Bournemouth main station on the same wave-length, thus basing its system on method (3) and a tuning-fork frequency standard.

From their recital of arguments and facts, the authors' conclude that single-wavelength working appears to be a practical proposition, albeit there are limitations to its application. Its chief sphere of usefulness would appear to be in bringing within first-class service area conditions the inhabitants of isolated towns outside the reach of high-power regional stations. There is thus a large sphere of usefulness for the national common wave. In Britain it bids fair to restore proper service to all relay stations which formerly were hopelessly jammed when working on international common waves. Further, even when regional stations are in operation, single-wavelength working may make for economy in the use of wave-lengths and still continue service to isolated towns not sufficiently covered by regional stations.

The scheme depends, of course, in large measure, upon land-line connections, and sometimes, in the lonelier parts of Europe, Australia, &c., the very towns that deserve, because of their density of population and their isolation, a broadcasting service, may be denied it owing to the lack of wire connection. The isolated tuning-fork, however, seems, when properly handled, to give the required measure of accuracy, and a wireless link might in some cases be used to cross the gap from programme centre to isolated transmitter. It is quite possible to use the same line for a master frequency to "drive" all transmitters simultaneously and also to modulate all such transmitters by the same programme. This would involve the use of a homogeneous air line, and a supersonic note would be superimposed over the programme. They sum up as follows:—

(1) If the fundamental radiation from two working broadcasting stations can be exactly synchronised and so held over a long period of time, then there will be around each station a service area in which good reception may be confidently expected (other things being equal), while outside such areas there will be a mush area in which good reception will be fortuitous and rare and where, in general, distorted reception will be manifest.

* Electrical Review, January 11th, 1929, p. 84.

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(2) The service area of each of two stations sharing a wave will be determined by their relative power, the geographical distance of separation, whether night or day conditions prevail, the wave-length used, the accuracy of synchronisation, and whether the same or different programmes are radiated simultaneously.

(3) Given fixed stations of definite power, night conditions and given wave-lengths, the greatest factor determining the extent of resultant service area will be whether the stations radiate the same, or different, programmes; if the same programme is radiated the service area of each station will be vastly greater than if different programmes are transmitted from the given station.

(4) That, following on (3), it is useless on a continent to share wave-lengths between stations belonging to different nationalities, or groups; one nation, or authority, able to radiate one programme should place surplus stations on one wave called a "national common wave."

(5) That these stations should be, preferably, low-power stations serving densely populated towns, not too close together, and using a short wave, since the longer waves are too valuable for regional high-power stations to be used for this work.

(6) In the generality of cases in civilised countries, single-wavelength working should be a valuable means of bringing isolated towns into "A" service area conditions and should go a long way towards solving the vexed problem of the lack of available wave-lengths.

(7) That it is possible to use many stations on the same wave-length, and the interference with one station by all the others is much less than the sum of the field strengths of the others if their number exceeds five.

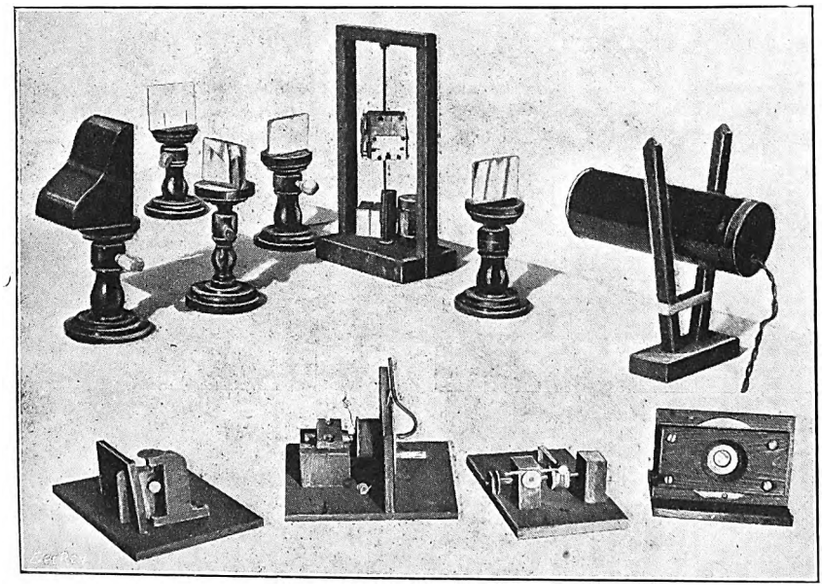
(8) There are, in general, two practical ways of synchronising the carrier waves of stations, (*a*) by separate valve-maintained tuning-forks, or oscillating crystals, forming the drive of the stations sharing a wave, and (*b*) by the distribution of a single low-frequency alternating current supplied from a reasonably constant source *via* ordinary land lines to the stations to share the same wave-length where, after multiplication, it is made to form the drive of the station; practical conditions must govern the choice between methods (*a*) and (*b*), but the service area will be slightly smaller with method (*a*) than with method (*b*).

Television.

A Brief Account of Recent Events.

It was announced in the House of Commons on March 6th by the Postmaster-General that a demonstration of television took place on that day and was witnessed by a few members of Parliament of all parties, in addition to representatives of the British Broadcasting Corporation, the Baird Television Development Co., Ltd., the G.P.O., and others. It was necessary to restrict the number to a minimum, because at present the nature of the apparatus made it impossible for more than a few persons to witness the experiment simultaneously. The demonstration took place on the understanding that no information would be issued to the Press, but it is understood that transmission was from the London (2LO) station of the B.B.C., and that the receiving gear was located in the General Post Office.

Some apparatus made by himself was exhibited by Mr. Ll. B. Atkinson, by invitation, before the Television Society on March 5th. He recalled that in the *English Mechanic* of April 21st, 1882 (p. 151) have appeared a letter signed "W.L." in which he proposed the construction of what he termed a "telectroscope" for transmitting visible pictures electrically. The transmitter's single selenium cell was carried line by line across a picture, the current being thus varied to correspond with the light and dark shades; the receiver consisted of a mechanical arrangement. The space distribution of a light point was to be made by refracting the light beam horizontally and vertically through a pair of achromatic prisms, to correspond with the movement of the selenium cell, whilst the light had to be simultaneously varied by rotating one of a pair of Nichol polarising prisms by electromagnetic means, the motion being varied and controlled by the current variations in the selenium cell. He pointed out that the inertia of the Nichol prism arrangement would, in itself, be an overwhelming objection. He corresponded with another worker for over two years, giving advice and assistance in experiments he was making.



Some Early Models of Atkinson Television Apparatus.

Being then a student at Kings College, London, he devoted a good deal of attention to methods of analysing the image so as to present every point in turn to the sensitive selenium cell and the synthesis of a point light into an image, and also to methods of varying the light in the receiver to correspond with the selenium changes.

He was at the time working in the laboratory of King's College under Prof. Grylls Adams, who, in 1875-7, had carried out researches on selenium, and was acquainted with the technique of making cells (fine parallel brass and platinum wires on mica with selenium between and annealed). It was known that light from an interrupted source falling on such a cell would produce a musical note in a telephone, and so he assumed that at least telephonic frequency could be reached; for the receiving apparatus he therefore largely adopted the telephone as a model (his exhibits indicated various ways in which he hoped to produce optically the required light and dark changes: the upper part of the accompanying illustration shows an arrangement for projecting an image from revolving mirrors, while the lower part depicts telephone-type receiving devices). Amongst other methods tried was an attempt to utilise the Kerr effect, but he never was able to make the plane of polarisation rotate; he believed this was the method now adopted by Alexanderson. For the synchronisation of transmitter and receiver he proposed to use the Cour phonic wheel. Although not suggesting that his exhibits were more than rough models, they nevertheless showed that 47 years ago methods of analysis and integration of an image had been worked out; the mirror method was, he believed, that used by Dr. Alexanderson with success. At that point he became immersed in active engineering work and had never since had time to take it up again.

In his presidential address nine years ago to the Institution of Electrical Engineers he referred to the problem, and ended by saying: "I am convinced, however, that all the elements for the purpose are now at hand, needing definite research to complete the task." That research had been going on vigorously in England, in America, and in Germany, but the use of the cathode tube, to which he attached great importance, still lagged, and there was thus much yet to be done.

Photo-telegraphy, tele-kinematography, television, &c., was the subject chosen by Mr. H. A. Hankey for his illustrated lecture before the Association of Supervising Electrical Engineers on March 5th.

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Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

A Screen Fire.

The "Redot" fire, fig. 1, a recent introduction of LIGHTING TRADES, LTD., 30-31, Farringdon Street, E.C.4, is constructed in the form of a screen, with a circular element in the centre. The body is made throughout of sheet-bronze, with a cast

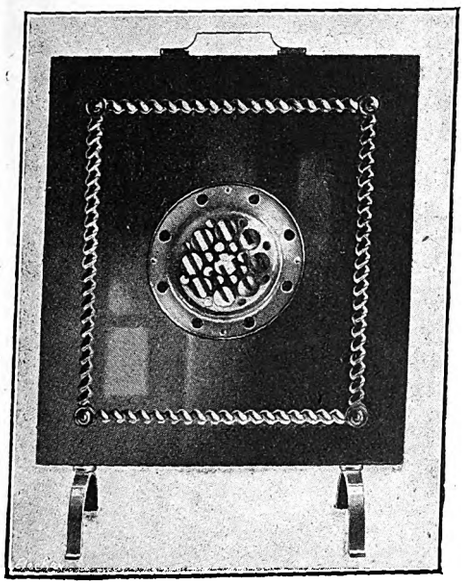

Fig. 1.—"Redot" Screen Fire.

ornamental surround of the same metal. It is a pattern which is likely to interest a large number of consumers of electricity, seeing that it serves a double purpose and can be used with advantage in dining and drawing rooms, lounges, and so on. The dimensions of the fire are 24-in. high by 18½-in. wide, and it is fitted with two substantial metal feet and a metal carrying handle. A connection for the two-pin plug is provided at the back of the element, which is loaded at approximately 800 watts.

A New Heating System.

"Electro-Velocity" radiators, a recent development of ARTIC FUSE & ELECTRICAL MANUFACTURING CO., LTD., Birtley,

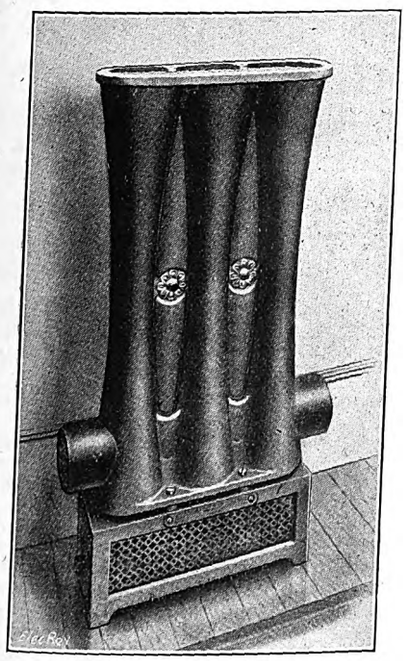

Fig. 2.—Three-nozzle "Electro-Velocity" Radiator.

Co. Durham, introduce a new system of electric heating, which, it is claimed, is, in effect, equal to central heating. The principle employed is really that of the convector. Cool air is drawn in at the bottom of the radiator and passes over electric heating elements, and heat is imparted to it. The warm air is then projected from the top of the radiator at a velocity of from 180 to 220 ft. per min. The velocity is automatically produced by the scientifically designed nozzles, and the circulation is equal, it is claimed, to that produced by a fan, without discomfort or draughts.

In addition to the main heat circulation by convection, a certain amount of heat is radiated from the surface of the apparatus. The elements are of nickel-chromium and, with their radiating fins, run at a black heat. The radiators are made for varying loadings from 500 W to 2,000 W, and are equipped with three or six nozzles, according to the loading. A 3-nozzle model is shown in fig. 2.

A Compact Cooker.

The "Redot" electric cooker, fig. 3, one of a range of such apparatus which has been introduced by LIGHTING TRADES, LTD., 30-31, Farringdon Street, E.C.4, embodies a number of features which make, it is claimed, for maximum efficiency. It is built round a heavily lagged sheet-steel case. The front of the cooker is of black-enamelled cast-iron, and

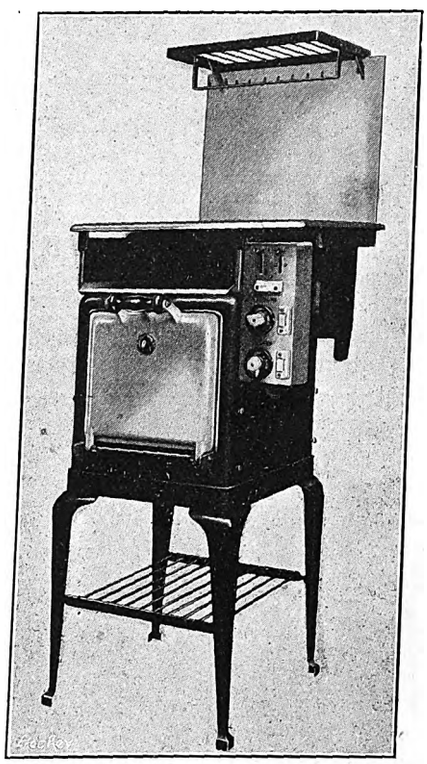

Fig. 3.—"Redot" Electric Cooker.

the apparatus is fitted with a polished bright steel top. The white enamelled door operates on a snap latch and spring hinges. The cooker is provided with a griller, simmering ring and boiling ring, and has a maximum loading of 5,000 W distributed in the following manner:—Griller, 1,000 W; simmering ring, 500 W; boiling ring, varying from 360 W (low heat) to 1,450 W (high); oven, 2,000 W (bottom heat 1,000 W and two sides 500 W each).

The grill and simmering ring are operated by snap switches. The boiling ring is controlled by a 3-heat rotary switch. The oven has also 3 heats provided in a similar manner.

Compactness of design has been closely observed in the construction of the "Redot" Cooker, the overall dimensions of which are 36-in. high (including 20-in. stand), 16-in. wide and 17- in. deep.

Three-heat Tailor's Irons.

During the last few months the demand for three-heat-control tailor's irons appears to have grown considerably, and the ELECTRIC HEATING CO., George Street, Croydon, has been called upon to supply a number of such irons. Fig. 4 shows a 10-lb. "Elect" tailor's iron which is fitted with three-heat series-parallel control. The loadings are 200, 400 and 800

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watts. The control equipment is carried in a special box near the handle, and the connecting lead is brought out at the side of the box and guarded at the exit by a special spring and

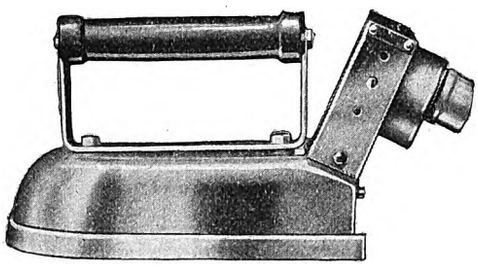

Fig. 4.—Three-heat Tailor's Iron.

insulation bush. A sliding panel is fitted in the switch box to provide easy access to the interior. The iron exterior is highly nickel plated and polished.

An Electric Egg Boiler.

The "Elect" egg boiler, fig. 5, recently introduced by the Electric Heating Co., George Street, Croydon, has been designed to meet the demand for a reliable egg boiler for hotels, tea rooms, and restaurants. The normal capacity of the boiler is eight eggs, but for a small additional cost a two-tier egg carrier can be supplied, bringing the total capacity

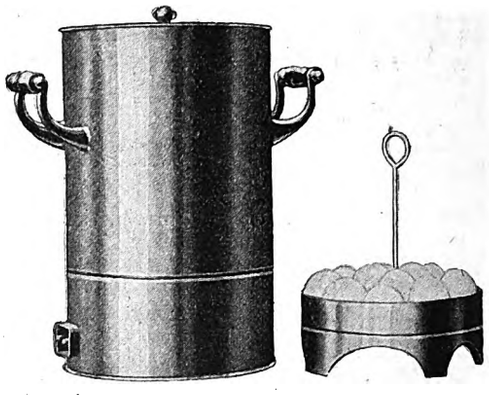

Fig. 5.—"Elect" Egg Boiler.

up to 16. The boiler is constructed of stout copper, highly polished to reduce radiation losses as far as possible, and the loading is 1,000 watts.

The Ideal Home Exhibition.—II.

A Review of the Electrical Features.

THAT the display and demonstration of electrical apparatus at popular exhibitions does good work in at least creating public interest in domestic electrical service was evident during the second week of the Ideal Home Exhibition. During the "rush hours" it was not easy to make a call at some of the "electrical" stands. On the whole the manufacturers and others who are displaying electrical equipment are to be congratulated on the success of their shows, especially those who are so efficiently carrying out demonstration programmes.

Generally, the lighting of the exhibition shows a considerable advance, and it is particularly encouraging to note the adoption of modern electric lighting methods and fittings, both for sale and for the lighting of their stands, by many of the general exhibitors.

Fig. 1.—One of the All-Electrical Stands.

Among a number of "non-electric" firms which are showing attractive and novel electric lighting fittings are Messrs. Louis Dernier & Hamlyn, Ltd., who have displayed "Litlux" and "Neolux" fittings. The former are made of silk, nacrolaque, parchment, and so on, screening the light and giving a diffused and golden glow, and the latter are made of glass panels with metal mountings, the panels being delicately colour tinted and designed in simple and clear-cut floral and geometrical form.

The General Electric Co., Ltd., has a very attractive and imposing display, the stand taking the form of a kiosk, fig. 1, so arranged that from whatever angle it is seen a clear view to the back of the stand is provided. The range of electrical appliances and accessories shown covers every household requirement, and demonstrations are being given with appliances in a model kitchen and scullery. Among the apparatus displayed is a series of electric cookers which are all fitted with easily-accessible elements and totally-enclosed quick-boiling plates.

A new "Magnet" wash boiler shown works on the thermo-siphon principle, the water being kept in constant circulation without the use of mechanism other than the special percolator. Also displayed on this stand are a number of "Magnet Cosy-glow" electric fires. In addition to two-panel elements on the front of each of these fires, the heat projected from them is supplemented by a Robertson-type flame-colour lamp affixed behind the elements, the glow from the lamp being reflected by a hammered-copper reflector. An automatic cut-out kettle is another feature. This has a simple device which cuts off the current before the kettle bottom becomes overheated; the device can be easily reset to allow the kettle to be used again. There is also an improved form of the popular "Magnet" vacuum cleaner, a revolving type of ironer, two new patterns of water heaters and urns, and an ingenious washing machine, the "Pixie," fig. 2, which does dish washing, it is claimed, with freedom from crockery breakage. The A.S. automatic refrigerating machine is another exhibit which is attracting attention.

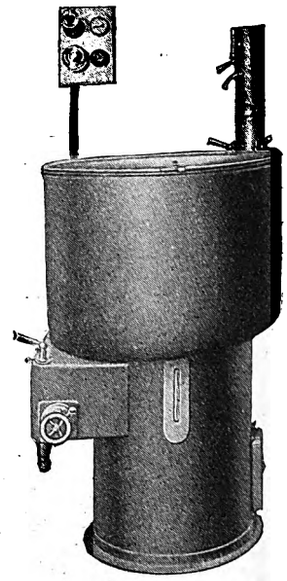

Fig. 2.—The "Pixie" Washing Machine.

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The company is also displaying ranges of electric-light fittings, fixtures and lamps, including a series of high-grade modern-type pressed and moulded glassware pendants incorporating wrought metalwork. A feature on the stand is a "photo-electric cell" arrangement by means of which the number of visitors to the stand is automatically counted; each visitor entering the stand breaks a beam of light projected on to the cell, and thereby operates a relay which, in turn, operates counting apparatus.

Another large stand devoted to household electrical appliances of all kinds is that of Messrs. L. G. Hawkins & Co., Ltd. Prominence is given to the "Universal" electric washing and drying machine, which comprises an agitator-type washer and centrifugal dryer or hydro-extractor, the latter taking the place of the usual wringer. It will damp-dry goods, it is claimed, from blankets to delicate fabrics ready for ironing. A small electrically-driven pump is provided for draining off the water from the washer. The "Universal" combined electric washer and wringer, fig. 3, is also shown, together with examples of the "Coffield" electric sheet and table-cloth ironing machine, and the new "Universal" electric hand irons, the latter being each fitted with an automatic device which switches off the current when the iron is not in actual use. Part of the Hawkins stand is set out as a model electric kitchen, the equipment including automatic electric cookers, washing and drying machines, and so on.

Fig. 3.—"Universal" Washer and Wringer.

Reliance Telephone Co., Ltd., is giving demonstrations of the Reliance automatic exchange telephone system, which is independent of the P.O. service, and is intended for internal communication in offices, clubs, hotels, and so on. The G.E.C. automatic private exchange telephone systems are also represented on this stand by 25-line and 50-line units. Also shown is a number of useful telephone accessories, including a range of "Magnet" extending arms, hygienic glass mouthpieces, phonopads, and so on.

Vampires, Ltd., is specialising on electrically-operated vacuum-cleaning machines, among which are the "Hobby," "Dandy," and "Vampire." The first-named is the popular household type, which is fitted with a 1/10th-h.p. motor; it weighs 18 lb. and is claimed to be capable of cleaning an area of 500 sq. ft. per hour on a minimum consumption of current. The "Dandy" cleaners are made in three sizes with motors of respectively ⅛, ¼, and 2/5th h.p., with correspondingly higher capacities. All the machines are supplied with interchangeable brushes for floor waxing and polishing.

Kelvinator, Ltd., is showing five different sizes of refrigerating cabinets, ranging in actual food-storage capacity from 5 to 12 cu. ft. A cold room of 150 cu. ft. storage capacity, suitable for large country houses, hotels, and so on, is also shown on this stand.

The Sloan Electrical Co., Ltd., is demonstrating the "locomotive" electric washing machine. The action of this machine produces a "loop the loop" action which forces the suds through the clothes. Several auxiliary devices to this machine include the "Safety" wringer, the upper roller of which is automatically raised upon being unduly loaded with clothes.

Popular models of the "Bulle" electric clock are displayed on the stand of Messrs. Bulle Clock. It is claimed that the clock will run on one small dry battery without attention for two or three years.

Combustions, Ltd., is showing the "Automestic" oil heater, an apparatus for fuelling domestic boilers. An oil jet is trained into the furnace by means of an electrically-driven compressor; electric ignition is provided, and the apparatus is automatically and electrically controlled.

The Delco-Light Department of Frigidaire, Ltd., is showing a selection of automatic and semi-automatic electric lighting plants. In a fully-automatic model a battery takes care of the load up to 300 W, but above that load the plant automatically starts, and stops when the consumption is reduced to 175 W.

A self-contained electric lighting plant is also being displayed by Messrs. Thorn & Hoddle, Ltd., who feature the "Pelapone" and other automatic sets. "Aquarius" and "Good-Egg" electrically-driven pumps are also being shown.

Kohler Co., Ltd., has installed a 1,500-W and an 800-W automatic sets working in connection with the "Georgian" house in the village of "Welcome In."

The Dowsing Radiant Heat Co., Ltd., is showing a wide variety of electric heating and electro-medical apparatus, including "Solarium" radiant sun-bath apparatus.

A special range of "Daylight" reading lamps is being shown by Sheringham Daylight Co., which is demonstrating by the usual cubicle method the changing of ordinary electric light into "Daylight."

Electrolux, Ltd., has its usual display of "Electrolux" refrigerators, cleaners, polishers, and so on, and Frigidaire, Ltd., have on show a wide and attractive range of Frigidaire automatic electrical refrigerators.

Electro Rays, Ltd., is showing several recent "Astro" specialities, including "Ideal" reading lamps, high-frequency generators, home-type artificial sun-light apparatus, and so on.

Electrical domestic labour-saving appliances of all descriptions are to be seen on the stand of Hotpoint Electric Appliance Co., Ltd., and demonstrations are being given of the "Hotpoint Maytag" clothes-washing and wringing machine and the "Hotpoint-Utenco" electric ironing machine. It is interesting to note that the "Premier-Duplex" and the "Premier-Junior" electric vacuum cleaners are now both fitted with polishing attachments.

Cookery demonstrations are being given daily on the stand of Jackson Electric Stove Co., Ltd., the apparatus used being, *inter alia*, the "Jackson Junior" cooker and the new "Jackson" table cooking cabinet. Water-heating equipment is also being shown by this company, as is also the "Jackson Atom" fire.

Oatway electric hot-water radiators, examples of which are to be seen on the stand of Oatway Safety Heating Co., Ltd., are available in sizes from 250 to 3,000 W.

Marco Refrigerators, Ltd., has displayed a range of cabinets, some of which are particularly attractive, and finished in white or oak.

Berry's Electric (1928), Ltd., has a very attractively set out stand, showing the latest models of "Magicoal" fires, Berry-McClary cookers, and so on. A feature of this exhibit is the "Louis Lattice" model of "Magicoal" fire, fig. 4, which has a standard "Magicoal"-fire effect, with flame, and is loaded at 3 kW. It is claimed to be rust-proof throughout, and is equipped with gilt enrichments, according to the period of the design.

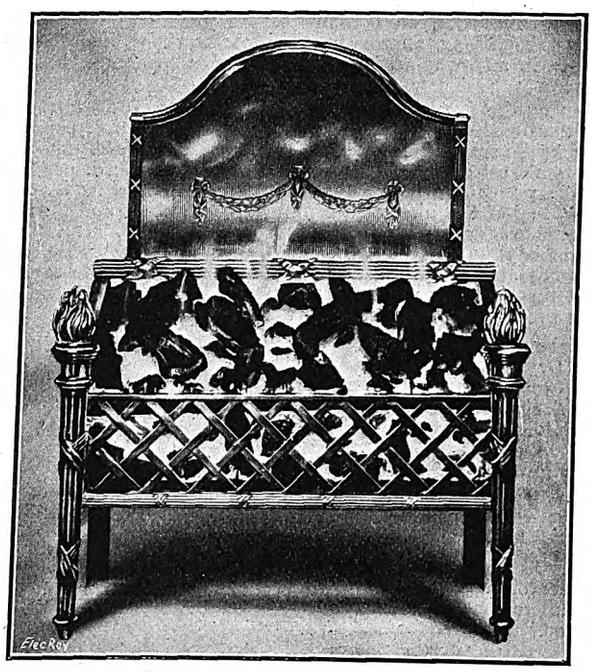

Fig. 4.—"Louis Lattice Magicoal" Fire.

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A new vacuum cleaner, the new "Super Eureka," is being shown by the Electric Appliance Co., Ltd. This apparatus has an adaptation for motor-car cleaning, a "Sanatizer," by which carpets can be floated on a cushion of disinfecting gas, and a moth-control method for fabrics of all descriptions.

"P.H." Electric Warm Air Convectors are showing examples of apparatus of the same name, which take the form of small electric convectors embodied in articles of furniture, such as umbrella stands, and so on.

A comprehensive display of lamps may be seen on the stand of Philips Lamps, Ltd., which attractively features the "Argenta" opal lamp as "the ideal lamp for the ideal home." Special attention is given to "Daylight Blue," "Duplo" anti-dazzle automobile, and "Duo-Savelite" lamps.

Revo Electric Co., Ltd., is showing a variety of much apparatus as cookers, washboilers, fires, and so on. A feature of the apparatus is an automatic kettle, which has a simple push-button resetting device and no fuses.

A reminder that the housewife's daily ally and friend in the matter of saving time, worry and expense in the telephone, is being given by the Telephone Development Association, which is demonstrating modern telephone service. This stand is the headquarters of the Telephone Growth Competition.

Models of the "Tellus" electric vacuum cleaner are being shown by the Tellus Super Vacuum Cleaner Co., Ltd., and "Thor" models are on show by Thor Electric Servants. The latter company has some special models with illuminated interiors.

Steam Power Plant.

A survey of modern practice, with particular reference to pulverised-coal-fired boilers and operating cost.

By F. W. NICHOLLS, A.M.I.E.E.

(*Extracts from a paper read before the* LONDON LOCAL TECHNICAL GROUP *of the* ELECTRICAL POWER ENGINEERS' ASSOCIATION.)

ANY success which we have established at Derby has been gained through a prompt recognition of our difficulties and overcoming them by engineering methods. The present paper covers a period of nearly three years during which our progress has continued upon scientific lines of development, the success of which promises to have a far-reaching effect upon boiler design in this country and other parts of the world.

The plant installed at Derby in 1925, one of the first of the "Lopulco" powdered-fuel installations in this country, comprises two Babcock & Wilcox boilers working at 300-lb. pressure per sq. in. and has continued to uphold every claim originally made for reliability, efficient performance, and extreme flexibility in operation; whilst experience has dictated certain improvements which have been included in later units, the original plant is our first favourite and continues to give most efficient service.

The first extension comprises one unit built to the original specification and operating at the same pressure, but embodying water-cooled tubes in the combustion chamber brickwork. It was put into service early in 1928 and the water cooling of the combustion chambers with solid-walls has been of real value. We operate with a higher CO_2 content of the gases without injuring the combustion chamber brickwork regularly. Slightly higher operating efficiencies have been obtained and our maintenance costs for furnace repairs are in for a considerable reduction on account of the protection which the water-tube lining affords to the brickwork, without interference in any way with the process of combustion in the furnace.

During the first year the coal consumed was 25,000 tons and the total cost of renewals was £836 6s. 9d., or 8.02d. per ton. During the second year the coal consumed was 24,000 tons and the total cost of renewals was £950 11s. 6d., or 9.2d. per ton. The increased cost of maintenance is accounted for by the cost of upkeep of the air-cooled combustion chambers and the systematic programme of changing parts of the plant. The effects of embodying the water-cooled features have been so clearly demonstrated in our new unit that it is permissible to suggest that these costs are more likely to recede in future operations. The average operating costs of the Derby plant are:—

Labour cost of—	
Drying, pulverising, exhausting to cyclone and conveying to pulverised-fuel bin	6.1d. per ton
Boiler operation, *i.e.*, boiler attendant	3.6d. ,, ,,
Ashing, cleaning of plant, &c.	3.08d. ,, ,,
Power for operating dryer, pulveriser, exhauster, conveyor and feeders— 23 kWh per ton at 0.25d. per kWh ...	5.75d. ,, ,,
Or a total of	18.53d. ,, ,,

Or slightly over 1s. 6½d. per ton.

Therefore, neglecting depreciation charges, the complete cost of all repairs throughout the boiler plant, power consumption in operation, attendance and cleaning is:—

Repairs and maintenance	9.20d. per ton
Operating	18.53d. ,, ,,
Total cost	27.75d. ,, ,,

These figures will indicate why we have been able to return a coal cost per kWh generated of 0.15d. throughout the whole of last year's operation, being one of the lowest in the whole of Great Britain.

Trouble connected with the formation of slag in the combustion chamber was overcome by the introduction of the patented water screen. The next stage in progress saw the water screen linked up as an integral part of the boiler circulation, which was followed by the introduction of headers to feed the tubes serving to cool the walls of the combustion chamber. Those modifications increased the heat liberation per cubic foot of combustion chamber, and decreased the dimensions of the combustion chamber, from which has followed the conception of the radiant-heat steam generator, first constructed in this country in 1924 and subsequently modified and brought to its present stage. It has been operating in a large engineering works in Manchester since the early part of 1925; the actual tubes are all arranged in such a manner as to form a completely water-cooled combustion chamber, and the plant regularly supplies the steam required throughout the works and has replaced a battery of eight water-tube boilers. The principal features are the distribution of the heating surface, following the realisation that the primary function of any steam generator is that of a heat-reclaiming plant. Therefore, the parts which are subjected to the pressure, which must be of robust design and to insurance standards, have been arranged to take advantage of the maximum heat transfer through radiation. Owing to its unique form of construction, there being no brickwork at all in the combustion chamber, a very large air preheater is incorporated which permits of a high degree of heat transfer from the gases and enables the combustion air to be preheated to temperatures averaging from 450 to 500 deg. F. A later installation embodying several minor changes in design has since been put in operation at the Brighton electricity works, whilst in America over 16 installations are in successful operation; the latest installation is to operate at a pressure of 1,850 lb. per square inch.

The plant being constructed for the Derby Corporation undertaking consists of two steam generators with a normal evaporation of 80,000 lb. of steam per hour, and will be ready for service for next winter's load. The working pressure will be 300 lb. per square inch and air preheating is being introduced for the first time on the Derby plant.

The original installation comprised hollow air-cooled side walls; when operating with a high CO_2 content, which is so easy to attain with this method of firing, the brickwork is liable to severe expansion strains, resulting in a tendency to break away from the holding tiles. A modification of the method of bonding was adopted for one boiler in 1927 and for the other in 1928, as noted in the maintenance costs. When operating with a high CO_2 content and using fuels with a low fusing ash point slagging was experienced, and if allowed to continue rapid erosion of the brickwork would have resulted; to obviate troubles in this direction the CO_2 content is restricted to from 12 to 13 per cent.

The boiler which commenced steaming in 1928 was equipped with a Murray fin-tube wall on the back and 16 tubes spaced at 14 in. centres on both side walls, the front wall being of hollow brick construction, a CO_2 content of from 14 to 15 per cent. being maintained without slag formation, with varying qualities of fuel, the cooler furnace in the vicinity of the side wall allowing of this, in addition to the support afforded to the brickwork.

The success of p.f. firing centres on efficient drying of the fuel to at least as low as 2 per cent. surface moisture (if possible, lower than that) at a temperature as closely approximating boiler-room temperature as is possible, as an aid to efficient transport and combustion. There is a tendency to decry the dryer as a nuisance and to eliminate it by increasing the capacity of the elements adversely effected by moist fuel. Raising the coal to a high temperature to effect drying does not obtain the desired purpose so readily as an air current passing through the fuel in a state of agitation, such as would obtain by passing air at high temperature through the transport lines with the fuel, after pulverisation has been

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effected. By this means also, condensation troubles would be avoided when fuel is passing through the system at a temperature higher than that of the surrounding atmosphere. Whilst transport and feeder systems give little trouble when the fuel and surroundings are at an even temperature with 6 to 8 per cent. surface moisture, the effect upon combustion renders it desirable to reduce to at least 2 per cent. the surface moisture.

The Raymond mill has proved itself to be a very efficient machine. Developments are in the direction of larger mills in order to reduce the power consumption per ton milled, whilst later designs of the "ring roller mill" offer certain improved mechanical advantages.

Discussion in London.

Mr. H. C. MOUNT pointed out that some of the author's costs were incurred two years ago, and in view of improvements effected in the design of plant produced to-day the cost of maintenance of new plant would be very much less than was indicated by the author's figures. He indicated items which could be eliminated, or reduced, and arrived at a total maintenance cost of £452, instead of the author's figure of £950. The cost per ton of coal consumed in 1927-28, therefore, would be 4.5d. instead of the author's figure of 9.2d.

Mr. E. F. HALL said few who had had anything to do with powdered fuel were so optimistic as Mr. Mount; in fact, they felt inclined to envy Mr. Nicholls his results, and did not hope to be able to halve their maintenance costs yet. In modern systems, in which drying was effected by means of hot air, or hot gas, and with the varying fuels they were forced to burn in these islands (which would not even be looked at in America) surface moisture should be regarded from the point of view of total moisture. It was misleading to talk of surface moisture when there might be present 8 or 9 per cent. of hygroscopic moisture; it not only accentuated slagging trouble, but led to the greater trouble of "bird-nesting" when the rate of combustion was raised very much. Various methods were being proposed by plant manufacturers to overcome that difficulty.

Mr. PERCY RYCROFT expressed the opinion that the plant at Derby was one of the best examples in this country. With regard to the maintenance costs, he regretted that Mr. Nicholls had not set out the figures for the first and second years of operation in exactly the same way. Tests carried out by an independent engineer on the original plant indicated a boiler efficiency of 83 or 84 per cent., but those were not high figures. When considering the coal cost of 0.15d. per kWh generated at Derby it must be borne in mind that the cost per ton at which the fuel could be obtained at Derby was extremely low, and in order to arrive at the cost of generation by similar means at other places one must have some knowledge of the cost of coal there. What Mr. Nicholls had proved was that in the case of fuel which it was difficult to burn by other means pulverising offered appreciable advantages.

Mr. E. N. TAYLOR said probably all would agree that by firing coal in the pulverised form they were able to obtain better combustion than by firing it in any other form. Mr. Nicholls gave one the impression that he was a firm believer in the complete water-cooling of a furnace, but he (Mr. Taylor) could not see how a furnace so completely cooled as Mr. Nicholls proposed it should be would attain to the furnace temperature which was necessary to give good conditions of combustion. From that point of view the completely water-cooled furnace was discounted, although it had its advantages from the point of view of refractory maintenance. With regard to the statement that on the side walls of one boiler the tubes were spaced at 14-inch centres, he said he did not consider that method of bare-tube cooling was correct.

Mr. R. H. GUMMER said that the success of any installation depended to a large extent upon the skill of the operators. He admitted quite freely that the dust problem was a very prominent one in connection with pulverised-fuel-fired installations, but the difficulties had been exaggerated. At Derby an efficiency of 86 per cent. had been attained with ordinary dust-collecting apparatus, quite apart from the water sprays in the stacks, which had an efficiency of upwards of 90 per cent.

Mr. A. W. NUNN asked a number of questions.

Mr. THOMAS said there was an essential difference between the bin-and-feeder and the direct systems. There was a possibility of the grinding in the latter case being less perfect than that carried out in low-speed mills; therefore, the particles of coal entering the furnace were likely to be larger and, if combustion were not complete and air distribution were not thorough, there might result a certain amount of stratification, a drop in velocity, and ultimately "bird nesting." Therefore, it seemed that the fineness of pulverising was of very great importance.

Mr. HALL agreed that the system adopted was the direct one, but, so far as an extended series of investigations had shown, fineness of grinding had nothing to do with the trouble. He had had coal ground very coarsely by speeding up the exhauster fan on the bin-and-feeder system, and had not obtained quite the same results. He and his colleagues had found that the difficulty was bound up more with the ash fusion temperature and moisture content at the moment the coal entered the furnace; the exact relationship, however, they had not yet been able to find.

Mr. STRETTON said he had been assured recently by the operating engineer at a large works where pulverised fuel was adopted that exactly the same trouble as was referred to by Mr. Hall was experienced there with a centrally-fired system. Apparently, therefore, fineness of grinding had nothing to do with it. In spite of the reputed cleanliness of the pulverised-fuel system, the operating engineer was somewhat black, and he appeared also to be somewhat heated, in spite of the reputed ease of operation of the system. Was Mr. Nicholls a very lucky man, or were the difficulties experienced by others exceptional?

Mr. LOWDEN said that there was a lot of talk about the thermal efficiency of pulverised-fuel-fired plant, but one never heard anything about its commercial efficiency. A thermal efficiency of 83.5 per cent. was not bad (attained at Derby), but he was able to obtain that efficiency also with mechanically-stoked plant. Maintenance costs equal to 9.2d. per ton of coal burned and operating costs of over 1s. 6d. per ton were rather high; 1s. 6d. per ton represented a very big percentage of the value of the coal, and the operating cost of plant used before pulverised fuel came into use was considerably lower than that; mechanical stoker operating costs were practically nil. If one added 1s. 6d. per ton to the value of the coal used at Derby, the 80 per cent. efficiency which Mr. Nicholls had claimed for his plant must be reduced to about 70 per cent. He had been examining tenders for the provision of plant with mechanical stoking and pulverised-fuel firing, of similar capacity, and in the majority of cases the capital cost of the pulverised-fuel-fired plant, everything included, was from 50 to 75 per cent. higher. Furthermore, the extra capital cost did not compare with the extra cost of operation and maintenance of the pulverised-fuel plant over the mechanically-stoked plant, as certain coals were burned on mechanical stokers which could not be used for a pulverised-fuel-fired boiler; those coals, of course, were cheap. Coal delivered at 9s. 6d. per ton in London was used at the L.C.C. power station at Greenwich; it was water-borne.

Mr. MOUNT doubted very much whether Mr. Lowden would find by examining the contracts placed during the last three, four, or five years, that in any one case the capital cost of pulverised-fuel installations was more than 20 per cent. higher than that of installations fired by mechanical stokers. In the case of boilers with evaporative capacities of 10,000, 20,000, or 30,000 lb. per hour the capital cost, if fired by pulverised fuel, would be greater than if fired by mechanical stokers, but the capital costs for capacities of 80,000 and 100,000 lb. per hour were comparable. As the size of plant increased, powdered-fuel installations were in the more favourable position, taking into consideration the buildings, space occupied, and the capital cost of the ground; it was not quite fair to compare the boiler installations themselves, apart from the buildings in which they were to be housed.

Mr. LOWDEN said the boilers he had referred to had an evaporative capacity of 100,000 lb. per hour.

Mr. NICHOLLS, replying to the discussion, said he had never found the hydrogen content of British coals was much more than 4 per cent.; 3.5 or 4 was the usual percentage of hygroscopic moisture in the coals used in the Midlands, and it had very little ill-effect on pulverising. "Bird-nesting" had been experienced, due to the use of fuels with a low fusion ash point. Yorkshire and Derbyshire coals had invariably a low fusion ash point, in the neighbourhood of 2,100 deg. F., and they would fuse at 13 per cent. CO_2, which was equivalent to a furnace temperature of about 2,300 deg. F., and give trouble. When the trouble occurred soot blowers were used, and the method adopted with a view to preventing its occurrence was to allow a certain infiltration of air at the bottom of the chamber, which would creep up the side walls and tend to keep the furnace temperature within limits and restrict the CO_2. One could light up in about 30 seconds by means of a torch, and could apply full-load conditions in 30 seconds and obtain a CO_2 content in the flue gases of 14 or 15 per cent., which was convincing proof that combustion was self-supporting and no refractory was required. He was quite convinced that the dust problem need never worry anybody who desired to install pulverised-fuel plant. His figure of 1s. 6d. per ton included all costs, and he could not see how one could operate a stoker plant for nothing. If the capital cost of pulverised-fuel plant were 75 per cent. more than that of stoker plant, the former would never have been installed at Derby. One could burn any coal on a mechanical stoker "after a fashion," but one could burn any coal in pulverised-fuel plant properly and obtain the highest efficiency. The cost of the coal pulverised at Derby was about 30 per cent. cheaper than that used for stoker firing.

Legal.

Fraudulent Electricity Consumption Charge Dismissed.

The Times reports that a summons alleging that Mr. Reginald Algernon Glindon, dentist, Worple Road, Wimbledon, had fraudulently used electricity at his premises was dismissed by the Wimbledon magistrates on March 6th. The chairman, in announcing the decision of the Bench, said that Mr. Glindon left the Court without any imputation or stain upon his character as a result of the proceedings. The magistrates desired him to say that in their opinion greater care ought to be taken in the preparation of such cases. Mr. Frank Powell, defending, applied for costs, but the chairman said that the Bench did not feel justified in allowing costs. It was alleged for the prosecution that at Glindon's house a standard lamp

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had been attached to the power wiring so that current for lighting was obtained at the power rate of 1d. per kWh. Mr. Glindon denied the charge, stating that a maid put a lighting point out of action by connecting up a vacuum cleaner to it instead of using the power plug. He therefore connected the light to the power plug until the light could be put right.

Glasgow Electricity Department's Accounts.

Sheriff Macdiarmid, on March 6th, issued his decision on a point that arose in the action referring to the Corporation electricity department's accounts, in which a ratepayer asked the Court to order the Corporation to lodge in Court full details of certain items referring to rent, rates, and taxes (£189,058); management expenses £12,644); and outstanding revenue assets (£29,769). The Sheriff has ordered the Corporation within 14 days from March 5th to lodge in process full details of all the items objected to. He continued the case till March 21st and granted leave to appeal.

British Thomson-Houston Co., Ltd., v. Uneedus Electrical Service.

This action came before Mr. Justice Eve, in the Chancery Division on March 8th, on a motion by the plaintiffs for an injunction to restrain infringement of their letters patent. Counsel said defendants were W. R. Bradley and his son, who were partners in the business.

Mr. Bradley, who appeared in person, was asked by his Lordship how he came to infringe the patents. Defendant said he had been going round with his son selling a few lamps which he had got from a man whom he did not know.

His Lordship said that the object of the action was to find out where the lamps came from. They might have been stolen goods.

Counsel asked for an injunction and an inquiry as to damages, and his Lordship made an order to that effect, and said that defendant must pay the costs.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Climate and Overhead Lines.

I was very interested in the report in your issue of January 25th of the Overhead Lines Association meeting at which Mr. G. W. Molle read a paper on the above subject, the main conclusion of which was that a 50-mile wind never coincides with ice accumulation on a wire and 10 degrees of frost; that consequently the Electricity Commissioners Regulations have a wrong basis, and that wind pressure and temperature should be the only considerations.

Mr. Molle appears to have made a thorough search through meteorological statistics, but I think he may have missed the devastating storm of March 27th, 1916, when so much havoc was done to the overhead telegraph and telephone lines of the Post Office and the railway companies. I have not the exact figures by me, but certainly in that case a wind greater than 50 miles an hour coincided with accumulations of over 2 inches of frozen snow on the wires. In the case of the Post Office alone 2,150 poles were broken, 6,050 were uprooted, and 33,300 were blown down, a total of 41,500 poles and 17,000 miles of wire broken. The railway telegraphs were similarly affected. The storm extended from the Humber to Pembroke and from the Wash to the Bristol Channel. Telegraph wires may be brought down by a silver frost, or by the accumulation of damp snow, subsequently freezing, and followed by a gale. In the first case descending rain freezes on the wire, accumulates, and forms a tube of transparent ice, which may break the wire even if there is no wind. In the case of frozen snow, light lines may be brought down, but not the heavier wires unless a strong wind follows the accumulation of the snow. In that particular storm the snow, or rain, was driven against the wire, where it froze hard on the windward side of it in a horizontal band of ice of little more thickness than the wire, but some 2 in. in width. Slabs of ice were formed from top to bottom of the poles on the windward side several inches thick and approximately of the width of the pole, where it was in contact with the pole, and tapering down towards the N.E. That great accumulation of solid ice, coupled with the very high and cyclonic wind, wrought the havoc referred to above. Storms of equal severity have occurred at about 10-year intervals and extensive breakdowns of communication circuits have always been associated as a combined effect of ice loading and wind.

It was stated in the paper that snow and ice accumulate on communication lines, but not on power lines, and, of course, if that is correct then the basis of the Electricity Commissioners Regulations is obviously wrong. There were few overhead power lines erected in the path of the 1916 storm and no comparison can be made of their behaviour with communication lines, but surely it should be easy to verify the contention now that overhead power lines are so common. If snow and ice do not adhere to power wires in this country Providence must be specially considerate to us, as they undoubtedly do in the U.S.A., where extensive breakdowns of overhead power lines occur periodically when there is a combination of sleet with high winds. As you are no doubt aware, Sir, the Safety Regulations of the U.S.A. are practically the same as in this country, *viz.*, ice loading, wind, and temperature. There are, however, classes depending upon assumed weather conditions. In the heavier loading districts allowance has to be made for ½ in. of ice, an 8-lb. wind, and a temperature of 0 deg. F. In medium loading districts the ice figure is reduced to ¼ in., the wind is 8 lb., and the temperature 15 deg. F. In the light loading districts no ice, a 12 lb. wind, and 30 deg. F. are reckoned. In several European countries and Japan ice loading and wind have to be allowed for when calculating the factors of safety under the regulations in force, but in many cases there is the alternative of a higher wind and temperature, the most unfavourable applying. Under the old Board of Trade Regulations no allowance was made for ice load, the calculations having to be made on the assumed wind pressure of 25 lb. per sq. ft. on 0.6 of projected area. I was surprised to find that during the discussion no one called attention to the point that where ice loading is *not* taken into account in the calculations, and ice in fact *does* accumulate on the wires, if light gauge wires are erected with a proper factor of safety then the larger gauges of wire will have an unnecessarily high factor of safety; whilst, if the large gauges have a reasonable factor of safety, then the smaller gauges will be unsafe. It was undoubtedly these considerations that decided the Commissioners to throw over the old Board of Trade Regulations based on a very high wind and temperature, for those based on a much lower wind velocity, combined with ice and temperature allowances. However that may be, if it is a fact that ice and snow do not adhere to power lines this point has no significance.

I have no knowledge as to this, but I see frequent references to short-circuits on power-lines being caused by accumulations of snow falling from one-phase wire, which then springs up and touches or becomes entangled in the others on which the snow has remained. It is an important matter, as any relaxation of the regulations in this respect might lead to widespread destruction of lines when a storm like that of March, 1916, occurs again, as undoubtedly it will.

S.C.B.

March 3rd, 1929.

Ex-Siemens Men.

The undersigned have had inquiries from time to time whether there is an organisation where ex-Siemens men can foregather, and it appears that such an organisation would meet the wishes of many.

We are, therefore, seeking the courtesy of your columns to invite those who have been connected with any of the Siemens concerns in the past, both at home and overseas, to communicate with one of the undersigned.

If there is sufficient response, it is proposed to form a small committee to arrange, in the first instance, a reunion.

J. Snow Huddleston,
Union Cable Co., Ltd.,
Dagenham.

E. P. Barfield,
Wild-Barfield Electric Furnaces, Ltd.,
Elecfurn Works, North Road, Holloway, N.7.

March 11th, 1929.

London Trunk Power Cables.

The correspondence under the above heading in your recent issues has been of natural interest to us, inasmuch as we specialise in the protection of all classes of buried cables.

Mr. K. Bell suggests that, rather than protect 66,000-volt cables with either reinforced-concrete slabs, or wooden covers, as an alternative, presumably for greater protection, such cables should be drawn into ducts. We must agree with your correspondent who signs himself "Resident Engineer" that such a method increases considerably the number of joints (always weak spots in a cable line), but we are also desirous of emphasising that, owing to their limited thickness and brittle nature, ducts offer considerably less resistance to a blow from any excavating implement than any other approved method of cable protection.

"Resident Engineer" states that "the usual method of covering cables for protection with concrete covers marked 'Electricity' appears to be quite satisfactory, but I do not favour the wooden protective covering." We are glad to be again in agreement with him regarding protection with wooden covers, which deteriorate rapidly, no matter how well creosoted, and ultimately completely fail to serve their purpose. We are, however, in fairness to ourselves, compelled to object strongly to his statement that the usual method of covering cables is by concrete covers, and consider we can justly claim that the usual method of covering e.h.p. cables is with our special interlocking tiles stamped "Danger Electricity." We base this claim on the fact that we supply these to approximately 75 per cent. of the leading electricity undertakings in the British Isles, and also ship large quantities for important contracts abroad.

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Our interlocking tiles will not deteriorate in any soil, as will boards, no matter how well creosoted; also, they set up no adverse chemical action, as some concrete has been known to do. Our interlocking device makes lateral displacement impossible. Finally, in comparison with either boards or concrete, our tiles have the distinct advantages of being 100 per cent. British and cheaper.

H. J. Baldwin & Co.

Cheapside, Nottingham, *March 8th*, 1929.

Prepayment Meters.

The relations between the consumer and the undertaking with regard to prepayment meters depend entirely on the terms of the agreement signed by the consumer.

The insertion of the following clauses in the agreement for supply appears to be adequate protection :—

Consumer Responsible for Damage.—The consumer shall be responsible for the due care and safe custody of the meter, main fuses, and other property of the Council, and in case of loss or damage by fire, or in any other manner, shall make good such loss or damage. He shall also be responsible for any electrical energy consumed on his premises, until three days' written notice is received from him requiring the supply to be discontinued, notwithstanding that he may in the meantime have ceased to occupy such premises. Subject to the general provisions with reference to meters contained in the foregoing terms and conditions for the supply of electricity, the record of the meter shall be conclusive evidence of the amount of electricity supplied.

Prepayment Meters.—Where prepayment meters are fixed, payment shall be made by the placing of the required coin in the meter and the consumer shall be accountable to the Council for the safe custody of the money until it shall have been collected by the Council's authorised officials and the official receipt shall have been given in exchange therefor (the authorised officials can be identified by their numbered badges).

In case of any defects or failures of the apparatus contained in the meter for controlling the supply and in case, for any cause, the sum placed in the meter is found to be less than the sum which ought to be there, having regard to the quantity of electrical energy recorded, the consumer shall forthwith on demand pay the deficiency.

No coins other than the legal coins of the realm, for which the prepayment meters are constructed, or any metal, or other, disks shall be inserted in the meter.

E. W. Jones,
U.D.C. Electricity Department.

Mountain Ash, *March 8th*, 1929.

Service Boxes.

I have been very interested in the correspondence relating to the above subject. Most mains engineers have definite views on the matter, but after all the simplest method of completing a low-pressure service joint would appear to be by enclosing it in a cast-iron box filled with compound, provided it can be shown that this method stands the test of time.

The system with which I am concerned has about ten thousand service joints so made, and joint box trouble is rare in the extreme. Joints made twenty-five years ago have been opened up and found to be in excellent condition.

I think, therefore, that a joint simply enclosed in a cast-iron box properly topped up, is at least as reliable in service as the more scientifically correct lead sleeve. It is certainly cheaper, both as regards time and material.

H. G. S.

March 8th, 1929.

[Two or three letters reached us too late for publication this week.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be numbered and abridged, and all subsequent proceedings will be taken.

1927.

21,264. "Wireless signalling systems." Q. C. A. Craufurd and C. C. J. Frost. August 12th, 1927. (305,953.)

21,697. "Television or like systems." J. L. Baird and Television, Ltd. August 17th, 1927. (306,158.)

26,850. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and O. A. Pearce. October 10th, 1927. (305,956.)

27,004. "Electrical switches." J. A. Crabtree. October 12th, 1927. (305,957.)

27,433. "Wireless receiving sets." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 15th, 1927. (306,056.)

27,614. "Producing gramophone records from wireless electrical impulses." J. Wilson. October 18th, 1927. (306,164.)

27,692. "Sound amplifiers." F. A. Mitchell. October 18th, 1927. (306,166.)

27,993. "Apparatus or devices used in the reproduction of sound." W. A. Halden. October 21st, 1927. (306,193.)

29,871. "Production of insulating material.' B. Marchini (G. Passatti). November 8th, 1927. (306,011.)

30,240. "Lighting apparatus." G. Murray and V. O. Simpkins. November 10th, 1927. (305,963.)

30,338. "Systems for repeating electrically the readings of gyroscopic compasses." A. E. White (Sperry Gyroscope Co.). November 11th, 1927. (306,057.)

30,371. "Storage batteries." C. H. Everett and G. R. Carr. September 3rd, 1927. (296,660.)

30,435. "Telephone systems." Associated Telephone and Telegraph Co. January 8th, 1927. (283,193.)

30,454. "Apparatus for electrically measuring fluid flow." H. Martin. November 12th, 1927. (306,014.)

30,526. "Oil-immersed electric switchgear." A. West & Co., Ltd., and A. West. November 14th, 1927. (306,016.)

30,885. "Protective arrangements for alternating-current electric circuits." A. Reyrolle & Co., Ltd., J. Mirrey and G. H. Gardner. November 17th, 1927. (306,178.)

30,955. "Lighting of indicating instruments on automobile and like vehicles." A. L. Jones. November 17th, 1927. (306,183.)

31,023. "Method for the production of cathodes for electric discharge tubes." Vereinigte Gluhlampen und Elektricitäts Akt. Ges. April 30th, 1927. (289,763.)

31,185. "Electric fuses." A. Reyrolle & Co., Ltd., B. H. Leeson and R. H. Brierly. November 21st, 1927. (Addition to 276,740.) (306,197.)

31,186. "Electric switches." A. Reyrolle & Co., Ltd., J. Mirrey and A. Allan. November 21st, 1927. (306,198.)

31,962. "Auxiliary control means for prime movers." British Thomson-Houston Co., Ltd. November 29th 1926. (281,329.)

32,165. "Electromechanical devices of the induction type." E. W. Challans and Westinghouse Brake and Saxby Signal Co., Ltd. November 29th, 1927. (306,211.)

33,738. "Electrode holders for arc-welding." R. Sarazin. December 18th, 1926. (282,392.)

34,439. "Electromagnetic testing of steel-wire ropes and other articles of magnetizable material." T. F. Wall. December 20th, 1927. (Cognate applications 5,547/28 and 12,320/28.) (306,292.)

34,865. "Electric discharge devices." British Thomson-Houston Co., Ltd. December 23rd, 1926. (282,766.)

1928.

23. "Electrolytic deposition of chromium." Langbein-Pfangauser-Werke Akt. Ges. December 1st, 1927. (301,478.)

1,049. "Manufacture of moulded articles, such as switch bases, fuse holders, and other electrical apparatus." J. A. Crabtree and J. R. Dolphin. January 12th, 1928. (306,249.)

1,348. "Sound recording and reproducing apparatus." H. Hallam and J. R. M. Hellary. February 17th, 1927. (285,454.)

1,404. "Inter-valve couplings for thermionic valves." A. F. Pollock and D. A. Pollock. January 16th, 1928. (306,253.)

2,811. "Sound reproducing and receiving instruments." E. V. Mackintosh and C. French. January 28th, 1928. (306,263.)

3,669. "Loud-speaker apparatus for wireless telephony." W. Bryan. February 6th, 1928. (306,268.)

4,368. "Loud-speaking apparatus for wireless or other purpose." E. J. Marriott and C. French. February 11th, 1928. (306,278.)

5,051. "Conveyors for baths for the treatment of objects, more particularly for electrolytic baths." Siemens & Halske Akt. Ges. October 5th, 1927. (298,184.)

5,301. "Manufacture of thermionic cathodes for electric discharge devices." M.O. Valve Co., Ltd., A. L. Reimann and J. W. Ryde. February 20th, 1928. (306,281.)

6,120. "Head-lights for motor vehicles and the like." M. Guye and R. Furrer. March 9th, 1927. (286,689.)

6,714. "High-frequency telephone systems." J. J. V. Armstrong (Telefunken Ges. fur Drahtlose Telegraphie). March 3rd, 1928. (306,292.)

6,971. "Electric meters." British Thomson-Houston Co., Ltd. March 7th, 1927. (286,647.)

8,100. "Circuit arrangement for telephone installations with main and branch exchanges and selector working." Siemens & Halske Akt. Ges. August 30th, 1927. (296,363.)

8,101. "Circuit arrangement for double-duty selectors in telephone installations." Siemens & Halske Akt. Ges. September 1st, 1927. (296,424.)

9,932. "Electric accumulators." E. Thomas & Williams, Ltd., and J. Bowen. April 2nd, 1928. (306,312.)

10,173. "Current transformers." International General Electric Co., Inc. April 13th, 1927. (288,606.)

11,347. "Telephone systems." Siemens Bros. & Co., Ltd., and D. P. Long. April 17th, 1928. (306,323.)

12,649. "Sheet-metal laminated cores for dynamo-electric machines." Siemens-Schuckertwerke Akt. Ges. August 27th, 1927. (296,299.)

13,121. "Electric light fittings." Maxlume Lighting and Heating Co., Ltd., and F. W. Thorpe. May 4th, 1928. (306,336.)

13,144. "Electric switchgear." C. Nunn. May 4th, 1928. (306,337.)

15,275. "Induction voltage regulators." British Thomson-Houston Co., Ltd. May 25th, 1927. (291,058.)

15,691. "Protective arrangement for springs used in association with electrical apparatus." Hermsdorf-Schomburg-Isolatoren Ges. May 1st, 1928. (306,344.)

18,358. "Electrical circuit-controlling apparatus." Metropolitan-Vickers Electrical Co., Ltd. June 24th, 1927. (292,922.)

21,101. "Cathode-ray oscillographs." Dr. W. Rogowski and Dr. E. Flegler. August 18th, 1927. (295,710.)

23,314. "Avoidance of cross-talk in telephone cables." Felten & Guilleaume Carlswerk Akt. Ges. August 11th, 1927. (295,592.)

23,359. "Means for transmitting radiant energy such as light, and apparatus for use therewith." Marconi's Wireless Telegraph Co., Ltd. August 13th, 1927. (295,601.)

26,000. "Circuit arrangements for use in high-frequency communication systems." Marconi's Wireless Telegraph Co., Ltd. September 10th, 1927. (297,004.)

32,520. "Electric signalling-circuit for use in mines." Siemens Schuckertwerke Akt. Ges. November 23rd, 1927. (301,021.)

36,351. "Trolley-heads for electric traction." C. C. G. Taylor. September 14th, 1928. (Divided application on 26,558/27.) (306,378.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 6th :—

The Whispering Cleaner. No. 495,350. All goods in Class 6.—Siemens-Schuckertwerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake and Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Stradonola. No. 497,086. Class 8. Instruments and apparatus and parts thereof for use in radio-telephony and telegraphy.—A. J. Balcombe, Ltd., 51, Tabernacle Street, E.C.2.

Carbeloy. No. 497,590. Class 6. Machine tools.—British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

Ramaco. No. 496,230. Class 8. Instruments and apparatus for use in radio-telephony.—Radio Maintenance Co., 8, Clarendon Road, Edgbaston, Birmingham.

Rotorohm. No. 498,852. Class 8. Apparatus for use in radio-telegraphy and telephony.—Rotor Electric Co., Ltd., 34, Kingsway, W.C.2.

Wild-Barfield. No. 497,389. Class 18. Electric furnaces and electric heaters.—Wild-Barfield Electric Furnaces, Ltd., North Road, Holloway, N.7.

Tensulam. No. 477,436. Class 50. Insulating preparations (electrical) of asbestos, mica, resin, oils or bitumen.—Berry, Wiggins & Co., Halling Works, Channelsea Road, E.15.

Zico. No. 497,466. Class 50. Bell pushes, ceiling rosettes, table and floor standards, &c.—Albert Feustel, trading as P. Zimmermann & Co., Deutschkatherinenberg, Germany. (British representatives: Hook & Willis, Ltd., 29, Ely Place, Holborn, E.C.1.)

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALSTON (Cumberland).—Extensions, Ruth Lancaster James Cottage Hospital; W. Lawson, hon. secretary, Roseland (returnable deposit of 5s.).

ARBROATH.—Extensions to Infirmary (£15,000); Mr. Clark, architect.

ASHFORD (Middlesex).—32 houses and 21 bungalows, Feltham Hill Road; Sandell & Wren.

BANSTEAD.—Isolation hospital extensions for Epsom, Sutton, Carshalton and Leatherhead Joint Hospital Board; A. C. Williams & Pettett, architects, Reids Building, Ashley Road, Epsom (returnable deposit of £3 3s.).

BARROW.—Hotel, Walney (£30,000); for James Thompson and Co.

BEDDINGTON AND WALLINGTON.—Houses (100), Elmgrove Estate; for C. R. Leach.

BIRMINGHAM.—473 houses, Court Farm Estate; Morris Jacombs & Sons, Ltd. 291 houses, Gospel Farm Estate; Henry Boot & Sons, Ltd. 100 houses, Witton Lodge Estate; W. J. Sims, Sons & Cooke, Ltd. 395 houses, Stockland Green Estate; W. Edwards, Contractors (Birmingham), Ltd. Baptist church, Six Ways; West Midlands Baptist Association (local branch).

BOLTON.—Works extensions, Bury Road; Ainsworth Mercerising Co., Ltd. Extensions, Chandos Street 'bus garage; J. E. Norris & Co.

BRENTWOOD.—Laundry, Mental Hospital (£34,000); Essex county architect.

BRIGHTON.—Extensions, Sussex Eye Hospital (£25,000); secretary.

CHELTENHAM.—50 houses, Steward, Folly Lane.

CHESTERFIELD.—New Boythorpe School (£18,000); Wilcockson & Cutts, architects.

CHORLEY.—Hospital, Preston Road, Rookwood; secretary, Chorley Hospital.

CLITHEROE.—Council school (to seat 600), Brownlow Street; secretary to the Education Committee.

DARLINGTON.—Extensions, ward blocks and operating theatres, Memorial Hospital; W. J. Moscrop, architect (returnable deposit of £3 3s.).

DUDLEY.—Extensions, Guest Hospital, Tipton Road; governors.

DUNFERMLINE.—Extension of West Fife Hospital; secretary to the Hospital.

EASTBOURNE.—Factory, Moy Avenue; commercial garage, Ceylon Place; J. Bowley, architect.

EDINBURGH.—18 houses for Welfare Housing Trust (electrical work); A. H. Mottram, architect, 59, Frederick Street.

EXETER.—Public library (£31,750), for the T.C.; city surveyor.

FLEETWOOD.—Dock extensions (£100,000); for L.M. & S. Railway.

GLASGOW.—Reconstruction of Waldorf Palais de Dance (to be wired for talking pictures); C. J. McNair, architect, Bath Street. 300 houses for Corporation; architect, Housing Department. Shops at Half Way for Kinning Park Co-operative Society; the manager. Hall for 500 persons, adjoining Pollokshaws Burgh Hall; city engineer.

GODALMING.—Additional 74 houses, for the T.C.; borough surveyor.

GRAYLINGWELL.—Extensions, Mental Hospital (£130,000), for West Sussex C.C.; clerk, Chichester.

GUILDFORD.—Extensions, High Street and Quarry Street, for F. W. Woolworth & Co., Ltd., bazaar proprietors, Kingsway, London.

HASTINGS.—Additions, Tilbury Home, West Hill, for Ranyard Mission; Searle & Searle, architects.

HORWICH.—School (£24,535), for Lancs. E.C.; education architect, Preston.

HOVE.—Nursery school (£37,000), for the Borough E.C.; director of education.

HULL.—154 houses, Rustenberg Street site; city architect. Alterations, Tivoli Theatre; Mr. H. Slingsby. 254 houses, Derrington Estate; H. M. Nowell, Ltd. Infants' school, Hall Road (£16,000); Hinch Bros., Ltd.

ILKESTON.—Factory, Bath Street; Henry Carrier & Son, Ltd.

KESWICK.—Re-erection of Royal Oak Hotel, for the Lake District Hotels, Ltd.; Colonel P. M. Hope, managing director (£15,000).

KIRKCUDBRIGHT.—Hostel for Scottish Artificial Silks, Ltd.; W. A. MacKinnell, architect, Town Hall.

LANCASTER. — Extensions, Royal Infirmary (£75,000); secretary.

LEAVESDEN.—Extensions, Mental Institution (£166,903); C. Miskin & Sons, Ltd., Bedford Row, W.C.

LEEDS.—Conversion Alhambra Palais de Danse to skating rink; H. Pemberton. Branch library at Hunslet; specification, &c., from W. T. Lancashire, city engineer; tenders to Town Clerk's office, Great George Street.

LIVERPOOL.—Women's hospital, Faulkner Street; Committee of Liverpool Women's Hospital.

LONDON (East Ham, E.).—Alterations, Empire Kinema, Barking Road; G. Coles. 234 houses, Roman Road Estate; J. Stokes & Son. 51 houses, White Horse Road; J. H. Lohden.

(Finchley, N.).—Maternity ward, Memorial Hospital; governors.

(Camberwell, S.E.).—Staff accommodation, Grove Hospital (£21,635); Metropolitan Asylums Board.

(Southwark, S.E.).—Reconstruction of workshops at central fire station (£6,000); L. H. & R. Roberts.

MAIDSTONE.—Additional housing scheme, Mote Park (130 to 150), for the T.C.; borough surveyor.

MANCHESTER.—Extensions, College of Technology, Sackville Street; Education Committee. Extensions, Oaklands Home; Manchester and Salford Blind Aid Society. Hospital, for the Committee of the Manchester Northern Hospital for Women and Children.

MILTON REGIS (Kent).—Housing scheme (92), for the U.D.C.; A. W. Callaway, surveyor.

MITCHAM.—Houses (87), for I. H. Wilson. Houses (67), Western Road, for H. Poulson.

NORTHAMPTON.—Extensions, boot factory, Adnitt Road; L. Sears & Co., Ltd.

ORMSKIRK.—Reconstruction, Scarth Hill pumping station, with engine house, &c., for Southport, Birkdale and West Lancashire Water Board; C. B. Ede, engineer, 14, Portland Street, Southport (returnable deposit of £2 2s.).

PAISLEY.—Extensions at Royal Alexandra Infirmary, to cost £6,000; the medical superintendent.

PENRITH.—Electric light installation, Christ Church; vicar.

PETERHEAD.—Conversion of mansion house into municipal offices; burgh surveyor.

PORT GLASGOW.—Conversion of mansion house into children's home (ray treatment); Sir James Lithgow.

POTTER'S BAR.—Housing scheme (118), for South Mimms R.D.C.; surveyor.

READING.—Aerodrome, Woodley, for Phillips & Powis, Oxford Road.

ROCHESTER.—Four blocks of flats, for the T.C.; W. Law, city surveyor (returnable deposit of £3 3s.).

ROTHERHAM.—Offices, shops, showrooms and workshops (£20,000), for the T.C.; borough engineer.

SHEFFIELD.—56 houses, Wisewood Estate; Messrs. H. Freckingham & Sons, Ltd. 47 houses, Wisewood Estate; W. Ellis.

SHERBORNE (Dorset).—Extensions, Yeatman Hospital (£6,000); John Dingley, hon. secretary.

SMETHWICK.—Works extensions, Dartmouth Road; Midland Motor Cylinder Co., Ltd. 58 houses, Smethwick Hall Estate; Housing, Ltd., Blackheath.

SOUTHPORT.—Ice skating palace; Gilbert Wilson, architect.

STAMFORD (Lincs.).—56 houses for T.C. at New Cross Road; borough surveyor.

SUNDERLAND.—Extension of Royal Infirmary (£50,000); for the governors.

TIVERTON.—Hospital (£30,000), for the Committee; secretary.

TWICKENHAM.—Garages, shops and flats, Richmond Road (£25,000), for W. Hinde.

WISBECH.—Factory, for the British Basket Co., Ltd.

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The

Electrical Review

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Electrical Development.

FOR several reasons more than usual interest attaches to the report of the past year's activities of the Council of the British Electrical Development Association. It has been a change-over period and we think the industry will wish to congratulate Lieut.-Col. W. A. Vignoles, the Director and Secretary, and his staff, upon the fact that steady progress has been made, and that greater support has been received from all sections of the industry than ever before. Reorganisation of the Provincial Area Sub-Committees has been proceeding and this has promoted new interest in both the supply and manufacturing departments and secured additional membership and financial support. When the new organisation is thoroughly established still greater progress of this kind is expected.

Good work has been done by the Industrial Electric Heating Sub-Committee, both in the carrying out of investigations and the writing of papers and reports, and in the organisation in conjunction with local electricity authorities of most interesting and effective exhibitions. From our abstract of the Council's report appearing on another page it will be seen that manufacturers of electric refrigerators were generally satisfied with the results of their particular sectional campaign, and that the National Window Display proved to be excellent propaganda, 704 displays being exhibited in different parts of the kingdom. There has been a good deal of exhibition activity included in the year's operations, not merely the holding of exhibitions, but preparatory and deliberative work for such events as the Newcastle-on-Tyne exhibition, of which we gave particulars in our last issue, and the proposed Faraday Celebrations to be held in 1931. It is a matter for regret that Electric Vehicle Committee proceedings seem still to be on so small a scale; this is a section where one has often longed for more "push and go." Even now we will not give up hope. The Factory and Workshop Lighting Campaign was a very specialized affair and the

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Council reports that it caused considerable interest in all parts of the country and brought about direct results and definite business. Next autumn there will be a more or less expert follow-up effort among specially prepared lists of factory owners. It is well that everybody should know that the Association has a large collection of lantern slides and special electrical kinematograph films for use by those engaging in electrical propaganda work; and a very satisfactory feature of the finances is found in the transfer to Reserve of £5,000 from the surplus at December, 1928. We have no doubt that there will be ample need for special funds in the year 1931, if not before.

One of the most important matters touched upon in the report is the very useful work that is being done by electrical women in arousing electrical interest in the minds of women in general throughout the country.

The annual dinner of the Association took place on Thursday evening last week, with Sir John M. Gatti, the president, in the chair, and the Earl of Birkenhead, who has lately become identified with the electricity supply industry, as guest. The Earl had something to say regarding the problem of encouraging foreign capital into British electrical enterprise, but he was on ground which everybody will consider appropriate to the work of the Association when he referred to the enormous scope that there is for developing the domestic load. It is emphatically in accord with our oft-reiterated policy that no limit can be placed to the early progress in this connection with excellent benefit both to the people of the United Kingdom and to the electrical industry. An interesting feature of the evening was the speech of Mr. J. W. Beauchamp, for not once during his period of the directorship was his voice heard at the annual functions. This time he toasted the guests, Sir Herbert Morgan replying.

The annual general meeting of the Association followed on Friday afternoon, when Dr. S. Z. de Ferranti was elected president in succession to Sir John Gatti. We are convinced that no more popular election could have been made. The Association stands for the popularisation of electricity supply and for many years Dr. Ferranti has been an outstanding leader of thought in that movement. We have every reason to look forward to a year of unhesitating advance and record success.

Imperial Chemical House.

The building and equipping of Imperial Chemical House, Millbank, London, the new headquarters of Imperial Chemical Industries, Ltd., the electrical equipment of which we describe in following pages, seem to have been governed by one consideration only—everything must be the best. Because of that the extent to which electricity has been employed is particularly interesting and encouraging. There is not an important service in the building in which electrical energy does not play an essential part—lighting, heating, cooking, lifts, pumps, telephones, bells, and so on.

It is not often that so many specialised electrical schemes are embodied in one installation, at any rate in this country, and there is something new to see for almost any electrical engineer, no matter in what branch of the industry he is particularly interested.

The outstanding feature of the electrical work is no doubt the lighting system. In view of the attention that is being given nowadays to obtaining effect by means of elaborate exposed fittings, the installation at Imperial Chemical House, which embraces some 3,000 points all arranged on the concealed principle, and of which some examples of the effects are indicated by means of reproductions of special night photographs, is especially commendable.

A very interesting point is that the schemes were drawn up by engineers who apparently have no personal bias in favour of electrical methods, and we congratulate Sir Frank Baines, K.C.V.O., the architect, and his staff, as well as the manufacturers and others employed on the installation, on the results obtained.

The G.E.C. Share Policy.

In proposing to make a large issue of ordinary shares to the general public, restricting them to British subjects, the General Electric Co., Ltd., was adopting an original course and one which Sir Hugo Hirst, Bart., the chairman, says will have to be adopted by other concerns in the interests of British national industry. The company has been emphatic in announcing its intentions to preserve its British national character, and the fact that it has been deprived by recent American buying of its shares of 60 per cent. of its shareholders has made necessary action more drastic than that taken last September in altering the Articles. Many of the shareholders have been and still are the company's customers, and the directors were taking the above action partly with a view to ensuring a continuance of that state of affairs.

The September resolutions providing for the retention of the control in British hands did not prevent considerably more than half of the ordinary shares going to the United States. It will easily be understood that a British board would find its position almost untenable if an overwhelming majority of the shares remained in American hands. Therefore to balance the American holdings, while redeeming the company's debentures, the directors are creating this new block of British ordinary shares.

It will be interesting to review briefly the market price movements in the shares. A year ago G.E.C. ordinary shares stood at 35s. They gently appreciated and in November and December were steady at 42s. In the middle of the latter month there was a slightly greater rise, which was maintained until January, when there was a sudden jump to 60s. Eventually they went to about 80s. and dropped to about 65 but still remained high until the directors' recent announcement was made, when they shed 10s. There is little doubt that American buying and purely speculative operations were responsible for the inflated prices reached for securities whose reasonable quotation based on the yield for an industrial security of the class could not be more than the price of the new issue—42s. During the early days of this week the shares were at one time dealt in at 70s., so that it can be seen that, from the "market" point of view, if the new shares were offered to the existing shareholders at 42s. the margin would provide a very substantial "bonus." The most casual students of G.E.C. finances have known for years past that Sir Hugo and his colleagues have regarded the 7 per cent. debenture stock as a blot on their balance sheet. It was issued, however, at a time when there was no alternative. The issue of 1,500,000 shares at £2 2s., that was contemplated, but is now announced as postponed, will bring in an accession of British ordinary shareholders and customers—a useful set-off against the recent American purchases; and it will enable the heavy interest debentures to be redeemed, reducing substantially the heavy charges which stand in front of the preference and ordinary securities. Thus will there be a better prospect for the ordinary shareholder in respect of interest and bonus, and the directors will preserve the British holding and the old traditions.

The postponement of the issue is due to a request cabled by the American Committee asking the G.E.C. board to consider negotiations on some different financial basis which would continue effective management without depriving American stockholders of proprietary ownership. To this cable Sir Hugo Hirst replied welcoming some such consultation so long as the board attained the objects it had in view; indeed he mentioned that the G.E.C.'s own financial advisers had already elaborated a plan "which in our opinion safeguards both objects."

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New London Tramcars.

A brief description of a new luxury type of electric tramway car that has been designed for service on the Metropolitan Company's system.

An entirely new type of tramcar has been built for Tramway Companies connected with the Underground Railway group, which has for some years been giving close attention to the design of new tramway cars, and two years ago put into service two cars built on somewhat novel lines.* As a result of experience and the valuable criticisms of passengers, an entirely new type of tramcar has been evolved and an experimental car of this latest design is now finished, fig. 1, and ready, when licensed, to be put into service on the Metropolitan Electric Tramway Company's lines. It has been designed and constructed by the Union Construction Company (the builders of the latest type of tube railway car) working in collaboration with the tramway staff. The intention of the designers is to provide the public of London with a large-capacity vehicle, running swiftly and silently, giving the maximum of comfort, and capable of dealing with mass traffic.

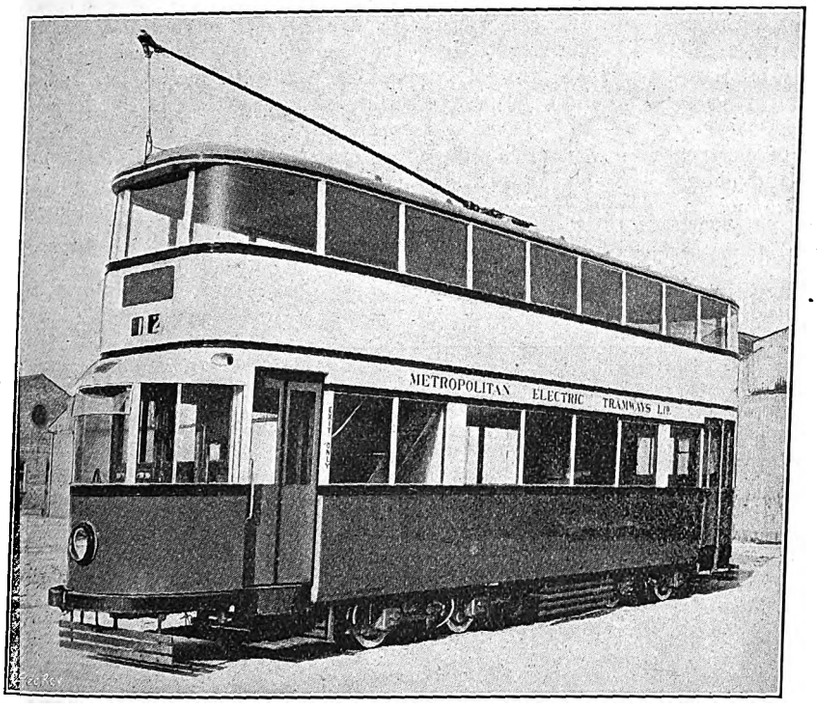

Fig. 1.—An Experimental M.E.T. Car.

An advantage of the new car which is immediately apparent is the separate entrance and exit doors, fig 2, while on boarding the car the impression is at once obtained of comfort, light, and general airiness. Large platform accommodation adds to the sense of roominess and the seats are of the cross type and upholstered in moquette.

The decoration is attractive and the centre of gravity is low, which makes for steadiness and stability when running at high speed. The driving equipment consists of four Metro-Vick motors of 35 h.p. each, which give quick acceleration. The comfort of the driver and conductor has not been overlooked. The driving cabin is so arranged that the driver, like the 'bus driver, may, if he wishes, be seated, having at his command electrically-operated 8-wheel brakes, which can bring the car to a stand-still in a very short distance in case of need, and yet act with smoothness for ordinary stops.

Some thirty-five 40-W lamps illuminate the saloons and platforms; they are semi-concealed in the ceilings. special dipping headlights can be operated by the driver in foggy weather to project a beam on to the track. The lamps over the exit steps are switched on automatically as the doors open. The interior has a cheerful apearance: on the lower deck are seven wide windows each side and on the upper deck 10 aside. In each case the window supports are thin, so that the passengers' view is practically unobstructed. The predominating colour of the interior is grey, all panels being of silver-grey wood.

There will be no lack of ventilation, for in the lower saloon simple apparatus enables four of the windows on each side to be raised and lowered by passengers, as desired; on the upper deck, there are 10 windows of the same type. Each platform, too, has a pair of "drop" windows and all the windows are of a maximum clear opening of 1 foot when fully open. The interiors of both saloons have been designed as free as possible from all mouldings, or corners, which would be liable to form dust traps. The floors are covered with cork carpet. The upper saloon, contrary to the present practice, is equally luxurious as the lower saloon. The companies have for some time been pursuing a policy of reconditioning and remodelling their rolling stock, and the result was reflected in the traffic in 1928, for the passengers carried amounted to 192,867,000, against 180,800,000 in 1927, an increase of 7 per cent.

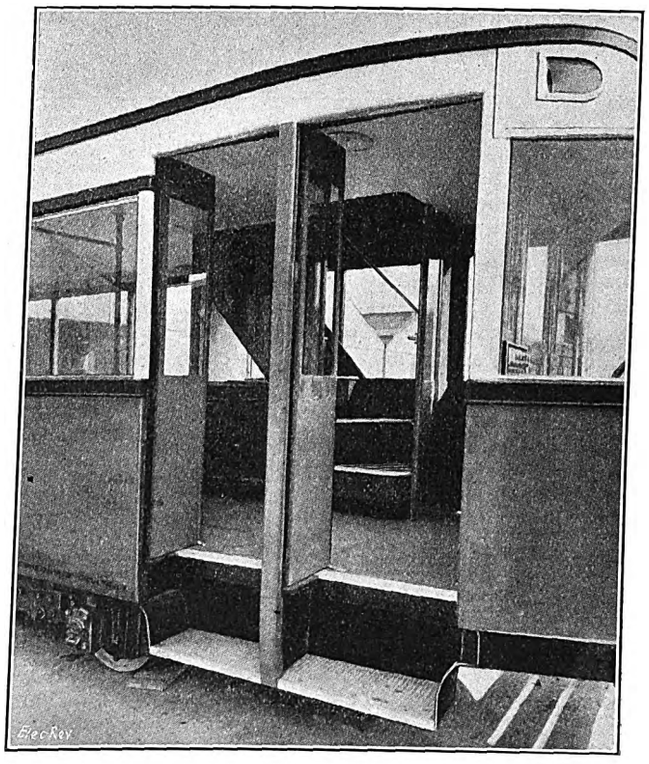

Fig. 2.—Entrance and Exit Doors.

* Electrical Review, March 11th, 1927.

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Imperial Chemical House.

Electricity is used extensively at the new headquarters of Imperial Chemical Industries, Ltd., for lighting, cooking and other services.

THE fullest possible use is made of electricity in Imperial Chemical House, situate at Millbank, London, the new head offices of Imperial Chemical Industries, Ltd., and there are many novel and interesting features in connection with the electrical equipment installed. The architect, Sir Frank Baines, K.C.V.O., has given considerable attention to the engineering services, realising that they play a vital part in the working of a large commercial building. Some idea of the extent of the electrical installation may be gathered from the fact that about 75 miles of electric cable and wire have been used on the job, and about 25 miles of conduit serves over 3,000 lighting points. The cable was supplied by Messrs. W. T. Glover & Co., Ltd., and the conduit and fittings by the Walsall Hardware Manufacturing Co. The electricity is taken from the mains of the Westminster Electric Supply Corporation at 3-phase, 400 V, 50 cycles. Practically all the motors in the building are supplied at 3-phase, and the lighting and cooking at single-phase, 230 V. The total connected load for the whole installation is about 1,600 kilowatts.

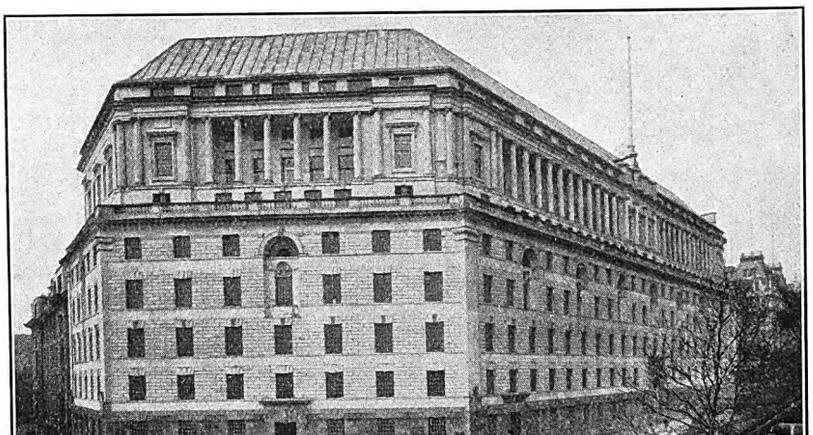

Fig. 1.—Imperial Chemical House.

Messrs. Richard Crittall & Co, Ltd., were entrusted, *inter alia*, with the installation of the equipment for warming and cooling the building. The installation is on the water-circulating panel system, the majority of the panels being cast in the soffits of the concrete floors to form ceiling heaters; supplementary panels are embodied in the external walls under windows in the corridors, and some of the parts exposed to frequent air changes, such as entrance halls, have floor panels. For the heating and hot-water supply there are three boilers, supplied by Messrs. H. & T. Danks (Netherton), Ltd., specially designed for burning anthracite, while a large refrigerator installed in the basement is used for the cooling-water supply. This equipment includes a triple-cylinder totally-enclosed ammonia compressor of Messrs. J. & E. Hall's latest design, directly coupled to a 140-h.p. Crompton Parkinson slip-ring induction motor, fig. 2, equipped with short-circuiting and brush-lifting apparatus, and control gear of the totally-enclosed oil-immersed type. Arrangements are made whereby the supply of power to the mtor is automatically cut off when certain predetermined temperature limits are reached. The compressor and motor are mounted together on a special foundation fitted with shock absorbers to deaden all noise and vibration. The water circulation is accelerated by directly-coupled electrically-driven centrifugal pumps, fig. 5; these, as well as the cold-water supply pumps, were manufactured by Messrs. Mather & Platt, Ltd. In the heating season water is circulated through the system at a temperature of about 110 deg. F., while in the summer, when necessary, cooled water at any required temperature down to 40 deg. F. can be circulated through the coils.

The water supply for the building is obtained from two artesian wells from which water is raised by means of compressed air. Two compressors installed for this purpose are each driven by a 28-h.p. motor, fig. 3; the maximum pressure employed at starting is 135 lb. per sq. in. There is a main storage tank in the basement and water is pumped to four steel storage tanks (capacity 10,000 gallons) in the roof by duplicate surface pumps operated automatically by float switchgear. The pumps are driven by 15-h.p. motors, fig. 5. In connection with the ventilation of the building, which was also carried out by Messrs. Crittall & Co., there are employed 23 extraction fans and 4 inlet fans driven by "Bull" motors.

There are some interesting features in connection with the lift installation in the building, supplied by Messrs. Waygood-Otis, Ltd., particularly as the lifts operate from a 3-phase a.c. supply. In the main entrance hall are four large lifts for general passenger service, the area of each car floor being approximately 25 sq. ft. The winding engines, fig. 4, which are fitted with high-speed internal-resistance motors of Messrs. Waygood-Otis's own design, are capable of raising a load of 2,000 lb. at a speed of 350 ft. per min., serving through a travel of 116 ft. The lifts are of the Waygood-Otis patent auxiliary micro-drive type, and are so designed that accurate stopping of the cars at the floor levels is assured, irrespective of the load or speed. The landing entrances are protected by specially-constructed two-speed self-closing doors, which work with ease and quietness. An interesting feature of the lifts is the illuminated call indicator which has been fitted to each car to warn the attendant when anyone is waiting on the landing for a lift; in place of the usual type of indicator, a soft-tone buzzer is employed, and instead of the usual flag indications used with an ordinary indicator, an illuminated figure appears, guiding the attendant to the right floor. On each of the landings an electric position indicator is fixed, and so arranged that the waiting passengers are able to see at a glance the position of each lift. There are four further lifts of the same type in different parts of the building for passenger service, and in addition there is a special lift devoted to the use of the directors; this lift is operated on the fully-automatic push-button system, and is capable of raising a load of 2,000 lb. at a speed of 350 ft. per min. It is claimed

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to be one of the fastest push-button lifts installed in this country, and is provided with two-speed self-closing doors. An illuminated call indicator is provided similar to those which serve the passenger lifts in the main hall. There are also two electric goods lifts, each capable of raising a load of 2,240 lb. at a speed of 200 ft. per min., travelling through a distance of 116 ft.

Not the least interesting of the equipment in the building is the plant installed in the basement for handling the sewage, drainage and rainwater. The foundations and the bottom floors of Imperial Chemical House are carried down to such a depth that they are below the level of the public sewer, and provision had therefore to be made for lifting all drainage up to the sewer level. After careful consideration of the various methods available for doing this work, it was decided to install two vertical-spindle pumps coupled to suitable induction motors through short lengths of vertical shafting. All sorts of fibrous and solid matter have to be handled. The pumps employed are of the "Stereophagus" type, manufactured by the Pulsometer Engineering Co., Ltd. They are arranged with vertical spindles, so that while the pumps themselves are below the level of the sewage at starting, the motors are carried at a higher level to protect them from any damage due to flood, and at the same time to reduce the amount of floor space occupied. Each pump handles 170 gallons of sewage per minute, discharging it against a total head of 30 ft. The motors are of the protected slip-ring type manufactured by Messrs. Crompton Parkinson, Ltd., and are automatically controlled by a double-unit panel operating from floats in the suction sump. The floats are so set that as the sewage rises in the sump, the pumps are tripped in successively. Normally the capacity of each pump is sufficient to handle the flow of sewage, and then one pump only comes into operation. It continues running until the sump is nearly empty, and then automatically shuts down. If, however, due to storm, the flow of sewage exceeds the capacity of one pump, then the second pump is brought into operation to cope with the abnormal demand. Provision is made on the starter to cross-connect the pumps and floats, so that each pump may in turn cope with the normal flow and thus divide the work between the two sets. Fig. 6 shows one of the motors and the control equipment.

There is an interesting vacuum-cleaning plant, fig. 7, installed in the building by British Vacuum Cleaner and Engineering Co., Ltd. This consists of two exhausters of the multi-stage turbine type, directly coupled to 25-h.p. Crompton Parkinson squirrel-cage motors, 2,900 r.p.m. Ellison oil-cooled motor-starters are provided, and the starting current is kept within 2½ times full-load current, which for the two exhausters is approximately 60 A at 400 V, with thirty operators at work, resulting in a current consumption of approximately 800 W per operator. Each exhauster has an air displacement of 1,200 cu. ft. per minute at 6 in. mercury vacuum, and is connected to a multiple-bag filter which separates the dust from the conveying air before the air enters the exhauster. A horizontal suction ring-main pipe is erected in the basement of the building and connected by two branches into a single cross pipe between the two filters. The ring-main gives off 21 risers or headers passing up through the floors of the building. Each header has a hose-connecting point at each of the nine floors, making in all approximately 190 hose-connecting points throughout the building.

The private automatic telephone exchange which has been installed by the Reliance Telephone Co., Ltd., at Imperial Chemical House, consisting of a 2,000-line automatic switchboard, equipped at present for 1,000 lines, will be, it is claimed, when extended to its ultimate capacity, the largest and most up-to-date private telephone installation in the world. The equipment was manufactured by the General Electric Co., Ltd., and employs the same switches and general design of circuit arrangements as those standardised by the British Post Office for use in public exchanges. The system is auxiliary to the Post Office installation in the building, and its adoption has relieved the operators of the work of dealing with internal calls, which exceed 50 per cent. of the total telephone traffic.

The system operates on the machine-switching fully automatic principle, employing rotary pre-selectors with 25- by 3-point banks, double co-ordinate group selectors of the Strowger type with 330-point banks, and double co-ordinate final selectors with 100-line banks. The equipment is designed to operate on a mixed 3- and 4-digit dialling system, requiring first, second and third selectors. This arrangement has been introduced in order to reduce to a minimum the time taken in dialling. A pre-selector is provided for each line and they are mounted on racks in groups of 100, together with the final selectors.

Two sets of batteries, each consisting of 25 cells having an initial capacity of 293 Ah, form part of the equipment, and there are two motor-generator charging sets, fig. 9, which operate from the 400-volt, 3-phase, 50-cycle supply, each generator having an output of 82 amperes at 57 volts. A power switchboard, fig. 9, which controls the main supply to the motors, the battery charge and discharge, and the ringing and tone circuits, is equipped with two ringing machines, one a motor-generator set arranged to run from the supply, and the other a dynamotor operated from the exchange battery. A main distribution frame is provided for cross-connecting and the termination of the multiple dry-core cables. Visual and audible alarms are given of blown fuses and failures of the ringing circuit. Similar signals are given after an average delay of 1½ minutes if a receiver is left off or the called party fails to clear, while other signals are given after an average delay of half a minute if a release magnet should stick. Circuit-breaker and voltage-drop alarms are also provided. The retarded alarms are operated by means of a time switch which receives an impulse every three seconds from the low-speed interrupter cam and spring assembly on the ringing machines.

Dialling tone, busy tone and ringing tone are incorporated with the switching equipment, and a specially-designed testing set is fitted in a position adjacent to the main frame which, in addition to being designed to make all the usual tests, is fitted with a device for enabling the speed to be ascertained of any dial switch on the system. Fig. 8 is a view of the selector equipment. In connection with the telephone service in the building there are a night watchman's tell-table clock system and a number of emergency services. The watchman's service embodies a number of "contact boxes" on each floor, at each of which there is fitted a central-battery telephone communicating with a specially-designed 50-line switchboard.

Electricity is used extensively in the kitchens for cooking. In the main kitchen, which is designed to deal with 2,000 luncheons per day, the total connected load is 250 kW, which includes all the electric cooking apparatus, service equipment and preparing machines. The equipment was specially designed for the job by Messrs. Richard Crittall & Co., Ltd., and it includes two roasting ovens, fig. 10, with internal dimensions of 24 in. wide, 28 in. deep, and 52 in. high. The ovens are lined internally with white porcelain-enamelled iron sheets and element guards, lagged with non-conducting material; the fronts are of cast-iron and each oven is provided with double side-hinged insulated steel doors faced with "Silveroid." The shelf supports are easily removable to allow access to the elements and back of the ovens. Each compartment is loaded at 15 kW (maximum) and the elements are controlled by 3-heat switches, 'ZED' fuses being arranged in each circuit.

An electrically-heated pastry oven, fig. 11, has two compartments, each 38 in. wide by 32 in. deep by 11½ in. high, inside. The body is constructed of cast-iron and sheet steel, and is double cased and lagged. The heating element in each compartment is loaded at 6 kW (maximum). The electric cooking apparatus also includes a fish-frying suite 6 ft. long by 2 ft. 3 in. wide by 6 ft. 6 in. high, overall. It has three welded-steel pans, each 18 in. by 18 in. by 6 in. deep inside, and a

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sheet-steel canopy enamelled inside and outside. Heating elements under each pan have approximate loadings of 7.5 kW each. A double-compartment electric grill is loaded at 10 kW per compartment.

There is also a suite of electrically-heated hot closets for the main service. The suite is approximately 36 ft. long by 3 ft. wide by 3 ft. high, and is constructed of cast-iron, with one continuous top plate made to fit round pillars of the building, and doors provided on the kitchen side. Two welded-steel Bain Maries form part of the hot closets. The heating elements in each of the end hot closets at the bottom are loaded at 6 kW, in the centre closet at 5 kW, and under each of the Bain Maries there are elements loaded at 4 kW. The remainder of the top plate of each of the end hot closets is equipped with elements loaded at 2.5 kW, while under the top plate of the centre portion elements loaded at 3 kW are provided. A private kitchen is equipped with an electrically-heated hot closet, with a maximum loading of 5.5 kW, and an electrically-heated grill, 10 kW.

In the service corridors, fig. 12, there are seven combined carving tables, Bain Maries and hot presses 8 ft. 8 in. long by 1 ft. 10½ in. wide. by 3 ft. high. These are heated electrically and thermostatically controlled. As part of the kitchen equipment there are three refrigerators supplied by Messrs. J. & E. Hall, Ltd. One of these is used for making and conserving ice cream. This comprises a compression machine directly coupled to a 3-h.p. Crompton Parkinson slip-ring induction motor. Two small "Hallmark" methylchloride compression plants are used to cool two insulated cold-storage chambers. These two machines are entirely automatic in operation, by means of electric thermostatic controls operated through mercury switches. One of these plants is driven by a 1-h.p. motor and the other by a ½-h.p. motor.

The artificial lighting of the building is, it is claimed, unique in two particulars: firstly, no pendant fittings are used in any part of the building above the basement, all the lamps being concealed in specially-formed recesses in the ceilings or walls, with their apertures closed by screens of diffusing glass; secondly, "artificial daylight" is used throughout. The pyramidical recesses in which the lamps are housed were formed during the construction of the floors above, each measuring 10 in. sq. by 7½ in. deep, with chamfered corners. The metal frames of the lighting units were pressed from sheet-aluminium by Messrs. Hailwood & Ackroyd, Ltd., and the diffusing-glass panels, which are each etched in a key pattern, were made by the London Sand Blast and Decorative Co. Fig. 17 is representative of the standard lighting in the ordinary rooms.

Thin sheet-steel liners, painted matt white and inserted in the recesses, act as reflectors. In the corridors the same type of lighting is used as in the offices, but the panels are larger and rectangular in shape and are spaced at 18-ft. centres. A specially designed reflector is housed above the glass panel, in the false ceiling of the corridor. The result is very successful, and the effect in the long corridors, fig. 15, with their perspective of glowing ceiling panels is particularly fine. The lighting point in the middle of each section of corridor is arranged as a pilot light, and is controlled by two-way switches at either end. In the conference rooms and rooms occupied by higher officials generally, octagonal ceiling fittings with a projection of about 7 in. are used.

Several methods of filtering were tried experimentally, and pale blue "Osram" lamps used behind uncoloured glass screens were finally adopted. Regarding the illumination provided, a scale of four foot-candles at the working plane was decided upon, and this is obtained with one 150-W gasfilled lamp in each standard unit. This gives a utilisation of about 25 per cent., or some 50 per cent. of that which would be obtained with "uncorrected" gasfilled lamps used in conjunction with direct reflectors.

A very pleasing "sunlight" effect obtains in the main entrance halls and on the staircases, where the lighting is carried out by means of artificial windows. These consist of large recesses in the walls, closed by means diffusing glass which is bevelled in panes, the effect being heightened by applied strips of blue glass. The lamps are used indirectly and are carried in Metropolitan-Vickers reflectors at the top of each recess. The light is reflected and diffused evenly over the glass by means of specially designed backings, carried out in ply-wood and painted matt white. On the main landing of the directorate floor, fig. 18, artificial windows are provided at one end only of the staircase hall, and the lighting there is supplemented by means of lamps used indirectly in Grecian urns placed on ornate pedestals.

The lighting of the palatial directors' suite, which extends along the whole of the 6th floor main fronts, is unique. In the richly panelled and decorated principal rooms, no lighting devices are visible by day, but at the touch of a push button, a centre panel in each ornamental ceiling rises, and at the same time a corona of powefrul lamps above the ceiling glows into radiance until the room is brilliantly lighted by reflection from the raised panel. The effect is novel and striking. In addition to the raised panel, lighting reflectors are concealed in the cornices, the object being to relieve the shadows which would otherwise be cast by the heavy mouldings of the ceiling, and also to assist the general illumination. These cornice lights are switched on simultaneously with the centre light. The pressing of the switch a second time extinguishes the centre light, and the panel gently descends, leaving the room illuminated by the cornice lights only to about half the former intensity. A third touch of the switch extinguishes the cornice lights. The operating push button is in an 8-V circuit with relay switches which light the lamps and operate the solenoid which raises the panels. The solenoid and its accessories comprise what is, in effect, a miniature electric lift, including many features of modern lift construction. When the panel is raised to the full extent a cooling coil is switched in parallel with the main lifting solenoid, thus minimising the heating. The ceiling of the magnificent walnut-panelled board room is exceptionally fine, and carries two of these novel lighting units; fig. 16 is a night view in this room, depicting one of the lighting units.

An interesting feature of the lighting of the directors' rooms is the desk lamps provided to supplement the general lighting, if required. Each of these takes the form of a terrestrial globe, mounted on a richly ornamented pedestal of "Silveroid," bronze, or inlaid ebony, and on the globe the general land masses, in high relief, are flashed white, while the oceans are etched and comparatively transparent, and the British possessions are coloured red. A daylight lamp is used in each globe.

The main refectory on the Millbank front on the 8th floor is over 200 ft. long and 40 ft. wide, forming, it is claimed, the biggest restaurant in London. Its high barrel ceiling lends itself perfectly to cornice lighting, and it is claimed that the system employed is the best example which has yet been designed. A departure from the normal blue lamps is made here. Clear lamps are contained in special reflectors concealed in the cornices, and the daylight effect is obtained by reflection from the coving of the ceiling, which is partly tinted blue. The ornamental mouldings of this ceiling stand out in bold relief, and the backgrounds of Wedgewood medallions are accentuated by a green tint, greatly enhancing their appearance when illuminated. The natural lighting of the refectory is by means of lunette windows, which are spaced at intervals high along the inner side, breaking into the coving of the ceiling. Through these lunettes flood-lighting fittings project light from outside. The effect, fig. 14, is novel and pleasing, and the shadows from the glazing bars of the lunette windows heighten the illusion of sunshine. The average illumination in the refectory is about five foot-candles.

The directors' dining room carries two stained-glass domes through which light is projected. In this posi-

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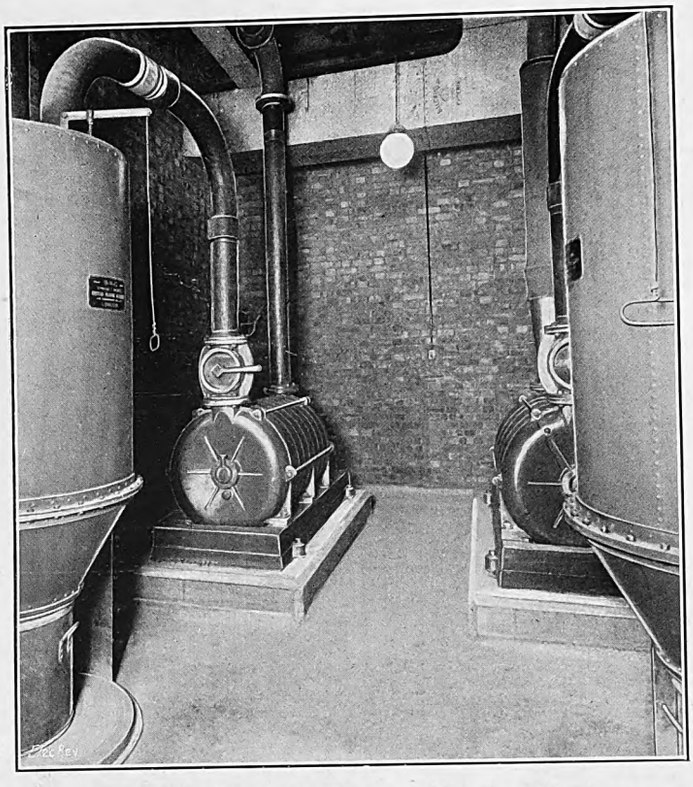

Fig. 7.—Electric Vacuum Cleaning Plant.

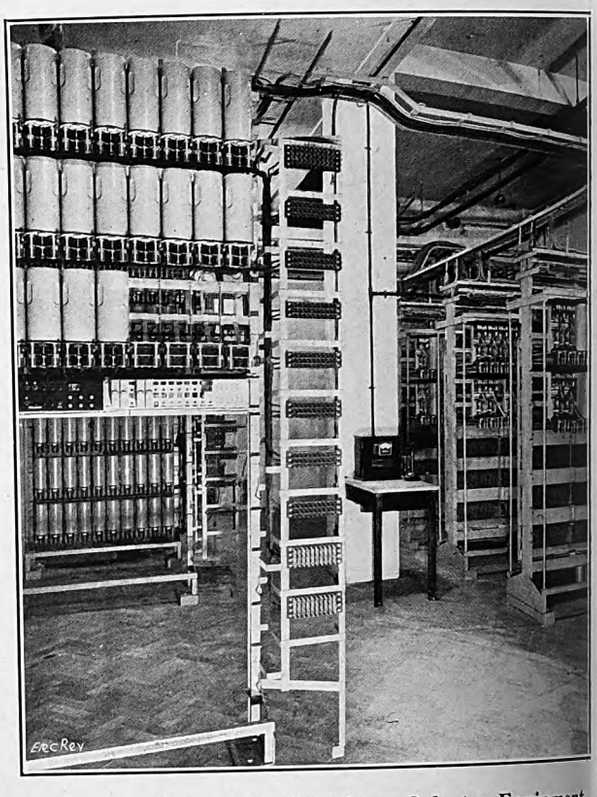

Fig. 8.—Automatic Telephone Selector Equipment.

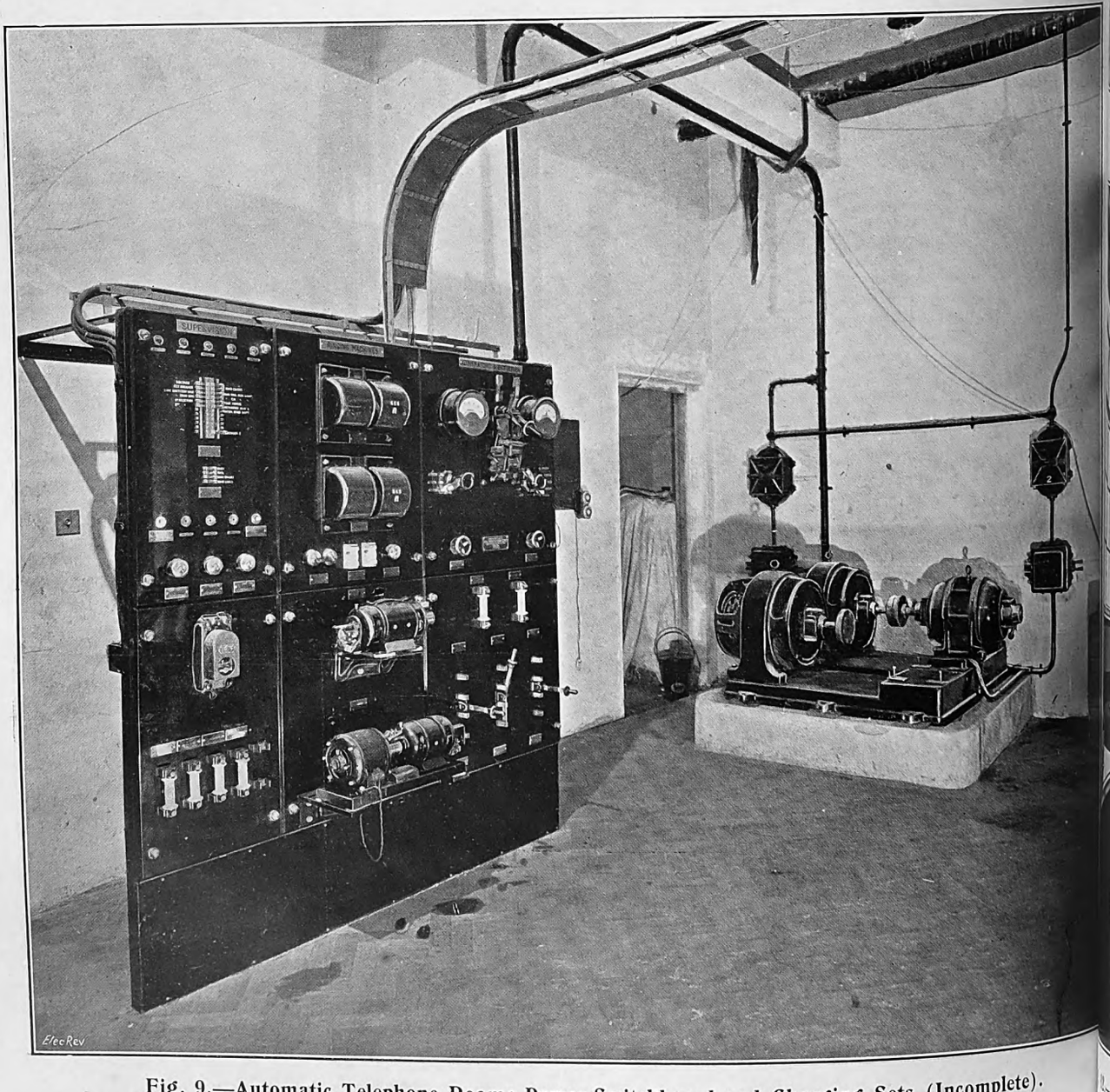

Fig. 9.—Automatic Telephone Room; Power Switchboard and Charging Sets (Incomplete).

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tion a mixture of clear and blue lamps was found to give the best results, as the tinting of the glass exerts some corrective influence. In the main kitchen, where good illumination both by day and night is of exceptional importance, the standard lighting units are freely used, supplemented where required by bulkhead fittings. The lighting of the stately colonnades, which rise at the 6th floor level on both the Millbank and Horseferry Road fronts and stand out in bold relief at night, is carried out by means of lamps housed in glazed recesses above each column, thus silhouetting the columns against the illuminated inner wall. Imperial Chemical House is planned around three main inner courts, the walls of which are tiled. These courts are brilliantly illuminated at night by means of special flood-light reflectors at ground level. The illumination of the walls is remarkably uniform, fig. 13. The illustrations of the lighting effects, figs. 13-18, are reproductions from untouched photographs.

A service of uniform and accurate time has been installed on the "Synchronome" system of electric clocks. The "controlling pendulum," or master clock, is rigidly fixed to a main wall in the basement. The outstanding feature of this installation is that there is only one master clock for the whole building, although it will have to carry a load of over seven hundred electrical-impulse dials. We understand that no relays are used, and that the working is effected by a special method of parallel grouping under which the benefits of the compensatory action of the Synchronome switch are retained throughout. The work has been carried out by the Synchronome Co., Ltd.

The wiring of the building for lighting, power, heating, cooking, bells and telephones, and the fixing of the switchboard and most of the control gear were carried out by Messrs. T. Clarke & Co., Ltd. The main switchboard was manufactured by the Astral Engineering Co., and its panels are arranged in horse-shoe fashion, parallel with the walls of the switch room, a space of about 4 ft. being left behind the panels for cable connections and access. The power panels are located in the centre and flanked on one side by the heating panels, and on the other by the lighting panels. At the free ends expanded-metal doors and screens are provided. A combined audible and luminous bell indicator system having some special features has been installed, and embodies some 500 or 600 points.

We are indebted to Sir Frank Baines for his permission to publish the above details, and to members of Sir Frank's staff and various manufacturers of the equipment for their help in collecting the information.

Lampholder Design.

The Development and Testing of a New Multifold Spring Contact.

By L. G. H. SARSFIELD, M.Sc., A.M.I.E.E., A.Inst.P.

Much attention has been drawn in recent months to the subject of the contact between the load and the supply in plunger-type lampholders, pear switches, and the like. This is a good sign and means that manufacturers are alive to the need for improvement in these small, though vital, links between the supply company and the consumer.

The increasing demand for electrical energy for domestic appliances must be associated with, if not led by, adequate development of reliable foolproof fittings. A very poorly constructed lampholder may be lucky enough to deal with a fraction of an ampere fairly successfully. Nevertheless, the design of lampholders is now rightly being directed towards making them reliable for heavier currents, so as to give this type of fitting a larger sphere of application.

It has been indicated by the writer in previous articles* that poorly designed bayonet-type lampholders may heat up dangerously when only supplying a 40-watt lamp, and also that properly designed specimens are capable of carrying up to 5 A without undue temperature rise.

It was also demonstrated that with normally clean surfaces contact between the top of the plunger and the adaptor, or lamp, remains good as long as the spring is sound, and that the greatest contact resistance and consequently greatest heating occurs at the sliding contact between the plunger and the sleeve.

Two possibilities, therefore, presented themselves for consideration in design; either the sliding contact must be greatly improved, or it must be eliminated altogether.

As an example of the first alternative the split plunger (fig. 1a) was put forward and described.† By virtue of its tendency to expand on to the inner walls of the sleeve this afforded good contact with the sleeve, and the resulting improvement was proved by test. A lampholder developed on similar lines has also been produced commercially, and the writer's methods of test were adopted‡ to obtain evidence of its superiority over ordinary plungers.

An example of the second alternative is found in the solid or "one piece" plunger (fig. 1b) into which the lead itself from the supply is screwed, so that contact

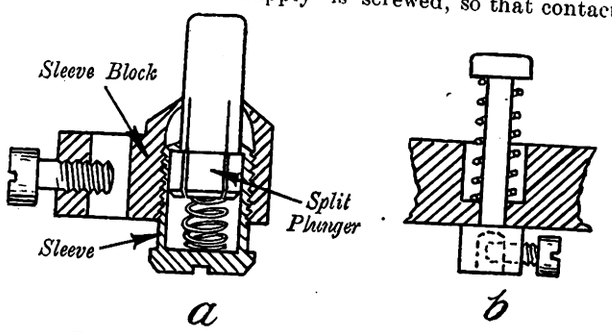

Fig. 1.—Split and Solid Type Plungers.

resistances only exist at the set screw on the supply side and between the plunger top and the lamp or adaptor terminal on the load side.

The Multifold Spring Contact.

The "one piece" type of plunger is the better proposition, since it avoids the complication of a sliding contact.

In the older models of lampholders the imperfect nature of the sliding contact meant that the enclosed helical spring was called upon to carry a large proportion of the total current. Since the spring was a steel or bronze wire of fine gauge, it was quite unable to meet this condition successfully.

A solution of the problem of this uncertain and inadequate conductivity is found in the use of a spring which combines the necessary electrical and mechanical properties.

A new "one piece" spring contact, due to Mr. H. Garde, with whom the writer has been co-operating in experimental work, not only eliminates sliding contact, but at the same time possesses additional features which

* Electrical Review, February 13th, 1925, April 30th, 1926.
† Electrical Review, April 30th, 1926.
‡ Electrical Review, September 10th, 1926.

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make it particularly suitable for heavy-current work and exacting conditions. It consists of phosphor-bronze strip formed into a multifold compression spring. Such a spring when used instead of a plunger in a lampholder is housed in a square hole and has one end of the strip extended at A (fig. 2a) to make a lug for clamping to the base block C (equivalent to the sleeve block in the common type) and the other bent over at B.

The flap B is of such length that with maximum compression the lower edge does not reach the bottom of the spring. When, however, the spring is extended to its normal height the lower edge of the flap does not emerge from the hole in which it is assembled in the insulating body of the holder, and therefore it is mechanically supported and at the same time flexible enough to secure important advantages which are discussed below.

Two plungers are shown assembled in the holder body in fig. 2b.

A set screw at D passing through the insulating body and the spring lug enters the tapped hole in the block C

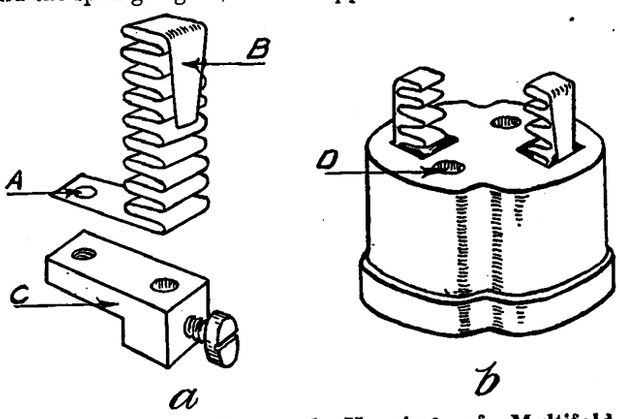

Fig. 2.—Construction and Housing of Multifold Springs.

and pulls it home in its slot on the under face of the insulating body, firmly clamping the lug in contact with the block.

With the absence of sliding contact, and having the lug end of the spring making good contact on the supply side, there remain the free end of the spring and its butt joint contact on the load side to be examined.

The Butt Joint.

It is essential in any electrical contact to have sufficient mass of material in good thermal connection with the actual area carrying the current, so that any heat developed can be conducted away. According to B. W. Jones§, who has drawn attention to the question of contact areas and pressures, contact resistance is a function of pressure and not of surface. He also shows that if there is adequate pressure and body of metal for heat conduction and radiation, a very limited area is sufficient for a very intense current density at the actual contact.

It can be seen then that a poor sliding fit between plunger and sleeve block in an ordinary plunger type lampholder not only developes heat itself due to its carrying current, but also prevents the conduction away of any additional heat which may be produced at the contact between the plunger top and the load terminal. The multifold spring, on the other hand, being a "one-piece" element constructed of heavy material having high conductivity, possesses the characteristics which are necessary for a cool joint.

The importance of all this is better realised when it is remembered that an average electrical butt joint probably consists of a few *points* in actual contact. In this connection it may be said that soft metal blobs like those on a lamp permit a certain amount of "bedding," which of course immediately increases the effective contact area.

Flexibility.

The multifold spring combines flexibility with robustness. Flexibility is a great advantage when the contact has to ride on an irregular, or oblique, surface, fig. 3a. The concertina formation of the spring allows the contact face to find a position which will give a normal pressure on the other face butting up against it. This correct alignment is effected without the tendency to jam, which is sometimes the case with other forms of plunger—see fig. 3b.

Flexibility is also of service when vibration is present, because any movement of the lamp or adaptor in the

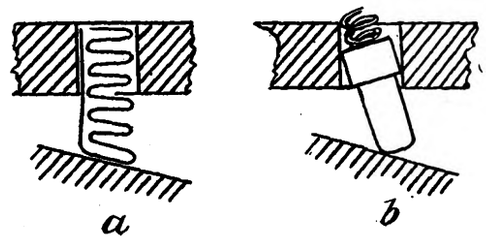

Fig. 3.—Irregular Contacts with Multifold Spring and Ordinary Plunger.

holder can better be followed by the multifold spring than by a plunger, which only has movement along one line, except at the expense of good fitting and perhaps of contact between the plunger and the sleeve block.

The multifold spring therefore lends itself to traction work.

Current-carrying Capacity.

A spring comprising eighteen folds is constructed from a strip 3.7 in. long and has a resistance from end to end (at contacts) of 0.011 ohm for a bronze having a resistivity of 6×10^{-5}.

A number of tests of current-carrying capacity have been made with springs in lampholders and for connecting other devices. No test to destruction has been made, but the following figures give proof that the contact spring is a satisfactory heavy-current-carrying element.

Fitted in an ordinary lampholder, two of these springs have for twelve months been delivering through a standard adaptor 4 A to an industrial-machine circuit during factory working hours of fifty per week. In another reliability trial two springs were mounted separately, each forming the centre contact of an Edison screw holder. One has carried 9 A for 1,248 hours on an average of six hours a day in two periods of three hours, four days a week. The other has carried the same load under the same conditions for 750 hours. In each case the spring was well compressed into the hole in the insulating body in which the contact was mounted, so that very little free radiation from the folds was possible.

From time to time the load screw was removed after a three-hour run, and the contact spring was always found to be quite cool. At the time of writing both contacts are still in operation on routine lines under these conditions.

Some Mechanical Features.

The multiple folds make the spring at once resilient and powerful. These properties are necessary for reliable electrical contact. With this design there is no risk of exceeding the elastic limit of the material, since each individual fold or bend contributes only a small fraction to any total extension or depression, and in this respect the arrangement represents an advance upon the single-leaf spring, such as is sometimes used for the centre contact of the Edison screw-type holder.

The device is easy to assemble, comprising, apart from casing and insulating body, three parts per pole (spring, base block, and set screw), instead of five (plunger, spring, sleeve, sleeve block, and set screw) as found in the familiar pattern of plunger-type lampholder.

Conclusion.

The spring has applications in a wide sphere. It is the writer's intention to discuss in a further article some operating characteristics of certain designs of small switches for domestic purposes. It is proposed also to present some results of tests of the multifold spring as adapted to this type of apparatus.

§ B. W. Jones "Contact Resistance" *G.E. Review*, February, 1927.

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Agricultural Electric Machinery.—II.

A review of the 1929 Paris Agricultural Exhibition, depicting some selected items of special interest to electrical engineers.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

It is true that more attention has been given to electric driving in farm buildings than in the fields, so that it is not to be wondered at that at the exhibition very considerable space was devoted to the first-mentioned class of machinery.

The great majority of French manufacturers, unlike German and Scandinavian makers, still offer their standard *industrial* motors, which, of course, are not really suitable for agricultural work, especially when compared with the special types of machines developed for that work in Germany and Scandinavia. Exceptions are the motors supplied by Law, Sté. Electro-Motoculture, Eve & Noizet and Roulland The Law motor is made in two distinct types. One, of half horse-power, is intended for operating almost any kind of barn machinery by direct connection, thus eliminating flapping belts. The motor is a single- or three-phase machine for standard voltages, and incorporates a speed reduction gear. By the manipulation of a hand-wheel at the end of the motor it can be reversed, or its speed regulated from 0 to 200 r.p.m. The motor is supported on an adjustable tripod and is supplied with three couplings which enable it to drive the great majority of existing hand-operated barn machines. Its weight, mounted on a tripod stand, is 56 lb. For the operation of hand-worked machines this was undoubtedly the best motor at the Show. In larger sizes the Law motor is made with the starter forming a portion of the motor frame, which is a very convenient form of construction for farm purposes. The same motor is also made with an extended case containing speed-reduction gears with five protruding shafts which run at, respectively, 40, 60, 100, 400 or 700 r.p.m.; in addition, there is a direct drive off the armature spindle. A motor of similar type is manufactured by Messrs Ransomes, Sims & Jefferies. A cheaper and very effective motor, not unlike the small-type Law motor, was displayed by the Sté. Electro-Motoculture. In this case a simple friction drive is adopted in place of the more expensive and complicated reduction tooth gearing. The efficiency of the transmission is not very good, but undoubtedly it serves its purpose since it is only used for a short time each day. It is very much to be doubted whether all the varieties of speeds noticed are really required by the average farmer, as most barn machinery can be very satisfactorily operated at 110 r.p.m.; in fact, in Germany this speed has been standardised.

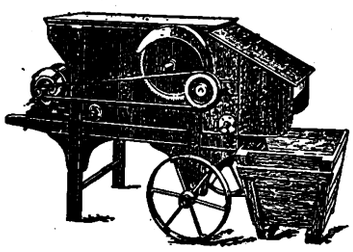

Fig. 1.—Portable Food-mixing Machine.

The Eve & Noizet motors are of unique construction; both the motor and reduction gear are contained with in an outer rotating body forming step pulleys like a lathe. A new application of this motor which was shown provides for the operation of a cart loader; the motor is placed at the lower end of the loader and employs a single wide belt. The usual lengthy chain drive is dispensed with, and the combined motor and pulley forms a very compact end to the elevator.

The Roulland motor, which is constructed with open ends for ventilation purposes, is specially designed to resist dust, and one working model was shown under a glass case, half buried in a heap of sawdust which was being stirred up and passed through the machine. Working under such conditions is achieved by the use of three slip rings which are mounted directly at one end of the armature instead of in the usual position. In the case of the squirrel-cage type motor the conductors are made of white metal cast into the core of the armature.

Coincident with the exhibition a report has just been issued by the Union des Syndicats de l'Electricité, on tests on French agricultural motors. The machines upon which the tests were made were all exhibited at a previous exhibition and were briefly referred to in the Electrical Review of March 4th, 1927, p. 332. Those who are specially interested in the design of agricultural electric motors cannot do better than obtain a copy of this Report, which is available from the Union at 25, Boulevard Malesherbes, Paris (8e).

A large number of electrically-driven cream separators was on view, but the greater portion still has a separate motor drive, and for this class of construction there is nothing to beat the British Lister machines. However, as in other industries, the properly incorporated electric motor is pretty sure to be the eventual model. Examples of this type of machine are the Persoon and the Melotte. The best apparatus from the farmer's point of view is the Stiemel combined separator, churn and butter worker. This is a directly-driven equipment with a built-in electric motor; hence it is a very easy machine to keep clean and a most convenient one for the farm.

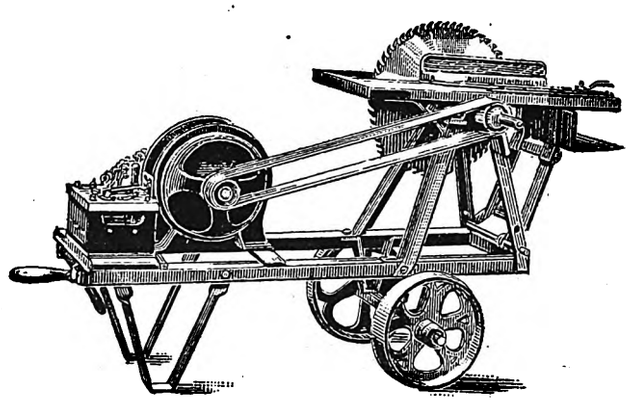

Fig. 2.—Mouzon Portable Saw; 1½ h.p.

In spite of the availability of cheap labour, the use

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of milking machinery is rapidly spreading on the Continent. Several makes, *e.g.*, the Dana, Melotte, and so on, are not yet available on the English market, whilst others are marketed under different names. A thorough examination of the various types leads one to wish that the best details of each could be incorporated into one machine. In that cows have not to be stripped (*i.e.*, the last small portion hand milked) with the Dana equipment, this is ahead of the others. The Titania has only a single moulded piece of india-rubber to form the teat cup, which greatly facilitates cleaning. The Alfa-Laval Co., which has replaced a portion of the rubber tubes with metal ones, demonstrated the altera-

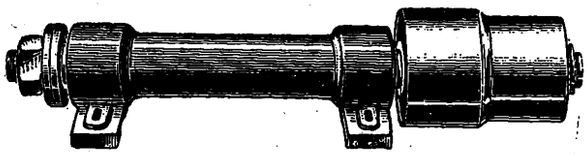

Fig. 3.—Ball-bearing, Saw-bench Countershaft.

tions of the suctions in the two pairs of cups, which formed the complete set of four, by aid of coloured electric lamps, so arranged as to make contact and light up as the suction took place. For the tenant farmer the portable Ford and Hinman milkers were very attractive with their self-contained electric motors. They only need to be connected to the nearest wall-socket or lampholder.

Hitherto food-mixing machines have been somewhat prohibitive in cost, but some new and less expensive ones were exhibited. Fig. 1 shows a portable model. It weighs 2 cwt. and has an hourly output sufficient for 20 to 30 head of cattle, or 200-300 sheep. It is driven by a ½-h.p. electric motor. A stationary machine is equipped with a 1.5-h.p. motor and has an hourly output sufficient for 80 to 100 cattle, or 800 to 1000 sheep; its weight is 7 cwt.

Disintegrators are tending to become more popular, and on account of their high speed of operation they lend to electric driving. Rather large motors, 10 to 15 h.p., are required. With the larger motor nearly 1½ tons of oats can be crushed per hour. Of machines of this class shown the Utica is probably the best.

In England the bascule type of saw is unknown, though it is very common on the Continent. The use of Y forks for the sawing of logs is certainly much to be commended from the safety point of view. Fig. 2 shows a 1½-h.p. Mouzon portable saw of this type which was seen at the exhibition. A new design of angle-steel saw bench with grips for sawing planks off small logs was shown by Duchêne. In the construction of portable electric motor equipment ball-bearing countershafts of the saw-bench spindle type are very useful. One of the Duchêne make is shown in fig. 3. A number of directly-coupled electric blacksmith forge-blowers were on view, though they were not any advance on British practice.

Though the use of manure and fodder overhead carriers is increasing on British farms, the same cannot be said of hay and corn hoists. In France, while the use of automatic grip-fork overhead transport is largely employed, the German and Scandinavian practice of dealing with complete cartloads at one lift is not so well known. Naturally, this method economises a great deal of time during harvest periods.

The Société Général Agricole exhibited a model of the author's system of making hay without sunshine. This and various methods of crop treatment are now handled in Great Britain by Sugar Beet and Crop Driers, Ltd.

A very large number of makes and types of pumps were on view, the great majority of which were electrically operated. The popular pump to-day is one equipped with a 1/3- or 1/4-h.p. motor, with an automatic controller which keeps a pressure tank full (except for the air cushion, which is an important feature of the system). This enables a supply of water to be piped over the farm-buildings and house, and at each faucet a supply at 30 or 40 lb. per sq. in. can be obtained, *i.e.*, a replica of a city service. The automatic controller employed on this equipment is that adopted by a great number of automatic pump-makers—the E.M.A.

There appears to be quite a demand for portable pumps. Fig. 4 illustrates a typical example of this type, for use in market gardens and on wine-making farms, made by Carouelle. The counter-weighted jockey pulley should be noted, as it is a method often employed on the Continent for keeping belt drives at a uniform tension.

In a wine-making country, naturally there were a number of ingenious devices for electrically operating the screws of grape and cider presses. The Garnier was a very good practical example of a very convenient electrical application for this purpose.

The all-metal washing machine has ousted the wooden type in France. The construction and cost are simpler and lower, respectively, than is the case with machines offered for sale at home. There is no doubt that the type of machine sold in England is of much better workmanship, but the price is such that they are not purchasable by the great majority of housewives. Hence there should be a good field here for those of the French pattern. Several new electric drives were on view, but none of them seemed to come up to the standard of the Birum. A difficulty in designing a washing machine drive is the necessity for reversing the clothes drum every eight revolutions, so that the clothes being washed do not get hopelessly and tightly tangled together.

A number of oil engines were staged, but of course the French farmer is not so dependent upon their aid as is the case with the British agriculturists. A noteworthy feature of the trend of design was the square and clean external appearance of most of the patterns. A large proportion were designed for the use of heavy oil. Particularly interesting engines were the C.L.M. (Peugeot patents) and Renault high-speed Diesel prime movers.

While there was nothing of outstanding novelty at this Exhibition, great progress has obviously been made

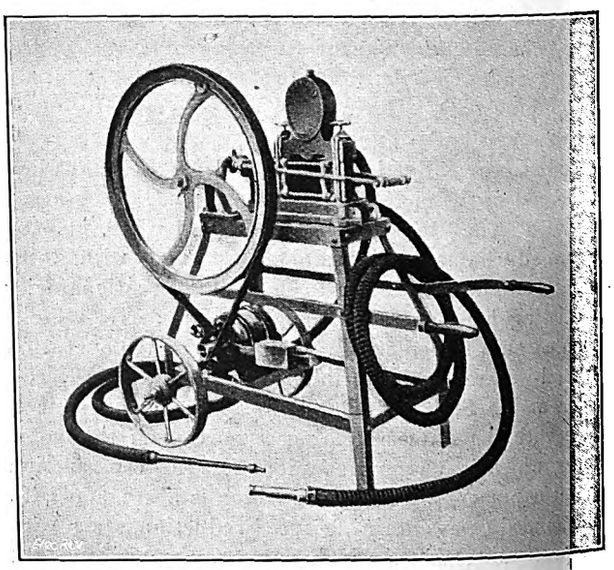

Fig. 4.—"Carouelle" Portable Electric Pump.

in detail design, and it is self-evident that applications of electricity in agricultural operations are steadily increasing in France. Chilling, case-hardening and heat-treatment processes are being partially superseded by electric-furnace steel, as made by such concerns as Sté. Amouroux Frères. Otherwise the workmanship is characteristically that of the typical agricultural engineer of all countries, even down to the bright and gaudy paint-work. Still, it is encouraging to note more and more demand for the products of the electrical engineer to aid in the operation of the aforesaid brightly beautiful barn machinery.

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Architectural Lighting.

New Exhibits at the London Lighting Service Bureau.

DURING the past year the London Lighting Service Bureau, Savoy Street, Strand, W.C., has been re-arranged and at least two new exhibits have been added to the admirable and interesting display of appliances and systems for correct illumination which is maintained there.

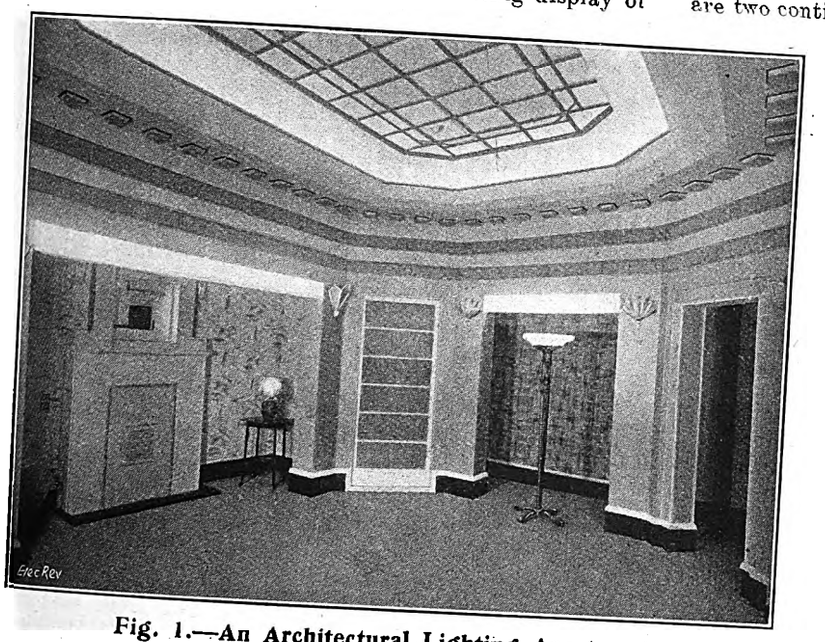

Fig. 1.—An Architectural Lighting Apartment.

These innovations are in the field of architectural lighting, dealing with the exterior and interior aspects of the matter. As regards the first aspect, the subject has been combined with the more general problem of street lighting.

An architect has been added to the Bureau staff to study architectural lighting problems and to design the best means of dealing with them. One of his tasks has been the arrangement of an apartment (fig. 1) in which various systems of interior illumination are treated, with particularly pleasing results. The greater part of the ceiling consists of a panelled octagonal skylight of diffusing glass above which are alternative white and orange lighting systems. Between the top of the walls and the ceiling there is a set of concealed lights giving ample indirect illumination supplementing or replacing that from the skylight. In the upper parts of the walls are two continuous channels covered in with glass panels. These naturally form a part of the decorations, but they can also be employed to light the apartment, lamps being fitted behind the panels. Below these bands the walls are broken into recesses and the lintels of the latter are composed of moulded glass in removable sections and thus provide another means of illumination. It should be emphasised that all the systems actually form parts of the room; in no sense are they additions to the design. Supplementing these general lighting systems there are several ingenious examples of detail lighting such as a French doorway of diffusing glass, wall brackets, appliqués of modern design, a lighted mirror, &c.

An ingenious model street has been prepared in which typical modern buildings are represented on a scale of ½ in. to a foot. The street thus reproduced to scale is 215 ft. long, but by means of a mirror at the end this is doubled; the street width is 50 ft. and the pavements at each side are 18 ft. wide.

The demonstration of the model commences with an exposition of the inadequate illumination usually provided under restrictive street lighting contracts, showing how little light is thrown upon the buildings and how dismal is the general appearance of the street at night. This stage is illustrated in fig. 2, where converted gas standards spaced at 40 ft. and bearing one 100-W lamp each are employed. The next stage shows the improvement effected by substituting higher columns with 200-W pole-top units on the same spacing. The change is carried out by sinking the standards in position below the pavement level, turning a handle to another position and raising the new set. Proceeding, a system employing 20-ft. columns with distinctive lanterns, spaced at 50 ft., with 1,000-W lamps is shown. The next development is the use of three-light pole-type

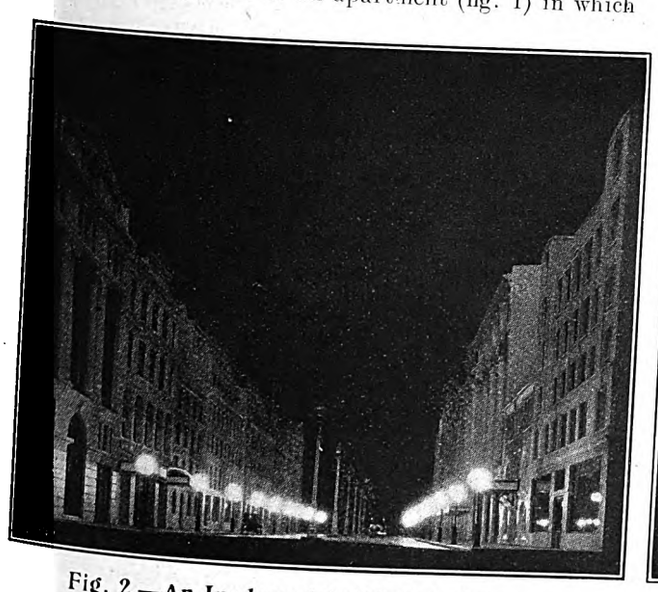

Fig. 2.—An Inadequately Lighted Street.

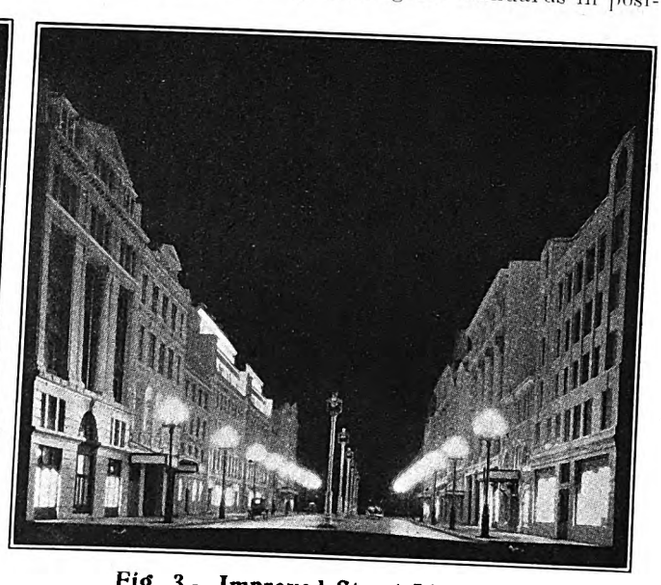

Fig. 3.—Improved Street Lighting.

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units on 20 ft. columns, spaced at 50 ft., with 300-W lamps. This phase is illustrated in fig. 3, from which the great improvement in both ground and building-front illumination will be observed. The slightly brighter appearance of the top of one of the buildings on the left-hand side is due to the flood-lighting employed on it. The fifth system demonstrated consists of the illumination of the standards seen in the centre of both illustrations; these bear dispersive lanterns equipped with 1,000-W lamps. Each of the four kerb-line arrangements is so wired that three different spacings can be demonstrated, expanding the usefulness of the model. Moreover, lighting features are incorporated in the shop windows, some of the upper windows, &c. A number of ingenious details make the model street very "true to life."

To use the accepted phrase, the new developments "must be seen to be appreciated," and we urge all who are interested in architectural and street lighting—as buyers or sellers—to pay an early visit to the Bureau.

Reviews.

Underground Cable Systems. By G. W. Stubbings. Pp. vii+216; figs. 106. London: Chapman & Hall, Ltd. Price 15s. net.

In this book, the author deals with both the construction and maintenance of underground cable systems from the source of supply to the consumers' premises, and he is to be congratulated on producing such a volume of information in so small a book.

The technical data is given in such a way as to be easily followed and understood by the technical staff of a supply undertaking, as well as by the electrical student who has passed the elementary stage.

No section or phase of distribution of electricity by underground cables has been omitted, but the author could have devoted, with advantage, a few extra pages in Chapter V to cable jointing, by giving details (supplemented with one or two illustrations) of joints on 3-core cables, for working pressures up to 11 kV.

In Chapter VI the author mentions that a large number of electricity supply corporations and companies have extensive feeder networks of 6.6 kV or 11 kV, and every mains engineer and his staff would appreciate data relating to the latest methods of jointing these cables.

Mention is made in Chapter V of cast-lead sleeves being used as an alternative to ordinary split lead sleeves made from extruded tubing or rolled sheet lead. As cast-lead sleeves, where there is a possibility of their being subject to vibration, are liable to become porous through disintegration of the metal, sleeves made from extruded tube or rolled sheet lead are recommended as being more reliable.

The subject of location of cable faults is fully treated so far as well developed faults are concerned. An outlined procedure for locating an obstinate high-resistance fault which only manifests itself occasionally would have been useful.

In dealing with cables for extra high pressures, considering present-day knowledge and existing literature, the author has expounded the old stress theories at greater length than necessary. A more comprehensive bibliography would have been an advantage. The more recent knowledge of e.h.p. cables is ably expressed, but an important omission is a reference to 66-kV and 132-kV oil-filled cables, examples of which have been in successful operation for some time.

A useful synopsis of protective systems in Chapter XII might well have been amplified with additional diagrams and operational data and by the inclusion of more references to current literature.

Chapter XV deals all too briefly with such an important subject as "Tests and Measurements," and here again an extensive bibliography would have considerably enhanced its value.

There are one or two misprints in the book, but these are so apparent that they can be ignored.

The Radio Manual. By George E. Sterling. Edited by Robert S. Kruse, B.S. Pp. vii+666; figs. 273. Third Printing. London: The Library Press, Ltd. Price 30s. net.

This is a comprehensive manual of the theory and practice of radio communication for the use of radio engineers, inspectors, students, operators, and experimenters. The author is a Government radio inspector in the United States of America, and the editor is a well-known American writer on radio signalling, formerly technical editor of the magazine of the American Radio Relay League, a leading amateur organisation. The book, which is well written and well produced, may therefore be considered as authoritative as regards practical work, from both the professional and amateur points of view. It is indeed a sort of "vade mecum" for all those interested in the subject from the American standpoint, and will be useful in this country as a guide to American practice, commercial, broadcasting and amateur.

As a text-book for the ordinary student, this Radio Manual suffers from its comprehensiveness. It covers far too much ground for that purpose, but as a book to be studied and used for reference by professional wireless workers, and to a much less extent by amateurs, it will no doubt be welcomed in the United States, and by those over here who wish to be acquainted with the general outlook, and the details in practice, of wireless work in America.

The book is elementary in the sense that it is not mathematical, and indeed assumes no previous knowledge of electricity, the first hundred pages being devoted to a summary of the theory of this subject. From that it launches straight off into the theory and practice of the oscillating valve, both as a receiver and as a transmitter. This subject is dealt with very fully; the practical portion, however, being confined to American installations in land and ship stations. This is followed by a detailed description of American broadcasting equipments. Arc and spark transmitters are then considered less fully, much less so on the theoretical side. Chapters on various commercial receivers, beacons and direction finders follow, and there is a thirty-page chapter on amateur short-wave apparatus. The book closes with a summary of the wireless regulations in the United States, the international regulations which came into force this year, and, happily, an index.

Electric Wiring. Eighth Edition. By W. C. Clinton, M.I.E.E., and E. H. Freeman, M.I.E.E. Pp. ix+260; figs. 96. London: John Murray. Price 4s. 6d. net.

The fact that an eighth edition of this little work has been called for is indicative of its utility to wiremen and students, for whom it was originally written. In preparing this edition, the authors have carried out a thorough revision to bring the work thoroughly up to date, and it has been strengthened by the addition of a chapter dealing with elementary a.c. theory.

The book may be divided into two parts, the first dealing with the elementary principles of electrical technology and with simple electrical calculations, and the second with the subject of wiring and installation work in its practical branches.

In the first part of the book a praiseworthy attempt has been made to inculcate exact notions regarding the fundamentals of electrical calculations. The authors are careful to state, for instance, that the proportionality between current and voltage in a circuit, which is usually known as Ohm's law, only holds generally if the temperature remains constant. The calculation of series and parallel circuits is explained with great clearness, and with the aid of many worked examples.

We doubt if the authors have been quite so successful in their new chapter on alternating currents. Inductance is perhaps better described as a factor connecting rate of change of magnetic flux with induced voltage, than in terms of the energy stored in a magnetic field. The authors have built up their teaching of power factor on a consideration of the impedance vector triangle. It may be useful to define power factor as the ratio of resistance to impedance, if the subject is in process of gradual development, but this definition is not very useful to practical men, whose experience with low power factor is in connection with motor circuits. The notion of wattless current is one which can be assimilated with fair success by those whose elementary training is not very sound, and by the use of this conception it is not difficult to obtain a clear notion of the meaning of power factor, and of the methods by which it may be improved. The reference to the two-phase, three-wire system of distribution seems quite superfluous.

The second portion of the book, dealing with wiring systems and wiring accessories, invites criticism, although it is admittedly difficult to make a judicious selection of the numerous aspects of such a wide field, when writing a small work. The account of the modern systems of surface wiring seems somewhat meagre in comparison with the considerable space devoted to the subject of jointing cables. Although the important subject of earthing is accorded a complete paragraph, and the reason of the necessity of earthing is clearly explained, some practical notes on the running, connecting and testing of earthing connections would have been very acceptable in a work of this character. The subject of wiring accessories is treated very well, and there are some useful notes on the planning of lighting installations. There are very good chapters on electric bell installations and on testing and testing sets. The chapter dealing with motors needs some revision in the references to induction motors. The reference to the cage rotor type on p. 236 is misleading, as it implies that a wound rotor is connected to the supply mains through the slip rings and brushes.

The book can be generally recommended as an inexpensive and comprehensive little manual, the utility of which is greatly increased by the profusion of the worked numerical examples which it contains.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Two Important Committees.

Last week-end the Electricity Commissioners announced the appointment of two committees to deal with matters of outstanding importance to the electrical industry. The object of the first committee is to "consider what steps can be taken to ensure that facilities for assisted wiring and for the hire and/or the hire-purchase of apparatus are made available, wherever needed, to prospective consumers of electricity in rural and other areas of supply, and to make proposals for a practical financial scheme for the purpose." The committee consists of Mr. Ll. B. Atkinson, representing the Cable Makers' Association; Mr. H. Bentham (Provincial Electric Supply Association); Mr. S. E. Britton (Incorporated Municipal Electrical Association); Mr. D. N. Dunlop (British Electrical and Allied Manufacturers' Association); Mr. J. T. H. Legge (Incorporated Association of Electric Power Companies); Mr. H. Marryat (Electrical Contractors' Association); and Lieut.-Col. W. A. Vignoles, D.S.O. (British Electrical Development Association). The secretary is Mr. E. W. Dickinson.

The purpose of the other committee is "to consider the various kinds of charges and tariffs offered by authorised undertakers in connection with the supply of electricity for lighting, domestic, office, and power purposes, and to make definite proposals whereby a greater measure of uniformity in respect of charges and tariffs can be brought about in the electricity supply industry." The members are as follows:—Mr. H. Bentham (Provincial Electric Supply Association); Mr. A. C. Cramb (I.M.E.A.); Mr. J. T. H. Legge (Incorporated Association of Electric Power Companies); Mr. F. W. Purse (London and Home Counties Joint Electricity Authority); and Lieut.-Col. W. A. Vignoles, D.S.O. Mr. C. E. Allan is secretary.

Central Electricity Board Contracts.

In our last issue we briefly reported the placing of contracts valued at £3¼ millions by the Central Electricity Board.

BRITISH INSULATED CABLES, LTD., informs us that its contract is for the supply and laying of approximately 90 miles of single cable for 66,000-V working, 30 miles of three-core cable for 33,000-V working and 15 miles of auxiliary cables. The approximate value of the order is £350,000. These cables will be laid in the following London districts, the total length of route being 25 miles:—Islington to St. Pancras; St. Pancras to St. Marylebone; Poplar to West Ham; Willesden; West Ham to link up with proposed overhead lines from Barking; East Ham to link up with West Ham to Barking cables; Kidbrooke to Woolwich; Fulham to Wandsworth; Battersea; and Wimbledon to Kingston.

The route covers densely populated parts of London, and well over 1,000 joints will be necessary. The contract involves approximately 500 tons of electrolytic copper, 1,500 tons of lead, and 250 tons of galvanised steel wires. The first portion of the order is to be ready for work by the end of September, 1929, and the whole contract is to be completed by September, 1931.

A Sound-Film Merger.

Two important German firms engaged in the production of talking films and equipment—the Tonbild Syndikat and the Klangfilm—are merging their undertakings, which represent a total capital of about £20,000,000. The Klangfilm A.G. is associated with the A.E.G. and the Siemens-Halske concern, while the Tonbild Syndikat represents, among others, the British and French Phototone Companies.

The Polish Electrical Industry.

In consonance with the country's small requirements, the Polish electrical manufacturing industry was only on a small scale prior to the war. During the past ten years, however, various works have been established and these now employ about 6,000 workmen and staff. In the main these works are promotions of foreign groups, including German firms. They produce electrical machines of small and medium size, apparatus, installation material, glow lamps, accumulators, electro-medical appliances, low-pressure equipment, and broadcasting apparatus. So far there is no production of meters, steam turbines, large generators, or h.p. apparatus, but as they will be largely required in connection with the extension of the supply of electricity, it is said that these manufactures will afford a good field of activity for foreign firms. The German firms who have embarked on production in Poland are as follows:—The Siemens concern, with its subsidiary the Polish Siemens Works; Brown, Boveri & Co. with two works; the Giesche Co. which produces electrical porcelain; the Osram Co.; and the Accumulator Co. Low-pressure works are almost entirely lacking. The only large works for the production of l.p. apparatus is that of the State which makes telephone and telegraph equipment.

The B.T.H. Ex-Service Association.

That war-time comradeship is still remarkably strong in Rugby is demonstrated by the B.T.H. (Rugby) Ex-Service Association, which has enrolled over a thousand members—about one-sixth of the employés of the main works of the British Thomson-Houston Co., Ltd. We have received a photograph of a group of 638 members. The Association is active in many ways, and besides running various social events for the benefit of members, is now turning its attention to helping local charitable institutions having no direct connection with the B.T.H. Co.

Ideal Home Exhibition Luncheon.

A luncheon was given by the Household Appliances Section of the London Chamber of Commerce on March 12th at the Clarendon Restaurant to Mr. F. E. Gordon, organising manager of the Ideal Home Exhibition. In proposing the toast of "The Ideal Home Exhibition," coupled with the name of Mr. Gordon, Sir William Bull, M.P., said that since the first exhibition was held in 1908 there had been a steady increase each year in the number of visitors, and last year the total reached 540,000. A great deal of the success of the exhibition was due to Mr. Gordon, who had been the organiser since 1924. Mr. Gordon, in responding, said that the chief difficulty experienced by the organisers was to think of new ideas to maintain the popular interest in the exhibition. The toast of "The Household Appliances Section of the London Chamber of Commerce" was proposed by Mr. G. H. Grimaldi, who said that in studying the aims of the section, he noticed that no provision was made for the education of the retailer. The retailer was the weak link in merchandising, and it was important that the wholesaler should commence an agitation in the retail trade and educate it in the art of salesmanship. In reply, Mr. G. E. W. Crowe said there was a tendency for the salesman to criticise competitors rather than to sell the idea. If he would only concentrate on the selling of the idea, then he would increase the demand for his products. Mr. E. W. R. Stapley proposed "The Guests," and Sir William Arbuthnot Lane responded.

The American G.E.C. in Russia.

It is reported from Moscow that the State Electrical Trust has entered into a new agreement with the American General Electric Co., under which the latter has undertaken to supply plant to the value of $26,000,000 on the basis of five years' credit. The new agreement is said to give the Soviet trust the right to utilise all the patents of the American company and to appoint specialists in the latter to responsible positions in Russia. It is possible that this has reference to the series of contracts spreading over six years to which we referred in our issue of December 7th, 1928 (p. 965).

"Cambridge" Instruments at the B.I.F.

The CAMBRIDGE INSTRUMENT CO., LTD., informs us that it was the maker of the automatic temperature control equipment fitted to the furnaces types "M.F.12" and "A.T.O.2" shown at the British Industries Fair, Birmingham, by Wild-Barfield Electric Furnaces, Ltd. The company's automatic regulator was illustrated on the panel on the left-hand side of fig. 26 on page 398 of our issue of March 1st. The company also supplied the automatic temperature control which was mentioned in connection with the exhibit of Birmingham Electric Furnaces, Ltd., on p. 399 of the same issue.

Swedish Automatic Telephone Patents.

It is announced from Stockholm that the patent action pending since 1924 between the American Telephone & Telegraph Co. and the Swedish Ericcson Co., with regard to the automatic telephone, has been decided in favour of the Swedish company.

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Bankruptcy Proceedings.

J. M. LONGE, 1, Queen's Gardens, Lancaster Gate, W.—An application was made to Mr. Registrar Francke on March 15th at the London Bankruptcy Court for an order of discharge on behalf of this bankrupt who failed in April, 1926. The Official Receiver reported that the estate had realised £190, and a dividend of 3d. in the £ had been paid on provable debts aggregating £8,866. The applicant began business in 1920 in partnership with two others, as manufacturers of electric lamps, under the style of "The Eclat Electric Lamp Co." The bankrupt estimated his losses on the partnership at £7,000; his late partners should have contributed £5,000 towards that amount, but he had not returned them as debtors to his estate because he was of opinion that the debts were irrecoverable. In January, 1923, the bankrupt purchased the "Spencer Lamp Works" and the "Standard Lamp Works," at Wimbledon, for £8,000. He carried on those concerns under management for six months, when they were taken over by "The Eclat Electric Manufacturing Co., Ltd.," registered in July, 1923, with a nominal capital of £500. The company issued first debentures to the mortgagees of the property, and a second debenture for £13,500 to himself as the purchase consideration for the business. He became a director of the company and a year later obtained for it a loan of £11,000 from his bankers against securities worth £9,000, and a guarantee of over £3,000 from the petitioning creditor. Early in 1925 owing to default in the payment of interest, first debenture holders obtained the appointment of a receiver and the bankrupt's second debenture produced nothing whatever. Towards the end of 1925, an order to discharge the loan of £11,000 obtained from the company's bankers, the bankrupt's securities were sold and the petitioning creditor was called upon and paid a certain amount under his guarantee. He next called upon the bankrupt to fulfil his obligations to reimburse the amount so paid, and in default of payment instituted bankruptcy proceedings. In September, 1923, the bankrupt registered, and became a director of "The Eclat Electric Accessories (Paddington) Co., Ltd." This concern also proved a failure, a receiver was appointed, and at the date of the receiving order in April, 1926, the company was moribund. The only fact reported by the Official Receiver in opposition to the application was insufficiency of assets to equal 10s. in the £ on the amount of the liabilities. His Honour granted a discharge subject to a suspension of four weeks.

H. H. D. RADCLIFFE and F. HADDLETON, trading as "City Electric Services," 51, Islington Row, Birmingham, electrical engineers.—The public examination herein was held on March 13th at the Court House, Birmingham, when a statement of affairs was presented showing liabilities of £489 and a deficiency of £332. The debtors attributed their failure to insufficient capital, loss on contracts, and excessive drawings of partners. The debtor Radcliffe commenced trading in January, 1927, and was subsequently joined by Haddleton, who invested £150 on a partnership basis. The business had never yielded sufficient to meet the partners' drawings. The examination was closed.

F. E. CARE (F. E. Care & Son), dealer in electrical goods, &c., 40, Paradise Street, West Bromwich.—First meeting held March 21st, at the Official Receiver's office, 191, Corporation Street, Birmingham. Public examination, April 5th, at the Law Courts, West Bromwich.

S. HALL (E. Green & Co.), electric lamp dealer, 13, Caledonian Road and 30, Leighton Lane, Leeds.—First meeting March 25th, at the Official Receiver's office, 24, Lower Bond Street, Leeds. Public examination, April 9th, at the County Court House, Leeds.

G. M. WILSHAW and G. SHARPE (Wilshaw & Sharpe), electrical dealers, 320, Padiham Road, Burnley.—Last day for proofs for dividend, March 29th. Trustee, Mr. J. W. Carter, Official Receiver, District Bank Chambers, Blackburn.

H. C. SHARPE, wireless engineer, late of 42, Molesworth Street, Wadebridge.—Last day for proofs for dividend, March 30th. Trustee, Mr. T. Barton, Official Receiver, City Chambers, Catherine Street, Salisbury.

E. D. JONES, electrical engineer, Royal Sportsman Hotel, Portmadoc.—First and final dividend of 1s. 5d. in the £, payable April 9th, at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

Company Liquidations.

MOULDINGS AND INSULATORS, LTD.—A meeting of creditors will be held on April 8th at the office of the liquidator, Mr. W. Honeyman Brown, 19a, Coleman Street, E.C. Particulars of claims to the liquidator by April 22nd. (This notice is purely formal; all creditors have been, or will be, paid in full.)

HINDHEAD AND DISTRICT ELECTRIC LIGHT CO., LTD.—A meeting of creditors is called for March 27th at the office of the liquidator, Mr. A. P. Ogden, Audrey House, Ely Place, E.C.1.

EPOCH ELECTRICAL SOCIETY, LTD.—Particulars of claims by April 5th to the liquidator, Mr. C. Hughes, 24 & 25, Ironmonger Lane, E.C.

DOUGLAS SOUTHERN ELECTRIC TRAMWAYS, LTD.—A meeting of members is called for April 15th at the offices of Messrs. E. Guthrie & Co., 71, King Street, Manchester, to hear an account of the winding up from the liquidator, Mr. G. A. Orme.

METROPOLITAN ELECTRIC WIRE CO., LTD.—Liquidator, Mr. E. T. A. Phillips, Carey Street, W.C., released March 7th.

Private Arrangements.

L. W. WESTBURY, trading as L. W. Westbury & Co., Lichfield Street, Walsall, wireless and electrical dealer.—A meeting of creditors was held recently. No statement of affairs was presented, but it was reported that the unsecured creditors' claims amounted to approximately £2,150. The assets consisted of stock in trade at cost £87. The debtor started business at Cannock four years ago, where he traded from his house. Subsequently he removed to Bloxwich, and two years later to the present premises at Walsall. A creditor had levied execution and the Sheriff had removed goods prior to selling them by auction. The debtor stated that his drawings had been between £4 and £5 a week. He said that during the past twelve months he had paid out about £500 to suing creditors and £164 by way of costs. During the early part of his trading he sold a retail shop, and the money obtained from that source was mainly used to pay the suing creditors. At the present time a number of writs and summonses had been issued and a creditor had obtained judgment. It appeared that the expenses on motors, wages, &c., had totalled about £15 a week. The debtor said that he did not become aware of his position until December last. It was resolved that provided the debtor found guarantors for the payment of a composition of 5s. in the £, payable as to 2s. 6d. in three months and 2s. 6d. in six months, the estate should be dealt with under a deed of assignment in favour of Mr. W. P. Barnfield, Walsall, as trustee.

WOODHEAD BROS., 31, Church Street, Rotherham, electrical engineers.—A meeting of creditors was held recently, when a statement of affairs was presented which disclosed liabilities of £2,570, of which £1,711 was due to the trade; there was a loan creditor amounting to £771, and the bank was a partly-secured creditor for £356, being unsecured for £88. The deficiency was £1,498. The business was commenced in July, 1923, with a capital of about £700. It was carried on successfully until about two years ago, when a branch was opened which did not prove successful, and was eventually closed down. Losses were made on various contracts, and on one estate a loss was shown of about £300. From April, 1927, to June 30th, 1928, a loss of £90 was sustained. The present deficiency was accounted for by the depreciation written off the various assets and the accumulated losses. It was resolved that a deed of assignment should be executed in favour of Mr. A. Arthur, Rotherham, as trustee, with a committee of inspection consisting of representatives of three of the creditors.

Reduction of Capital.

ERSKINE, HEAP & CO., LTD., and reduced.—A petition for the confirmation of the reduction of the capital of the company from £50,000 to £25,000 has been presented to the Court of Chancery of the County Palatine of Lancaster, and will be heard in Manchester on March 25th.

Deed of Arrangement.

R. E. A. EAVES and H. D. CAMERON, trading as the Empress Radio and Electrical Co. at Manor Works, Stonehouse, Plymouth, and as the Westminster Radio at Plymouth, Bridgwater, Taunton and Newquay.—Particulars of claims by March 31st to the trustee, Mr. P. White, 6, Sussex Terrace, Princess Square, Plymouth.

Local Exhibitions.

BRADFORD-ON-AVON.—An electrical exhibition organised by the Western Electricity Supply Co., Ltd., was held in the Town Hall on March 7th and 8th. It was officially opened by Mr. A. W. Edwards, J.P., who welcomed the enterprise of the company in providing facilities for the residents of Bradford to see some of the many uses of electricity in the home. Mr. A. J. Bridge, publicity and development manager, outlined the progress made during recent years in encouraging the use of electricity in the home. The exhibition, which was devoted chiefly to home lighting and small domestic appliances, was very well attended.

EALING.—Ealing registered electrical contractors are to hold an electrical exhibition at the Ealing "Palladium," from April 6th to 13th inclusive; the Borough Council has agreed to give a free supply of electricity for the purposes of the display.

PRESTON.—The scope of the forthcoming electrical exhibition at Preston is to be larger than that of the previous event five years ago, and will embrace radio and commercial electricity, a feature being a model bakery. The Corporation's special exhibit will be model rooms in an average house demonstrating the application of electricity to domestic uses.

Agents in the Baltic States.

The British Consuls at Helsingfors and Kovno have furnished the Department of Overseas Trade with memoranda upon the appointment of agents in Finland and Lithuania. British firms interested in these markets can obtain copies of these memoranda upon application to the D.O.T., 35, Old Queen Street, S.W.1. (Reference 8790/2/28.)

The American G.E.C. in Portugal.

It is reported that a director of the American General Electric Co. is at present in Lisbon for the purpose of studying the project of electrifying the Portuguese railway system.

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New Catalogues and Lists.

MESSRS. G. A. HARVEY & CO. (LONDON), LTD., Woolwich Road, S.E.7.—A profusely illustrated catalogue (No. 355) of ornamental metalwork, including examples of electric heater covers; also a leaflet containing particulars of the company's mild steel plates for the fixing of electric wires and cables.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Book I, Section 2b, illustrating and describing iron-cased signalling apparatus for mines, railways, industrial use, &c. Priced.

KELVINATOR, LTD., 258, Gray's Inn Road, W.C.1.—A booklet containing lists of users of "Kelvinator" refrigerators, with illustrations of actual installations of the equipment.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—A pamphlet—"The Lure of the Cotswold Hills"—describing, with illustrations, The Church Cottage, Witcombe, in which a Chloride battery has recently been installed.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1.—An amusing pamphlet, with illustrations by Riley, embodying a series of advertisements expounding the advantages of the company's "Cablegrip" service boxes.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—A booklet giving preliminary details of the 1929 "Inventum" water-heating programme, with particulars and prices of water heaters.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—Publication No. 8329, containing illustrations and details of the company's new ironclad isolating links for factories.

MESSRS. BEST & LLOYD, LTD., Handsworth, Birmingham.—A priced catalogue of modern lighting fittings illustrating many examples of wall lights, table lamps, floor standards, pendants, &c., employing the company's "Firelight" glass.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A circular letter advertising "Duplex-a-lite" units; and particulars of, and an agreement form for, the company's hire-purchase system.

MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—A folder (No. 1053), illustrating the economies in wiring effected by the use of individual light control. Details and prices of the company's ceiling switches are given.

THE WALSALL HARDWARE MANUFACTURING CO., LTD., Hatherton Works, Ablewell Street, Walsall.—A pamphlet containing illustrations, particulars and prices of "Walsall" combined switch and fuse boards.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—March stock list of motors, dynamos, transformers, &c.

MR. T. A. ROSE, 25, Milton Street, E.C.2.—Two illustrated and priced pamphlets dealing with pocket, panel-mounting and switchboard instruments, and a portable miniature testing set.

MESSRS. JAMES HENDRY, LTD., 252, Main Street, Birmingham.—An illustrated brochure dealing with the manufacture and applications of the company's laminated leather belting.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A brightly-coloured poster advertising the company's hire-purchase system in relation to its "Model 37 receiving set.

SETALITE, LTD., 1-4, Morley House, Regent Street, W.1.—Leaflets describing the "Setalite" universal voltage instrument for use on automobiles.

MESSRS. GUY V. LAYCOCK, LTD., 12, Cloth Hall Street, Huddersfield.—Leaflet describing the "British" electric paper cutting or perforating machine.

B.T.H. Magnetos in Speed Test.

The BRITISH THOMSON-HOUSTON CO., LTD., informs us that magnetos of its manufacture were fitted to the car in which Major H. O. D. Segrave attained a speed of 231.36 m.p.h. last week. B.T.H. magnetos also formed part of the equipment of the cars in which Capt. Malcolm Campbell and Major Segrave established earlier "records," while the motor-boat "Miss England," in which Major Segrave is attempting to set up a new water speed record is similarly equipped.

The "Electrical Review" in New Jersey.

British electrical visitors on their return from the U.S.A. sometimes tell us with satisfaction that they have found the familiar blue-covered REVIEW available at certain points on their travels. It will interest some of our readers to know that every issue of the ELECTRICAL REVIEW is fully indexed, by the Engineering Index Service, as soon as it is received, in a set of cards, which brings ready to hand any article on any subject in this journal and in any one of 1,700 other journals in all languages. This Engineering Index Service, instituted in January, 1928, is to be found in the Public Libraries of Newark, Cleveland, Bridgeport, Baltimore, and the John Crerar Library, Chicago. Engineers in any field who live or work in New Jersey, have access to this index to the latest engineering literature, in the Public Library of Newark, N.J., which has this journal on file.

Central Electricity Board.

In this issue the Central Electricity Board calls for tenders for the supply, delivery and erection of 33,000-V and lower voltage transformers in connection with the North-West England and North Wales Electricity Scheme, 1928.

New French Companies.

Among the companies recently formed in France are the Société de l'Union Coloniale d'Electricité, Paris (94, Rue de la Victoire), capital, 2½ million francs, to establish electricity supply undertakings in the French colonies; and the Compagnie Hydro-Electrique de la Cure, Paris (96, Rue de la Victoire), capital, 20,600,000 fr., to acquire and extend the undertakings of the Société des Chutes de la Cure et des Chemins de fer Electriques de l'Yonne.

Book Notices.

"Elektrisace Ceskoslovenska, 1918-1928" ("Electrification of Czecho-Slovakia, 1918-1928"). Pp. 177, 36 figs. and two maps. Prague: Elektrotechniky svaz Ceskoslovensky (Czecho-Slovak Electro-technical Union). Price 100 Czech crowns.—This volume has been published in connection with the tenth anniversary of the Republic to demonstrate what has been done in the electrification of the country since the War. In the first part of the volume, the originators of the systematic electrification express their views under the headings—Systematic electrification and its general importance, its promotion by means of a special law, its development in different parts of the country, comparison of the results obtained in Czecho-Slovakia during the ten years with those of foreign countries, electrification of country districts, of industry, of homes and of railways. Reports upon the activities of electricity producers' and distributors' organisations follow. The second part contains statistical data and descriptions of the most important plants. The public utility companies, who are charged with the task of carrying out the electrification programme, twenty-four in number, produced in 1922 90 million kWh, and in 1927 300 millions; their total investments in 1922 were 342 millions of Czecho-Slovak crowns and 1,347 millions in 1927. The 231 "non-utilities" produced in 1927 284 million kWh. The total length of distributing lines in 1926 was 18,000 km. The average consumption of electricity has risen from 71.5 kWh *per capita* in 1922 to about 140 kWh in 1928.

"Willing's Press Guide, 1929." Pp. xii+514. London: Willing Service (Willing & Co., Ltd.). Price 2s. 6d.—The 1929 issue of this useful handbook is the second of the new series and the fifty-sixth annual issue. The volume contains several new features, such as the introduction of indicative initials at the head of each page. Net sales or guaranteed circulation figures have been added where this information has been furnished by the different newspapers and periodical Press. All the remaining features have been carefully checked and brought up to date. The book contains much information useful to those who use the Press for advertising purposes.

"Nickel Steels." Pp. 36; figs. 28. London: Mond Nickel Co., Ltd.—A publication of the research and development department of the company, which deals with the mechanical properties of nickel steels and the effects of composition and heat treatment.

"Practical Geometry and Engineering Graphics." By W. Abbott. Pp. 304; figs. 343. London: Blackie & Son, Ltd. Price 10s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. March, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

For Sale.

By order of the liquidator, Messrs. H. Butcher & Co. will sell by auction on April 16th, on the premises, Station Road, Maldon, Essex, the freehold factory, plant and machinery of the Maldon Electrical Works. Weston-super-Mare District Council invites offers for 3,000 ft. of h.d. copper wire cable. The Burgh of Hamilton Electricity Department has for disposal one 620-Ah Tudor battery. Falkirk Borough Electricity Department invites offers for one 250-kW Westinghouse rotary convertor with starter and switchgear. Worcester Corporation Electricity Department has for disposal several motor-generators and a 2-ton electric motor hoist. The West Central Merchandise Mart will sell by auction on March 27th, at York House, Southampton Row, W.C., a stock of cables, electrical fittings and wireless goods. Great Yarmouth Corporation Electricity Department invites offers for 20,000 used electric lamps of various sizes, all 100 V. Greenock Corporation Electricity Department has for disposal surplus generating plant, &c. (See our advertisement pages to-day.)

Unemployment.

There was a fall of 4,560 in the number of registered unemployed during the week ended March 4th. At that date the total was 1,387,300, as compared with 1,391,860 on February 25th, and 1,094,452 on March 5th, 1928.

Social Events.

The first annual dinner of the staff of the London Power Co., Ltd., was held at the Connaught Rooms on March 8th, the chairman of the company, Mr. W. F. Fladgate, M.V.O., presiding, supported by Mr. W. A. Pearman (general manager) and Dr. S. L. Pearce (engineer-in-chief). There was an attendance of over 200. After the loyal toast, Dr. Pearce, proposing the health of the chairman, drew attention to the prominent part which Mr. Fladgate had taken in securing the co-ordination of electricity supply in London. In acknowledging the toast, Mr. Fladgate said that his connection with

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electricity dated from the time when, as a boy, in 1863, he heard Tyndall lecture on electricity at the Royal Institution. Since that time a great deal had happened in the electrical world. There was still much to be done, and he looked forward to a continuance of the good feeling which existed between all sections of the company. The health of the general manager and the engineer-in-chief was proposed by Mr. Mackenzie, and briefly responded to. A musical and comedy entertainment followed the dinner.

The sixth annual staff dinner of the Automatic Telephone Manufacturing Co., Ltd., was held on March 8th at the Exchange Hotel, Liverpool. Sir Alexander Roger (chairman) presided over a company of about 170, and was supported by Mr. G. W. Moore (director and manager). The toast of "The Company" was proposed by Mr. C. Hitchen and responded to by the chairman, whilst the guests were toasted by Mr. G R. Maitland, Mr. E. A. Ward responding. Other speakers during the evening were Mr. H. E. Powell-Jones, Telephone Development Association, and Mr. G. W. Moore. The dinner was followed by an entertainment provided by the "Duds" concert party, under the direction of Mr. Ralph Collis.

Henley's Dramatic Club is producing "The Whole Town's Talking," a farce in three acts, at the Cripplegate Theatre, Golden Lane, London, E.C.1, on March 23rd, at 7.30 p.m. Tickets are obtainable at from 2s. to 5s., from Mr. W. G. Turner, 11, Holborn Viaduct, E.C.1.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price Mar 19.	Fortnight's inc or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	"	£52	...
a	Bisulphide of Carbon	"	...	...
a	Borax	"	£25	...
a	Copper Sulphate	"	£25 10s.	...
a	Potash, Chlorate	per lb.	8½d. to 4d.	...
a	" Perchlorate	"	5½d.	...
a	Shellac	per cwt.	£18 10s.	...
a	Sulphur, Commercial	"	£11	...
a	" Roll	"	£11	...
a	Soda, Chlorate	per lb.	8d.	...
a	" Crystals	per ton.	£5 to £5 5s.	..
a	Sodium Bichromate, casks ...	per lb.	8¼d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£95 to £100	...
b	" Wire	per lb.	1/1 to 1/9	...
b	" Sheet	"	1/1 to 2/9	..
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£204	£4 inc.
	Grade II	" "	£142	£3 inc.
	Grade III	" "	£79	£4 inc.
c	Brass (rolled metal 2" to 12" basis)	per lb.	11½d.	⅜d. inc.
c	" Tubes (solid drawn)	"	1/2 to 1/2⅔d.	⅜d. to 1d. inc.
c	" Wire, basis	"	1/0½	⅜d. inc.
c	Copper Tubes (solid drawn) ...	"	1/4¼	1d. inc.
c	" Bars (best selected) ...	per ton.	£125	£9 inc.
c	" Sheet	"	£125	£9 inc.
c	" Rod	"	£125	£9 inc.
c	" (Electrolytic) Bars ...	"	£125	£9 inc.
d	" Sheets ...	"	£148 10s.	..
d	" Wire Rods ...	"	£109 10s.	£8 inc.
d	" H.C. Wire	per lb.	1/1⅜	⅛d. inc.
d	"	"	2/8 to 2/6	...
f	Ebonite Rod	"	2/8 to 2/6	...
l	" Sheet	"	2/2	...
n	German Silver Wire	"	nom.	...
h	Gutta-percha, fine	"	1/1½	¼d. dec.
h	India-rubber, Para fine	"	67/-	3/- dec.
l	Iron Pig (Cleveland No. 3.) ...	per ton.	£21	...
l	" Wire, galv. No. 8, P.O. qual.	"	£29	£1 inc.
g	Lead, English pig	per bot.	£22 2s 6d. to £22 5s.	...
g	Mercury	per lb.	3d. to 3/-	...
e	Mica (in original cases) small ...	"	4/- to 8/-	...
e	" " medium	"	10/- to 20/- & up	...
e	" " large ...	"	1/3½	...
p	Phosphor Bronze, plane castings	"	1/5	1½d. inc.
p	" " drawn bars & rods	"	1/4½	⅜d. inc.
p	" " rolled strip & sheet	"	1/6½	½d. inc.
p	" " wire...	per oz.	£13 17s. 6d.	..
o	Platinum	per lb.	1/1	...
d	Silicium Bronze Wire	"	7½d.	...
r	Steel, Magnet, in bars	per ton.	£224 10s. to £225 10s.	£5 to £5 10s. inc.
n	Tin, Block (English)	per lb.	8/11	...
n	" Wire, Nos. 1 to 16			

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated March 16th, Messrs. James Forster and Co. stated that a setback during the week was followed by a recovery and, assisted by further speculative buying, lead prices rose 15s. per ton, the tone at the close being firm. There were speculative orders from America, based presumably on the strength of the continuation of the Mexican revolution. At present shipments of lead from that quarter are being held up, but regular shipments are expected to be resumed shortly. Demand in this country remains quiet; supplies are ample and higher prices than the present are not justified. However, speculation may drive prices higher yet.

Proposed South African Duty Reductions.

In introducing the Budget for the year, Mr. Havenga, the South African Minister of Finance, announced that it was proposed to reduce the Customs duties on several classes of goods of a kind not made in South Africa. Among them was included certain electrical apparatus.

Trade Announcements.

Mr. C. McKinlay has resigned his position with Metro-Vick Supplies, Ltd., and has been appointed sales representative in England, Wales and Ireland for Messrs. Lane and Girvan, Ltd., Bonnybridge, near Glasgow, who have just completed a new works for the production of "Caledonia" electric cooking and heating apparatus. Mr. Douglas Arthur, who for some years has been associated with the Falkirk Iron Co., Ltd., has been appointed in a similar capacity for Scotland.

"K.N." Electrical Products, Ltd., has removed to larger premises at 5, 6 & 7, Singer Street, Tabernacle Street, E.C.2. (Telephone: Clerkenwell 6643; telegrams "Kayenelec, Finsquare.")

The telephone number of Hooper's Telegraph & India Rubber Works, Ltd., Adelaide House, King William Street, E.C.4, has been altered to "Mansion House 6626."

The registered offices of the Lorival Manufacturing Co. (1921), Ltd., have been transferred to the company's Norwood Works, Southall, Middlesex.

The Corlett Electrical Engineering Co., Ltd., has removed to 85, Wallgate, Wigan.

The address of the Piggott Electrical Co., Ltd., is now Salisbury Square House (Dorset Street entrance), Fleet Street, E.C.4. The telephone number (City 1014) is unchanged.

The offices of Francis Lamp Locks, Ltd., have been removed to 2, 3 and 4, Cockspur Street, S.W.1. (Telephone: Regent 1227 and 1228; telegrams: "Lamlok, London.")

Commercial Electrical Travellers.

The Electrical Trades' Commercial Travellers' Association is holding a whist drive this evening (Friday) at the British Commercial Travellers' Club, 24, New Oxford Street, W.C.1.

Lighting and Power Notes.

Argentina.—Electrical Development.—According to a return recently prepared by the Argentine Electrotechnical Association there were 1,266 power stations, with a total capacity of 305,348 h.p., in operation in the Argentine at the end of 1927. The total was made up of 226 steam-operated stations (140,470 h.p.), 979 plants operated by internal combustion engines (125,240 h.p.), and 61 hydro-electric power stations (39,648 h.p.).

Ashford (Kent).—Loans.—The Urban District Council has applied for sanction to a loan of £2,000 for supplying electricity to Wye, and £9,000 for extensions to the plant at the electricity works.

Barnsley.—Mains Extensions.—The Corporation Electricity Committee has received sanction to a loan of £2,322 for mains extensions.

Birmingham.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to the following loans: buildings (sub-station), £51,700; consumers' sub-station equipment, £198,100; frequency-changer, £11,500; purchase of Imperial Arcade, Dale End, £30,000.

Blackpool.—Loans.—The Corporation has received sanction to the borrowing of the following loans for additional h.p. transmission lines from Preston to Blackpool:—Underground mains, £13,000; overhead lines, £6,500; plant (transformers and switchgear), £20,500.

Canada.—Hydro-Electric Development.—The Premier of Ontario recently announced in the Provincial Legislature that additional development of power would be undertaken by the Hydro-Electric Power Commission of Ontario to supply the northern section of the Province, in addition to the increased requirements of the section already supplied. The project will include a transmission line running north from Toronto, to tap new power sources with a total capacity of approximately 500,000 h.p. These sources of supply include the Nipigon, power reserve, the Mississauga reserve, power sites on the Ottawa River, prospective development on the Abitibi Canyon, and the Wahnipitae system of Sudbury. This huge development, it is proposed, will centre around the Wahnipitae system, which is within comparatively easy reach of the Ottawa and Western power reserves, and can easily be linked in with them.

Continental.—Germany.—An official return recently issued shows that the output of the 127 principal power stations in Germany during the first eleven months of last year amounted to approximately 12,974 million kWh, as compared with 11,110 million kWh in the corresponding period of 1927.

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Belgium.—The Société des Charbonnages de Ressaix, Leval, Peronnes, Ste. Aldegonde and Genck, which has recently formed a subsidiary concern for the manufacture of synthetic ammonia, has decided to erect a new steam-operated power station with a capacity of 30,000 kW to supply the necessary power for the new undertaking. The boilers at the new power station will be adapted for pulverised fuel firing.

Colchester.—Loans.—The Town Council is making application for sanction to the borrowing of £7,500 for cookers, wiring and fittings, and £7,500 for prepayment meters and wiring.

Consulting Engineer.—In connection with the proposed extensions to the power station, the Council has decided to retain the services of Mr. W. C. C. Hawtayne as consulting engineer.

Dewsbury.—Electricity Supply.—The Town Council has decided to carry out a scheme for the supply of electricity to the new General Infirmary and adjoining area at an estimated cost, including the necessary sub-stations, of £7,164.

Dumfries.—Loan.—The Corporation Finance Committee is to apply for sanction to a loan of £10,000 to meet the cost of extensions, &c., at the electricity works.

Eastbourne.—Loans.—The Corporation Electricity Committee is applying for sanction to the borrowing of £15,408 for provision of mains, &c., Sanction has been received to a loan of £2,793 for mains and services in connection with the supply of electricity to Attfield Estate, Hampden Park.

Exmouth.—Transfer of Undertaking.—The Urban District Council is to instruct Parliamentary agents to lodge an objection to the draft Order for which the Electric Supply Corporation, Ltd., is applying to the Electricity Commissioners. The Order will authorise the transfer of the electricity undertaking to another company.

Glasgow.—Administration.—The Corporation Electricity Committee on March 15th approved a report submitted by Mr. H. Bell, general manager, dealing with his preliminary investigation of the administration, operation, and general efficiency of the Electricity Department. Mr. Bell stated that it was estimated that the saving in revenue expenditure in respect of wages, material, debt charges, and rates and charges as compared with the previous year, would, due to various causes, amount to £40,000. It was further estimated that there would be a reduction in capital expenditure in respect of wages amounting to £31,000 and of materials amounting to £149,000. Pointing out that the sales of the Department over the past five years had increased from 142 million kWh to 220 millions, he stated that it would be apparent that any development of business could only be accomplished by a materially enlarged and improved sales organisation. The principal proposal contained in the report was the appointment of a sales manager competent to co-operate with the existing technical staff. During the present financial year considerable curtailment of activities at the premises at Port Dundas had taken place. Of 31 transport vehicles, eight were redundant and taken off the road. During the past year the Department had reduced the number of employés by over 300. The clerical staff had been reduced during the last three years by nearly 10 per cent., but no further material reductions could take place without loss of efficiency.

Gravesend.—Loan.—The Corporation Electricity Committee is applying for sanction to borrow £3,165 for the provision of eight 200-kVA transformers, five kiosks and e.h.p. switchgear.

Guisborough.—Loan.—The Urban District Council has applied for sanction to a loan of £1,000 for meters.

Hastings.—Overhead Lines.—The Corporation Electricity Committee has received sanction to the borrowing of £1,265 for the erection of overhead lines in Battle.

Heston and Isleworth.—Street Lighting.—The Electricity Department of the Urban District Council proposes carrying out street lighting improvements in Hounslow High Street and London Road by the provision of 1,000-c.p. lamps, at an estimated cost of £4,612, for which sanction is to be sought.

Isle of Wight.—Change-Over.—At a meeting of the Newport Corporation, the town clerk submitted a letter from the chairman of the Isle of Wight Electric Light and Power Co., Ltd., as to the suggested change in the system of electricity supply in the island from d.c. to a.c., in which the company stated that if this was agreed to it would mean a new Special Order for the whole island to replace existing Orders, of which there were 10 in force. If the local authorities of the island were willing to co-operate with the company to obtain such an Order the company was willing to put into force reductions in the charges for electricity. The town clerk reported that at a conference of local authorities to consider the company's proposals the matter was deferred in order that further information might be obtained.

Irish Free State.—Manorhamilton (Co. Leitrim).—The power station in the town was destroyed by fire on the night of March 9th, the damage being estimated at £2,000. There was no water supply available, and no attempt could be made to save the concern.

Lathom and Burscough (Lancs.).—Electricity Supply.—The Urban District Council has asked Mr. James Scott, electrical engineer of Bootle, to furnish a report to the Council on the advisability of applying for an Order authorising the Council to supply electricity in the district.

Lewes.—Street Lighting.—The Town Council has adopted a scheme for extending the public lighting by electricity under a ten years' contract with the Lewes and District Electric Supply Co., Ltd. Under the new arrangement the consumption will be increased from 64,000 to approximately 125,000 kWh per annum, and the company will bear the whole capital cost, together with the maintenance and renewal of all lamps and fittings. The charges per lamp are to be reviewed at the end of every third year.

Lincoln.—Loans.—The Town Council has applied for sanction to loans of £10,000 for cables, and £4,750 for switchgear.

London.—Islington.—The Borough Council Finance Committee is seeking sanction to borrow £80,000 for mains, services, meters, transformers, time switches, &c.

Hackney.—The Electricity Committee has recommended that Messrs. May & Hawes be appointed consulting engineers in connection with the proposed extension of the power station as a "selected" station under the South-East England Electricity Scheme, 1927, at a fee of 1 per cent. upon the capital expenditure on plant, subject to a maximum of £3,500.

Manchester.—Progress During December.—During the month of December the Corporation electricity undertaking showed an increase in connections of 2,539 kW, bringing the total up to 370,202 kW; and the number of applications received for supply, including those for additional supplies, was 1,152, representing a total of 2,309 kW. The number of hired cookers connected increased by 78, bringing the total actually on circuit to 5,025. Applications for the hire of cookers totalled 56. The maximum load recorded reached 156,370 on December 17th, a record for the undertaking. One new sub-station was put into commission, and additional plant installed at three existing sub-stations. The change-over from d.c. to a.c. has been completed in the cases of 3,679 consumers, work is in progress involving 533 consumers, and sanction has been received in respect of an additional 632 consumers.

Newark.—Electricity Accounts Estimates.—The estimates of the electricity undertaking which were recently submitted to the Town Council show a satisfactory financial position. The scheme was inaugurated just over two years ago, the Council entering into an agreement with the Derbyshire and Nottinghamshire Electric Power Co. for a supply in bulk, the minimum guarantee to the company for the year being £5,000. The actual payment was £5,284, with an additional £1,000 for a supply to the Corporation's waterworks at Farnsfield. The accounts for the twelve months show a gross profit of £4,757, of which interest on loans absorbs £1,532, sinking fund instalment, £1,027, deficiency of the previous two years £700, leaving a balance of £1,494. There has been an increase in sales of nearly two million kWh on the previous year.

Paisley.—Electricity in Bulk.—The question of taking all the electricity required under the bulk supply agreement and shutting down the station at Blackhall was considered recently by the Corporation Electricity Sub-Committee. It was agreed to recommend that, owing to irregularity in the supply, it would be inadvisable at present to close down the station.

Portsmouth.—Street Lighting.—The Corporation Electricity Committee has decided to reduce the charges for the erection of small street lamps, at present £6 13s. 6d., and for the conversion of gas lamps, at present £3 15s. 6d., to £3 3s. in both cases.

Loan.—Application is to be made for sanction to the borrowing of £9,500 for the provision of 0.15 sq. in. e.h.p. 66,000-V mains in the city from the generating station to sub-stations at Dover Road, Fawcett Road, Lower Forbury Road, Fratton Grove, and Terwick Street.

Assisted Wiring Scheme.—On the recommendation of the Committee, the City Council has adopted a scheme for the electrical wiring of private dwelling houses in the city upon the hire-purchase principle. The scheme does not apply to houses in the course of erection. Ten per cent. of the cost must be paid by the consumer to the Corporation upon his signing the agreement to have the work carried out, the balance of 90 per cent. being met by equal quarterly payments over a period of five years.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Whitby.—Commercial baking ovens and restaurant cooking: From 1½d. to 1d. per kWh.

Dover.—Lighting: From 6½d. to 5½d. per kWh, with a discount of ½d. per kWh for prompt payment of accounts.

Wallasey.—Lighting: From 4½d. to 3¾d.

Elgin.—*The Elgin Electric Supply Co., Ltd.*—Lighting: From 1s. to 10d. per kWh.

The Lothians Electric Power Co., Ltd.—Consumers supplied on the contract system: From 1½d. to 1d. per kWh.

Hackney.—Private lighting and domestic uses:—Scale "A," alternative No. 1, from 1d. to ¾d. per kWh; scale "D," from 1d. to ¾d. per kWh; scale "C," from 1d. to ¾d. per kWh; scale "F," from 6/10d. to ½d. per kWh. Power and factory lighting:—Scale "D," alternative No. 1, from ¾d. to ½d. per kWh.

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Ripon.—Supply Extension.—The City Council is applying for sanction to borrow £1,170 for an extension of the electricity supply to Wormald Green, and a further sum of £3,875 for work in connection with the construction of an overhead transmission line from a point near Burton Leonard to Ripon. The electricity supply for Ripon is expected to be available in the early summer, and the charges will be 6d. per kWh for lighting, and 2d. per kWh for power.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Holderness Trust, Ltd., to supply electricity in the urban district of Withernsea and part of the rural district of Patrington; the Culm Valley Electric Supply Co., Ltd., to supply in the rural district of Culmstock and part of the rural district of Tiverton; and the Yorkshire Electric Power Co., to supply in parts of the rural districts of Chapel-en-le-Frith and Bakewell.

The Minister of Transport has confirmed a Special Order made by the Commissioners authorising the Braunton Electric Light and Power Co., Ltd., to supply electricity in part of the rural district of Barnstaple.

St. Helens.—Loan Sanctioned.—The Town Council has received sanction to a loan of £2,950 in connection with the supply of electricity to the Blackbrook housing estate.

Torpoint.—Opposition to Application.—The Urban District Council has resolved to oppose the Torpoint Electricity Supply Company's application for powers to supply electricity in the district. It was mentioned at a recent meeting that the Saltash Town Council and the St. Germans Rural District Council had approved the company's application.

Wellington (Salop).—Electricity Supply.—At a recent meeting of the Urban District Council the clerk stated that he had been interviewed by representatives of a firm which had acquired rights to provide electricity in twelve districts from Exmouth to Minehead. It was expected that the matter would be through Parliament in about three months, and that within eight months standards would be erected in Wellington. The price would be about 9d. per kWh for lighting and 2½d. per kWh for power.

Winchester.—Cable Extensions.—The Town Council has decided to carry out cable extensions for improving the supply to the lower end of High Street and to St. Giles' Hill and surrounding district, at an estimated cost of £4,865.

Worthing.—Loans.—The Town Council has applied for sanction to loans totalling £31,665 for the following purposes: Convertor plant and switchgear to deal with the bulk supply from Southwick, £8,832; cables for the supply of electricity to Findon, and overhead extensions from Findon to Muntham Court, £1,050; feeder cables, £4,680; alterations and additions to boiler house, £6,240; motor generator for feeder regulation, £525; d.c. balancing transformer, £430; new sub-station, £550.

Tramway and Railway Notes.

Birmingham.—New Cars.—The Corporation Tramways Committee has obtained sanction to a loan of £125,000 for the purchase of 50 new tramcars.

Continental.—Italy.—A new funicular railway has recently been inaugurated, which connects the centre of Naples with the hill of du Vomero and is 1,230 m. in length. Each of the two trains weigh 14 tons empty and are capable of transporting 100 passengers. The normal power is 240 h.p.

To improve the transportation facilities in Genoa it is proposed to construct an electric funicular railway between Borgoratti and Apparizone, which will have an average gradient of 22 per cent. and a total length of 4,500 m. The cars will be fitted with hand and electric brakes and each will accommodate 44 passengers.

London. — Loud-Speakers on Platforms. — Experiments have proved successful with loud-speakers to impart information regarding incoming trains at London Bridge station of the Southern Railway, and it has been decided to make them a permanent part of the organisation for handling the homeward rush-hour traffic.

Children's Fares.—The issue of 6d. daily tickets for children last year having proved satisfactory, the Highways Committee has recommended that the scheme be continued during the period April 1st to September 30th next.

Mexborough.—Railless Cars.—A new railless-car service between Maltby, Rotherham and Conisborough was recently inaugurated. The new service is intended to improve travelling facilities over the original route of the Mexborough and Swinton Tramways Co., plus an extension to Conisborough.

Plymouth.—Transport Improvements.—It was stated at the March meeting of the City Council by the chairman of the Tramways and Transport Committee that the work of building new omnibus bodies and new tramcars, together with a heavy programme of permanent-way reconstruction, had now been completed. The Committee had resolved to purchase twelve omnibuses of the single-deck type to meet the requirements due to the normal growth of the undertaking and for the replacement of the rolling stock, at a price of £1,466 per 'bus, and application is being made to the Ministry of Transport for sanction to borrow £18,000 for the purchase.

United States.—New York.—The Bronx Concourse subway extension in New York City, which will join the Manhattan Line at 148th Street and St. Nicholas Avenue, is progressing along St. Nicholas Place toward the vicinity of the Polo Grounds, where it will cross under the Harlem River and pass the Yankee Stadium, continuing on up under the concourse. According to the *Electric Railway Journal*, five contracts on the Bronx line have been awarded as far as Kingsbridge Road, amounting to approximately $28,000,000. The balance of the concourse line will be under contract during the present year, according to the authorities. Mayor Walker, of New York City, states that plans for the consummation of the entire programme of the rapid transit development, involving an expenditure of $700,000,000, are being anticipated It is expected to advance the work this year by at least $100,000,000 and that the end of 1929 will bring a solution of practically all the problems involved in this undertaking.

Warwick.—Parliamentary Bill.—*The Times* reports that the Local Legislation Committee, which has been considering the Bill promoted by the Leamington and Warwick Electrical Co., Ltd., to authorise it to run railless cars in the two boroughs in which it is at present operating a tramway service gave its decision on March 14th. Mr. Wrottesley, K.C., for the promoters, said that his clients and the public bodies opposing the Bill—the Warwick and Leamington Corporations and the Warwickshire County Council—had agreed to a settlement as follows: (1) The promoters were to take up their tram way in a manner approved by the Corporations and to make a contribution in respect of restoring the highways. (2) The promoters agreed to abandon the clauses of the Bill seeking power to run railless cars and to run omnibus services. (3) The promoters had agreed to charge 1d. per mile fare instead of the 1½d. charged as the normal maximum fare all over the country. (4) In return, the Corporations were to give protection against competition to the promoters' omnibus service. The chairman announced that the Committee held that the preamble had been proved subject to the conditions agreed to between the promoters and the local authorities. The promoting company would be protected and have absolute running powers for omnibuses, not only over its present tramway route but over all the routes specified in the Bill.

Telegraph and Telephone Notes.

Australia.—Radio Tariffs.—The Melbourne correspondent of *The Times* reports that Rear-Admiral W. R. Napier, of the Australian Naval Board, giving evidence at the Senate inquiry into whether wireless charges should be reduced to a penny a word, said the beam system was unable to carry single-handed the traffic between England and Australia. He advocated the maintenance of the cable system, which offered means of secret communication and also a 24 hours' service. The nation commanding the sea, he observed, also guaranteed cable communication.

Telephone Tariff.—On an average subscribers in the capital cities of the Commonwealth make approximately 1,400 telephone calls each year. Using this figure as a basis, the annual cost in respect of a telephone service is as follows: Australia, £12 5s. 10d.; Great Britain, £13 16s. 8d.; New Zealand, £15; United States, £17 1s. 8d.; Canada, £17 10s. A country subscriber makes approximately 500 calls a year, and the comparative figures are as follow: Australia, £5 1s. 8d.; Canada, £5 12s. 6d.; New Zealand, £6; United States, £7; Great Britain, £7 11s. 8d. Evening and trunk-line tariffs are even more generous to the Australian subscriber.

South America.—Automatic Telephony.—The municipality and the telephone company have agreed on the installation of automatic telephones in the whole of the Rio de Janeiro Federal district in twenty-four months. The Light and Power Co., according to the *Financial News*, will employ £1,000,000 worth of material.

Sweden.—Submarine Telephone Cable.—The laying of what is claimed to be the longest submarine telephone cable in the world between Sweden and Finland, connecting Stockholm with Aabo, has just been completed. The cable distance is 242 kilometres, of which 212 kilometres' length is marine cable, the total weight being 2,000 tons. The thickness of the cable is 45 mm. on the Swedish side and 50 mm. on the Finnish side. It contains 32 copper wires, made up together four and four into eight four-wire conductors; seven of them are intended for an equal number of calls on the four-wire principle between Sweden and Finland, the eighth trunk permitting two calls on the two-wire principle between Aaland and the mainlands of Finland and Sweden.

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The Telegraph Service.—COMMISSION OF INQUIRY.—The Commission of Inquiry which was appointed by the British Post Office authorities last year to visit the U.S.A. and investigate the organisation and methods of working of the American telegraph companies has reported to the Postmaster-General. Its report includes recommendations relative to apparatus, the recruitment and training of staff, control, and various proposals for popularising the inland telegraph service.

United States.—TELEGRAPH CABLE MERGER RUMOURS.—Mr. Newcom B. Carlton, president of the Western Union Telegraph Co., stated on his return from Europe on March 12th that a communications merger between the Radio Corporation of America (which works in conjunction with the Marconi European services) and the Western Union Co. was still under discussion; no definite decision, however, was in sight. Mr. Carlton went abroad in order to observe the results of the British cable merger, which, he said, would have "a decided effect upon the activities of American companies." He explained that he had discussed a tentative *modus operandi* between British and American cable companies, but that no final agreement was reached. A combination of the Western Union Co. and the Radio Corporation of America would form one of the most extensive communication systems of the world. Recently negotiations were reported to have been postponed owing to fear that such a deal might violate the provisions of the American White Law, which is designed to prevent mergers calculated to diminish competition.—*Reuter's* (New York).

NEW RADIO COMPANY.—The Radio Corporation of America announces the formation of a new subsidiary company called "Radio Corporation of America Communications, Incorporated," which will take over its communication business, except that of the ship-to-shore service. The announcement follows the recent negotiations between the R.C.A., the Western Union, and the Postal Telegraph Co., which have evidently terminated, since the new company is wholly owned by the R.C.A., and will be a direct competitor against the other two. General Harbord has been elected president of the subsidiary company, which will develop independently of the manufacturing and sales interests of the Radio Corporation of America.

Radio Notes.

Common Wavelength.—DUNDEE.—The Dundee station has been included among those stations transmitting on the national common wavelength of 288.5 metres (1,040 kilohertz), which is ultimately to be adopted by practically all British relay stations. The change took place on March 16th; as the station formerly transmitted on a frequency of 1,020 kilohertz (294.1 metres), the change is so slight that very little, if any, readjustment of listeners' receiving apparatus should have been necessary.

France.—RADIO BILL.—The Bill which is shortly to come before the French Parliment, defining the rights and conditions of broadcasting, will raise the question of the censorship of programmes. Two suggestions will be put forward, one emanating from Mr. Francois-Poncet before he was appointed Under Secretary of State for Fine Arts, and the other from the Government. Objection is being taken to the Government's proposal, which would delay by three hours most news.—*Reuter* (Paris).

United States.—LAW TEST CASE.—The Court of Appeals of the District of Columbia has delivered a judgment which is likely to cause the Federal Radio Commission serious embarrassment in future. Station WGY (Schenectady), operated by the General Electric Co., took legal action against the Commission when it refused to renew the station's broadcasting licence on a full-time basis. The Commission was obliged, by the equalising requirement of the Davis amendment to the Radio Act, to curtail the time allotted to one or other of the powerful stations operating in Columbia, says *World Radio*, and the appellate court which heard the appeal ruled that curtailment of the Schenectady station's time was not justified.

This is the first decision of the kind made by an appellate court designated in the Radio Act to settle disputes. Its importance is the fact that henceforth the ruling of the Radio Commission on any station's comparative utility is legally open to serious challenge, and unless it appeals successfully to the Supreme Court of the United States against the judgment it is likely that other stations will begin legal action against its rulings.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—May 15th. Victorian Railways. One geared 3-phase electric winding engine. (A.X. 7650.)*

MELBOURNE.—Victorian Railway Commissioners. April 5th. Rectifiers and storage batteries for power signalling. (B.X. 5166.)* Dwarf electric signal mechanisms. (B.X. 5168.)*

Blackpool.—March 27th. Town Council. Two electrically-driven sewage pumps. Specifications from F. Wood, borough engineer, Municipal Buildings, Town Hall Street.

China.—SHANGHAI.—March 30th. Kailan Mining Administration. Two 300-kW turbo-generator sets. (B.X. 5174.)*

East Ham.—March 23rd. Electricity and Tramways Department. 5,750 yd. e.h.p. cable. (March 15th.)

Edinburgh.—March 25th. Electricity Supply Committee. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuseboards, electricity supply meters. (February 15th.)

Edlington.—April 17th. West Riding Education Committee. Installation of electric lighting at new schools and caretaker's house. Education Officer, County Hall, Wakefield.

Farnworth.—April 3rd. Electricity Department. L.p. cables. (March 22nd.)

Gloucester.—March 25th. Electricity Department. Two 1,000-kW motor-generators. (March 8th.)

Harrogate.—March 23rd. Electricity Department. Cables, joint boxes, joint box compound, service meters, cut-outs and transformers for 12 months. (March 8th.)

Ilford.—March 25th. Electricity Department. Supply of paper-insulated cables. (March 8th.)

India.—NEW DELHI.—Indian Stores Department. March 26th. Oil engine generator set. (B.X. 5157.)*

Knottingley.—March 25th. Urban District Council. Wiring 48 houses in Weeland Road, and Womersley Road. Forms of tender from the Council's Surveyor, Town Hall.

London.—CENTRAL ELECTRICITY BOARD.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (March 15th.)

March 25th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V and lower voltage transformers. (See this issue.)

BETHNAL GREEN.—March 25th. Borough Council. Electric lighting installation at seven blocks of tenement buildings in Bethnal Green. (March 8th.)

ISLINGTON.—March 26th. Cleansing Committee. One new lead battery for Edison vehicle. (March 15th.)

PADDINGTON.—April 8th. Great Western Railway. Stores, including electrical wires and cables, telegraph ironwork, and iron and steel wires. (See this issue.)

Manchester.—April 3rd. Electricity Committee. One 8,000-kVA air-cooled transformer. (March 15th.)

April 8th. Two 33,000-V metal-clad switch units. (See this issue.)

March 25th. Corporation. Heavy a.c. equipment, cables and lighting installation at tramway works extensions. City Architect, Town Hall. Deposit £1 1s.

New Zealand.—WELLINGTON.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Oldham.—March 27th. Housing Committee. Electric lighting installation for 200 houses on the Corporation housing estate. Borough Engineer, Town Hall.

South Africa.—PORT ELIZABETH.—March 28th. Municipal Council. 33,000-V cable, transformers, disconnecting boxes, oil switches, link switches, trifurcating boxes, and electricity meters. (B.X. 5146-7-8.)*

UMTALI.—April 18th. Municipal Council. 1,000-kW turbo-alternator, spray cooling plant, switchgear, transformers, crane, &c. (B.X. 5142-5.)*

JOHANNESBURG.—April 25th. South African Railways and Harbours. Three electrically-driven wheel lathes. (A.X. 7621.)*

May 16th. Electric signalling apparatus. (B.X. 5165.)*

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Stirling.—March 25th. Corporation. Electrical work in connection with 10 houses. Specifications from burgh surveyor.

Wolverhampton.—April 5th. West Midlands Joint Electricity Authority. Three single-phase, 4,000-kVA transformers. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Ashford (Kent).—Urban Council. Accepted :—
Eight-cylinder engine, with supercharger and alternator, for the electricity works (£7,798).—Davey, Paxman and Co., Ltd.

Bedwas and Machen.—Urban Council. Accepted :—
Overhead lines, &c., in connection with extensions to Maesycwmmer, Bedwas, and Machen.—W. T. Henley's Telegraph Works Co., Ltd.

Brentwood.—CORRECTION.—In the list of tenders for the internal wiring at Brentwood Mental Asylum (ELEC. REV., March 15th, p. 478), the amount of the tender of Read and Partners, Ltd., of Westminster, was incorrectly given as £9,240. The actual quotation of this company was £11,240.

Carlisle.—Town Council. Accepted :—
Installing electric light in Council houses.—A. G. Bullen and Co., and W. Batey & Sons.

Dewsbury.—Town Council. Accepted :—
L.p. cable (£1,000).—Power and Lighting Cables, Ltd.
E.h.p. cable (£1,495).—W. T. Henley's Telegraph Works Co., Ltd.
H.p. switchgear (£1,143).—Ferguson, Pailin, Ltd.

Doncaster.—Town Council. Accepted :—
Installing electric light at the new Infectious Diseases Hospital (£1,707).—W. Skewes, Ltd.

Douglas (I.O.M.).—Electricity Committee. Accepted :—
L.p. board for Pulrose and h.p. panels for Summer Hill sub-station (£339).—New Switchgear Construction Co., Ltd.
Wiring 100 houses on Pulrose Estate (£656).—Siemens Bros. & Co., Ltd.

Dumfries.—Town Council. Accepted :—
Installing electric light in 36 houses, at £18 9s. 4d. per block.—Gordon & Moodycliffe.

Ealing.—Borough Council. Accepted :—
Electrical sewage pumping machinery at Northern sewage works (£440).—R. E. Smart & Co.

Glasgow.—Tramways Committee. Recommended :—
2,000 tons of steel rails (£19,700).—Bolckow, Vaughan and Co., Ltd.

Gravesend.—Electricity Committee. Recommended :—
Transformer (£136).—Bruce Peebles & Co., Ltd.
Switchgear (£234).—British Thomson-Houston Co., Ltd.

London.—ST. PANCRAS.—Contracts and Stores Committee. Recommended :—
L.p. cable for stand-by supply to the *Daily Sketch* and *Sunday Graphic* premises (£6,315).—Hackbridge Cable Co., Ltd.
One kiosk-type sub-station (£388).—Electric Construction Co., Ltd. (Recommended.)

ISLINGTON.—Electricity Committee. Recommended :—
Scott-connected transformers of either 750 kVA, and/or 1,500 kVA capacity up to a maximum of 9,000 kVA, for sub-stations as and when required up to December 31st, 1931 :—

	Price per unit. 750 kVA.	1,500 kVA.
C. Dikkers, Ltd. (made in Holland) ...	£370	£572
HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD. (Recommended.)	379	625
Foster Engineering Co., Ltd.	446	683
Yorkshire Electric Transformer Co. ...	478	666
C. A. Parsons & Co., Ltd.	540	730
A.S.E.A. Electric, Ltd.	545	850
Brush Electrical Engineering Co., Ltd.	432	656
English Electric Co., Ltd.	432	655
Metropolitan-Vickers Electrical Co., Ltd.	488	686
Johnson & Phillips, Ltd.	531	726
British Electric Transformer Co., Ltd....	567	839
Ferranti, Ltd.	573	926
British Thomson-Houston Co., Ltd. ...	579	775

5,000-kVA Scott-connected transformer—with booster regulator, &c. :—

FERRANTI, LTD. (Recommended.)	£2,730
English Electric Co., Ltd.	2,820
Hackbridge Electric Construction Co., Ltd. ...	2,918
British Electric Transformer Co., Ltd.	3,105
C. A. Parsons & Co., Ltd.	3,298
A.S.E.A. Electric, Ltd.	3,490
British Thomson-Houston Co., Ltd.	2,548
Metropolitan-Vickers Electrical Co., Ltd. ...	2,864
Johnson & Phillips, Ltd.	2,917
Brush Electrical Engineering Co., Ltd.	2,996

E.h.p. and h.p. switchgear :—

METROPOLITAN VICKERS ELECTRICAL CO., LTD. (Recommended.)	£10,712
Park Royal Engineering Co., Ltd.	10,712
Switchgear & Cowans, Ltd.	11,218
Johnson & Phillips, Ltd.	11,343
A. Reyrolle & Co., Ltd.	11,443
New Switchgear Construction Co., Ltd. ...	11,507
General Electric Co., Ltd.	11,575
Ferguson, Pailin, Ltd.	11,624
English Electric Co., Ltd.	11,679
British Thomson-Houston Co., Ltd.	11,795

Manchester.—Electricity Committee. Accepted :—
Single-phase a.c. meters.—Ferranti, Ltd.; Measurement Ltd.; Metropolitan-Vickers Electrical Co., Ltd.

Newbury.—Town Council. Accepted :—
135-b.h.p. electric motor, with pump, for the drainage pumping plant, at £899.—Hathorn, Davey & Co., Ltd.

Ramsgate.—Town Council. Accepted :—
Cable, electrical equipment and electric lamps for the Sands and Entertainments Committee (£207).—J. Carman.

Truro.—Public Works Committee. Recommended :—
Electric lighting at Town Quay.—Truro Electricity Supply Co.

Worthing.—Electricity Committee.
Converting plant and switchgear (£5,710 and £3,112 respectively).—British Thomson-Houston Co., Ltd.
Cable work in connection with the supply to Findon (£9,367), overhead extension from the Kennels to Muntham Court (£1,050).—Callender's Cable and Construction Co., Ltd.

Forthcoming Events.

Institution of Civil Engineers (Midland Area).—Friday, March 22nd. Chamber of Commerce, Birmingham. 6 p.m. "Developments of the Generation and Distribution of Electrical Power in the British Isles." Mr. A. Page.

Junior Institution of Engineers.—Friday, March 22nd. 39, Victoria Street, S.W. 7.30 p.m. "Ventilation." Mr. D. A. Collin.

Birmingham Electric Club.—Friday, March 22nd. Grand Hotel, Birmingham. 7 p.m. Annual dinner.

Physical Society.—Friday, March 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Annual general meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 23rd. South Wales Institute of Engineers, Cardiff. 6 p.m. "Power Factor: Its Cause and Effect." Mr. C. L. James.

(Lothians Branch).—Saturday, March 23rd. Philosophical Rooms, Edinburgh. "A.C. Winding."

(London Branch).—Saturday, March 23rd. Visit to Gas Light and Coke Co.'s Works at Beckton.

Royal Institution of Great Britain.—Saturday, March 23rd. 21, Albemarle Street, W. 3 p.m. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford, F.R.S.

Nottingham Society of Engineers.—Monday, March 25th. Victoria Station Hotel. 7.30 p.m. "Surface Condensing Plant." Mr. A. Beeston.

Institution of Electrical Engineers (North-Eastern Centre).—Monday, March 25th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Direct Generation of Alternating Current at High Voltages." Sir Chas. A. Parsons, F.R.S., and Mr. J. Rosen.

(North Midland Centre).—Tuesday, March 26th. Hotel Metropole, Leeds. 7 p.m. "The Testing of Porcelain Insulators." Mr. B. L. Goodlet.

(South Midland Centre).—Monday, March 25th. University, Birmingham. 7 p.m. "The Construction of the Grid Transmission System in Great Britain." Mr. Johnstone Wright and Mr. C. W. Marshall.

(Western Centre).—Monday, March 25th. Town Hall, Cheltenham. 6.15 p.m. "The Planning and Layout of a Rural Overhead Line." Mr. S. E. Britton.

(North-Western Students' Section).—Tuesday, March 26th. Engineers' Club, Manchester. 7.15 p.m. "High-voltage D.C. Transmission." Mr. D. G. Reed.

Electrical Power Engineers' Association (London Local Group).—Tuesday, March 26th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Foundations." Mr. J. C. Hughes.

Institution of Engineering Inspection. — Wednesday, March 27th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "Acoustics in relation to the Gramophone and Radio Loud-Speaker." Mr. A. M. Hallawell.

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The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

"K" switches.
Duro pumps.
Virson cable connectors.

Notes.

Sir Hugo Hirst, Bart.

The following letter has reached us at the moment of going to press, too late for inclusion in our "Correspondence":—

The name of Sir Hugo Hirst has been added to those other names of super patriots of foreign origin already emblazoned upon the scroll of English history. Electrical engineers are generally so much occupied in their industrial interests that they have neither the time nor inclination to worry about the affairs of others, so that it may be necessary in this context to remind them of the list that begins with St. Augustine and includes almost every kind of social condition and occupation.

William the Norman; the Dutchman of the same name; George the First; the Prince Consort; Sir Anthony Vandyk; G. F. Handel; Joseph Conrad and others whose names escape me at the moment, because I am not writing with a book of biographical reference at my hand, have done their bit towards exalting the name of England.

Sir Hugo Hirst has thrown caution to the winds and has done his bit to rescue electrical engineering from the condition to which it had fallen in 1913. Some authorities say that we were run by the Germans at that date, others make us subservient to the U.S.A. In any case, whatever the tune may have been to which we danced in 1913, it was not English. In 1929 history seemed likely to repeat itself; we groaned under an intolerable bank rate which threatened to go higher, not a week passed but that we heard of the acquisition of our works or power companies by the foreigner; the prices of our electrical securities were forced up to dangerous heights from which the inevitable fall would land us in disaster, and our national pride, triumphant in 1918, suffered humiliation at the hands of the financial competitor.

Sir Hugo has struck a blow in our defence; he has arrested the artificial inflation of our electrical securities; he has reminded us of our duty to ourselves; has provided a rallying point whence our repulsed battalions may engage, and has generally raised Cain. I suggest, in recognition of his public services, that you, as our leading electrotechnical organ, should raise a fund to present him, in commemoration of his glorious act, with a copy of the "Declaration of Independence."

Epimetheus.

E.P.E.A. Dinner.

Mr. G. A. Goodall presided over the annual dinner of the Devon and Cornwall Section of the Electrical Power Engineers' Association at Plymouth on March 9th. The success of "The Association" was proposed by Mr. E. G. Okell, City of Plymouth electrical engineer, who spoke of the valuable work done in various centres by the Local Technical Groups of the Association, and response was made by Mr. A. N. Sendell (Bath). "The Electrical Supply Industry" was toasted by the general secretary of the Association, Mr. W. A. Jones (London), who reviewed the general advancement made by the industry. Mr. O. S. Hosgood (Cardiff), chairman of the Western Division, replied, and to the toast of "The Visitors," proposed by Mr. R. H. Lee, Mr. Turner responded. A programme of music and variety was provided.

Measuring Fluid Velocity.

A new method of effecting the measurement of fluid velocity has been devised by Profs. H. E. Hartig and H. B. Wilcox while carrying out the experimental programme of the American Society of Mechanical Engineers' Special Research Committee on Velocity Measurement of Fluid Flow, which they are conducting at the University of Minnesota. The method depends upon measuring differences of audio-frequencies, the fluid velocity being proportional to the frequency difference. In August last year a shielded 6-stage resistance-coupled radio amplifier with two 3,000-cycle tuned-input circuits was tested in connection with two magneto sound pick-up devices. It was found that the device as constructed could differentiate very sharply between frequencies differing by a very small amount, in the neighbourhood of 3,000 cycles per second. The experimenters are experiencing difficulty in finding two sound pick-up devices which do not introduce a phase shift in the two signals produced, over a sufficiently large range of frequencies. A number of expedients have been tried with commercial apparatus to eliminate this difficulty, so far without success.

An Irish Invention.

Benefits to the Irish Free State railways are expected to accrue from a patent which the Free State Government a fortnight ago voted £5,000 to acquire certain rights in, but the Minister refused to give any details. The inventor is Mr. James J. Drumm, who was born in Dundrum, Co. Down. After graduating from University College, Dublin, he went to Manchester in 1917 as an analytical chemist, and studied at the School of Technology. He then carried on research work in metals and collaborated in the production of chromium as used in stainless steel. Mr. Drumm returned to Dublin in 1920, and since then has devoted most of his time to research work at the National University.

Educational.

The Board of Education has issued Form 105 U (Ti) describing short courses for recognised teachers in technical schools, &c., which are to be held in 1929. They will include courses on engineering, science, and electrical engineering at Merton College, Oxford, from July 20th to 31st. Those desirous of attending them would apply to the Board on Form 106 U (Ti) before April 20th.

Accident.

Mr. Alexander Munro, Glasgow a Lloyd's surveyor, was killed, and Mr. Joseph Myers, chief electrical engineer, was injured on board the new P. and O. liner, *Viceroy of India*, at the Tail-of-the-Bank, Greenock on March 4th. The vessel, which is undergoing trials on the Clyde, was returning to the anchorage when the accident occurred. When one of the anchors was being lowered the pin came out of one of the shackles and the anchor rattled down into the water at terrific speed. The shackle-pin rebounded, struck Mr. Munro a glancing blow on the right side, and knocked him down. Mr. Myers was hit on the left shoulder and thrown to the deck. A tug was summoned, and both men were taken aboard. Mr. Munro died before the vessel reached the shore.

St. George's Chapel, Windsor.

According to the *Daily Telegraph*, the experiment is being made of installing electric light in the choir of St. George's Chapel, Windsor Castle. The nave and side aisles have been illuminated by electricity for many years, but the choir for the last five centuries has been lighted by candles. Six electric chandeliers, each carrying five lamps, have been temporarily suspended from the vaulted roof, and various tinted globes have been tried to see which produce the most effective glow. The object is to secure that the light shall be thrown downwards, not around and upwards. Electric radiators were installed over a year ago, because it was found that the heating apparatus was practically useless during the work of renovation. The choir of St. George's has been restored at a cost of over £100,000, and the nave is now being renovated.

Cable Sheath Losses and Carrying Capacity.

In an article by Messrs. Herman Halperin and K. W. Miller, in a recent issue of the *Electrical World*, evidence is given of the increase obtained in the current-carrying capacity of single-conductor cables by the elimination of sheath losses. In 1926 the Commonwealth Edison Co. began the installation of single-conductor underground cable on three-phase, 60-cycle, 66-kV lines, and on 12-kV leads to transformers feeding the lines. Since calculations showed that if the sheath losses were eliminated the carrying capacity of the two sizes of cable would be increased, it was decided to make trial installations with various kinds of insulating sleeves, bonding apparatus and methods of bonding. It was found that the elimination of the sheath losses from three-phase, 60-cycle, 66-kV lines, consisting of single-conductor 750,000-circular mil cables installed in conduits with other cables, increased the average yearly carrying capacity from approximately 50,000 to 60,000 kVA, or about 20 per cent. Since the total investment cost of the installed cable is approximately $60,000 per mile of line, or about $1.20 per kVA-mile, the increased investment value resulting from the elimination of sheath losses is, therefore, approximately $12,000 per mile of line. An additional saving is made in the cost of reduced sheath losses, which is about $1,000 per mile of line per year, assuming 55,000 kVA average yearly rating and a 60 per cent. load factor. Capitalised at 10 per cent. per year, this represents an additional investment saving of $10,000 per mile of line.

Electric Vehicles in France.

An active campaign with the object of popularising the use of electric vehicles throughout France is being conducted by the Société pour le Developpement des Véhicules Electriques, a body which corresponds to the Electric Vehicle Committee in this country. Two two-day meetings have lately been held in Paris, to which representatives of the principal French railways, harbour, and dock authorities, various motor-using Government Departments, members of Chambers of Commerce, &c., were invited to listen to a series of papers on the subject of electric vehicles, see lantern displays of their uses, and to witness road demonstrations of different types of electromobiles. Similar demonstrations are to be organised at a number of the trade fairs to be held in France this year.

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The Electrical Association for Women.

Recently members of the Leeds and West Riding Branch of the E.A.W. held their first luncheon at the Queen's Hotel, Leeds, at which the Lord Mayor of Leeds (Alderman D. B. Foster), Miss C. Haslett, director, E.A.W., and Mr. W. B. Woodhouse, engineer and manager, Yorkshire Electric Power Co., were present.

On February 26th, a party of E.A.W. members, including the president, Mrs. Wilfrid Ashley, and the Viscountess Elibank, visited the electric restaurant kitchen car of the London and North-Eastern Railway Company at King's Cross Station. Members were received by Messrs. Hind, Gresley and Sutcliffe on behalf of the company. The chef and the engineer were also in attendance, and explained how so many passengers could be catered for and served in so small a kitchen.

The inaugural meeting of the Bristol and District Branch of the E.A.W. was held on March 5th.

At a recent meeting of the South Wales and Monmouthshire branch of the Association, Mr. J. W. Beauchamp, M.I.E.E., engineer and manager of the South Wales Electrical Power Distribution Co., gave some interesting figures concerning the consumption of electricity in the home.

By kind invitation of the British Thomson-Houston Co., Ltd., and the Hotpoint Electric Appliance Co., Ltd., members of the Association visited the Ideal Home Exhibition on March 13th and were entertained to luncheon and tea. The party numbered over 300, including members from Birmingham and the Midlands, Cheltenham, Gloucester, Rugby, Ashford, Bristol and Cardiff. Demonstrations were given of the latest electric lighting, heating, cooking, refrigeration and labour-saving appliances. After luncheon the members adjourned to the Hall of Music, kindly lent by His Master's Voice Gramophone Co., when Mr. F. W. Leevers welcomed the party on behalf of the B.T.H. Co., and gave a most interesting address on the steadily-growing appreciation of the advantages of electricity in the home.

A one-day conference has been arranged by the Association for April 16th, when a meeting of members will be held at the Hotel Cecil (London) at 11.15 a.m. to discuss the work of the Association and receive reports from headquarters and the various branches throughout the country. At a luncheon on the same day the speakers will include Mrs. Wilfrid Ashley, president, E.A.W., Sir John Snell, chairman, Electricity Commissioners, Lt.-Col. K. Edgcumbe, president, Institution of Electrical Engineers, and Lady Emmott, president, National Council of Women of Great Britain. In the afternoon a party will leave the Hotel Cecil by motor coaches to visit the works of Messrs. Belling & Co., at Edmonton and Enfield, to see the manufacture of electrical "outlet" equipment. The day's programme will conclude with a ball at the Hotel Cecil. Mrs. Wilfrid Ashley will receive guests at 9 p.m. Tickets for the luncheon and ball can be obtained as follows: Combined, 25s. each; luncheon, 6s. each (exclusive of wines); ball, 21s. each.

Appointments Vacant.

Electrical artisan (£380) for the Nigerian Government Railway. Lecturer in electrical engineering for the City of Leicester Education Committee. Charge engineer (£250) for the City of Canterbury Electricity Department. Charge engineer for the Stoke-on-Trent Corporation Electricity Department. Electrical mechanical engineer for the Government of Palestine Public Works Department (£550). Three temporary sub-station attendants for the Stepney Corporation Electricity Department. Draughtsman (£414) for the Hammersmith Borough Council Electricity Department. Shift engineer for the Borough of Darwen Electricity Department. (See our advertisement pages to-day.)

An Electrostatic Voltmeter.

At a meeting of the Physical Society of London, Dr. E. H. Rayner demonstrated a standard electrostatic voltmeter and wattmeter used for measuring a.c. at power frequencies at the National Physical Laboratory. The voltmeter indicates up to about 120 volts on a scale about 18 ft. long, and the quadrant electrometer designed for use as a wattmeter has a similar scale. They are of the type used as the national standards for such work, in which accuracy is of primary importance; as regards sensitivity, they must be considerably superior to commercial apparatus, the errors of which it is their purpose to determine. The voltmeter is used commonly at 100 or 110 volts, higher voltages being measured on accurate potential dividing resistances; at 100 volts the scale divisions are about 80 mm. per volt, enabling values to be measured to 0.01 volt over a large part of the range of the instrument. The latter is of the multicellular type with "needles" specially shaped to open up the bottom and top parts of the scale, which are normally much more contracted than the middle part. The suspension is a bifilar one, fine tungsten wire being used; a horizontal aluminium disk in oil provides the damping. The wattmeter is a more delicate instrument, the torque available being much less than in the case of the voltmeter; its nominal range is 100 or 110 volts on the "needle" and 2 volts on the quadrants. The needle is of thin aluminium alloy with stiffening ribs which have been pressed up in it by means of a grooved metal die. Blotting paper is used to press the metal foil into the die under pressures up to 10 tons. No oil damping is permissible; the separation of the quadrants is about 2 mm., which is sufficiently small to provide, with the grooving of the needle, the necessary amount of air damping. The separation naturally affects the sensitivity, so that the sensitivity, damping, and grooving are interdependent. The scale deflection with 100 volts on the needle and 2 volts on the quadrants is about 12 ft. Mechanical adjustments are provided for levelling the quadrants and varying their separation, and for moving them round inside the casing, so that they can be oriented in any desired direction as regards the position of the needle. The insulation is made of "amberite." Special calibrating resistance boxes are made for the voltmeter and wattmeter, and selector switches are also required, the one for the wattmeter being of some elaboration, since the needle and quadrants must never be open circuited in passing from one method of connection to another, or from one circuit to another.

An Italian Electrical Endowment.

On behalf of the board of directors of the Edison Electric Co., of Milan, Signor Motta, a deputy, has presented Signor Mussolini, Prime Minister of Italy, with a sum of 10,000,000 lire (about £100,000) to provide scholarships for foreign travel and scientific research. They are to be administered by the Italian Academy, says *The Times*, and the fund is to be called the Alessandro Volta Foundation. The Edison Electric Co. has also decided to increase its grants to the Milan Polytechnic with the object of assisting scientific studies.

Therapeutic Light Treatment.

A warning against extravagant expectations relative to the value of artificial-light treatment is contained in the recently-published report of the Medical Research Council. Its comments on the subject are reported to be, *inter alia*, as follows: It would seem to be the duty of those who take the responsibility of prescribing light treatment, not only to secure that its known dangers shall be avoided, but also to find and announce evidence of its benefits that do not come only from strong commercial advocacy and popular credulity. It would seem also to be the special duty of hospitals and schools and other clinics, expending large sums of public money upon artificial light to use part of the expenditure to demonstrate by properly-controlled trials their justification for spending more. Prolonged research has provided no scientific reason at all to suppose that the treatment of rickets, or the supply of vitamin D to the body, is better effected by ultra-violet rays falling on the skin than by the direct provision of the necessary food values. The use of artificial light to supply only what the right food can give is merely wasteful. It commonly costs 3s. or 4s. to furnish by light an effective supply of vitamin D that would cost less than 1d. if taken through the mouth in the form of cod liver oil, or otherwise. The discovery of the powerful intervention of sunlight in nutrition led naturally to the suggestion, and even to the expectation, that it might act beneficially in other unrevealed ways. It was hoped that it might have other beneficial effects on child life besides its indirect value in supplying a vital food constituent. Following an experiment, no evidence could be found of any gain. When conditions between children with and without treatment were equalised, the results of the light were negative. The council is aware of no properly controlled experiments which have been made elsewhere to set against these results. The last report of the chief medical officer of the Ministry of Health shows that the results collected from artificial-light centres provided by local authorities exhibit much variation of opinion. No objective evidence is provided that results have been achieved that could not have been far more cheaply gained by proper food, and if that be so it is obvious that exercise and fresh air are greatly preferable to indoor sessions around a lamp.

The fact that light does cause an increase in the power of the blood corpuscles, as tested in shed blood, to dispose of bacteria has been largely used as a justification for the recent advocacy of light treatment, but such increased power, as shown in the laboratory, has not yet been correlated with any permanent effects of value in the body. It is quickly followed by a decrease of bactericidal power (power to kill bacteria), which not only soon returns to the normal, but at least sometimes goes below it afterwards. There is no present reason to know that artificial light can do more in this way than a mustard plaster, which is infinitely cheaper. The council draws attention to the various negative results because it had had the responsibility of expending public money in support of those researches which give the real, and perhaps at present the only, sanction for light treatment.

Rural Trend of Industry.

That the availability of electric power at cheap rates in rural areas will probably lead to the tide of industry running back from the towns to the country is the prophecy contained in a report dealing with South Buckinghamshire and the Thameside that has been issued by the local Regional Planning Advisory Committee, for whom it was prepared by Mr. W. R. Davidge, a past president of the Town Planning Institute. Electricity supplies, it is pointed out, "should enable the establishment of cottage industries to be a practical undertaking, and may lead to vigorous manufacturing activity in light industries in what are now purely agricultural centres. The report contains a survey of the geographical character of the region, its people and their occupations, the existing public utility services, and transport facilities.

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Institution Notes.

Institution of Electrical Engineers.

The annual dinner of the North-Midland Centre of the Institution took place on March 12th, at the Hotel Metropole, Leeds, Mr. F. S. G. Hinings (chairman of of the Centre) presiding over a gathering of close upon 100 gentlemen.

Proposing the toast of "The Institution," Mr. J. J. H. STANSFIELD, F.C.I.S., said there was no doubt the industry owed a tremendous debt of gratitude to it.

Lt.-Col. K. EDGCUMBE, T.D., R.E., president of the Institute, in response, said he was glad to learn that special efforts had been made to get the students to that gathering. He referred to the hope of the Council to improve the usefulness of the Students' Section, and invited the District Centres to do their best in the way of helpful suggestions. The electrical industry had made itself indispensable to big brother industries, such as mechanical engineering, and co-operation of that kind would go far to improve British production generally, but it must be recognised that if industries generally were not doing well, the electrical industry could not expect to prosper alone. He believed, however, there were definite signs of a general improvement.

Mr. W. B. WOODHOUSE (past-president of the Institution), proposing a toast to the guests, said he was particularly glad to note the close association between the electrical engineering industry and those who were engaged in teaching the science and practice of it. The industries of this country had been going through a very bad time, but out of adversity he believed some good was emerging. One of the most valuable outcomes of the troubles of industry had been the vast improvement in relationships between employers and employed. Another important development had been the great reorganisation now going on in industry; it was fashionable now to call it rationalisation. Undoubtedly it had to be recognised that the commercial unit of to-day must be on a larger scale than twenty years ago.

Professor F. C. LEA, O.B.E., D.Sc., responding on behalf of the guests, suggested that the Institution, which had already done much to encourage young men in scientific training, should still further encourage them to stay at the universities and do research work, and even when they left the universities to continue in the spirit of research even if they were bound by industrial duties to give less time to direct research. As one who had travelled a good deal, he was inclined to think some other nations had utilised young scientifically trained men rather more than this country had.

STUDENTS' DINNER.—The twenty-second annual dinner of the London Students' Section was held on March 5th at Les Gobelins' Restaurant. The number of members and guests was nearly 140, including Mr. P. V. Hunter. Mr. H. T. Young, and Mr. P. F. Rowell; the chair was taken by Mr. S. H. Hart. In toasting "The Institution of Electrical Engineers," Mr. L. S. Crutch drew attention to the fact that 25 per cent. of its members were students, and nearly 25 per cent. of the latter were members of the London Section. Mr. P. V. Hunter replied, and Mr. Moffatt, in proposing "Our Guests," mentioned that the Section had some lady members. Mr. Cousins replied. "The Students' Section" was proposed by Mr. H. T. Young, who regretted the poor attendance at meetings, the average being 60. Mr. S. H. Hart, in a short reply, said that the attendance at the dinner was the largest they had had for six years.

SUMMER MEETING.—At the invitation of the Société Française des Electriciens, the summer meeting of the Institution this year will be held in France. The following is a brief outline of the programme, full particulars of which will shortly be issued in the form of a circular to the members:—

Tuesday (June 11th), leave for Paris, where visits will be paid to various power stations, the wireless station at Sainte-Assise, the Carnot central automatic telephone exchange, &c.; excursions to Versailles, Malmaison, Chantilly, and Sevres, and on the evening of Wednesday (June 12th) there will be a banquet offered by the Société Française des Electriciens.

Sunday (June 16th).—Leave Paris for Bordeaux and the Pyrenees, with a stop at Eguzon to inspect the dam and the hydro-electric station of the Paris-Orléans railway.

Monday (June 17th).—Leave Bordeaux for Pau, where the party will be entertained at dinner by the South-Western Local Centre of the Société Française des Electriciens; visits to places of interest near Pau, including the Houra works and Eaux-Bonnes, the party proceeding to Loudres in the afternoon of Tuesday (June 18th). Next day there will be excursions from Loudres to works at Soulom and Gavarnie, and the party will leave Loudres for Toulouse in the afternoon of June 20th. On the Friday (June 21st) there will be an excursion to the old city of Carcassonne, returning to Toulouse in the evening.

Saturday (June 22nd).—Leave Toulouse for Paris, arriving there about 10 p.m.

The approximate cost of the Paris portion of the meeting will be from £12 to £19 10s. (depending on the class of hotel and route), and that of the whole trip (Paris and the Pyrenees) from £21 to £28 10s., which will include all transport, hotels, and meals (except luncheons and dinners in Paris, and wines). The very low cost of the Pyrenees trip is due to the fact that the Paris-Orleans and Midi Railways have generously agreed to provide railway transport for the party free of charge; in addition, the Chemin de Fer du Nord is transporting the party from Calais (or Boulogne) to Paris and *vice versa* at half fare.

The Physical Society.

The annual report of the Council for 1928 shows that 14 ordinary science meetings were held at which 33 papers were presented and 10 demonstrations given; the average attendance at meetings was 67. At the eighteenth annual exhibition, arranged jointly by the Physical and Optical Societies the total attendance was estimated at about 5,000. In January the Council passed unanimously a resolution that any Fellow having reached the age of 65, and having retired from the practice of his profession or business, may apply to the Council to remit, or reduce, his future annual subscriptions, provided his Fellowship of the Society has been continuous for at least 25 years. As a result of the labours of the Publications Sub-committee several important changes have been introduced. The number of honorary Fellows on the roll on December 31st, 1928, was 10, ordinary Fellows numbered 691, and students 47.

During the year the membership's net increase was 29, raising the total to 747. The total income of £3,503 exceeded the expenditure by £98.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. G. S. HAYDON, resident engineer and manager of the Nottingham Corporation's North Wilford power station, is severing his connection with that undertaking. Mr. Haydon superintended the construction of the North Wilford station as resident engineer for Messrs. Preece, Cardew & Rider, consulting engineers.

Mr. S. T. DAVIES, deputy borough treasurer, of Accrington, has been appointed secretary to the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board.

Mr. J. C. DENISON-PENDER, elder son of the late Sir J. Denison Denison-Pender, has been elected chairman of the Eastern Extension Telegraph Companies and the Western Telegraph Company. Mr. Denison-Pender, who was born in 1882, entered the cable service after leaving Eton, and went through all branches, including important cable-laying expeditions. He is a director of many cable companies, also banking and insurance companies. Mr. Pender's elder son recently joined the Eastern Telegraph Co.—the fourth generation of the Pender family to enter the service.

Mr. W. J. TERRY has been appointed deputy chairman of the London Electric Wire Company and Smiths, Ltd., and Mr. ERIC L. WILDY has been elected a director of the company.

Sir PHILIP DAWSON is in Egypt for the purpose of advising the Egyptian Government respecting a number of electrical matters.

Mr. W. L. HICHENS is one of the members of the recently-constituted board of the English Steel Corporation, Ltd.

Mr. JOHN DAWSON, for 34 years electrical engineer to the Marquis of Zetland on the Aske Estate, near Richmond, Yorkshire, has retired.

The Stockport Town Council has appointed Mr. W. L. CHUBB as mains superintendent.

Sunderland Town Council has appointed Mr. C. A. HOPKINS, general manager of Wigan Corporation Transport Department, as engineer and general manager of Sunderland Corporation Tramways, at a salary of £800 per annum. Mr. Hopkins, who succeeds the late Mr. A. R. Dayson, has been manager at Wigan since 1925, and previous to that was chief assistant from 1919.

The Worcester City Council has appointed Miss K. M. SHAW as lady demonstrator at the electricity showrooms at a salary of £160 a year, rising to £200.

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The Tilbury Urban Council has referred back to committee a recommendation to pay the electrical superintendent the salary laid down in the E.P.E.A. schedule, *viz.*, £485 per annum, as from April 1st next.

According to the *Industrial Australian and Mining Standard*, the recently appointed electrical sales manager of the Victorian State Electricity Commission (Mr. D. E. WILLIAMS) was leaving Sydney on February 7th for the United States and Canada, to study at first hand all matters related to the sale of electrical energy and the merchandising of electrical appliances by undertakings which, like the Commission, generate and distribute electricity on a large scale.

Mr. S. T. DAVIES, who has been in the service of the Accrington Corporation for 21 years, has been appointed secretary of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board

Mr. CHARLES N. PICKWORTH, Wh. Sch., who for 40 years has been editor of the *Mechanical World* and associated publications, has now retired from that position. Mr. Pickworth who is the author of several technical works, including the well-known book "The Slide Rule," will continue his consulting practice. His new address is 17, Griffiths Drive, Southport.

Obituary.—MR. A. A. SIMON.—We regret to record the death, which occurred on Friday, March 8th, at his residence in London, following a short illness, of Mr. Antony Andre Simon. Mr. Simon was born of French parents in Moscow, and was educated in that city. Following graduation from the Imperial University in Moscow, he joined the Russian Dynamo Company as a sales engineer. This company was at that time representing the old British Westinghouse Company, and in 1914 Mr. Simon was transferred to the British Westinghouse Company's staff then maintained in Russia. Although at first acting purely as a technical translator, within a few months he demonstrated his outstanding ability as a sales engineer, and up to the time of the Revolution he carried out many important negotiations for the British Westinghouse Company. In the disturbances following the Revolution he lost practically all his possessions. After several adventurous months he came to England, where he rejoined the British Westinghouse Company's staff, first in Manchester and later in London. For many years past Mr. Simon has held the position of manager of Continental sales for the Metropolitan-Vickers Company, and he was also a director of several subsidiary companies operating on the Continent. His duties entailed considerable travel throughout Europe, and he was consequently well known in practically every Continental country. He was a man of charming personality, which, in addition to his great abilities, both as a linguist and as an engineer, brought him an exceptionally wide circle of friends. The funeral service was held on March 11th at the Russian Cathedral Church in Kensington, and the interment took place at the Brompton Cemetery. The service was attended by a large number of Russian and British personal and business friends, including many past and present directors of the Metropolitan-Vickers Company and its subsidiaries both at home and abroad.

MR. F. W. METCALFE.—We regret to record the death of Mr. Frank Walker Metcalfe, B.Sc., manager of the Machine Section of the Contract Department, British Thomson-Houston Co., Rugby. Mr. Metcalfe, who was only 38 years of age, was a man of exceptional attainments, and his loss will be greatly felt, not only by his colleagues at Rugby, but by the large circle to whom he was well known throughout the country. After nine years with Messrs. Yates & Thom, he joined the British Thomson-Houston Co. in 1915, and made rapid progress until the time of his death. Apart from his engineering career, he did exceptionally good work in connection with the Adult School movement. Some two years ago he made an extended tour in Japan, spending some time in India on the return journey. The body was cremated on Saturday last, and the memorial service was held in the Rugby School Chapel. Mr. Metcalfe leaves one little son and a widow, with whom the utmost sympathy will be felt.

MR. CHAS. STANLEY.—We learn with feelings of deep regret of the death, which occurred on Monday, under tragic circumstances, at Alcester, of Mr. Charles Stanley, general manager of the British Industries Fair at Birmingham, and director of the National Trades Exhibition at Bingley Hall, Birmingham. He had recently suffered from influenza and family bereavement. In our various meetings with Mr. Stanley in connection with the Fair at Castle Bromwich, we have always found him to be most courteous and willing in rendering assistance to the Press. Those responsible for the organisation of the Birmingham Section will badly miss him, though in their future operations they will benefit from the efficient manner in which he has laid down the lines that have led to success.

MRS. W. FRISBY.—We regret to learn that Mrs. Lily Frisby, wife of Mr. William Frisby, borough electrical engineer of Colchester, passed away on March 12th as a result of pneumonia, following influenza.

Wills.—The late Mr. A. T. HOLLINGSWORTH, of *Engineering*, left £210,152 gross and £190,497 net personalty.

Mr. A. R. MACDONALD, of Bournemouth, left £9,726 gross and £9,673 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

J. Smith & Son (Brighton), Ltd.—Private company. Registered March 13th. Capital, £12,000 in £1 shares. Objects: To acquire the business now carried on at Brighton and elsewhere by Mary A. Smith and J. D. Smith as "J. Smith and Son," and to carry on the business of heating, lighting and electrical engineers, &c. The directors are:—J. D. Smith, "Hillsdown," Heath Road, Haywards Heath; Mrs. Mary A. Smith, 21, Windlesham Gardens, Hove; H. L. Smith (managing director), 23, Cissbury Road, Hove. Secretary: P. F. Spooner. Registered office: 33 & 34, North Road, Brighton.

British Meters, Ltd.—Private company. Registered March 14th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of gas, water, electrical and other meters, &c. The subscribers (each with one share) are:—D. W. Child, 132, Perry Rise, Forest Hill, S.E.23, solicitor's clerk; H. Pushee, 4, Mornington Street, Regent's Park, N.W.1, law writer. Registered office: 34, Castle Street, Liverpool.

Genuine Co., Ltd.—Private company. Registered March 12th. Capital, £10,000 in 8,000 ordinary "A" shares of £1 each and 40,000 ordinary "B" shares of 1s. each. Objects: To acquire the business of a manufacturer of and dealer in gramophones, wireless and general electrical goods, &c., carried on by Max Bilantz at 546, Harrow Road, W., 13 & 77, High Street, Harlesden, N.W., and at 364, Edgware Road, W., as the "Genuine Company," and the business carried on by him at 200, Portobello Road, Kensington, as "Lewis Turner & Company." The subscribers (each with one ordinary "B" share) are:—S. Gorrie, 32, Rosebank Avenue, Wembley, accountant; R. Greenhalgh, Wiggin Hall, Watford, accountant. The first directors are:—M. Bilantz (permanent governing director and chairman), T. Turower, and Miss Millie Bilantz. Secretary: A. W. Bedingfield, 42, St. James Road, S.W.9.

Blythe & Marden, Ltd.—Private company. Registered March 12th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in electrical, optical, photographic, wireless and scientific instruments and appliances, &c. The directors are:—B. S. M. Blythe, 22, Croydon Road, Caterham Valley; F. J. Marsden, Millford, Markville Gardens, Caterham Valley. Registered office: 26, Croydon Road, Caterham Valley.

Broadcasting Lampshades, Ltd.—Private company. Registered March 11th. Capital, £200 in 1s. shares. Objects: To carry on the business of wholesale, retail and export manufacturers of and dealers in all kinds of lamp shades, lamps, lighting apparatus, loud speakers, wireless receivers and components, gramophones, electrical and mechanical instruments and apparatus, &c. The permanent directors are:—J. Phillips, 146, Broadhurst Gardens, West Hampstead, N.W., company director; E. Joseph, 15, Vale Court, Maida Vale, W., merchant.

Imperic Radio Gramophone Manufacturing Co., Ltd.—Private company. Registered March 6th. Capital, £100 in £1 shares. Objects: To carry on the business of designers and manufacturers of and dealers in television and sound-producing and reproducing instruments, gramophones, ribbon

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records for gramophones, &c. The directors are:—T. F. Farrimond, 13, Virginia Road, Thornton Heath, company director (chairman); R. E. Townshend, 7, Woodend, Sutton, Surrey, electrical engineer (both permanent).

S. Hathaway & Co., Ltd.—Private company. Registered March 15th. Capital, £1,500 in £1 shares. Objects:—To carry on the business of electricians, mechanical engineers, manufacturers of and dealers in radio telephones and telephonic and telegraphic and telegraphic apparatus, parts and accessories, &c. The first directors are:—S. F. Hathaway, radio factor (managing director); and T. A. Veavon (traveller), both of 91, Durning Road, Liverpool; E. W. Hathaway, 7, Moscow Drive, Stoneycroft, Liverpool, traveller (all permanent). Registered office: 3, Bold Place, Liverpool.

W. E. Amies & Co., Ltd.—Private company. Registered March 12th. Capital, £2,000 in £1 shares. Objects:—To acquire the business of manufacturers of mouldings and synthetic materials carried on by G. L. Ackland and W. E. Amies as W. E. Amies & Co., at 36 and 38, Matilda Street, Sheffield, and to acquire from the said W. E. Amies a patent relating to improvements to an electrical plug fuse-switch and contact blocks and the like. The subscribers (each with one share) are:—W. E. Amies, 407, Fulwood Road, Sheffield, engineer; G. L. Ackland, 24, Thornsett Road, Sharrow, Sheffield, commercial traveller. Solicitors: Slater & Elliott, 39, Bank Street, Sheffield.

Electric Lamp Distributors, Ltd.—Private company. Registered March 15th. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers, importers, exporters and sellers of electric lamps of all kinds, electrical accessories, cables, commodities appertaining to electrical industries, &c. The first directors are:—A. Siderman, 51, Cleveland Street, Fitzroy Square, W.1, electrical factor; Miss I. Cornes, 12, Crayford Road, Holloway, N.7, clerk. Registered offices: 55/63, Goswell Road, E.C.1.

Official Returns of Electrical Companies.

Watson-Norrie, Ltd.—Debenture dated March 2nd, 1929, to secure £1,800 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. A. Nelson, 23, Eldon Place, Newcastle-upon-Tyne.

H.E.C. Electric Co., Ltd.—Capital, £1,000 in 400 preference and 600 ordinary shares of £1 each. Return dated October 15th, 1928. 170 preference and 203 ordinary shares taken up. £173 paid on 170 preference and 3 ordinary shares. £200 considered as paid on 200 ordinary shares. Mortgages and charges nil.

West Wilts. Electric Light & Power Co., Ltd.—Capital, £100,000 in 10,000 preference shares of £5 each and 50,000 ordinary shares of £1 each. Return dated September 5th, 1928. 1,700 preference and 22,608 ordinary shares taken up. £31,108 paid. Mortgages and charges nil.

Wakelins Wireless Co., Ltd.—Capital, £2,500 in 1,250 preference and 1,250 ordinary shares of £1 each. Return dated December 1st, 1928. 135 ordinary shares taken up. £102 paid. £33 considered as paid. Mortgages and charges, £675.

Kent Bros. Electric Wire Co. and E. H. Phillips, Ltd.—Capital £15,000 in £1 shares. Return dated December 31st, 1928. 11,500 shares taken up. £500 paid. £11,000 considered as paid. Mortgages and charges, £20,000.

Craven & Speeding Bros., Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1929. 10,000 shares taken up. £10,000 paid. Mortgages and charges nil.

East India Tramways Co., Ltd.—Capital, £150,000 in 15,000 preference, 35,000 ordinary and 100,000 deferred shares of £1 each. Return dated November 23rd, 1928. 7.476 preference, 33,433 ordinary and 100,000 deferred shares taken up. £7,489 paid on 7,476 preference and 7 ordinary shares, and including £6 paid on 24 preference shares forfeited. £133,426 considered as paid on 33,426 ordinary and 100,000 deferred shares. Mortgages and charges nil.

Shirebrook Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 10th, 1929. 4,800 shares taken up. £1 per share called up on 2,800 ordinary and 5s. per share on 2,000 ordinary shares. £3,200 paid, leaving £100 in arrears. Mortgages and charges nil.

Radio Service (London), Ltd.—Satisfaction to the extent of £125 on February 15th, 1929, of debenture dated July 25th, 1927, securing £2,750.

Reed, Evans & Co., Ltd.—Capital, £100,000 in £1 shares. Return dated December 31st, 1928. 92,292 shares taken up. £6,576 paid (£1 on 657 and 4s. on 29,595 shares). £85,716 considered as paid (£1 on 62,040 and 16s. on 29,595 shares). Mortgages and charges nil.

Yale Electric Power Co., Ltd.—Capital, £20,000 in 3,300 preference shares of £1 each and 668 ordinary shares of £25 each. Return dated December 4th, 1928. 525 preference and 668 ordinary shares taken up. £15,525 paid on 525 preference and 600 ordinary shares. £1,700 considered as paid on 68 ordinary shares. Mortgages and charges, £5,226 3s. 5d. (bank overdraft secured by £6,000 debentures).

Precision Radio & Manufacturing Co., Ltd.—Mortgage debenture dated March 2nd, 1929, to secure £100 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. C. Powers, 56, Fleet Street, E.C.4.

Albion Shades, Ltd.—Particulars filed of £2,000 debentures authorised February 20th, 1929, charged on the company's property and assets, present and future, including uncalled capital, the amount of the present issue being £1,200.

Izzard Bros., Ltd.—W. B. Pearson, 5, John Street, Bedford Row, W.C.1, was appointed receiver and manager on February 28th, 1929, under powers contained in certain debentures dated December 22nd, 1925.

Gas and Electricity Development Co., Ltd.—Capital, £2,000 in 1,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each. Return dated December 31st, 1928. All shares taken up. £2,000 paid. Mortgages and charges nil.

City Notes.

General Electric Co., Ltd.

As we briefly stated in our last issue, the shareholders at an extraordinary meeting on March 13th approved resolutions providing for the creation of 1,600,000 British ordinary shares, to be non-transferable to foreigners, and the public issue of 1,500,000 of these shares. Addressing the meeting, Sir Hugo Hirst, Bt. (chairman and managing director), said that shortly after the war the need became evident for a big and powerful electrical concern in this country to be built up based partly on stock ownership in the concern, as was done so frequently in America and other countries. In the midst of their programme of extension, however, the difficult days of 1921 arrived, and they had to issue debentures. He had never ceased to regard 7 per cent. debentures as a blot on the balance sheet of a company such as theirs, and he had been waiting ever since for a favourable opportunity to redeem them. By redemption and occasional purchases they had reduced the debentures by approximately £400,000, and they now desired to redeem the balance without weakening the cash resources of the company. The directors' proposal to issue these shares to the British public had apparently given umbrage in some quarters, but he believed that the criticism was entirely due to a misunderstanding of their objects. He had always held the conviction that a company like theirs received strength and support from the fact that its shares were held by people who were users of its products and who took an interest in its development. It had been his ideal that some day the "G.E.C." might mean to the people of this country what the "G.E.C." meant to the people of America and the "A.E.G." or Siemens to the people of Germany, a national institution. During the last twelve months dealings in the company's shares had started in the Kerb Market of New York. They accordingly took steps last September to ensure that any attempt to secure foreign control should be made impossible. In spite of that, purchases in the United States continued, raising the price of the shares to an abnormal extent, and on returning from Australia he found that considerably more than a half of the ordinary share capital had wandered across the Atlantic. Thus they had been deprived of 60 per cent., if not more, of their ordinary shareholders, to whom they looked for support in the home market; 70 or 75 per cent. of their business was in the home market. It was absolutely vital that apart altogether from control, the company's British character should be preserved, and therefore its shareholders should include in their number the greatest possible percentage of British subjects. It was for these reasons only that it was proposed to confine the present issue to the British public. The American public who before long might hold practically all their ordinary shares issued, were barred from giving them this help by their protective fiscal legislation. In order to achieve this object and to avoid any suggestion that they were unduly favouring any class of shareholders, British or otherwise, they were not making this issue to the public themselves. Subject to its authorisation by the meeting, they had sold 1,500,000 shares to the British, Foreign and Colonial Corporation at £2 per share, leaving it to allot the shares at a price not exceeding £2 2s. per share to such British subjects as they thought fit, with definite instructions to distribute the shares amongst the greatest number of applicants without regard to whether they were shareholders or not. Any future increase of dividend or capital bonus would go to the whole of the shareholders according to their holding without any discrimination. It was absolutely incorrect to think that the price of £2 2s. made it a bonus issue. Several first-class independent issuing houses had advised them that the price was a fair one, compatible with the yield on industrial

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shares in this country of similar class and prospects. Owing to the wealth and prosperity which America enjoyed, investors in that country appeared to be content with a smaller return for their money. As the result of the issue they would have in hand £3,000,000 to pay off their debentures. That, on a dividend of 10 per cent., which he had every reason to believe would continue to be paid, meant, at 40s. per share, a cost to them of 5 per cent. The debentures bore 7 per cent. interest, and that would be a saving to the ordinary shareholders of £60,000 per annum. They would have an additional £1,500,000 to reserve; the security of the preference shareholders would be enhanced by the removal of £3,000,000 debentures at present standing in front and the addition of £3,000,000 more capital behind them; and, finally, they would have a large additional and permanent body of British shareholders to preserve and maintain the traditions of the company. This proposal had no object but which he, as managing director, and his colleagues considered as essential if the company was to continue its upward career. There were no personal interests concerned. The proxies showed that the vast body of the shareholders supported them.

Sir Hugo then moved the first resolution, providing for the increasing of the capital; this was seconded by Mr. E. G. Byng and carried practically without dissent. Upon the second resolution, providing that the 1,600,000 new shares should be called "British ordinary shares" and should be held only by British subjects, there arose a lengthy discussion. It was opened by Mr. D. Kingdon, who quoted comments from *The Times* to the effect that the new shares should be offered to the whole of the shareholders as they carried valuable rights. The market point of view was put forward by Mr. J. J. Barnard, who also considered that the shareholders were being deprived of their rights. After other shareholders had spoken, Mr. Noel Berridge expressed the view of the Committee of American shareholders that the action of the board was unfair to them and the general body of shareholders. It was suggested that the meeting should be adjourned for the purpose of allowing the board to reconsider its proposals in the hope that it would allot the shares to the whole of the ordinary shareholders. The chairman said that the matter had been considered from every angle and no useful purpose would be served by an adjournment. Mr. Berridge accepted this ruling but said that his committee would have to take such steps as were advised. Mr. E. G. Humphreys, speaking on behalf of the holders of the depositary receipts issued by the Guaranty Trust Company, New York, said that in September last the American shareholders had shown their confidence in the board by raising no protest against the arrangements designed to secure British control of the company. They now considered that their confidence had been misplaced. After the expression of other views Sir Hugo Hirst said that the board had no control over Stock Exchange influences; their business was to carry on manufacturing in the best manner to earn profits for the shareholders. This was a matter of life or death to the company. The board could not possibly carry on if it could not be sure that it had the moral support of the great bulk of the holders of the ordinary shares. He was sorry to have to be a pioneer in this matter, but he was certain that the company's example would have to be followed by others in the national interest. The resolution, which was seconded by Mr. M. J. Railing, was carried by an overwhelming majority, as was the third resolution altering the articles of association. A vote of thanks was enthusiastically accorded to Sir Hugo Hirst.

The American shareholders' committee appealed to the State Department. The latter replied that while it was unable to intervene it had instructed the American Embassy in London to watch developments with a view to rendering any assistance possible.

A further cable was sent to the company by the American Shareholders' Committee asking for a postponement of the issue pending negotiations. In reply to this Sir Hugo Hirst announced that after consultation with the company's financial advisers they had decided to hold up the issue of the new shares. A plan had been elaborated which, in their opinion, would satisfy the shareholders while safeguarding the company's policy, and it was suggested that representatives should be appointed by the committee to discuss the new proposals.

The Committee replied that Mr. T. L. Chadbourne, its chairman, and Mr. H. B. Swope would sail for England in the *Aquitania* on Saturday, or in the first available vessel, to discuss the matter. Sir Hugo Hirst suggested that to save time it would be better for the Committee to appoint someone in London who would be in constant touch with it by cable and telephone. He said that the company was on the point of completing proposals drawn up on lines which, it was felt, would meet all reasonable criticism levelled against the first proposals.

In response to this the Committee expressed dissatisfaction, and reiterated its desire that representatives from America should discuss the matter with the board itself and not with the board's financial advisers.

Marconi International Marine Communication Co., Ltd.

The annual meeting was held on March 11th, when the deputy chairman and managing director (Mr. F. G. Kellaway) said that the year had been one of preparation for the new order of things that would come into force at the end of 1929, resulting from the decisions taken at the International Radio-Telegraph Convention at Washington in 1927. After the end of this year no more spark transmitters would be fitted on board ship. Designs of ships' wireless telegraph and telephone apparatus had been made to meet the new requirements, and they were being offered at prices which approximated very closely to the standard figures for spark outfits. Referring to the "Four-second Auto-alarm" device, Mr. Kellaway said that reports from nearly 1,000 ships equipped with this apparatus showed that the device had an efficiency of not less than 90 per cent., with prospects of improvement as further experience was gained. The wireless direction finder was being employed to an increasing extent. Another feature of 1928 was the increase in the use of wireless in trawlers. To date there were 191 trawlers and drifters carrying the company's apparatus. The possible market was about four times this figure. The company had begun the present year with a large number of orders in hand for execution, promises of many more, and the prospect of less adverse effects from reduced wastage through sales of ships abroad and for breaking up. In connection with the recent announcement that the Gramophone Company ("H.M.V.") had acquired the Marconiphone Company, and that in future the Marconi Company, which owned the Marconiphone Company, would have a substantial interest in the development of the gramophone and wireless business so far as it applied to receiving sets, and to the entertainment and educational fields, he said that this arrangement was the first step taken in this country to put the broadcasting reception and entertainment business on a rational footing. Under the arrangement the Wireless Company would no longer be directly concerned with wireless in its application to the entertainment and educational fields, but would confine its activities to research and invention in wireless generally, to its manufacturing business as carried on at Chelmsford, and to the development of its traffic services. Mr. Kellaway referred with regret to the death of Sir J. Denison-Pender. The report and accounts were adopted.

London Electric Supply Corporation, Ltd.

The annual meeting was held on March 13th, when the Earl of Bessborough, who presided, said that sales during 1928 were 203,711,271 kWh, as compared with 162,047,193 kWh in the preceding year, an increase of more than 25 per cent. This was due to additional railway demands and to a large increase in the domestic and industrial loads. The average price obtained per kWh had fallen from 1d. to 0.816d. With regard to the London Electricity (No. 2) Act, 1925, which provided for the setting up of standard prices for electricity, the benefits consumers had received during 1926, 1927, and 1928, due to their being charged less than the standard price, amounted to approximately £300,000. The purchase of the Deptford power station by the London Power Co. was completed during the year, and a new station was being erected on an adjacent site by the London Power Co., which would ultimately have a capacity of 200,000 kW. A new "all-in" tariff had been introduced, and although this tariff had only been in operation for one month, it had been adopted by a large number of consumers. A new showroom was to be opened in the residential area. The future business of the company was solely that of distribution, and expenditure would be incurred on sub-stations, transformers, and cables. Electricity was purchased from the London Power Co., but the supply was not on the standard system, and new sub-stations and a network of cables on the standard system would be laid down for all future extensions. It was hoped that the standardisation, not only of electricity, but all forms of apparatus, would lead to more economical generation and a lower purchase price for appliances required by the consumer. An employés' pension scheme had been introduced at the commencement of the current year. The report and accounts were adopted.

British Insulated Cables, Ltd.

The directors report a profit of £617,951 for the year ended December 31st, 1928; this compares with £609,242 for the preceding year. A balance of £305,880 brought forward is added making £923,831. After making provision for debenture interest, preference and interim ordinary dividends, &c., there remains £783,389 which it is proposed to deal with as follows: To depreciation on buildings, plant, machinery, &c., £100,000; to reserve account, £299,966; final ordinary dividend of 10 per cent. (again making 15 per cent. for the year); leaving £250,089 to be carried forward. As already reported, it is proposed to distribute, by way of bonus, 333,333 ordinary shares in the proportion of one new share for each four held, together with 500,000 "A" 5½ per cent. preference shares of £1 each in the proportion of three new shares for each eight already held; the shares will rank for dividend from January 1st, 1929. A proposal is also to be made at the annual meeting on March 26th that a capital sum of £50,000 be set aside from the reserves to form a fund, the interest on which will be used at the directors' discretion to provide compassionate allowances for the work-people and their dependants. The directors regard the result of the year's working as satisfactory. The reserve against investments being considered no longer necessary, the amount (£185,034) has been added to the reserve account on the other side of the balance sheet. The report records the resignation from the board of Mr. J. C. Stitt, and states that during the year Mr. D. Sinclair relinquished the position of managing director (remaining chairman), Mr. G. H. Nisbett being appointed in his place. Mr. D. Johnstone Sinclair has recently been elected a director.

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Scottish Power Co., Ltd.

Presiding at the annual meeting on March 13th, Mr. George Balfour (chairman) said that it had been decided to make available a supply of electricity over a considerable portion of the Grampians area from existing power stations so as to develop the growth of the load while the hydro-electric works were being constructed. Consumers were being connected in Auchterarder and were being supplied from the company's power station at Bonnybridge pending connection with the main transmission system of the Grampians Co. A supply would be extended to Blackford and other districts towards Perth as soon as possible. Regarding rural electrification, supplies were being brought into a large rural area by means of transmission lines provided last year and under construction. The one great essential to enable supplies to be given to hamlets was a further relaxation of conditions regulating pole and transmission line details so as to reduce the mileage cost of these lines. Good progress had been made with extensions to the steam power stations at Bonnybridge and Arbroath, and the work would be completed during the early summer of this year. The combined generating plant installed would then amount to 32,500 kW. The electrical energy sold amounted to 35,457,000 kWh, as against 32,600,000 in 1927, and the maximum supply demanded was 12,340 kW. A commencement was made with the construction of the hydro-electric works of the Grampian Co. at Rannoch, the preliminary installation of which would consist of two units having a total capacity of 32,000 kW. The report and accounts were adopted.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Presiding at the annual meeting on March 14th, the chairman (Col. R. E. Crompton) said that the capital expenditure during the year was £37,861, most of which was due to laying down additional mains and material in converting stations. The policy announced last year of providing mains suitable for the new standardised system of a.c. distribution was being proceeded with, and work had already started in one part of the area which required that suitable static transforming sub-stations would have to be provided, involving further capital expenditure. Reductions made in electricity charges had resulted in benefits amounting to £45,258 to consumers during 1926, 1927, and 1928. The showrooms had been successful, and were largely responsible for the increased use of electric cookers by consumers. An additional 1¼ million kWh was purchased during the year. The report and accounts were adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The report for the year ended December 31st last states that the connections rose by 29,119 h.p. to 716,678 h.p. The profit for the year was £819,456 (as compared with £783,493 for 1927). From this debenture interest is met and £150,000 is reserved for special depreciation and contingencies (the same), and £60,500 for plant renewals and improvements (against £50,000). To the balance of £404,286 is added £43,206 brought forward, making £447,492. The final ordinary dividend is 3½ per cent., making 6 per cent. for the year (as for 1927), and £80,653 is carried forward. During the year £60,426 was charged against the reserve for plant renewals and improvements. Capital expenditure amounted to £318,811, representing mainly extensions of the distribution system. An issue of 925,000 ordinary shares offered to the shareholders at 23s. 6d. per share, in November last, was largely over-applied for. Meeting: March 26th.

Liverpool Overhead Railway Co.

The annual meeting was held on March 13th, Alderman M. H. Maxwell (chairman) presiding. In moving the adoption of the accounts, the chairman said that the enlarged advertising scheme was well carried out, and the fact that the shipping companies were granting permits to passengers to view liners in the docks on several days a week resulted in large numbers of visitors taking advantage of this, thereby increasing the traffic receipts, particularly in connection with the round trip tickets. The expenditure for the year showed a decrease of £3,589, the percentage to traffic receipts being 82.43, against 89.21 in 1927, 104.07 in 1926, 99 in 1925, and 98.31 in 1924. The reasons for this decrease were mainly staff economies and reduced cost of electricity. The railway had carried 7,511,559 passengers during the year, an increase of 183,383 as compared with 1927. The notification by the Mersey Dock Board of its intention to make Liverpool a free port for goods exported coastwise should help very materially, and any increase in traffic to be handled at the docks should benefit the company.

Waygood-Otis, Ltd.

The annual meeting was held on March 15th, when the chairman (Mr. H. C. Walker) outlined the progress of the lift service from the hand-operated lifts to the automatic signal control lift which permitted a speed of 900 to 1,000 ft. per minute. He said the policy of the Central Electricity Board to introduce a standard a.c. system had necessitated many alterations in design and manufacture of lift apparatus involving new types of motors and controllers. The company had actually supplied a large number of installations for speeds up to 400 ft. per minute on a.c. Referring to the manufacture of escalators, Mr. Walker said this type of apparatus was not only used for underground railways, but had also been adopted in many department stores in Great Britain, the Dominions and the Continent. Vertical transportation was now generally recognised as being of as great importance as horizontal transportation. There was no part of the equipment of a modern building which would give so handsome a return on the investment as a high-grade lift equipment. He referred with regret to the death of Mr. Charles Clarke, joint managing director. The report and accounts were adopted.

Folkestone Electricity Supply Co., Ltd.

In their report for the year ended December 31st last the directors state that the connections rose by 789 kW to 9,961 kW. Including receipts from hired installations, the profit amounts to £40,781 (against £41,920); to this is added £2,047 brought forward, and interest, and after deducting debenture interest, preference dividend, &c., there is a balance of £39,019. From this, £11,249 is allocated to depreciation, £8,000 to reserve, and £1,000 to employés' superannuation fund. An issue of 35,000 new ordinary shares was made during the year; these rank for dividend from July 1st, 1928. A final dividend of 6 per cent., free of tax, is recommended on the old ordinary shares (making 10 per cent., tax free, for the year), and one at the rate of 10 per cent. per annum, free of tax, on the new ordinary shares. The report states that the company's rating assessment has been considerably increased, and notice of appeal has been lodged.

Bristol Tramways and Carriage Co., Ltd.

The gross revenue for the past year amounted to £1,145,474, and the net revenue (including the balance brought forward) to £118,185, against £111,285 in 1927. After the usual appropriations, a final dividend of 4 per cent. is recommended on the ordinary shares (again making 7 per cent. for the year); £15,000 is transferred to the reserve fund for contingencies and renewals, and £3,786 is carried forward. Interest on investments has been carried to the reserve fund, which now stands at £421,945. Both the tramways and carriage departments showed increased receipts; the total number of passengers carried rose from 107,634,308 to 112,168,239. The death is recorded of Mr. Samuel White, J.P., who had been successively secretary, managing director and chairman of the company. Mr. W. G. Verdon Smith, C.B.E. (managing director) has been elected chairman, and Mr. F. N. Cowlin has been appointed to the board.

Imperial Tramways Co., Ltd.

After meeting debenture interest and interim preference dividend, the balance available for 1928 is £13,678 (against £14,469). The balance of the preference dividend is paid, and the ordinary shares receive 5 per cent., leaving £878 to be carried forward. The company's holding in the London and Suburban Traction Co., Ltd., was disposed of during the year and the proceeds were used to pay up calls on Bristol Tramways & Carriage Co. ordinary shares. Mr. W. G. Verdon Smith has been appointed chairman in the place of the late Mr. Samuel White, and Mr. S. E. Baker has joined the board.

Mersey Power Co.

The report for 1928 records an increase of about 6 million kWh in the sales of energy; the connections have risen to 54,500 h.p. The Minister of Transport has authorised an increase in the maximum charge for certain areas under the Runcorn Electric Lighting Order; this will enable the company to extend into those areas. Issues of capital totalling £708,975 during the year have enabled the company to redeem the balance of the Government 6 per cent. mortgage and 6 per cent. second debentures. The working profit for the year, plus interest received, was £100,869; a net amount of £16,420 brought forward is added, making £117,289. After meeting interest charges and issue expenses, it is proposed to pay 5 per cent. on the ordinary shares, to place £30,000 to reserve, and to carry forward £17,081. Meeting: March 26th.

Newcastle and District Electric Lighting Co., Ltd.

The accounts for the year ended December 31st last show a profit of £72,809, as compared with £76,236 in 1927. To this is added £15,658 brought forward, and after the deduction of debenture interest, &c., there remains available £70,534. From this, £4,970 is allotted to second mortgage debenture, &c., funds; £22,000 to depreciation; and £10,000 to general reserve. A dividend of 7½ per cent. is recommended on the ordinary shares (as for 1927) and a balance of £15,564 remains to be carried forward. Since the end of the year under review, 150,000 £1 ordinary shares have been offered to the shareholders at 24s. 6d. each: these were fully subscribed. The company moved into its new offices last year, and opened a showroom there. The meeting is to be held to-day (Friday).

Telegraph Construction and Maintenance Co., Ltd.

The net profit for the year ended December 31st last fell from £115,135 to £106,144, but the 1927 figure included a sum transferred from reserves which were not required. The addition of £112,618 brought forward makes available £218,762. After transferring £15,000 to reserve (against £20,000), the directors recommend a final ordinary dividend of 7½ per cent., free of tax, again making 10 per cent., tax-free, for the year;

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a balance of £114,122 is carried forward. The report states that the orders received and the general business of the company were on a relatively small scale. The c.s. *Colonia*, which was built in 1902 for the purpose of laying the first Pacific cable, was disposed of during the year. The meeting was to be held yesterday (Thursday).

Llanelly and District Electric Supply Co., Ltd.

The profit rose from £42,463 in 1927 to £53,705 during the past year. After providing for debenture interest, the preference dividend, &c., and placing £19,000 (against £13,500) to reserve, a balance of £3,327 is carried forward. The last distribution on the ordinary shares was 5 per cent. in respect of 1925. In view of the depression in the district, the increased profit is considered satisfactory. A new turbo-alternator was put into service during the year, and extensions to Kidwelly and Gowerton are in progress. In the course of the year £50,000 of debenture stock was issued and the authorised capital was increased by 100,000 6 per cent. preference shares and 50,000 ordinary shares.

Hendon Electric Supply Co., Ltd.

The report for 1928 states that after meeting debenture interest and the interim ordinary dividend, there is an available balance of £39,811. From this £4,728 is placed to general reserve, £8,293 to repairs and renewals fund, and £5,900 to income tax account. It is proposed to pay a final ordinary dividend of 2s. per share, free of tax, making 15 per cent. for the year, as for 1927. The net balance carried forward is £9,628. During the year the 6 per cent. debenture stock was paid off, and £200,000 of 5 per cent. debentures were issued.

Midland Electric Corporation for Power Distribution, Ltd.

It is reported that the profit for the year 1928 was £154,460, as compared with £194,922. The balance brought forward is £9,128 making £163,588. The ordinary dividend is reduced from 15 per cent. to 8 per cent. (interim of 6d. per share paid), and £24,549 is carried forward. Last year a 100 per cent. bonus issue was made, thus on the old capital the distribution is 16 per cent. At last year's annual meeting the chairman stated that it was not expected that there would be any immediate increase in the aggregate amount of dividend.

Lancashire Dynamo and Motor Co., Ltd.

After providing for obsolescence, depreciation and debenture interest and crediting dividends from subsidiary companies, the total profit for 1928 is £21,003 (as compared with £19,726 for 1927), and the addition of £5,350 brought forward makes available £26,353. The preference dividend and directors' fees are paid, £5,000 is transferred to reserve, and 5 per cent. is again to be paid on the ordinary shares, leaving £7,809 to be carried forward. During the year the Crypto Co. purchased the business of the Langham Engineering Co., which specialises in the manufacture of self-contained gears for electric motors. Meeting: March 26th.

Automatic Telephone Manufacturing Co., Ltd.

A profit of £123,670 is recorded in the 1928 accounts, after providing £50,000 for depreciation; this compares with £171,359 for 1927. A balance of £81,755 brought in is added, making £205,425. After meeting directors' fees and preference and interim ordinary dividends, £35,000 (against £15,000) is transferred to reserve, leaving £137,233. It is proposed to pay a final ordinary dividend of 6¼ per cent., again making 10 per cent. for the year, and, in addition, a bonus of 2½ per cent. is recommended; £93,483 remains to be carried forward. The directors consider the results to be satisfactory. Meeting: March 26th.

International Automatic Telephone Co., Ltd.

The profit rose from £124,369 in 1927 to £130,823 last year. A final dividend of 6¼ per cent. (again making 10 per cent. for the year) is to be paid on the ordinary shares, together with a bonus of 2½ per cent. The deferred shares are also to receive a 10 per cent. dividend and a 2½ per cent. bonus. £10,000 is placed to reserve and £69,734 is carried forward.

Davis & Timmins, Ltd.

Speaking at the annual meeting on March 14th, the chairman (Mr. F. Le Neve Foster) said that satisfactory results had followed the company's acquisition during the year and the consequent alterations of the capital. The outlook was most encouraging; the turnover during the first two months of this year was in excess of that for the corresponding period of 1928. They had repaid the whole of the debentures of the subsidiary companies; to meet this and to provide further finance the directors proposed to issue at an early date the remaining 3,000 ordinary shares.

Pinchin Johnson & Co., Ltd.

The net profit for the past year was £422,796, as compared with £327,942 in 1927 (when £26,000 non-recurring profit was included). The final ordinary dividend is 20 per cent., making 30 per cent. for the year, as for 1927. Of the balance, £67,000 is placed to reserve, and £80,103 is carried forward. A portion of the reserve funds is to be capitalised and distributed in the form of ordinary shares to existing ordinary shareholders in the proportion of one new share for each three held. Meeting: March 25th.

American Telephone and Telegraph Co.

The accounts for 1928 show a total revenue of $235,781,978, net earnings of $165,268,049, and a net income, after deducting interest, of $143,170,491. Dividends absorbed $103,821,440, leaving $39,349,051 to be carried to surplus. The operating revenues of the Bell System totalled $660,059,821 and the net income $191,087,639. After the payment of dividends amounting to $119,348,612, a balance of $71,739,027 remains.

Tees Power Station Co., Ltd.

The profit for the past year was £122,231, as compared with £85,672 for 1927. After meeting debenture interest the directors propose to pay a dividend of 6 per cent. (against 5 per cent.) and to carry forward £750, against £1,311 brought in. During the year the authorised capital was raised to £992,978 by the creation of 17,978 £1 shares; the Newcastle-upon-Tyne Electric Supply Co., Ltd., has been allotted 20,000 shares.

Isle of Thanet Electric Supply Co., Ltd.

This company's report for 1928 was reviewed in our last issue (p. 486). The annual meeting was held on March 13th, when Mr. A. R. Monks (chairman), who presided, said that the lighting and power business of the company continued to develop, and they looked for increased revenue from that source. The board had no knowledge of any proposal relative to the purchase of the undertaking by one of the larger electricity supply companies.

English Electric Co., Ltd.

Speaking at the annual meeting on March 18th, Mr. W. L. Hichens (chairman) referred to the great improvement in the results, and said that there were solid grounds for hoping that under normal conditions and with the same volume of orders they might look forward with confidence to continuing on the up-grade, although progress might be slow. A fuller report of the speech will appear in our next issue.

Aluminium Corporation, Ltd.

At meetings of the holders of the company's debentures and shares last week approval was given to the proposals to sell the company's hydro-electric undertaking to the North Wales Power Co., to reduce the capital from £1,000,000 to £808,508 10s. by writing 10s. off the ordinary shares, the sub-division and conversion of the preference shares into ordinary shares, and the restoration of the capital to £1,000,000.

County of Durham Electrical Power Distribution Co., Ltd.

A profit of £59,299 (against £44,966) is shown in the accounts for the past year. A balance of £887 brought forward is added making £60,186, and after meeting debenture interest, &c., an ordinary dividend of 6 per cent. is recommended (as in 1927), leaving £1,224 to be carried forward.

British Aluminium Co., Ltd.

After meeting debenture charges, &c., placing £50,000 to depreciation reserve, £100,000 to reserve fund, and £10,000 to staff benefit fund, and adding £27,858 brought forward, the profit for the past year is £151,921. It is proposed to pay a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year (as for 1927), and to carry forward £33,843.

Mid-Cheshire Electricity Supply Co., Ltd.

After providing for debenture interest and depreciation, the net profit for 1928 was £9,254; to this is added £1,609 brought forward, making £10,863. It is proposed to pay a dividend of 5 per cent. on the ordinary shares, to write £500 off new issue expenses, and to place £350 to employés' dividend bonus account, leaving £1,833 to be carried forward.

Associated Gas and Electric Co.

The Times states that the Associated Gas and Electric Co. has concluded a contract to acquire control of the General Gas and Electric Corporation. This transaction, it is stated, will place the company among the seven or eight largest power groups in the United States.

Postal Telegraph and Cable Corporation.

The directors have declared a quarterly dividend of 1¾ per cent. on the 7 per cent. non-cumulative preferred stock, payable April 1st.

Eastern Telegraph Co., Ltd.

A dividend of 2½ per cent. on the ordinary stock, free of tax, for the quarter ended December 31st, 1928, has been declared.

Eastern Extension, Australasia & China Telegraph Co., Ltd.

The directors have declared a final dividend for 1928 of 5s. per share, free of tax.

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Brompton and Kensington Electricity Supply Co., Ltd.

The ordinary shares are to receive a final dividend of 10.706d. per share, making up the standard dividend for the past year.

Elgin Electric Supply Co., Ltd.

Out of the profit of £2,701 for 1928 the directors are paying a dividend of 5 per cent.

Power Corporation of Canada.

The company is issuing $10,000,000 of series "B" 4½ per cent. 30-year debentures. These will be convertible into no-par-value common stock within a five-year period.

Vickers, Ltd.

A dividend of 8 per cent. has been declared on the ordinary shares, as for 1927.

Chelsea Electricity Supply Co., Ltd.

A final dividend of 11.3d. per share, making up the standard dividend for the past year, has been declared on the ordinary shares.

Egham and Staines Electricity Co., Ltd.

The profit for the year 1928 was £32,661, as compared with £29,507 in 1927. A dividend of 7½ per cent. is again recommended on the ordinary shares.

Ward & Goldstone, Ltd.

An interim dividend of 3½ per cent. has been declared.

Swedish Company.

The *Allmänna Svenska Elektriska A.B.* (*A.S.E.A.*) is raising a debenture loan at 5 per cent. amounting to 20,000,000 kr. The proceeds are to be devoted to the extension of the Swedish workshops, the establishment of new foreign organisations, and the financing of the newly formed subsidiary company, the Elektro-Invest, which is to establish electricity works abroad. The share capital of the A.S.E.A. amounts to 75,000,000 kr.

The company's report for 1928 states that during 1928 it received orders for and delivered a large number of generators, transformers and electrical apparatus of various kinds to concerns in Sweden, England, Norway, Belgium, Denmark, Holland, Italy, Poland, Canada and other countries. The company now has 7,210 employés in Sweden and has established new branch offices in Bombay, Calcutta and Melbourne. The net profit for 1928 was 4.65 million kr. and the dividend remains unchanged at 6 per cent.

South London Electric Supply Corporation, Ltd.

The balance of the "standard" dividend (5½ per cent.) is to be paid on the ordinary shares.

County of London Electric Supply Co., Ltd.

The directors recommend a final ordinary dividend of 7 per cent., making 10 per cent. for the year (against 7½ per cent. for 1927). The dividend is supplemented by an appropriation in respect of the company's extra-London interests.

South Metropolitan Electric Light & Power Co., Ltd.

A final dividend of 5½ per cent. is recommended on the ordinary shares, making 8½ per cent. for the year. This dividend is supplemented by an appropriation for the company's interests outside London.

Clyde Valley Electrical Power Co.

The directors' report for the year ended December 31st, 1928, shows a profit of £304,296 (as compared with £288,166 for 1927); to this is added £84,290 brought forward, making available £388,586. The interim ordinary and preference dividends are met and £120,000 is transferred to contingency fund. It is recommended that a final dividend of 5 per cent. be paid on the ordinary shares, again making 8 per cent. for the year, and that £30,000 be set aside for the establishment of a staff benevolent fund, leaving £84,586 to be carried forward. The number of consumers now supplied by the company, directly and indirectly, is about 40,000. The Central Electricity Board has required the company to change its frequency of supply from 25 to 50 cycles; a special department has been set up for the purpose and the work is proceeding. Meeting April 3rd.

Stocks and Shares.

Monday Evening.

Stock Exchange markets continue to hang to a great extent upon the financial position in America. This is thought to have become materially relieved—at any rate, so far as the Bank of England is concerned—by a reported change in the method under which foreign capital is taken into New York. The effect of this alteration is, according to gossip, that foreign capital will receive no more than 6 per cent., whatever the rates may be which are ruling in America at the time. If this is the case, the 6 per cent. maximum is not likely to attract foreign gold to America to any great extent, and on this assumption it is taken for granted that the Bank of England position will become greatly strengthened, capital remaining in this country instead of being exported to America. The immediate effect was to bring about substantial rises in the prices of gilt-edged stocks, which rises were reflected in the firmness shown by investment securities of all kinds.

General Electric Issue Postponed.

The projected issue of 1,500,000 General Electric British ordinary shares was postponed at fifty-five minutes after the eleventh hour. Everything stood ready. Prospectuses were out: stockbrokers had circulated them amongst clients. Stags had filled up large numbers of forms. Investors had obtained advice from their counsellors as to whether or not to apply. Some General Electric shareholders resented the fact of outsiders as well as themselves being offered shares at 42s. The British, Foreign & Colonial Corporation had taken 1½ million shares at £2, and probably expected to make a profit of £150,000, less whatever sub-underwriting had been done, plus a certain amount of other expense. Candid comment became vocal that the Americans had some ground for protesting against the board's action. Then the issue was postponed. It may appear rather absurd that an issue of shares in a British industrial company—made, too, at a substantial premium—should have assumed sufficient importance to cause a hot-and-bothered atmosphere. But it did, and therefore the postponement of the issue, pending further developments, is a cause for satisfaction. On the resumption of business in the market, the shares rose from 57s. to 65s. It is thought that in any fresh arrangements which are made, the present shareholders will be given "rights"; hence the recovery, which amounts to 12s. 6d. on the week, in the price of the shares.

Marconi Shares.

Marconi shares have been a very active market, advancing to 4 1/16 on the news mentioned here last week to the effect that the company has entered into association with the Gramophone Company through the medium of the Marconiphone Co. Marconi preference have strengthened to 47s. 8d. Marconi Marines are 1/16 down at 3 3/16, the effect of the dividend disappointment being still felt. Canadian Marconis hold their rise at 38s. 9d. Negotiations are in progress for a working agreement between the Electramonic Company, and the Celestion. The issued capital of the latter company is £253,007; Electramonic's capital is £100,000. An Electric Shareholdings Trust which was contemplated in New York, and an issue in respect of whose shares was thought likely to be made, has been postponed owing to the discouragement that is offered to new financial issues at the present time on the other side of the Atlantic.

Eastern Cable Stocks.

The Eastern group of cable stocks and shares had been depressed until the money situation showed indications of brightening. Quotations promptly rallied, and previous declines were wiped out. Eastern Extensions show a gain of 10s. at 26⅛, and Westerns are 7s. 6d. up at 26. The new chairman of the Eastern, Eastern Extension and Western Companies, Mr. J. C. Denison-Pender, is well-known in connection with the cable industry.

Electrical Supply and Power.

Home electricity supply shares are what the Stock Exchange calls "dull for choice." County of London ordinary recovered to 53s. Egham and Staines are better at 36s. 6d. on the dividend of 7½ per cent., and the decision to issue new shares. Further good reports are being published by the London companies. The Kensington and Knightsbridge chairman very fairly described the result of the past year's operations in his company as being eminently satisfactory. Receipts from sales are better, and costs have been kept down to the lowest possible figure. The price of the shares is unchanged at 27s. Metropolitan Electrics are flat at 2⅛. Scottish Power have lost 6d. at 33s., Yorkshire Electrics are similarly lower at 35s. The crumbling process continues in Bournemouth and Poole, which show 1/16 loss at 67s. Midland Electric Power weakened to 2. The dividend on the ordinary capital, which a year ago was doubled, is to be 8 per cent., which goes against 15 per cent. on the smaller capital this time last year. Electrical Distribution of Yorkshire ordinary shares are quoted ex rights, at 36s. 3d., the new shares changing hands around 10s. premium. London Power new debenture stock is better at 12s. 6d. premium.

Kolster-Brandes.

The new Kolster Brandes shares started off at a premium of 27s. 6d., rose to 32s. 6d. premium, and then subsided to the neighbourhood of 16s. 3d. premium. The applications were so great that the issuing house had to resort to a ballot for the purpose of making the allotment, and, even so, the amounts which the fortunate few secured were comparatively small. People who thought there would be a repetition in the Kolster Brandes Company of what happened in connection with the Ford issue, when the Americans bought huge quantities of shares, and at rising prices, have been disappointed at the demand from the States being very much less for Kolsters than it was for the Fords.

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Central Electricity Board Contracts.

Reference has already been made here to the very substantial contracts which the Central Electricity Board announced its intention of placing with British firms, in connection with State schemes for electricity supply. Further details are now available, the contracts amounting to approximately 3¼ millions sterling, and going to British Insulated Cables, Callender's, British Thomson-Houston, Pirelli-General, the General Electric Co., and others. The market in the shares of the various companies has been little affected by this announcement, for the reason that prices already stand tolerably high, and, with the pressure exerted by dear money, fresh buying has been restrained. Shareholders in the companies must feel, however, quite satisfied as regards the next year or two, that their undertakings will be provided with plenty of work, and that the dividends can be expected to remain at not less than their present level.

The Telegraph Construction Company, in its recent report, shows a lower profit than that earned in the previous twelve months, but the dividend is maintained at 10 per cent., and the reserve raised to £365,000. The reduction in net earnings is shown in the appropriation to reserve being reduced. The company is exceedingly strong as regards its finances, and shareholders who have waited long and patiently in the expectation of receiving some kind of a bonus, are not likely to feel any the less hopeful by reason of the figures that have just been presented.

Tubes and Trams.

Home Railway stocks show no vitality. Approach of the Easter holiday has failed to arouse any hopefulness in regard to possibly bumper traffics. The effect of the rise in petrol makes its influence still felt upon undergrounds. Moreover, the income bonds of the Underground Railways of London are said to be held fairly considerably in America, and the General Electric incident has led to some question as to whether Americans may elect to sell other British investments. (The case of Marconi is different from certain others, in that the company stated definitely that only 25 per cent. of its capital could be held by foreigners). After being heavy, the income bonds braced up to 111, so showing an advance of a point.

The London Tramway descriptions hold their prices. British Electric Traction deferred stock has been changing hands at 905, 915 and 930.

Manufacturing and Miscellaneous.

Callenders are better at 4 5/16, but in spite of a fine annual report from the company, British Insulated reacted to 4 11/16. Enfield Cable ordinary drooped to 5¼. Beyond these changes, the manufacturing list is quiet. Ever Ready shares eased off to 21s. 9d. The iron and steel issues went dull on the repetition by Vickers of last year's 8 per cent. dividend. Optimism looked for 10 per cent., and Vickers shed a few pence to 11s. 7½d. The English Steel Corporation has been formed to take over certain steel interests from Vickers, Armstrongs and Cammell Laird. A fall of 1/16 in Babcock & Wilcox has left the price at 3 7/16. Rubber shares followed a decline in the price of the produce to 1s. per lb. This appeared anomalous in view of the fact that the American consumption in February constituted a record, allowance being made for the month being a short one. Associated Electrical Industries—the former Metropolitan-Vickers—are 33s.; the £2 preference shares stand at 55s.

Foreign and Canadian Utilities.

The Mexican "revolution" seems to be progressing favourably for the course of law and order, but precise information is difficult to come by, and Mexico Tramways 5 per cent. bonds are 4½ points down at 77½. Mexican Light & Power failed to recover any of the drop of 11 sustained last week, and the 7 per cent. preferred shares further receded to 75½. The Northern Mexico Power & Development Company has declared a dividend of 1 per cent. on its common stock. Brazilian Tractions are up 1, at 67.

Amongst other issues, Para Electric Railway shares are firmer at 8s. The preference shares at 21s. 6d. have risen 4s. Power Corporation of Canada strengthened a trifle to 115. Shawinigan is dull at 87½, and no particular changes have occurred in Montreal Light & Power at 110, or in Canadian General Electrics at 235. International Holdings remain at 9⅞, Hydro-Electrics, which have been over 40, reacted to 39. British Columbia Power "A" shares at 53, and the "B" at 33, are attracting but little attention. Anglo-Argentine Tramways first preference, and the 5 per cent. debenture stock have gone back to 3 13/16 and 74, respectively.

Telephone Dividends.

The International Automatic Company and Automatic Telephone Companies have both declared dividends making 10 per cent. for the year, with a bonus of 2½ per cent. in each case. This was regarded as satisfactory, but as being no more than what had been expected for some time past. The price of Automatics is 42s. 6d., and of International Automatic B, 39s. 3d. Telephone Manufacturing eased off to 5s. 6d. Bogota Telephones show a small gain at 30s. International Telephone and Telegraph rallied to 225, after being several points lower.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 18 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	14†	15	67/-	$-\frac{1}{16}$	... ...
Brompton Ordinary	1	8⅜	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8 1/7	8 1/7	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7 1/7	7½	53/-	+3/-	2 16 7
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	24/6	−6d.	5 14 3
Elec. Supply Corporation	1	11	11	56/3	—	3 18 3
Kensington Ordinary	1	8	8	27/-	—	5 3 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	17/6	—	5 1 10
Metropolitan	1	8	9	2⅛xd	$-\frac{5}{16}$	4 4 8
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	27/6	—	4 8 3
Mid. Elec. Power	1	—	15	2	$-\frac{1}{16}$	4 0 0
Newcastle on-Tyne Ordinary ...	1	5	6	1¼	—	4 16 0
do. 7% Pref.	1	7	7	26/-	−6d.	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	−6d.	4 17 0
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	44/6	—	... ...
Westminster Ordinary	1	8⅖	8⅖	26/-	−6d.	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	+3d.	6 1 3
Yorkshire Elec.	1	8	8	35/-	−6d.	4 11 5

†4% of which was tax free.

Home Rails.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 18 1929.	Rise or fall	Yield p.c.
Central London Ord. Assented ...	Stock	4	4	7½	—	5 11 1
Metropolitan	,,	3	3	60	—	5 16 8
do. District	,,	£½	4	76	—	6 10 9
Underground Electric	£1	1½	5	24/-	—	5 16 8
do. do. Income ...	Bonds	6	6	111	+1	5 8 1

Telegraphs and Telephones.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 18 1929.	Rise or fall	Yield p.c.
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24	−¼	6 3 9
Automatic Telephone	1	10	10	2⅛	—	4 14 1
Eastern Extension	10	10	10	26⅛	+½	*3 16 8
Eastern Tel. Ord.	Stock	10	10	260	—	*3 17 0
Globe Tel. and T. Ord.	10	10	10	26	—	*3 15 9
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	20	32	−½	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	5	*10	4 1/16	$+\frac{1}{16}$	... ...
Marconi-Marine	1	8¾	12½	3 7/16	$-\frac{1}{16}$	4 12 4
Oriental Telephone Ord.	1	12	12	3	—	...
Western Telegraph	10	10	10	26	+⅜	3 17 0

*Interim.

Home and Foreign Trams, &c.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 18 1929.	Rise or fall	Yield p.c.
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3 13/16	$-\frac{1}{16}$	7 4 3
do. do. 2nd Pref. ...	5	6	6	4	—	7 10 0
do. do. 5% Deb. ...	Stock	5	5	74	−1	6 15 2
British Electric Traction Def. Ord.	,,	—	—	925	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	6	7	67	+1	2 19 8
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 3 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	77½	−4½	6 9 0
Mexican Light Common	100	Nil	Nil	80	—	... ...
do. 7% Pref.	100	Nil	7	75½	−1	9 5 6
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 18 1929.	Rise or fall	Yield p.c.
Assoc. Elec. Ord.		1	—	—	33/-	—	... ...
Babcox & Wilcox		1	13	15	3 7/16	$-\frac{1}{16}$	*4 7 3
British Aluminium Ord.		1	10	10	46/3	—	*4 6 7
British Elec. Transformer Pref. ...		1	7	7	15/-	—	9 6 8
Br tish Insulated Ord.		1	15	15	4 1/16	$-\frac{1}{16}$	3 3 3
Brush Ord.		1	10	10	27/6	—	7 5 6
Callenders		1	15	15	4 5/16	$+\frac{1}{16}$	3 9 9
do. 6½% Pref.		1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.		5/-	—	—	1	—	... ...
do. 8% Pref.		1	—	8	25/9	—	6 4 3
Edison-Swan 1st Pref.		1	7½	7½	25/9	—	7 1 2
do. 5% Deb.		Stock	5	5	86½	—	5 15 7
Electric Construction		1	7½	7½	1	—	7 10 0
Enfield Cable Ord.		1	20	20	5¼	$-\frac{1}{8}$	3 16 4
English Electric		1	Nil	Nil	8/3	—	... ...
do. do. Pref.		1	3	Nil	9/6	—	... ...
Gen. Elec. Pref.		1	6⅔	6½	24/6	—	5 6 1
do. Ord.		1	7½	10	3⅜	+12/6	2 19 6
Henley...		1	25	25	6	—	4 1 8
do. 4½% Pref.		5	4½	4½	4¼	—	5 6 0
India-Rubber		1	Nil	Nil	11/3	—	... ...
Johnson & Phillips		1	12½	10	1 13/16	—	5 3 1
Siemens Ord.		1	7½	7½	1⅜	—	5 9 1
Telegraph Construction		12	10	10	25½	—	*4 14 3

* Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during February.

OUR extract from the February Board of Trade returns shows that there was a smaller volume of electrical exports during the month, as compared with January, but when regard is had to the fact that the month was three days shorter, the decline was more apparent than real; the daily average was actually a little higher last month than in January. The decrease was fairly general, but the machinery section showed the largest fall—£130,995 in the case of "other motors and generators." Other large decreases occurred in unenumerated electrical goods and apparatus (£78,647) and insulated wires and cables (£54,215). A notable increase is recorded for telegraph and telephone instruments and apparatus (£103,155), and batteries and accumulators showed a fairly substantial rise (£45,488). The month's figures were not greatly affected by the submarine cable item.

February, 1928, had an extra day, and that may account for the exports during that month being greater in value than last month's shipments. The principal variation was an increase of £61,972 in the value of exports of unenumerated electrical machinery, but this was partly offset by a total decline of £40,383 in the other two items in the machinery section. Non-submarine telegraph and telephone cables experienced the largest decrease (£43,456), but against this there was a rise of £41,349 in exports of batteries and accumulators. It is satisfactory to note that the improvement recorded for the first month of the year was not seriously affected by the February decrease.

The decrease of imports in February as compared with January is, of course, due to the same cause as the fall in exports, but in this case the daily average was lower, and so the decline was an actual one. By far the largest factor contributing to the decrease was electrical machinery, which fell in value by over 20 per cent. Other large decreases occurred in the cases of insulated wires and cables (£19,970) and batteries and accumulators (£11,704). There were only two increases, the more important being a rise of £4,711 in imports of non-submarine telegraph and telephone cables. As compared with February, 1928, in spite of the extra day in that month, there was an increase in imports of £28,292. This was mainly due to a rise of £56,931 in the case of telegraph and telephone apparatus, although imports of unenumerated goods and apparatus also rose to an appreciable extent. These and the other rises were partly offset by large decreases in imports of glow lamps (£25,069) and unenumerated electrical machinery (£19,596). It is not very satisfactory to see that imports so far this year have shown greater progress than exports.

There is little of interest in the re-export section, unless it be the two increases in the case of unenumerated electrical goods and apparatus.

The appended table analyses the exports of electrical machinery during February, and the figures are compared with those for the corresponding month of last year:—

Destination.	Feb., 1928. £	Feb., 1929. £	Inc. or dec. £
European countries ...	59,954	103,512	+ 43,558
Japan	37,557	17,317	− 20,240
South America	83,447	35,897	− 47,550
South Africa	37,370	28,466	− 8,904
British India	91,731	124,916	+ 33,185
Australia	40,632	97,330	+ 56,698
New Zealand	20,643	22,617	+ 1,974
Canada	11,909	13,603	+ 1,694
Other countries	106,945	68,119	− 38,826
Totals ...	£490,188	£511,777	+£21,589

It will be observed that, with the exception of South Africa, there were larger shipments of machinery to Empire markets, while non-Empire markets (except Europe) took smaller quantities.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Feb., 1929.	Inc. or dec. as compared with Jan., 1929.	Inc. or dec. as compared with Feb., 1928.	Electrical imports for Feb., 1929.	Inc. or dec. as compared with Jan., 1929.	Inc. or dec. as compared with Feb., 1928.	Electrical re-exports for Feb., 1929.	Inc. or dec. as compared with Jan., 1929.	Inc. or dec. as compared with Feb., 1928.
Electrical goods and apparatus (unenumerated)	£178,207	− £78,647	− £23,963	£120,540	− £9,737	+ £10,191	£7,264	+ £2,347	+ £2,598
Insulated wires and cables ...	219,090	− 54,215	− 20,535	56,481	− 19,970	+ 1,885	540	+ 59	− 160
Glow lamps	43,993	− 9,369	+ 7,009	20,922	− 1,405	− 25,069	865	+ 319	− 573
Arc lamps and parts ...	2,572	+ 746	+ 1,038	1,020	− 3,112	− 412	153	+ 133	− 48
Batteries and accumulators ...	113,556	+ 45,488	+ 41,349	43,805	− 11,704	+ 5,770	207	− 168	− 867
Meters and instruments ...	26,787	− 4,032	− 994	17,837	− 3,702	− 4,357	512	− 598	− 716
Carbons	677	− 218	− 923	12,993	− 178	− 114	224	+ 141	+ 12
Switchboards (not telegraph or telephone)	2,421	− 9,301	− 10,786	832	+ 613	+ 766	—	—	—
Electrical Machinery—									
Electrical machinery (unenumerated)	324,248	− 26,763	+ 61,972	120,780	− 35,874	− 19,596	8,624	− 342	+ 751
Railway and tramway motors	31,724	+ 6,096	− 30,236	—	—	—	—	—	—
Other motors and generators...	155,805	− 130,995	− 10,147	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	79,494	+ 12,352	− 43,456	8,492	+ 4,711	+ 2,297	45	+ 40	+ 45
Submarine telegraph and telephone cable	5,983	− 6,233	− 2,236	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	277,808	+ 103,155	+ 12,071	105,114	− 8,921	+ 56,931	2,966	− 509	− 416
Totals	£1,462,365	− £151,936	− £19,837	£508,816	− £89,279	+ £28,292	£21,400	+ £1,422	+ £626
Inc. or dec. for two months ...	Exports + £47,773			Imports + £53,633			Re-Exports − £1,984		

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Industry, Trade and Employment.

A Brief Review of the Balfour Committee's Final Report and Some Kindred Matters.

AFTER four and a-half years' work, during which six interim reports have been issued, the Committee on Industry and Trade, under the chairmanship of Sir Arthur Balfour, K.B.E., has completed its task. Its final report can be obtained from the Stationery Office (5s. 6d. net). It is impossible in the space at our disposal to do more than indicate the matters covered and summarise the Committee's conclusions. The main headings of the report are as follows :—

The Means of Access to External Markets in which tariff matters and commercial treaties, trade within the Empire, the machinery of commercial diplomacy and political obstacles to overseas trade, are considered.

Access to Means of Production covering such matters as materials, finance, transport and power.

Conditions of Employment in Relation to Competitive Power, which is a study of wages, hours, industrial peace, irregularity of employment, industrial welfare, &c.

Other Factors in Commercial Efficiency such as marketing organisation, industrial structure and combination, standardisation, education and efficiency, scientific research, industrial mobility, &c.

Public Charges in Relation to Competitive Power which deals briefly with national and local taxation and its effects.

British Customs Policy in Relation to Competitive Power in which tariff policy is treated.

Conclusions.

In its conclusions the Committee says that it makes recommendations in each section of the report and thus in the final section confines itself to certain broad results of a practical order on which the whole of its investigations appear to converge. While many causes of the existing economic situation existed before, and were only intensified by the war, others are the direct offspring of war conditions. Among the latter are the after-effects of the abnormal inflation of the "munition" industries, the loss of goodwill caused by the cutting off of external markets, the chaotic conditions of foreign currencies, the increase of trade barriers and the crushing burden of debt carried by the country. These factors have combined to impair the competitive power of British trade in overseas markets and the problems which arise are how to restore this competitive power without impairing the standard of living and how to enable British exporters to place their products in external markets in sufficient volume and on terms acceptable to overseas buyers. The survey makes it clear that organisation and equipment require thorough re-conditioning and this process necessitates the will and power to reorganise. A great deal of scrapping and replacement of plant will have to take place, and the industrial unit will have to be enlarged both by growth and by the re-grouping of units through consolidation or other forms of association, so as to obtain the full benefits of "rationalisation." On the other hand, great judgment, discrimination and restraint are necessary in carrying out the transformation, in order to preserve those special characteristics of variety and quality of products which have been the main strength of British industry and commerce. The human factor is of supreme importance and concurrently with the reorganisation of industry there should be an improvement in the quality of the higher control. This involves a great change in the attitude of the average business man towards new ideas, and in particular towards the results of scientific research and of higher education. It is suggested that a close study of the Report will assist in producing a type of industrial leader and administrator who will be capable of directing British industry and trade, as re-equipped and reconditioned, to the best advantage. The difficulty of depressed industries to raise the necessary capital for re-equipment is thought to be due not to any defects on the part of the banks and financial institutions or to the indisposition of the public to subscribe new capital, but to the inability of the industries to give security to the banks or offer an attractive investment to the public. While the general economic policy of the State may contribute to the solution of the problem, the first steps must come from the industries themselves. It is believed that the principal basic industries still have the power of regeneration within themselves. The necessary measures may include the writing-down of capital and the amalgamation of undertakings and these initial steps, painful as they may be, must be taken with courage and judgment. Reconstruction may at first involve an increase in the number of unemployed, but it is better to face this temporary evil than to drag on as at present. The evidence before the Committee convinces it that industrial relations are generally on a healthier footing than they have been for many years, and thus the present is an exceptionally favourable opportunity to take a further step in the direction of close and intimate co-operation. The full advantages of the reorganisation and reconditioning of works and equipment can only be reaped if the employés and their representatives are looked on as partners in a joint enterprise. There is an urgent need for managers and workpeople to adopt a better appreciation of the advantages of mobility, *i.e.*, transfer, industrial or geographical. To produce the best results an end must be made of trade restrictions and demarcation rules from which this country suffers more than any other. There are indications that leaders of labour organisations are learning to appreciate the importance of the relaxation of such rules. Industrial fatigue and the whole range of questions generally classed as "welfare" will need much greater attention in the future. The Committee concludes :—"We confidently hope that all these new demands and new duties will find the ready and general response which the situation requires and the nation expects."

In a memorandum seven members of the Committee, while agreeing with the facts presented in the surveys, dissent from the general conclusions and suggest, *inter alia*, the nationalisation of some important industries and greater State control.

The Liberal Party's Policy.

Last week the Liberal organisation published a pamphlet—"We Can Conquer Unemployment"—setting out the party's proposals for dealing with unemployment. The means put forward are the development of road construction, housing, telephones, electricity supply, land drainage, London passenger transport, &c. After stressing our backwardness in telephone development as compared with some other countries, proposals are put forward for greater publicity and financial provisions to accelerate progress, and it is suggested that this would provide work for 60,000 persons over a period of two years at a profit to the nation. With regard to electrical development, it is considered that the work to be carried out by 1940, as recommended in the Weir report, should be concentrated into the next five years to give employment to an additional 48,000 men in each of the next two years, and 14,000 additional men in each of the next two years in the electrical machinery industry, apart from the increased employment in the wiring of premises and manufacture and installation of fittings and plant. Extensions, electrification and construction of tube and surface railways are put forward as a means of providing work for 24,000 men for the first two years and 10,000 men for two years more. It is alleged that under the specific proposals made, work would be found for 586,000 men within the first year from the commencement of the schemes and 611,000 within the second year, and a number of minor methods of providing employment would, it is said, bring down the unemployment figure to normal proportions within twelve months of the formation of a Liberal Government. So far as the roads are concerned, it is proposed to raise a loan; the finance in other cases would apparently be provided by the authorities carrying out the scheme, with assistance from the State if necessary. It is emphasised that taxation would not be added to.

The Melchett-Turner Proposals.

On March 12th the "Melchett-Turner" conference of employers' and trade unions' representatives approved an interim report on unemployment. The report which was prepared by a joint committee of members of the conference presents a number of suggestions for alleviating unemployment and cognate recommendations. An emigration programme extending over 20 years is suggested, the necessary funds being raised by loan instead of being paid out of revenue, and under the control of a joint committee of British and Dominions Government representatives. A separate committee of employers and trade unionists should co-ordinate policy. Other suggestions are :—The development of Crown Colonies with a view to orders for equipment being placed in this country; the creation of a development fund for financing schemes of national importance; the carrying out of new constructional works and the speeding-up of existing schemes; adequate pensions for workers attaining the age of 65 who cease work, supplemented by employers where possible; a Government inquiry into currency and banking policy; the pressing forward of "rationalisation" in the widest sense of the term; the raising of the school leaving age, &c. Among other things it is considered that the establishment of better trading relations with Russia would have a beneficial effect upon unemployment in this country.

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The Electrical Development Association.

The Annual Dinner, Meeting and Report.

On Thursday last week the annual dinner of the British Electrical Development Association was held at the Piccadilly Hotel. Sir John M. Gatti (president) was in the chair, and among those present were Lady Gatti, Lord Birkenhead, Ald. Sir Duncan Watson, Ald. W. Walker and Mr. Frank Hodges (Central Electricity Board), Sir John R. Brooke, Sir Harry Haward, Mr. W. W. Lackie and Mr. T. P. Wilmshurst (Electricity Commissioners), Sir Herbert E. Morgan, K.B.E., Col. R. E. B. Crompton, Mr. W. H. Walton (president, E.C.A.), Mr. C. H. Merz, Mr. F. Massingberd Rogers, Mr. M. Solomon (chairman, C.M.A.), Mr. W. F. Moir (chairman, E.L.M.A.), Mr. J. W. Beauchamp, and Mr. A. Nichols Moore (president, I.M.E.A.). The gathering included a large number of ladies. The first speaker was Lord Birkenhead, who proposed the toast of the Association. After referring to the pioneer work of Sir John Gatti's father, he said that the object of the Association—spreading the electrical idea without making a profit—was an admirable one. He did not know whether it would be of advantage to this country to exclude foreign capital. He wished that some historical economist could ascertain how much British capital had been invested abroad since the Napoleonic wars, and it would be interesting to know how much was invested abroad at the present time without any discrimination between the British and native investor, and with what results. Capital was cosmopolitan and no attempt should be made to impose conditions which were not encouraging to the further investment of foreign capital. Reverting to the subject of the toast, his Lordship said that the future developments of electricity were illimitable, for hardly one house in six in the existing supply areas was wired for electricity. The others would not be content to remain without it long. The future domestic consumption was incalculable and must progress very rapidly. The economic fortunes of this country during the next ten years would be profoundly influenced and probably ultimately determined by the development of electricity supply.

Sir John Gatti responded, and said that Lord Birkenhead, able to choose among many avenues for his activities, had selected the electrical industry as one in which his great experience would prove of the most value. He went on to say that so far as E.D.A. was concerned it didn't matter where the money came from so long as they got it. If Lord Birkenhead could influence subscriptions they would not inquire too closely as to the source. He quoted two amusing "gas" newspaper items in one of which a gas company claimed that its progress had been equal to that of any other gas company, *viz.*, one per cent. Sir John remarked that the electrical industry was not satisfied with anything less than 10 per cent.

Mr. J. W. Beauchamp, in proposing the health of the guests, appealed to the visitors to tell everybody in their respective spheres of influence about electricity and the Association. The latter carried on the work of the Central Board and the Commissioners from the point at which, by the nature of things, they were compelled to leave off. It was the aim of the Association to build up in the minds of the public a sort of "personality" for the electrical industry. Under modern conditions the personal touch between buyer and seller was disappearing; the electrical industry had to set out to give every consumer a personal interest in electrical service.

Sir Herbert Morgan, K.B.E., responded to the toast. He said that low electricity charges not only benefited the consumer, but were also good for the industry, and concluded by suggesting that the right course to pursue in electricity supply was to estimate the possible consumption in each locality, treat that as an economical unit, and supply energy at a predetermined price.

The Annual Meeting.

On the following day the annual meeting took place at the Hotel Cecil, and Sir John Gatti again presided. After formal business, Mr. A. C. Cramb, chairman of the Executive Committee, presented the Council's report for 1928, which is reviewed below. He drew special attention to a number of items, particularly the reorganisation of the provincial area sub-committees, which, he said, would contribute materially to better results. He pointed out that a number of supply undertakings, although partaking of the advantages of the Association's work, would not pay their share of the cost. The adoption of the report was seconded by Mr. H. C. Lamb, and the motion was carried unanimously.

Mr. R. P. Sloan proposed that Dr. S. Z. de Ferranti, F.R.S., should be elected president for the ensuing year, stating that nobody was more fitted for the position than this pioneer of the electrical world. Mr. C. W. Sully seconded the proposal, which was unanimously adopted.

Mr. H. H. Berry then proposed Capt. J. M. Donaldson as chairman of the Executive Committee; this was seconded by Mr. E. Leete and carried. The meeting concluded with votes of thanks to Sir John Gatti, Mr. Cramb, and others.

The Report for 1928.

Further progress is recorded in the report for the past year. An important part of the Association's work during the year has been the reorganisation of the provincial area sub-committees on a new basis, with a definite constitution and rules as to the election of members, together with the appointment of four officers in four of the eight areas into which the country has been divided. The Association has taken over the Manchester Lighting Service Bureau. At the end of the year area sub-committees were in existence or in process of formation for the following areas: North-East, North Midland, South Wales and Monmouth, North-West, South Midland, and South-West. Steps are being taken to re-establish the Scottish area committee. Twenty-seven supply undertakings joined the Association during the year, while twelve others increased their rate of subscription. With regard to sub-committees, that on Industrial Electric Heating has carried out a great deal of investigation work; a comprehensive paper on the subject prepared by the Committee was read at the Fuel Conference in September last. The Sub-Committee is considering the production of a film demonstrating electric heating processes. Exhibitions were organised at Poplar and Manchester in conjunction with the local electricity supply authorities. Among the work of the Rural and Agricultural Electrification Sub-Committee was the preparation of a paper for inclusion in the report of the Electricity Commissioners' Conference on "Electricity Supply in Rural Areas." It also produced a 3,500-ft. film showing the applications of electricity in rural areas. A conference was organised at the Royal Agricultural Show, Nottingham, last July. The Refrigeration Sub-Committee made an exhaustive inquiry into the suitability of British domestic electrical refrigerators and issued a satisfactory report. A Refrigeration Campaign was held from June 8th to 25th, the cost being met from a special contribution of £1,650 from the refrigerator section of the B.E.A.M.A. Among other things, a special window display was exhibited in 704 showrooms. It is claimed that the campaign was of considerable educational value, and that it increased sales of refrigerators. The Exhibition Advisory Sub-Committee has assisted in the promotion of local exhibitions, and is organising an exhibit at the forthcoming Newcastle exhibition. Displays were arranged at three exhibitions during the year. The Electric Vehicle Committee of Great Britain organised a display of electric vehicles in connection with the C.M.U.A. annual parade. The Committee has arranged that the case for the electric vehicle shall be presented by an independent witness before the Royal Commission on Transport. The report briefly summarises the results of the 1927-28 Circle Campaign, during which lectures and demonstrations were attended by 1,200,000 people and about a quarter of a million pamphlets were circulated. Greater space is given to the Factory and Workshop Lighting Campaign. A total of £7,500 was contributed for the purposes of the Campaign by E.L.M.A., the Electric Light Fittings Association (Industrial Section), the C.M.A., the E.C.A., and the Association itself. The Campaign aroused considerable interest in all parts of the country, and 2,400 inquiries for further information were dealt with. The Campaign is to be followed up during the autumn of this year. For the 1928-29 season, instead of a short-period campaign, it was decided to introduce a special continuous programme of activities, and £12,000 was provided for special propaganda.

A special design for an E.D.A. poster board was circulated, and as a result many undertakings have placed orders for a regular supply of posters. Continued growth in the attendance at E.D.A. conferences is recorded. During the year Mr. G. S. Francis delivered 144 lectures to many kinds of associations and gatherings, the estimated total of the audiences being 10,000. The director and the business manager also delivered a number of lectures in many parts of the country. There was a large demand for lantern slides, and 69 loans of kinematograph films were made. The receipts from the sale of literature (approximately three million pamphlets) amounted to £3,237. The E.D.A. publicity service now includes 128 stock publications and 16 posters dealing with various applications of electricity. The director and business manager represented the Association at various conventions during the year, and the director read papers at two of these. Increasing support is being received from all sections of the Press. The report makes reference to the good work which is being accomplished by the Electrical Association for Women; the total number of branches at the date of the report was 16. The "outlet" campaign has brought this important matter to the attention of large numbers of electrical engineers, builders and architects, and it is planned to extend the campaign during this year.

The accounts show a credit balance of £3,862 for the year, to which is added £4,307 brought forward, making £8,169; it is proposed to transfer £5,000 of this to reserve.

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Dielectric Studies.

. Electrical insulating papers for the manufacture of power cables ; the prevention of ionisation in impregnated paper dielectrics.

AT a meeting of the Institution of Electrical Engineers on March 14th, two papers were read relative to the above subjects, extracts from which follow :—

Cable Insulating Papers.

By T. N. RILEY and T. R SCOTT.

Since cable paper must be applied in layers to secure flexibility, it must have sufficient mechanical strength, both along and across the machine direction of the sheet, to permit of the core being wrapped without undue breakage of paper, and to permit of the cable being bent in service without cracking the paper tapes.

The paper fibres always contain moisture colloidally linked with the cellulose as part of the structure. In the air-conditioned state they also contain a large percentage of free moisture. The "combined" moisture cannot be removed without physical damage to the paper. Manufacture of the paper must be so carried out that the "combined" moisture is kept to a minimum, and the electrical conductivity can be

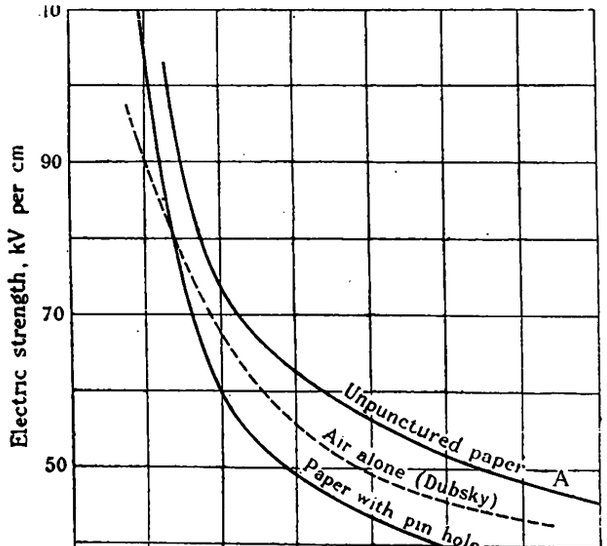

Fig. 1.—Electric-strength Thickness Characteristics of Unimpregnated Paper.

reduced to the lowest possible value by the removal of the whole of the free moisture. The structure must also be such as to facilitate the removal and replacement by oil of all the gas content, both in the pores of the fibres and between them.

It is impracticable to discuss electric strength as a function of the paper alone; but obviously the structure must be such as to result in the highest possible electric strength in combination with the impregnating compound in the finished cable. The paper must also have good ageing qualities, so that there will be no deterioration of the electrical or physical characteristics with time.

Since certain terms with regard to the structure of paper are used somewhat loosely at times, it is necessary to define accurately the meaning of the terms used by the authors. *Bulk* is defined as the ratio of the total volume to the volume of solid content, and is therefore the inverse of "apparent density." *Porosity* is the inverse of fluid resistivity, which may be simply defined as the resistance offered to the passage of a fluid by unit volume of the material (due account being taken of the viscosity of the fluid). *Oil absorption or capillarity* may be defined from two different aspects : (*a*) the force causing flow, and (*b*) the rate of flow. *Mechanical strength* may be defined in several ways, according to the nature of the stress employed, *e.g.* tensile, tearing, bursting, folding, creasing, etc. The first three are of most importance in cable work, and the methods of test are laid down by the Electrical Research Association.

High breakdown voltage may be dependent on the impregnating compound, on the paper, or on the two in conjunction. Its exact value will also depend on the temperature of the sample and on the rate and duration of application of the voltage. The mechanism of failure may also vary with variation of these conditions, but this is still imperfectly understood, and in comparing several types of material for construction we are interested mainly in relative values.

Proposals have also been made from time to time for a cable in which oil alone is employed as a dielectric, the conductor being supported at intervals by special insulator brackets. For cable work such structures have not been successful, and this has usually been due either to surface leakage over the supports, or to breakdown caused by lining up of any impurities in the oil. One function of the paper insulation of a cable is to prevent this lining-up action, and this can be done by employing a paper in which the maximum barrier-action, so-called, is obtained (see Del Mar and Hansen,* also Dawes and Hoover†). From this point of view the compound is the main dielectric, the paper serving mainly to prevent the lining up of any loose particles present, and also acting as a mechanical support with a long leakage surface.

In fig. 1 the dielectric strength of air-conditioned paper is plotted against thickness in curve A. The effect of introducing an artificial pinhole normal to the surface of the paper is shown in curve B, the values of electric strength for a given thickness being appreciably lower. They are actually lower than would be obtained for air alone with the same gap dimensions, as is indicated by the dotted curve founded on the tests of Dubsky. This indicates that the presence of a direct surface leak along the sides of the pinhole reduces the breakdown, as compared with that obtained with the same length of gap of air alone, and still more as compared with the un-

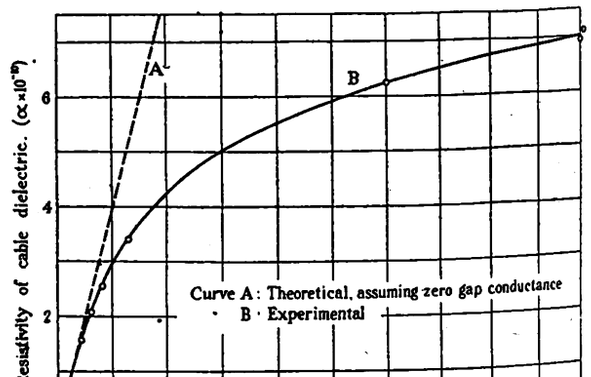

Fig. 2.—Air Resistivity of Cable Insulation as Function of A.R. of Paper.

punctured paper. That the fibres direct will stand higher voltages than are sufficient to cause breakdown along the surface leakage path is also indicated by the effect of drying on the breakdown values of several papers.

It appears clearly that the greatest gain in electric strength is to be obtained by reducing the surface leakage, first by removing every trace of surface moisture, and second by increasing the length of the leakage path. In order to effect improvements in this respect, some means of comparing different papers quantitatively must be devised. For the usual cable-paper structures, any increase of the length of the intercable-paper structures, any increase of the length of the flow fibrous channels will also increase their resistance to the flow of air. This was the basis of Emanueli's suggestion‡ that the electric strength is a function of the porosity (or its inverse—fluid resistivity) of the paper structure, *i.e.* the breakdown strength is increased by the same increase in channel length which gives the paper high fluid resistivity.

The fluid-resistivity value obtained from sheet tests can be applied theoretically to cable structures by use of the normal $\log_e (R/r)$ formula for cylinders, and practically by considering cylindrical layers of paper each sealed longitudinally, so that the fluid must penetrate each layer as it passes from the outer radius to the central core. Practical measurements in this form agree well with tests made on sheets, except that the spaces between concentric layers constitute regions

* A.I.E.E. *Transactions*, 1922, Vol. 41.
† Ibid., 1926, Vol. 45.
‡ Conference Internationale des Grands Reseaux Electriques, Paris, 1925, Vol. 1.

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of low resistance, and the total resistance, therefore, is slightly lower than that indicated by the theoretical formula. If, however, an actual cable sample of equivalent dimensions be examined, the value of the resistance is found to be enormously decreased, the actual reduction in value being a function of the sheet-resistivity value, the method and tightness of lapping, etc. This reduction is obviously due to the laminated tape structure of the cable insulation, this providing paths from sheath to core which do not penetrate fibrous insulation. This structure also brings into play the capillary force due to the narrow channel between the layers, in addition to that due to the fibrous structure of the sheet itself. Fig. 2 illustrates the

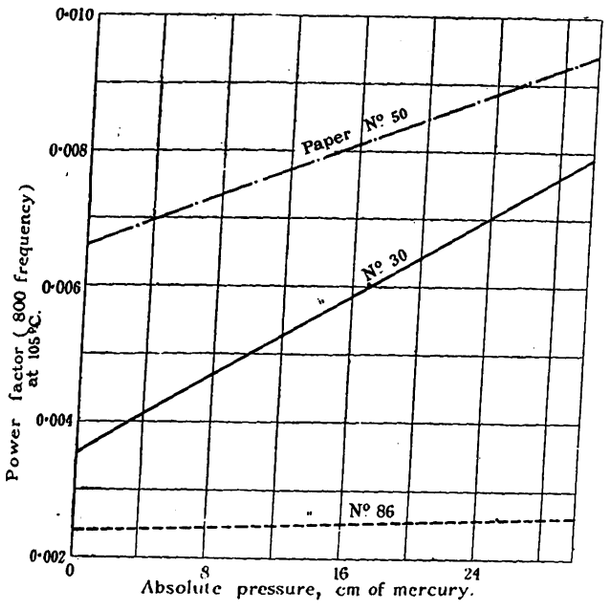

Fig. 3.—Variation of P.F. of Paper with Vacuum during Drying at 105 deg. C.

resistivity value of the core insulation as a function of the paper-sheet resistivity, and also the resistivity of these gaps for one standard type of lapping. In all practical cases of cable impregnation there is a pressure head of oil acting in addition to capillary pressure, and there will be a tendency for the oil to take the paths of least resistance. During impregnation, therefore, the tendency is for the oil to flood these gaps and to isolate the paper tapes, leaving impregnation of the tapes to follow at the rate determined by the structure of the paper. If a sheet of paper at atmospheric pressure be immersed in an oil bath so that the upper and lower surfaces are penetrated simultaneously, a certain volume of air will be trapped and compressed until the pressure built up equals the capillary driving force and equilibrium is reached. If the hydrostatic pressure of the oil be raised so that a pressure is added to the capillary pressure, the air will be further compressed until the required equilibrium pressure is attained. Simultaneously, of course, a certain volume of the air will be dissolved in the oil, owing to the normal higher solubility at increased pressure. On release of the pressure, an approximation to the previous equilibrium will be obtained.

The influence of capillarity on the retention of the impregnating fluid during thermal cycles in service has already been illustrated. The paper structure may, however, exert influence in two other directions. The decrease in bulk of a paper by increase in the cellulose content reduces the volume of the impregnating fluid present, and, in virtue of the low coefficient of expansion of the paper, reduces the thermal expansion effects produced. In an observed case in which two cores of an H-type cable were made up with different papers the oil content in the paper of lower bulk was reduced by 26 per cent., relative to the oil content of the bulky paper.

In general, the number of factors influencing the electrical characteristics is so great that any analysis designed to investigate one particular factor is extremely difficult to make. There is, however, distinct evidence that although in all conditions in which paper is in practical use as an insulator it is nominally in a dry state, its electrical conductivity and electrostatic capacity are still modified by the presence of moisture, and that the variation of moisture content leading to irregular electrical tests is intimately connected with the structure of the paper.

It is known that the fibre walls contain fine pores similar to those which have been studied in fibres used for textile manufacture. In flax, for example, Nodder found them to vary in diameter from 2 μ down to the limit of microscopic size (0.2 μ), and it has been suggested by Hedges that the lowering of vapour pressure over the concave surface of water in such pores would account for the retention of the last traces of water in these materials. Calculations, however, show that in order that the water should not evaporate under the normal cable-drying conditions, the radius of such pores would have to be of the order of 10^{-9} cm, which is less than the dimensions of the hydrogen atom (5×10^{-9} cm). Hence it is improbable that the final traces of moisture are held in this manner. It is possible that the moisture is colloidally adsorbed into the fibre wall, and in this case its removal might be expected to affect the structure of the paper. In this connection it may be observed that raising of the temperature above 105 deg. C. or 110 deg. C., the vacuum of 1 mm. of mercury being maintained, lowers the power factor beyond the values shown in fig. 3, say, but that loss of mechanical strength has always been observed.

"Swollen cellulose" is a colloidal form of cellulose with increased adsorptive power for water and for dyes and certain salts.

Another factor is worthy of note in connection with the colloidal structure. During manufacture, paper comes in contact with many times its own weight of water, and the purity of the water in respect of dissolved salts must affect the purity of the paper. The adsorptive properties of the colloidal cellulose for electrolytic salts must, therefore, be taken into account, but there is little doubt that conductivity values are considerably affected. The amount of such impurities is indicated by the ash content. In the papers considered, freedom from metallic particles as determined by E.R.A. tests can be assumed, but the presence of such particles would, of course, considerably modify the results obtained.

Mechanical strength is a secondary consideration in selecting a type of structure, since in most cases it is comparatively simple to obtain sufficiently high values to meet the various stresses encountered in manufacture, laying and service. Similarly, ageing is a characteristic which should be considered only after the initial requirements have been obtained. It does not appear to be reasonable to build up a structure capable of retaining its qualities for many years if the structure itself is unsuitable and likely to induce breakdown at an early stage in the life of the cable.

Prevention of Ionisation.

By S. G. BROWN and P. A. SPORING.

It has been found that if the power factor of, for example, a high-pressure cable is measured at increasing values of voltage, the measured losses increase rapidly when a certain voltage is exceeded. This potential has been referred to as the "critical" or "ionisation" voltage, and it has been tacitly assumed that as long as the cable is working below this voltage, ionisation of the enclosed air cannot take place.

The assumption is not quite correct; if the dielectric contains only little occluded air, then, since the proportion of air to the remainder of the dielectric is very low, the losses in the air must rise to a very great value before they can be detected by the measuring instruments, which automatically read an average power factor over the whole of the dielectric. The true ionisation voltage may be exceeded many times before any increase in the power factor can, with certainty, be detected.

The history of an unevacuated oiled-paper condenser working on 600 V and 50 cycles is shown graphically in fig. 1. It will be noticed that the power factor and the insulation resistance both show a gradual deterioration. In addition it can be shown that the usual V-shaped curve for the relation between loss and temperature is considerably altered.

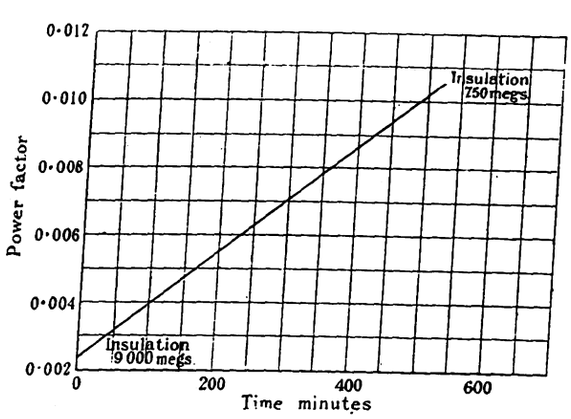

Fig. 1.—Time/Power Factor Characteristic of Unevacuated Condenser.

A further illustration of the effect of ionisation of gas bubbles upon the dielectric is given in fig. 2 which gives the variation of power factor with voltage for an unevacuated oil-impregnated condenser.

Ionisation voltage is not proportional to the dielectric thickness, but rises relatively slowly, so that in order to raise the ionisation voltage to any noticeable extent a very considerable increase in dielectric thickness is necessary.

The inference is that if the dielectric can be arranged in a number of sections electrically in series, the ionisation voltage will be greater than for a plain dielectric of equal thickness.

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This conclusion can be tested experimentally, and the results for one particular case are given in fig. 3, in which power-factor/voltage curves for two condensers in series, each of dielectric thickness 1 mil, are compared with those of condensers of 1 mil and 2 mil dielectric thickness respectively.

It appears that if the dielectric contains air it is not possible to prevent ionisation by increasing the dielectric thickness, except to a prohibitive extent. In other words, the absolute potential, rather than the potential gradient, is the deciding factor. It is true that any particular potential difference across a definite distance can be expressed as an average potential gradient, but no real advantage is gained. It is quite impossible to tell from the potential gradient alone whether the dielectric will eventually fail; but it is suggested that, from a knowledge of the absolute potential, this is possible on the above basis.

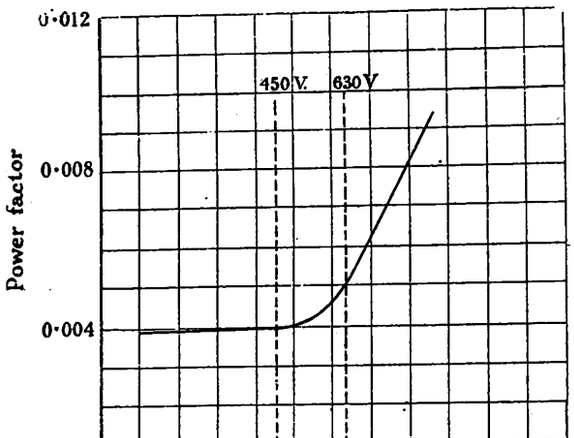

Fig. 2.—Variation of Power Factor with Voltage for Unevacuated Condenser.

The principle on which design is to be based is that ionisation of entrapped air is impossible unless the voltage applied to the electrodes exceeds the minimum sparking potential, which in air at atmospheric pressure is about 300 volts.

The correct method, then, of building a dielectric to work at a given voltage is not to increase the thickness so that ionisation is prevented by that means, since economic considerations render this practically impossible; but rather to arrange that the dielectric consists of such a number of series sections that the voltage across any one section shall not exceed that required for ionisation.

The limiting thickness which may be used for one section will be determined by the puncturing voltage of the thin layers used. The permissible potential gradient will increase indefinitely as the thickness of the dielectric decreases, the voltage remaining constant at 300 volts. Thus the final thickness used will be a compromise, and will be such as to give a reasonable factor of safety in regard to puncture tests.

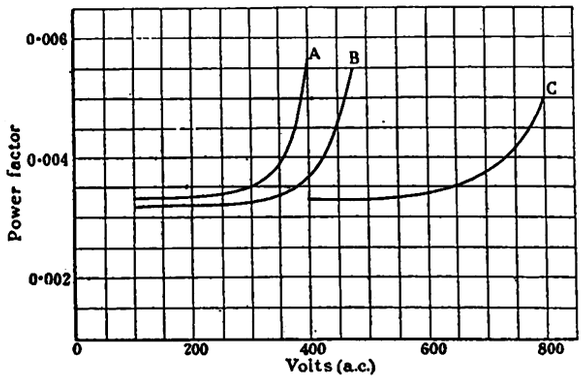

Fig. 3.—Power Factor/Voltage Curves for Condensers in Series.

Breakdown has often been ascribed to the effect of surges. It is interesting to note that although the possibility of puncture by the surges may be remote, yet it is still possible for the surge to be the immediate cause of the breakdown.

The instantaneous breakdown voltage is of value in so far as it discloses actual mechanical defects in construction. On experimental lengths, power-factor/voltage curves, taken with the dielectric impregnated, but not evacuated, give a reliable indication of the performance under working conditions. Obviously, however, this test cannot be applied to any finished product. The test suggested for such a case is that a sample length of cable, or condenser, should be placed in a vacuum, and its power-factor/voltage curve taken under those conditions.

Joint Discussion in London.

Capt. P. Dunsheath, referring to Messrs. Riley and Scott's paper, said he could not support the authors' apparent suggestion that the temperature fall in the power-factor/temperature characteristics (fig. 8 of the paper) was due to moisture. Had the authors considered the possibility of the effect being due to size? He was rather puzzled by the power-factor/temperature curves during various stages of drying (fig. 7), and would have expected a bigger slope at 100 deg C. It was a pity the authors had not given values for different frequencies—such information would have been of more value. Referring to the specific-inductive-capacity/temperature characteristics obtained by the authors, he suggested that if the tests were repeated different results would be obtained, and the difference would probably be due to water content. He could not accept the test in Messrs. Brown and Sporing's paper which involved taking the p.f./voltage curve in a vacuum.

Mr. P. R. Coursey said that Messrs. Riley and Scott appeared to have dismissed calendering as unimportan, but the effect of the process was of great importance. Referring to the suggestion that the power factor could be lowered if the temperature was raised above 105 deg. C., he asked what extent of temperature rise the authors visualised, and what degree of lowering of the power factor was anticipated. He thought that the rise in power factor at the higher temperature was probably due to the chemical structure of the paper. He asked if the s g figures were taken by the method of the Electrical Research Association; they appeared to be on the low side. He thought that Messrs. Brown and Sporing must take a pessimistic view in their suggestion that failure took place in a short time. By means of a slide he indicated that failure occurred over a comparatively long time.

Mr. N. A. Allen thought that Messrs. Brown and Sporing's calculations on the dielectric thickness of 1/5th mil for 250 V was unpractical. He roughly calculated that 100 layers of paper would be wanted for 50,000 V. It was no longer necessary to get manila paper in order to ensure good paper. The makers were getting increasingly good results by concentrating on wood pulp. In tests carried out in America 90,000 samples of paper were tried. In the case of manila there was a 20 per cent. reduction in mechanical strength after six months; the figure for wood pulp was greatly below that. Referring to the authors' examples of the effect of the paper density on the current-carrying capacity of the cable, Mr. Allen showed that the increase of carrying capacity of a 0.2-sq. in., 33,000-V cable could be as much as 2,500 kW—a striking achievement.

Mr. H. D. Symonds asked what times the papers were kept at the temperatures referred to. It was difficult to get paper under 1 mil thick that was free from breakdown. He had made six attempts to get paper free from metallic particles, and had only found one that could be tested with a roller and pin at 25 V. Some method was wanted for testing paper in bulk to see if it was entirely free from pin holes.

Mr. T. Barton thought that the paper ought to be tested before filling with compound.

Mr. A. Collins suggested that the ageing test of the E.R.A. in some cases ought to be more severe.

Mr. T. R. Scott, in reply, referred to Capt. Dunsheath's criticism of the p.f. characteristics, and said he could not agree that the results were due to size in the paper; he attributed the results entirely to moisture. He had had experience with size, but there was no difference. In their paper before the Institution last year the authors had given results at three frequencies. Regarding the specific-inductive-capacity/temperature curves, they were too flat to suggest effect from moisture content. He agreed that research was wanted in the absorption in fibres. Calendering was a very wide term which covered most of the processes; the paper referred more particularly to "super calendering." A great deal depended on how calendering was carried out, the temperature, and so on. Some condenser papers had no penetration of oil. Calendering effect in those cases was ruled out. Under vacuum the temperature could be taken up to 105 deg. C. There was no question of cellulose oxidation nowadays. The s.g. figures were taken by the E.R.A. method, but he did not think they were very low. Manila was a trade term applied to white paper; in this country most of the paper which was classed as manila was hemp paper. He did not think that the actual time over which the paper was tested at each temperature was of importance, as the actual p.f. was taken before the test. He agreed that ageing of paper for other than cable papers was of importance.

Mr. P. A. Sporing also replied; referring to Capt. Dunsheath's criticism of the test in vacuum, he pointed out that it was only intended to test a sample piece in that way, and the idea of the vacuum was to get the ionisation voltage. The p.f. of the standard condenser used was that adopted by the National Physical Laboratory. The three condensers compared in the paper were purposely selected as bad examples to show up the defects. Over the past 18 months he had not had one condenser breakdown at 50 cycles.

Referring to Mr. Allen's criticism of the thickness of paper given, he said it was not seriously suggested that cables should be made to those dimensions.

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Electricity Measurement.

Recent Developments in Electrical Instruments and Meters for Bulk and General Supplies.

By C. L. LIPMAN, A.M.I.E.E.

(*Extracts from a Paper read before the* LONDON BRANCH *of the* ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

CONSIDERABLE advances have recently been made in the design and construction of induction-type instruments, with the result that they can now be supplied with an inherent accuracy higher than B.E.S.A. first grade. The following technical particulars relate to a new induction ammeter manufactured under the author's patents and wound for 5 A, 50 cycles. By way of comparison similar data are given for the ordinary shaded-pole type of induction ammeter.

	Nalder-Lipman improved induction ammeter.	Ordinary shaded-pole induction ammeter.
Change of reading for a rise or fall of 1 deg. C. in temperature ...	0.015%	0.4%
Change of reading for a change of 20% up or down in frequency ...	0.4%	12%
Change of reading after being left in circuit for two hours	0.5%	3%
Weight of moving parts	9 gms.	30 gms.
Volt-ampere consumption for full-scale deflection	4	10

The new induction voltmeter and wattmeter possess similar advantages as regards accuracy and construction.

Satisfactory direct-reading power-factor meters of the moving-iron type work on the "alternating-field" (as opposed to the "rotating-field") principle. The distinguishing feature of these phase meters is that owing to their special construction no resultant rotating field is set up, and consequently no "rotational drag torque" upon the moving-iron system is produced, and the disadvantages and errors arising from that torque are eliminated. For important polyphase circuits unbalanced-load-pattern instruments and meters should be specified.

A form of three-phase balanced-load power-factor meter which has gained considerable popularity during the last few years has one current coil and three pressure coils. The readings of this meter are unaffected by variations of the load current, pressure, frequency, temperature, or wave form, within the limits met with in ordinary practice. It enables a saving in the number of current transformers to be effected, and is less disturbed by slight unbalanced loads than would be the case of a balanced-load-pattern power-factor meter having one pressure and three current coils.

Recording instruments have been specially adapted for fitting to electric trains, and a special system of cradle mounting has been devised which protects the instruments from the effects of excessive vibration. These recorders give valuable information, and tend to promote the efficient and economical running of trains. Tapping mechanism by which the chart is linked at regular intervals consists of a short length of fine tube fixed to the end of the pen arm, one end of which moves in a trough, at the back of which is an inking pad; the other end taps on the chart at regular intervals, generally a quarter or half minute, and is depressed on to it by a bar actuated by an electro-magnet, thus (simultaneously) causing the ink to flow in the tube from the pad and making a dot on the chart. If the time intervals are sufficiently short, the record differs little from a continuous line. The advantage of this method of inking is that the pen is not continuously in contact with the chart, and thus "pen to paper friction" is eliminated.

For the purpose of the registration of total kilovolt-ampere hours several methods have been devised, most of which are, however, of an approximate nature. The torque of the induction type a.c. meter changes with the power factor, according to a sine function. As a result, the torque is practically constant in the neighbourhood of the power factor at which it is a maximum. The instrument registers the kVA-hours with a relatively small error, irrespective of the power factor. By suitable choice of the displacement between the active shunt flux and the impressed voltage, the maximum value of the torque can be arranged to occur approximately in the middle of the power-factor range for which the instrument is designed. These meters are, therefore, only suitable for a fixed range of power factor.

A recent development of kVA-hour meter is the "trivector" meter, in which an integration of kVA-hours is obtained by a mechanical combination of an energy meter with a reactive meter, and is suitable for use over a wide range of power factor and voltage. In another interesting construction of kVA-hour meter the revolutions of the two meter rotors are transmitted to a suspended sphere. A floating gear is arranged to take the drive off the sphere at the point where the peripheral speed is greatest, and the drive is transmitted to the maximum demand indicator mechanism, which records the maximum demand in intervals of 15 or 30 min., both in kW and kVA.

The type of meter adopted for the metering of bulk supplies depends largely on the tariff which is selected for the supply. The usual form of tariff for a supply of this nature is one which includes a term proportional to the maximum demand on the system. Taking kilowatt maximum demand as the first example, the usual induction meter is used, together with a Merz-type maximum-demand indicator. The maximum demand is averaged over a certain definite period, which is controlled by a contactor that may be either self-contained with the meter, or separate. As an alternative an averaging recorder is available. When the maximum demand is required to be in kVA, separate kVA and maximum-demand indicators must be employed, or, as an alternative, the "trivector" type of meter can be used. The latter incorporates both kilowatt and kVA record.

Sometimes two or more feeders are used, and the load from each of these feeders has to be summated in order that a true maximum demand may be obtained. If the several circuits are supplied from a common voltage, then the secondaries of the current transformers are often connected in parallel with the current coils of the meter, the latter, of course, being wound suitable for the sum of the secondary currents. A better solution of this problem is to use meters compounded on to a common spindle. Four-element meters have been specially developed for this purpose. They integrate the total energy and simultaneously indicate the combined maximum demand in two or more independent circuits.

Some time ago the author considered the problem of straight-through metering on extra-high-voltage systems with primary currents as low as 10 amperes, in conjunction with Messrs. Nalder Brothers and Thompson, Ltd., and Messrs. A. Reyrolle & Co., and we concluded our investigations with the development of a new series of highly efficient low volt-ampere consumption instruments, including ammeters, wattmeters, power-factor meters, and protective relays, the current windings of which were made suitable for a secondary current of 0.5 A instead of the usual 5 A. This recommendation has now been approved by the Central Electricity Board for the British "Grid." The advantages arising from 0.5 A as full-load secondary current, instead of 5 A, are manifold. The 0.5 A metering improves the performance of the bushing transformer, permitting a finer turn adjustment; it reduces the secondary burden; it reduces the losses in the long run of connecting leads; it enables accurate measurements to be carried out in the usual manner on e.h.p. systems; and it has led to the development of a new and improved series of instruments, requiring very small power consumption and exerting exceptionally large working forces, control springs of normal strength being employed. In order to keep the size and weight of the low-ampere-turns bushing transformers within reasonable limits, it is further recommended to make the magnetic cores of such transformers of metal laminations.

Discussion.

Mr. J. A. B. HORSLEY expressed the view that for colliery purposes very much more use should be made of chart recording instruments. The author of the paper had not referred specifically to recording leakage indicators, but obviously the principles described were equally applicable to that form of instrument. Generally there was some form of leakage indicator in use at a colliery, but it was of very little practical value, because the main purpose of a leakage indicator was to enable the operator to obtain a continuous record of the state of the installation, and that could be obtained only by means of a chart form of instrument.

Mr. C. S. BUYERS, referring to the author's statement that in the ordinary shaded-pole induction ammeter the change of reading for a rise or fall of 1 deg. C. was 0.4 per cent., asked if that meant that if there were a rise in temperature to the extent of 20 deg. C. the change of reading would be 8 per cent. Referring to the author's statement that the change of reading after the instrument had been left in circuit for two hours was 3 per cent., he said that an ammeter was left in circuit practically continuously. The author's remarks with regard to the use of power-factor meters of the unbalanced type, as against the balanced type, had puzzled him, and he asked whether an unbalanced-load power-factor meter should be used in, say, the circuit of a rotary convertor or a synchronous motor, where apparently the load was balanced. The unbalanced type of instrument was the much more difficult to

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connect up correctly. The problem of tariffs was extremely involved; each supply authority appeared to have a separate tariff of its own, especially where power factor was taken into consideration and a kVA maximum demand meter was used. Dealing with the problem of summation metering, he said that some consumers had both a.c. and d.c. supplies. He did not know if a charge were made on the maximum-demand basis in both cases, but he gathered it was not possible to have a summation meter which would give the true maximum demand of the two different systems.

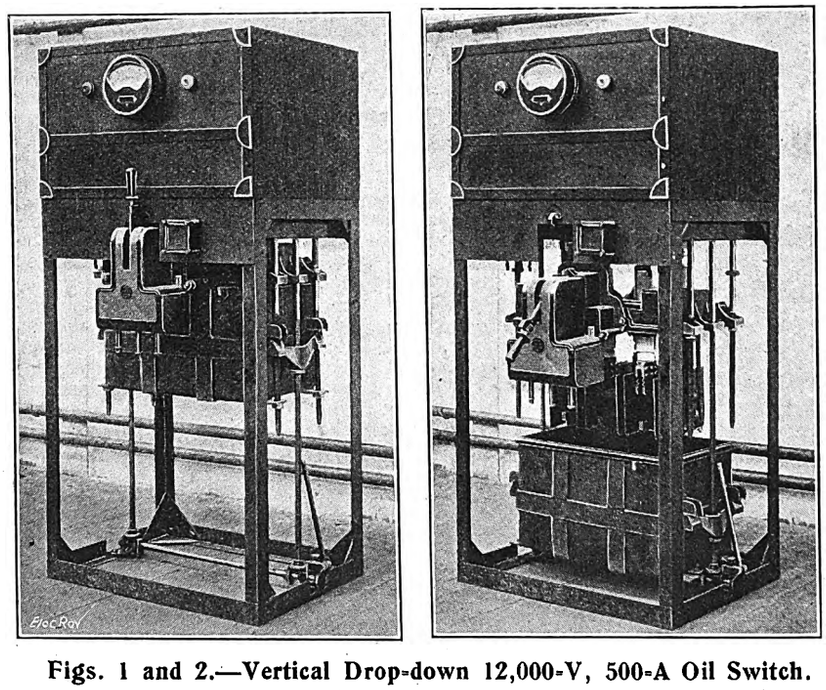
The Chairman, Capt. A. C. Sparks, said that he had avoided using a power-factor meter wherever possible, but in view of the improvements effected, as indicated by the paper, the position appeared to be a little more hopeful, and he hoped to follow up that matter. In some cases there was a tendency for manufacturers to economise in connection with the clocks, in order to secure an order, thus detracting from the value of the instruments. Unless good clocks were used there was danger that one could not take full advantage of the increased accuracy of the instruments themselves. In cases of more than one clock being used there was great difficulty in dealing with the diagrams unless all the clocks were quite accurate. With regard to summation metering, he asked how the author would deal with the proposition of measuring the summation of two demands at a considerable distance—perhaps a mile apart.

Mr. Lipman, replying to the discussion, apologised for having omitted to mention the recording leakage indicator, and said one could not over-emphasise the importance of keeping continuous records in collieries. He claimed to have been the first to introduce a first-grade induction ammeter. With regard to the errors in the shaded-pole induction ammeter, he said that if an instrument were cold in the first place, and the current was then switched on, the reading would fall gradually, due to the heating up. In the case of the induction-type of instrument, the 3 per cent. error was entirely eliminated by the calibration. With regard to the use of unbalanced or balanced power-factor meters, a rotary convertor was usually perfectly balanced, and the use of a balanced meter was justified; but for power circuits generally he recommended the unbalanced type of instrument. The connecting of the unbalanced meter was a little more difficult than the connecting of the balanced meter, because in the former case the number of terminals was greater. He knew of a good many engineers who did not know what was the sequence of phases in their stations. On occasions he had found that the phase rotation was opposite to what they had thought it was, and if they had used phase-rotation indicators they would not have been in that position. With regard to the changing of recording charts, he had intended to emphasise that if one used instruments which did not give a continuous record, but which were used for short periods at intervals, one might get wrong results, due to surges occurring at the time the instruments were used, whereas by means of instruments which gave continuous records one knew what the conditions were at all times. He suggested that for summation metering for both a.c. and d.c. supplies, the method of the future would be to convert the a.c. quantities to correspondingly proportional d.c. voltages or currents, and then add up the latter by means of ordinary d.c. meters.

Further Vertical Switchgear.

Some Particulars of Drop-down Oil-immersed Circuit-breakers made by Erskine, Heap & Co., Ltd.

That a considerable measure of interest is being evinced in improved types of switchgear construction just now is indicated by the several descriptive articles recently published.* In this connection it is recalled that Erskine, Heap & Co., Ltd., who claim to be amongst the originators of the vertical drop-down isolation feature, obtained letters patent covering that principle in the year 1910. Originally they embodied that method of isolating in low-pressure and 3,300-volt gear, but extended it some years ago to switches for up to 12,000 volts, and the accompanying illustrations actually show a 12,000-volt circuit breaker rated to rupture 150,000 kVA and having a carrying capacity of 500 amperes, the switch needing 23 gallons of oil.



Figs. 1 and 2.—Vertical Drop-down 12,000-V, 500-A Oil Switch.

About space economy there does not appear to be any divergence of opinion: in the case illustrated, the depth from back to front is 2 ft. 7 in., with an additional 10 in. for the maximum projection of the handle, the overall width being 3 ft. 4 in. While overall height is of importance, it is not as important as the width and depth, because a sub-station must at least be of sufficient height to allow an attendant to enter, and it is not a particular advantage to kneel in order to operate a circuit breaker in comfort. The raising and lowering mechanism is an integral part of the gear, so that a separate carriage for lowering the breaker is not required; the one set of mechanism serves the dual purpose of lowering and isolating the main circuit breaker and of lowering the oil tank (generally, when full, the latter is about 40 per cent. of the weight of the complete circuit breaker). The breaker is safely isolated before there is any possibility of an attendant touching any "live" parts, both the isolating and tank lowering being operated by means of a single handle which functions in the following manner:—The first movement causes the switch to open in the event of it having been left closed; further movement causes the switch to be withdrawn bodily from the isolating contacts, and when the movement is continued the tank is lowered, so as to expose the contacts, &c., for inspection.

When the switch is in this position, it can be operated to make sure that renewed sparking contacts, &c., which may have been required, are in working order before the switch is again placed in circuit. A further interlock prevents, if the switch is left in the "on" position when an attempt is made to put it back into circuit, any parts making contact until the switch has been placed in the "off" position. An additional advantage is that as the isolating contacts are not completely encased with insulation, it is possible for the operator, after the switch body has been lowered to the correct position for examination, to see that it is actually disconnected from "live" parts before beginning any examination, or repairs, an additional safeguard being the interposition of an insulated shutter between the "live" and the "dead" parts.

The oil-immersed circuit breaker itself is of recent design on the lines laid down in the latest B.E.S.A. specifications, and similar sizes are interchangeable; being vermin proof, they are particularly suitable for use in tropical countries. The contacts are of the wedge-and-finger type and are easily renewable. All the operating mechanism is contained below the main top plate of the breaker, efficient vents being so arranged that the gasses can be conducted clear of the switch in any desired direction. The main top plate and tank have been given special consideration to render them safe under short-circuit conditions.

The operating lever embodies the Erskine Heap standard true free-handle mechanism and, in addition, is so arranged that a quick break is obtained quite independently of the speed at which the oil-switch handle is operated, while the transformer-operated overload coils are fitted in front and are therefore quite accessible. The normal construction of these sub-station switches does not include compound-filled bus-bar chambers, but they can be easily arranged for, if required.

* Electrical Review, June 15th, 1928, p. 1044; December 14th, 1928, pp. 1011, 1013 and 1017; also February 8th, 1929, p. 256.

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Electric Water Heating.

The Sixth and Last E.D.A. Salesmanship Conference of the Session.

ON March 15th, the last E.D.A. Conference of the session was held at the Royal Society of Arts. The chair was taken by Mr. P. F. Crinks (Metro-Vick Supplies, Ltd.), and the author of the paper was Mr. M. O. F. England (Messrs. Benham & Sons, Ltd.).

Mr. England confined himself more particularly to hot-water supply apparatus. He pointed out that electrically-heated water boilers could not only be arranged to supply all the hot water required in a system, but could be used if necessary to supplement other methods. Humidification could also be carried out electrically. Other applications were sterilisers and the prevention of freezing in large tanks, a thermostat being installed in connection with the apparatus. A more unusual application of electric water heating was for what was known as continuous bathing, a process used for soothing mental patients in asylums, the heated water entering at the foot of the bath and returning at the head. A bottle containing a 2-kW immersion-type element was situated at the end of, and below, the bath, the thermostat lying parallel with the flow, the water in this way being kept at a constant temperature. Then there were the electric geyser and the electric storage cylinder, and electrically-heated water for the purposes of steam cooking. Apart from purely domestic water boilers, there were the non-pressure and the pressure types of boilers used for restaurants and tea-rooms. In the former, the water was boiled electrically either by clamped-on or immersion types of elements, whilst in the pressure type of boiler the elements were usually immersed. Owing to the beneficial effect of a water heating load upon central stations, it was urged that the aim should be to encourage water heating in off-peak periods, and it was further suggested that calculations, at least for large buildings, must be based upon a charge of ½d. per kWh. At such a charge, the prospects were undoubtedly good because the consumer gained not so much from the relative cost of electricity and other fuels, but from the all-round advantages. For instance, space was saved; in a certain London building, £2,000 per annum was saved on account of the relatively small amount of space required. Modern electric boiler plants ran without attention, effecting a great saving in wages, whilst the efficiency of such plants was between 85 and 90 per cent., if the surfaces were properly lagged and thermostatic control was adopted. Storage cylinders, of the non-circulating type, had an efficiency of 95 per cent., if the draw-off pipes were short, and they were specially suitable for off-peak periods. High-voltage boilers had been developed, principally for high loadings, and were suitable only for a.c. systems. With these boilers, there were no elements, the water inside the boiler acting as a resistance through which current passed direct from the mains. Heat regulation was a comparatively simple matter, although the necessary relays were rather complicated. With large units containing wire elements, the problem of automatic control was greater. The electrode type of boiler had been made as a three-phase boiler up to 6,600-kW capacity. It could operate on pressures up to 16,000 V. or down to 500 V. Another kind of off-peak load was being developed in connection with the heating of individual radiators, in which a mass of material or a quantity of water was heated, the heat absorbed being allowed to dissipate itself, under control, when the current was switched off.

Mr. England then gave some explanation of the various types of apparatus for controlling "off-peak" water heating. The most common form of apparatus was the time switch and reference was made to a type of time switch in which the main spring was wound electrically. Another type mentioned was driven by a synchronous motor. Mention was also made of Mr. G. Wilkinson's "change-circuit" method, the aim of which was to supply water heating loads entirely automatically without load jumps of any kind. Mr. England said that Dr. Ferranti had made a special study of automatically-controlled domestic water heating loads, the aim being to control each house separately by local apparatus so that by maintaining a reasonably steady load per house, the load factor in the network could be improved. In principle, the scheme was to cut off water-heating circuits when the current taken by other circuits reached a pre-determined value. The levelling devices were cheap to install, and metering was simple. Mr. Wilson, Ashford, had developed a scheme of automatic water-heating control in individual houses. By means of pilot-wire control and house relays, he caused the water-heating circuits to be switched off when the street lighting came on. A similar system was in operation in Southend, which only differed in detail. In the "M.O.F.E." system of pilot wire control a current transformer was fitted at the power station having a two-way switch arrangement controlled by the current in the main bus-bar. Alternating current at a low potential was conveyed by two pilot wires to the customer who had a mercury relay switch. The station transmitter was adjusted to cut off the energy at a pre-determined current. Mr. England said he believed that in San Francisco a carrier wave was used to control certain street-lighting circuits. Mr. England dealt in some detail with the technical details of various types of thermostats and said that with a two-wire control the thermostat acted as a switch to excite the coils of either a relay switch or a contactor, the thermostat current flowing until its switch, owing to change of temperature, de-energised the coil of the relay or contactor. With the three-wire control, a relay switch was controlled by the thermostat in such a way that the current passing through the thermostat at functioning point, flowed only momentarily; further, the current was never broken at the thermostat but in the mechanism of the relay. In some bi-metal types of two-wire control thermostats, the contacts were broken with a parting of only 1/10,000th inch, the temperature interval being determined by the length of the expansion element. Three-wire control instruments had a "magnifying" system of levers ranging from 1/100th inch to 1/1,000th inch. There were also other types of two-wire instruments in which expanding liquids were used, and there were quick make-and-break gaps of ½ in. or more; these were capable of carrying several amperes for controlling the heating circuit. A more unusual type of relay switch control was operated by an electric motor. The speaker said that he had carried out experiments with thermostats operating rockers having ball bearing rolling contact guide rails, but had found that the balls were apt to weld or stick. Thermostats were invariably more satisfactory on a.c. circuits since the arc was broken at zero potential. With regard to breaking circuits in general, the rule for a.c. was to have a short and slow break, whilst with d.c. it was best to have a quick and long break. Speaking of elements, Mr. England said that he himself preferred a sound non-withdrawable type but the elements generally were not large enough. He preferred elements of 30-kW capacity, since a number of small units were unnecessary where a job might run into 200 kW or more. With small elements, there were too many fuses and their heat losses and those of the numerous pilot lamps had to be taken into consideration.

Discussion.

Opening the discussion, Mr. G. NOBBS said that enormous progress had been made in the last few years. He would like to hear some experiences with some of the very large boilers that had been referred to.

Mr. C. H. RAYNER (Manchester), thought that the paper was too technical and said very little about salesmanship. He considered that thermostatic control was not necessary with domestic water heating appliances. One of the secrets of successful electric water heating was suitable lagging. Thermostatic control was certainly necessary with large installations, and architects should be encouraged to install large boilers in big buildings and take a supply of electricity at a low figure at night.

Mr. EDINBURGH (North Metropolitan Electric Power Supply Co.), urged the need for closer co-operation between the supply authorities and manufacturers, in order that an efficient range of apparatus might be produced at a suitable price to meet domestic requirements. The time was ripe for the formation of a joint committee to consider this subject. There was room for a certain degree of standardisation. Apparatus was required for from 5 to 20 gal. with a loading not exceeding 1 kW suitably controlled by some bi-metal type of thermostat. A booster element was also necessary, not, perhaps, as a standard, but for those people who desired it for the purpose of getting a number of baths from, say, a 20-gal. boiler. He suggested that the E.D.A. should take the first steps in the matter.

Mr. BRYAN (St. Pancras), spoke of the success of the lagged storage cylinder up to 30-gal. capacity in private houses, and also of apparatus for raising the temperature of water quickly for industrial purposes. In film washing, the electrically-heated geyser had proved to be the solution of the problem of varying the temperature in a manner which was impossible with the storage system. Heating water to a very high temperature for domestic purposes was quite wrong, owing to radiation losses; a lower temperature was ample for all ordinary domestic purposes. Electric water heating was one of the most lucrative and attractive branches for the electricity supply industry.

Mr. JACOBI said that in order to be competitive on price of fuel, electricity for hot water heating would have to be supplied at 0.2d. per kWh with coal or coke at 52s. per ton. In order to supply at very low figures, the energy must be supplied at off-peak periods and the storage system must be adopted. In these circumstances he believed many supply authorities were prepared to supply at 0.2d. or 0.3d. per kWh.

Mr. HONEY (Croydon), said that during the cold spell, the contractors and the supply authority in Croydon made such

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sales of heating apparatus that the demand on one sub-station went up by 120 per cent. With electricity at ½d. per kWh or less, it was possible to compete with 500-B.th.u. gas at 3s. per thousand for water heating. At Croydon they had specialised on the storage type of apparatus, having a capacity varying from 1½ to 33 gal. A thousand apparatus having a maximum demand of 800 kW had been connected to the mains with thermostatic control. A special night tariff of ½d. per kWh between 11 p.m. and 7 a.m. was in force, the hire charge being £2 8s. 6d. per quarter, with a rebate to the consumer if he had not used the maximum amount of energy. This charge covered hire of heater, time switch, separate meter and the total number of kWh that could be used during the eight hours. That had not taken on so well as had been hoped, but it was because builders were erecting houses with such small accommodation that a 33-gal. tank could not be fitted in. He asked for experience of the night tariff system elsewhere, and also of immersion heaters in tanks about which not much had been heard in the London area. At Croydon 2,000,000 kWh per annum was supplied for water heating out of a total of 34,000,000 kWh with 30,000 consumers, but he did not think saturation point had been reached yet.

Mr. G. C. Allingham said the ordinary householder should have it impressed upon him that there were advantages in electric heating other than that of price alone.

Mr. Selly (St. Marylebone), said that with electricity at 0.3d. per kWh they had found that to raise 1,000 gallons of London tap water per day to 150 deg. F. throughout the year —the figures were the average of the years 1922-23-24—cost roughly 7s. 1d. or 1d. for 10 gallons; with electricity at 0.375d. per kWh the cost worked out at 8s. 9.37d., whilst with electricity at 0.5d. per kWh the cost would be 11s. 8d. per day. It was therefore advisable to adopt the storage system for domestic purposes, using thermostats and sufficient storage and taking advantage of night tariffs. There was a danger of looking at the problem from the wrong angle when making comparisons with coke-fired boilers, because with electricity used in the manner he had suggested, there was a constant supply of hot water at a constant temperature and no mess, to say nothing of the saving in floor space and simplicity of operation.

Mr. Ayres emphasising the point that the mere question of cost must not be taken into account when considering water heating by various methods, mentioned the case of a hospital where, on the question of fuel cost alone, it would have been necessary for the energy to be supplied at 0.18d. per kWh, which, of course, was impossible. Taking into account, however cleanliness, convenience, &c., there were actual savings which could not be measured in terms of money, and the electrical installation was preferred.

Mr. England briefly replied to the comments.

Mr. P. F. Crinks, chairman, in proposing a vote of thanks to the author, wished that in the discussions not quite so much was made of the troubles of the central station in relation to these new types of load. The object of those concerned with selling was to sell as much electricity as possible and let the station men solve the difficulties that might be involved.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Lead-melting Furnace.

In order to meet the demand for a highly efficient furnace especially suited to the peculiar needs of accumulator makers, Sir W. G. Armstrong-Whitworth & Co., Ltd., have introduced the "Monometer" patent ladling furnace, fig. 1. This furnace has a capacity of 2 tons, and is equipped with four ladling positions, each of which is separated by cast-iron sections in order to prevent poisonous fumes or waste gases entering the work room. The design has been specially prepared with a view to ensuring uniform and continuous melting, and that this has been successfully accomplished is evidenced by the claim that cold pig metal up to 250 lb. at a time can be added without lowering the temperature at which the furnace is operating. The furnace is gas fired by means of "Monometer" atmospheric siphon-type burners, which operate without fans or blowers, no added air pressure being required. A very fine control of temperature, it is claimed, is secured by this system. Alternatively, the furnace may be fired with "Monometer" low-pressure oil burners; the air pressure required in this case is approximately 1 lb. per sq. in. All waste heat and spent gases pass, by way of elongated slots in the flange supporting the iron crucible, into an upper chamber, where they form a reducing atmosphere, which is of the utmost importance in preventing oxidisation of the metal, and at the same time enabling the calorific value of the fuel to be utilised to the utmost extent. The body of the furnace is constructed of cast-iron, and is very rigidly built to withstand rough foundry use. It is portable, self-contained, except for the fuel connection in gas-fired types, and requires no special foundation. The iron crucible or pot is made of a special tantalum alloy to resist the action of both heat and molten metal. The furnace is designed to operate continuously 24 hours a day for long periods, with practically no attention.

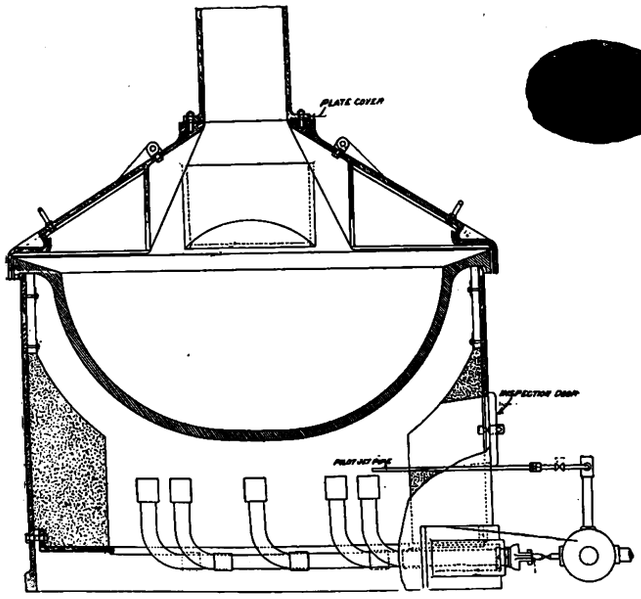

Fig. 1.—"Monometer" Ladling Furnace.

The "Runbaken" Unbreakable Hydrometer.

A handy device for use in connection with battery-charging has been received from the Runbaken Magneto Co., Tipping Street, Ardwick, Manchester. It is a hydrometer (fig. 2) produced in a transparent "unbreakable" material, and a perforated disk is fitted through which the shaft of the float passes, keeping the latter in a central position. The float itself is coloured in sections and not only indicates the s.g. of the acid, but also the state of charge at a glance. A long rigid nozzle is provided which enables acid to be drawn up, even if it is at a low level in the accumulator. Two sizes are made; one is a pocket model supplied in a convenient leatherette case, while the other is a larger one intended for garage use.

Fig. 2.—An Unbreakable Hydrometer.

An Air-disinfecting Device.

A scientific method of freshening and purifying the air in places of amusement is by means of the "Oxygen Rotor," which has been introduced in this country by Major Frank Small, M.I.Mech.E., and is being developed by the Sentry Safety Control Syndicate, Ltd., 132, Wardour Street, W.1. The rotor, fig. 3, consists of a torpedo-shaped aluminium body, containing a ½-h.p. electric motor, which propels the machine by means of a small air screw at the rear. Panels for advertisements are fitted on both sides, and are illuminated from within by electric lamps controlled by a flasher for colour-changing and other effects. The lower part contains a storage tank for scent, which is withdrawn and discharged in a finely-atomised spray by means of oxygen gas fed through a flexible tube incorporated in the suspension cable. The whole machine is supported from the roof by a special cable fitted at its lower end with a swivel, so that it is free to rotate without twisting the cable. The swivel is provided with slip rings and brushes for the lighting and power circuits, and also with a central duct and gland for the oxygen supply. The weight is carried by duplicate steel wire ropes which, together with the electric leads and oxygen tube, are formed into a cable and covered with braiding. Through a special system of sheaves, guides,

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and so on, haulage is done by an electrically-driven winch in the roof, fig. 4. The electrical controls have been specially designed to secure the greatest possible safety in operation, and to comply with the stringent requirements of the authorities. Automatic switches A and B, fig. 4, are fitted on the channel guides, and operated by a striker on the travelling crosshead to prevent the machine from being raised or lowered beyond certain fixed points, their operation being shown by neon pilot lamps on the control board. The switch A has an extra set of contacts connected in the rotor motor circuit, so that it cannot be started until the machine is lowered away from the ceiling. As the machine has to be lowered to the floor from time to time for refilling with

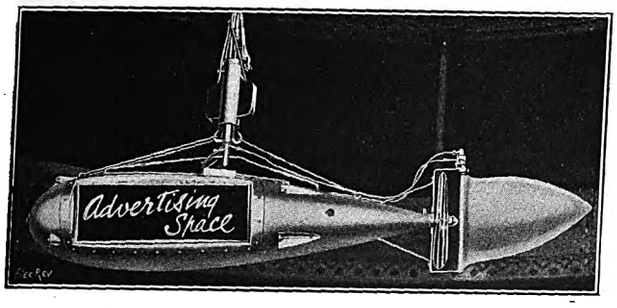

Fig. 3.—The "Oxygen Rotor."

scent, a switch is provided on the control board to re-establish the circuit broken by the limit switch B, and this can only be operated by using a key. Speed control being essential, motors of the universal type are used on the rotor, a resistance or choke coil being inserted in circuit and adjusted on site to suit local conditions and limit the circular path of the machine to a certain maximum diameter. A push-button switch, which has to be held in, permits of a section of the resistance or choke coil being cut out temporarily in order to drive the machine out to its full circle as quickly as possible. As the machine is only used during intervals between acts, it is desirable that it should be brought into and out of action quickly, and provision has therefore been made for reversing

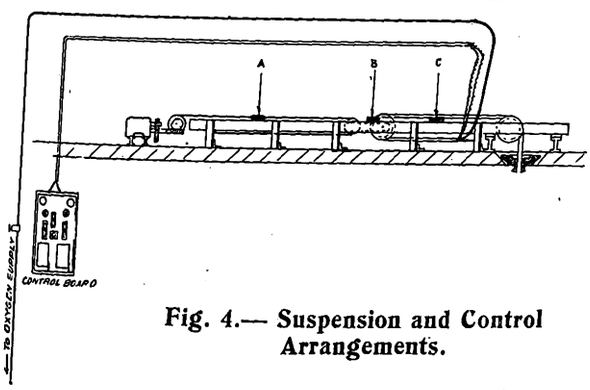

Fig. 4.— Suspension and Control Arrangements.

the propeller. By this means it is brought practically to rest in the centre within twenty seconds, whereas under the action of gravity alone the time would be over two and a half minutes. We are indebted for the above particulars to Captain A. W. Empson, A.M.I.E.E., who, as technical adviser in connection with the production of the apparatus, designed the controls and lay-out and supervised the installation.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Railway Electrical Systems.

On March 11th, Commander Bellairs asked the Minister of Transport whether he was aware that on the amalgamation of railways conversion schemes had to be entered on owing to different electrical systems having been previously adopted; and whether the electrical systems on the Southern and Great Western Railways were such as to obviate any such difficulty in the future.

Colonel Ashley said he was aware that the constituent railways of the Southern group were not electrified on the same system, and that the company had found it desirable to alter the system on certain sections. As regarded the future, the general question had recently been exhaustively reviewed by the Railway Electrification Committee (1927).

Electricity Board Tariffs.

Mr. Kelly asked what were the areas for which the Central Electricity Board had fixed tariffs of charge.

Colonel Ashley replied that no tariffs had yet been fixed for any area.

The Control of Copper.

On March 12th, Mr. Hannon (U.) asked if the President of the Board of Trade could make a statement showing the stocks of electrolytic or other copper in this country at the end of 1925 and last year, respectively; whether the Government was satisfied that adequate supplies were available in the event of national emergency; and whether, in view of the foreign control of copper production, which had led to a large rise in prices, the Government was prepared to encourage firms in this country to undertake the smelting and refining of copper.

Sir P. Cunliffe-Lister said that the London Metal Exchange figures of stocks in public warehouses showed 56,047 tons at the end of 1925, and 6,801 tons at the end of last year. He had no information with regard to private stocks. The position with regard to prices and stocks was being watched.

The G.E.C. Share Issue.

On March 14th, Col. Wedgwood (Lab.) asked the President of the Board of Trade whether any countries placed obstacles in the way of the investment of British capital in public companies registered in those countries.

Sir P. Cunliffe-Lister replied that a number of countries had regulations governing the investment of foreign capital, but considerable inquiry would be necessary before a complete list could be given.

Col. Wedgwood asked if the President of the Board of Trade would take steps to prevent discrimination here, which was injurious to this country's reputation in the capital markets of the world, and was likely to produce ill-feeling, such as had recently been perpetrated.

Sir P. Cunliffe-Lister considered that the matter could not be suitably dealt with by legislation. Further asked if he approved of what had taken place, Sir Philip said that it was very desirable that as much capital as possible should come into this country from all sources.

Jarrow and District Electric Traction Co.'s Bill.

Consideration of this Bill was commenced by a Select Committee of the House of Lords on March 11th. The Bill provides for the substitution by the company of motor omnibus services for the tramway between Jarrow and South Shields. There was opposition from the Durham County Council, the South Shields and Jarrow Corporations and the London and North-Eastern Railway Co. The company sought protection from competition on the route, and this was objected to by Jarrow and South Shields as giving the company a monopoly. Evidence was given that in 1926 the two Corporations had refused to exercise their right of purchasing the company's undertaking.

The Loch Doon Hydro-Electric Scheme.

A Committee of the House of Lords on March 12th approved a Bill providing for the production of electricity by the damming of Loch Doon, &c. Sir John Snell, chairman of the Electricity Commission, gave evidence in support of the scheme, stating that it would be of great advantage to the national "grid" connection between England and Scotland.

Legal.

Welding Machine Patent Appeal.

The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Lawrence and Russell, on March 12th delivered its reserved judgment upon the appeal of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., from the judgment of Mr. Justice Eve in the Chancery Division, holding that they had infringed the letters patent of the plaintiffs, the Rose Street Foundry & Engineering Co., Ltd., for a welding machine. The hearing of the appeal was reported in our issue of February 8th (p. 262). It was alleged by the plaintiffs that the defendants had caused to be altered a manually-operated butt-welding machine so that it infringed their patent covering the automatic control of the welding operation.

The defendants pleaded that the plaintiffs' invention was insufficiently described in their specification, and alleged that it had been anticipated by prior publication, public work and prior common general knowledge. They also denied infringement.

The Master of the Rolls, in the course of a long written judgment, said that in his opinion the plaintiffs' specification was too ambiguous to be allowed to be good, and they had failed to establish the validity of their patent. There were other points on which the defendants relied, such as prior publication. In the view he had taken it was not necessary to give any decision on that point, but holding as he did that the invention was claimed to apply to "spot" as well as "butt" welding, there were grounds for holding that prior publication would be a grave difficulty in the plaintiffs' path

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to establish the patent. The appeal would therefore be allowed with costs and the order of Mr. Justice Eve discharged and the action dismissed with costs.

Lords Justices Lawrence and Russell delivered judgments to the same effect.

British Electrical Instruments, Ltd., v. Super Radio Co.

In the Manchester Chancery Court on March 11th the plaintiffs asked for an injunction restraining the defendants from using the plaintiffs' name or initials, and from representing themselves to be connected with the plaintiffs.

The solicitor for the defendants said that they submitted to judgment. The Vice-Chancellor accordingly made an order, with costs, and directed an inquiry as to damages.

British Engineering Products Co. v. British Electric Plant Co., Ltd.

In the Court of Session, Edinburgh, last week, judgment was pronounced by Lord Fleming in an action by the British Engineering Products Co., Victoria Street, S.W.1, and C. L. Brown, the sole proprietor, against the British Electric Plant Co., Ltd., Alloa, for payment of two sums of £70 and £900 respectively as damages in respect of an alleged breach of contract. In March, 1923, the parties entered into an agreement under which the plaintiffs were to act as agents for the sale of the respondents' manufactures for a period of three years within an area comprising the county of Monmouth and part of the county of Glamorgan. The plaintiffs appointed a Mr. Dunbar to act as their district engineer, and he so acted until January, 1924, with satisfaction to both parties. The plaintiffs appointed a successor, and from the outset the respondents were dissatisfied with the arrangement made, and on April 30th, 1924, definitely repudiated the agreement. The present action was not raised until April 10th, 1928, nearly four years after the termination of the agreement.

Lord Fleming assoilzied the respondents. He said that the ground upon which the respondents maintained that they were entitled to rescind the contract was that the plaintiffs had failed to maintain a branch office and district engineer in the district. The plaintiffs had notice at the beginning of January, 1924, that Mr. Dunbar was to resign the agency in Cardiff, and on April 30th, when the respondents repudiated the agreement, what his Lordship described as a temporary and inadequate arrangement was still in force. Mr. Brown might have been quite sincere in his representations to the respondents that he was going to put the Cardiff agency on a proper footing, but his failure to do so for a period of four months was, his Lordship thought, a serious breach of contract.

Fraudulent Consumption of Electricity.

At Fleetwood, on March 13th, Lucy Ann Robinson, Fleetwood, was fined 40s. for fraudulently consuming electricity by using a standard lamp upon the heating circuit. The price for lighting was 6d. per kWh and for heating 1d. per kWh. It was stated that in 1927 the total amount of electricity used by Mrs. Robinson for lighting was 72 kWh and for heating 90 kWh, and in 1928 the figures were 36 and 142 kWh, respectively.

Mr. W. P. Lilwall, electrical engineer, said he told defendant that she could charge her wireless accumulator from the power circuit, but not use it for illuminating purposes.

An Unearthed Electric Drill.

At Wallasey on March 15th, the Gandy Belt Manufacturing Co., Ltd., Seacombe, was summoned for not having certain electrical apparatus properly earthed. It was stated that on January 11th an electric drill was connected to a 200-V a.c. circuit and used for drilling a steel girder. The drill was not earthed. Parts of the premises were in course of erection, and a man was working at a height using the drill for a few minutes. To save time the regulations were not carried out. Defendants were fined £5.

Ranton, Ltd., v. Wayne Electrical Co.

In the King's Bench Division on March 14th, Mr. Justice Branson had before him an action brought by Ranton, Ltd., London, against the Wayne Electrical Co., Nottingham, claiming £1,146 damages for breach of contact. Defendants denied liability. Plaintiffs' case was that in December, 1927, the defendants agreed to buy from them 5,000 "Bakelite" reels for attaching electric lamps to ceilings. Plaintiffs undertook to manufacture the reels at 5s. 9d. each according to sample. It was agreed that defendants should take delivery of the goods as required by them within 12 months from the date when plaintiffs were first able to supply them. Defendants, however, only took delivery of 48 of the reels in seven months, and plaintiffs took the view that this was a repudiation of the contract. Defendants now said that the goods supplied were not according to sample, and there had been no breach of the agreement as at the time of the issue of the writ they were willing to take delivery, and further there was no need for them to take delivery till the last day of the contract.

Mr. John B. Taunton, director and manager of the plaintiff company, said that his company spent a considerable sum of money in getting brass parts of the reel made which they themselves could not manufacture. At last they were in a position to deliver at least 500 weekly. Defendants, however, did not give orders for delivery, and plaintiffs took action, believing that defendants intended to repudiate the contract.

Counsel for defendants contended that the action was premature, and his Lordship held that this was so. The plaintiffs' case failed and was dismissed with costs.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Conditions in Baghdad.

As requested by "Baghdad" in your issue of March 1st, p. 408, I give below the approximate cost of living in Baghdad based on experience covering 10 years in Iraq:—

Monthly cost of living (food and general stores) not including drinks, Rs.200; servants, *i.e.*, cook and houseboy, Rs.100; conservancy, Rs.25; rent of European house, Rs.100 to Rs.150. Income-tax is payable on all incomes above Rs.400 per annum at 8 per cent., payable monthly if in Government service.

Ordinary European clothing can be worn for three months in the year; for four months the ordinary tropical outfit is needed; and for the remaining five months the lightest possible kit is worn with the thermometer in the region of 127 deg. F. in the shade. The climate is not really too bad, and the wet season extends from December to March. Usually cool winds blow at night during the hot season, which render the high day temperature bearable, and as much as 40 deg. F. difference is registered between maximum day and minimum night readings.

There are two good clubs in Baghdad and several good hotels where dancing and other functions take place nearly every night in the week. During the season good wild fowl and grouse shooting is available.

Iraqui.

March 11th, 1929.

Service Boxes.

Having read with interest the correspondence on the various types of service boxes in use on cable networks, may I, a skilled and so-called costly workman (to use, as near as possible, the words of a previous correspondent), an e.h.p. plumber-jointer, give expression to my views on the matter?

In the first case, the class of ground a network is installed in will, I contend, determine to a fair extent the type of box to use, and its price. To some engineers the latter overrules any other factor, meaning in quite a lot of cases a cheap job, both in material and workmanship, and consequent lost sleep and heavy repair costs. Unfortunately, this applies to a great amount of mains work. Dealing with c.i. boxes, of which many types are open to choice, and cheap: when installed in any ground, of an efficient make, provision being made for bonding armour, and roomy, the joint made with resin oil boiled tape, cooled off and properly topped up, made by a workman who understands and appreciates the necessity to install a decent job; this type of box has been found trouble-free in a large number of cases, though, as Mr. Payn says, the compound will not resist the penetration of moisture indefinitely. Therefore, this box is a potential source of trouble, and must give way to what I claim, and I believe will be agreed, a fool-proof job, and that is the stamped lead box. In my opinion, this box is the ideal towards a really efficient network. It necessarily follows there is no use in an engineer going to the expense of lead work, and having installations put in by inexperienced workmen. For were it not for the mechanical protection and the compound filling usually put in around the lead work, it would prove a bigger source of trouble than a c.i. box, due to would-be plumber-jointers and their so-called wiped joints, probably the kind of plumbed joint "Deuce" had in mind when he referred to a wiped joint not being watertight. I also agree with Mr. Payn regarding the filling of iron joint boxes and cooling off, a point neglected by most engineers, and not appreciated by others; the jointer should have sufficient experience to allow his work to cool down before capping up. Personally, I would install all cast lead boxes, stamped, or beaten up on site out of 10 lb. linear foot sheet lead, properly bonded (there are various methods of bonding) joint made with Indian cotton tape, boiled in resin oil, lead box with a resin oil filling, immersed in a creosoted wooden box filled with a low-grade compound. The cooling down of the resin would vary according to temperature, poured at, say, 170 deg. F. This would assure proper penetration over all parts of the joint. I have also made joint boxes from lead sleeving, which requires skill to make and install. I note

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Mr. Payn's remarks of failure of jointers to answer advertisements, and their scarcity, which has previously been referred to by Mr. Robbins. It may interest Mr. Payn to learn that I have on occasions, along with others, advertised for employment with similar results to Mr. Payn—no answer. I have also written innumerable letters to supply authorities, but they had nothing to offer. This is due to Mr. Payn's idea having been given effect to, and a bunch of slap and dab hands engaged at a cheap rate to carry out the work; and the engineer wonders why he is always racing around with a test set. It is stated that good jointers are scarce: any wonder? A diligent man goes all out to get an all-round experience, travels thousands of miles, as I and as many others have done; when it comes to a supply job in particular, they want experienced hands, but are very adverse to offering a wage somewhat in keeping with the experience of the individuals concerned. Therefore, the all-rounder, capable of working without supervision, and carrying out a job from start to finish, or taking charge of work, finds himself with the same pay packet as the chancer who reaches the length of a service line, and I know cases where they are hardly fit for that, and would tremble to lose sight of the town clock. First-class hands can be obtained if the employer will offer the incentive. I would be interested to learn of a shop where the work of a good all-rounder would be appreciated. A trade test should be an item insisted upon by all engineers as a proof of competence, then less faulty work would be installed.

March 9th, 1929. **Cockenzie.**

Engineers and the Future.

At a time when a future El Dorado is prophesied (and let us hope it does not turn out to be a mirage) it is rather interesting to note in a recent issue of the ELECTRICAL REVIEW that an "assistant instructor" is required by one of the leading correspondence colleges at a salary of £160-£180 per annum!! I think it would be rather difficult for the apostles of "Do you ring, or are you rung for?" to explain how they are going to turn out those £1,000-a-year men from the experience and knowledge of an engineer (must hold a degree) drawing £3 per week. All rather amusing, but hardly the material to convince people that these institutions do "deliver the goods."

Leslie R. Simmonds, Grad. I.E.E.

Nag Hammadi Barrage, Upper Egypt, *March 4th*, 1929.

Tramcar Regenerative Braking.

On June 15th, 1928, you published an article of mine on the subject of re-generated currents in tramway motors when braking. In the *Asea-Journal*, Volume 5, 1928, there is an article by a Mr. P. Friebel in which he refers to my article and suggests a very simple method of overcoming the difficulties which I bring to notice.

Mr. Friebel states that a very simple method of obtaining good braking is by connecting a small resistance in series with each armature. If this is to be introduced in existing equipment, it means that the resistance must be permanently in series, not only during braking, but during motoring also. Mr. Friebel suggests that a resistance of 1 ohm for each motor is a suitable value and that in some cases a much smaller value will suffice. Even if half an ohm were considered a suitable value, in my opinion it represents a most undesirable loss to be permanently in series with a large tramway motor, and I do not consider that it would be acceptable to the average British engineer.

Mr. Friebel states that the best means of overcoming the difficulty is by means of the well known cross-field connection. The advantages and disadvantages of this method are well known, but it is as well to point out that the chief objection is that any one lead breaking will prevent braking on both motors, and this point does not appear to be mentioned by Mr. Friebel.

Birmingham, *March 13th*, 1929. **E. H. Croft.**

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be numbered and abridged, and all subsequent proceedings will be taken.

1927.

22,648. "Electric transformers." British Thomson-Houston Co., Ltd., and C. G. Mayo. August 29th, 1927. (306,194.)
25,109. "Electric fuses." C. E. Bennett. September 23rd, 1926. (277,991.)
27,376. "Sound-reproducing apparatus for use with kinematograph films." A. Stevens. October 15th, 1927. (306,426.)
27,945. "Recording sound." S. K. Wilson and De Forest Phonofilms, Ltd. October 20th, 1927. (306,438.)
31,021. "Delay-action mechanism for electrical switches, gas cocks, or the like." W. W. Whiffin. November 18th, 1927. (306,574.)
31,064. "Low-pressure electric discharge apparatus." G. Valensi. November 18th, 1926. (280,948.)
31,132. "Electric vibratory relays." A. Reyrolle & Co., Ltd., and B. H. Leeson. November 19th, 1927. (306,470.)
31,162. "Circuit arrangements for thermionic devices." C. Flannagan. November 19th, 1927. (306,436.)
31,379. "Low-pressure electric discharge apparatus." G. Valensi. June 17th, 1927. (Addition to 280,948.) (292,455.)
31,390. "Constant-frequency control devices suitable for use in picture telegraphy." G. M. Wright. November 22nd, 1927 (306,580.)
31,392. "Apparatus for supplying power to the anodes of thermionic valves." H. A. Ewen. November 22nd, 1927. (306,500.)
31,441. "Apparatus for the application of the constant electrical current in medical practice." J. Shaw. November 23rd, 1927. (306 583.)
31,498. "Telephone systems." Siemens & Halske Akt. Ges November 24th, 1926. (281,297.)
31,548. "Telephone systems." Associated Telephone & Telegraph Co. March 23rd, 1927. (287,515.)
31,549. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. E. Beale. November 23rd, 1927. (306,592.)
31,959. "Manufacture of gasfilled electric incandescent lamps." General Electric Co., Ltd., F. J. G. Van Den Bosch, and N. R. Campbell. November 28th, 1927. (306,612.)
32,476. "Constant-voltage dynamo-electric machinery." J. K. Im Thurn and T. H. Baines. December 1st, 1927. (306,626.)
32,772. "Terminal fitting for connector for spark-plugs." P. T. Webb. December 5th, 1927. (Convention date not granted.) (282,376.)
35,250. "Automatic circuit-breaker arrangements for the protection of electric generators." C. Meyer. May 4th, 1927. (289,846.)

1928.

158. "Electric bells." General Electric Co., Ltd., and J. R. Conchie. January 3rd, 1928. (306,661.)
215. "Electric transformers." W. C. Kennett and Hackbridge Electric Construction Co., Ltd. January 3rd, 1928. (306,662.)
294. "Selective switching devices for electric circuits." Tyer & Co., Ltd., and F. W. Leake. January 4th, 1928. (306,663.)
484. "Tramcars and similar vehicles." G. D. Peters & Co., Ltd., and H. R. Hockley. January 6th, 1928. (306,664.)
3,806. "Sending or controlling apparatus set by electrical impulses." Siemens Bros. & Co., Ltd., and D. A. Christian. February 7th, 1928. (306,683.)
4,321. "Acoustical devices such as loud speakers." E. D. Selway. February 11th, 1928. (306,692.)
5,758. "Electrical induction furnaces." N. R. Davis and Metropolitan-Vickers Electrical Co., Ltd. February 23rd, 1928. (306,707.)
7,425. "Electric motor control systems." G. H. Fletcher, R. Brooks, and Metropolitan-Vickers Electrical Co., Ltd. March 9th, 1928. (306,726.)
10,284. "Electrical gear for operating furnace and like doors." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. April 5th, 1928. (306,749.)
12,806. "Automatic and semi-automatic telephone systems." Telefonaktiebolaget L.M. Ericsson. May 2nd, 1927. (289,816.)
16,987. "Radio-transmitting systems" Westinghouse Electric & Manufacturing Co. June 18th, 1927. (292,409.)
20,745. "Electrodes for arc-welding and like purposes." Weldrics (1922), Ltd., and A. D. Anderson. July 17th, 1928. (306,785.)
21,453. "Filaments for electric incandescent optical-projection lamps." Falk, Stadelmann & Co., Ltd. November 23rd, 1927. (301,015.)
26,738. "Aerial systems." Marconi's Wireless Telegraph Co., Ltd. October 28th, 1927. (299,447.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 13th:—

Sopranist (lettering and design). No. 490,126 All goods in Class 8.—S. Kalisky (Aldgate), Ltd., 75, High Street, Aldgate, E.1.
Electronette. No. 491,858. All goods in Class 8.—The Parlophone Co., Ltd. 1, Broad Street Place, E.C.2.
Yep (lettering and design). No. 495,316. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony.—George Constable, 49, Ballater Road, Acre Lane, Brixton, S.W.
Centrolian. No. 498,875. All goods in Class 8.—The Central Radio Co., Britannia Buildings, Fenwick Street, Liverpool.
Lister-Bruston. No. 491,091. Class 18. Electric lighting plants.—R. A. Lister & Co., Ltd., Victoria Ironworks, Dursley, Glos.
Toastmaster Automatic Electric Toaster (lettering and design). No. 497,956. Class 18. Electric toasting stoves.—Hector C. Adain, Ltd., 19-23, Oxford Street, W.1.
Limpet Tape. No. 496,270. Class 50. Electrical insulating tape composed of cotton impregnated with india-rubber.—Connollys (Blackley), Ltd., Blackley, Manchester.

Spray-Cooling of Water.

In a recent issue of *Chemical and Metallurgical Engineering* some interesting notes are given on the development of apparatus for the spray-cooling of water, by Mr. B. R. T. Collins. About 18 years ago the first low-pressure spray nozzle was developed. This nozzle operated at 7 lb. pressure at the nozzle, and confined the spray to a reasonable area, even in windy weather, so that the difficulty from drift with the high-pressure nozzles was avoided. During the past 15 years there have been between 6,000 and 8,000 installations of cooling ponds made in the United States and other countries. Some of the types of nozzle used have had small passages, which might become clogged with foreign matter if there should be any in the circulating water. Consequently, there is a tendency now toward nozzles which have no centre or openings smaller than the orifice, and rely upon impact of the water against itself to obtain the spraying effect.

A recent development of this type is the "ramp bottom" nozzle, which, as the name implies, has a bottom constructed on the principle of a spiral ramp, gradually ascending from the entrance until it has made one revolution. Here the water is caused to collide half way up on the entering stream, and this collision effect, with the large mixing chamber above, produces an absolutely uniform distribution of fine drops, leaving the orifice around its entire circumference.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Military barracks at Bridge of Don (£140,000); officer in command, Castlehill Barracks.

AMPTHILL.—Housing scheme (36), for the R.D.C.; L. Foster, surveyor, Flitwick, Bedford (returnable deposit of £1 1s.).

BARNSLEY.—Public abattoir (£33,250), for the T.C.; borough surveyor.

BECKENHAM.—Residential hotel, Elmers End Road (£17,000), for Copes Taverns, Ltd.

BLACKBURN.—Extension of Nurses' Home, Royal Infirmary (£19,980); Wm. Livesey & Sons, Ltd., builders. Addition to Albert Mill, Gate Street; manager. Addition to works, Ashton Street; manager.

BRADFORD.—Extensions at Technical College (£41,000); 100 tenements, Broomfields; city architect.

BRENTFORD.—108 flats for U.D.C.; E. Willis, architect.

BRISTOL.—Buildings for higher education and shop premises, corner of Unity Street and College Green; Education Committee and Society of Merchant Venturers. Boot factory, Forest Road, Kingswood, for Bawn Bros.

BROMLEY (KENT).—School, Bromley Common, for the Borough E.C.; director of education. Block of 24 shops, Widmore Road, for A. Frampton.

BUCKHURST HILL (ESSEX).—Extensions, Forest Hospital (£7,000); F. T. Cooper, hon. sec.

BURNLEY.—Fire station and firemen's dwellings, Belvedere Road and Leyland Road (£20,000); borough surveyor. Warehouse, &c., for the Brun Manufacturing Co., Ltd. (£10,000).

CAERPHILLY.—Church, for the Wesleyan trustees; secretary.

CARLISLE.—Additions, Cumberland Infirmary, Infirmary Street; John Burnett, Sons & Dick, architects.

CHESHIRE.—Isolation hospital; county medical officer.

COVENTRY.—Rebuilding scheme, Smithford Street, for Marks and Spencer, Ltd., bazaar proprietors, London.

CROSTON.—Public offices, for the U.D.C.; surveyor.

DARLINGTON.—Club and institute, Eldon Street; Cayley and Jarvis, architects. Houses (33); J. E. Chilton, architect, Houndgate.

DARTFORD.—Housing scheme (90), for the U.D.C.; surveyor (returnable deposit of £2 2s.).

DERBY.—Re-erection (after fire) of portion of Derwent Foundry, for the Qualcast Mowers Co., Ltd. (£30,000).

DORCHESTER.—Grammar school, for Dorset E.C.; director of education.

DORKING.—Telephone exchange, Abinger Hammer, for H.M. Office of Works, King Charles Street, S.W. (returnable deposit of £1 1s.).

DOVER.—Alterations, King's Hall, Biggin Street, for Theatre Securities, Ltd.; A. H. Steele.

DUKINFIELD.—Housing scheme (32) (deposit £2 2s.), Lord Street site; borough surveyor. Housing scheme (54) (deposit £2 2s.), Lodge Lane; borough surveyor.

DUNMOW.—Housing scheme (72), for the R.D.C.; J. Plumbley, surveyor, 58, New Street (returnable deposit of £1 1s.).

EDINBURGH.—Shops in Dundee Street for St. Cuthbert's Co-operative Association, Ltd.; the manager.

GILLINGHAM (KENT).—Houses (46), King Edward and Court Lodge Roads, for C. J. Howard.

GREEN STREET GREEN (KENT).—Cinema, for V. Gardner.

HADDINGTON.—Restoration and improvements at Holy Trinity Episcopal Church; the rector.

HALIFAX.—High school (£25,000), for the Borough E.C.; clerk.

HANLEY.—Additions, Victoria Works, Victoria Road; Swinnertons, Ltd.

HARROGATE.—Extension of Ashville College (£10,000); governors.

HASTINGS.—Reconstruction, White Rock Baths (£60,000), for the T.C.; borough engineer.

HENDON.—Public library (£35,000), for the U.D.C.; surveyor.

HUDDERSFIELD.—Additional 40 houses, Almondbury, for the T.C.; borough architect, 26, Ramsden Street. Extensions, Empress Works, for Brook Motors, Ltd., with electric light and heating work; J. Ainley, architect, 55, New Street (March 29th).

IPSWICH.—Houses (100), for the T.C.; Pearson & Blackwell, Ltd., Doncaster, builders.

IRISH FREE STATE (CLONMEL, Co. TIPPERARY).—Completion of SS. Peter and Paul's Church (£17,000); Mr. Hearne, Waterford.

(ENNIS, Co. CLARE).—County sanatorium for the County Board of Health.

KEIGHLEY.—New buildings for Drake & Tonson's School (£19,950); governors.

KELSALL.—School (£15,422), for Cheshire E.C.; county architect, Newgate Street, Chester.

KING'S LYNN.—Extensions, Institution, with heating work, for the B.G.; E. E. Colman, architect (returnable deposit of £3 3s.).

LANARKSHIRE.—Cinema at Cambuslang (£22,000); W. B. Inglis, architect, Bath Street, Glasgow.

LINCOLN.—Additional 104 houses, for the T.C.; city surveyor.

LINTON (CAMBS.).—Houses (76), for the R.D.C.; H. J. Painton, builder

LITTLE SHELFORD (CAMBRIDGE).—Re-erection (after fire) of the Hall, residence of Capt. Gordon Dill (£10,000).

LONDON (LAMBETH, S.E.).—60 flats, China Walk; L.C.C. architect.

(LEWISHAM, S.E.).—60 flats, Winchfield Road; borough engineer.

(BAYSWATER, S.W.).—Extensions, Falmouth House, Clarendon Place, for Countess of Gosford; Wellesley & Wills.

(STREATHAM, S.W.).—Cinema, High Road, and Pendennis Road; Streatham Properties, Ltd. Dance hall and theatre, Streatham Hill: Pitcher Construction Co., Ltd.

(WANDSWORTH, S.W.).—Alterations and additions, factory of Sutherlands, Ltd., Riverside Road; W. G. Shearer. Additions, factory, Merton Road; Starkey & Gardner, Ltd.

LUDLOW.—Additional 40 houses for the T.C.; borough surveyor.

MAIDSTONE.—New buildings for Grammar School; Kent Education Committee.

MANSFIELD.—Additional 38 houses for the T.C., by direct labour; borough surveyor. Extensions, Brunts School (£12,000), for the Notts. E.C.; B. C. Westwick, architect.

MORDEN.—150 dwellings, St. Helier Estate; trustees, Douglas Haig Memorial Homes.

PAIGNTON.—24 bedrooms, ballroom, &c., Palace Hotel, Steartfield Road; Palace Hotel Co., Ltd. 42 houses, Lower Polsham Estate; C. Geen.

PAISLEY.—200 houses for Corporation; burgh surveyor.

PETERBOROUGH.—Houses (39) and shops, for the T.C.; W. H. A. Court, city engineer (returnable deposit of £1 1s. on each of two contracts).

PLYMOUTH.—Cinema, Union Street, for the Provincial Cinematograph Theatres, Ltd. Nurses' home, Mental Hospital (£19,580); borough architect.

PORTSMOUTH.—Secondary school for E.C. (£114,942); Rowland Bros., Horsham, contractors.

RICHMOND (SURREY).—New Cinema, Hill Street, with shops, flats, and houses (lighting and heating work), for Alderman J. T. Mears.

ROTHERHAM.—Joint hospital, St. Catherine's Estate; borough engineer. Extensions, Ivanhoe Works, Wortley Road; Robert Jenkins & Co., Ltd. Extensions, engineers' workshop, Thames Street; H. Duncan White.

ST. HELENS (ISLE OF WIGHT).—Housing scheme (30), for the U.D.C.; surveyor.

SALFORD.—Extension of Hope Infirmary; for Board of Guardians.

SANQUHAR.—Re-erection (after fire) of portion of Crawick Forge, for James Rigg & Sons, shovel manufacturers.

SHEFFIELD.—Mental institution, Hollow Meadows; Medical Officer of Health.

STEVENAGE.—Re-erection of The Croft, Walkern, residence of Mrs. Schlesinger.

STRETFORD.—Factory, Chester Road; W. S. Toms, Ltd.

UTTOXETER.—Additional 97 houses for the U.D.C.; surveyor.

WETHERBY.—Hotel (£30,000), for Wilfred Guy Johnson, Bradford.

WOODFORD (ESSEX).—Anti-aircraft headquarters, for the War Office; Pearson & Blackwell, Ltd., Doncaster, builders.

WORCESTER.—Re-erection of windscreen and electro-plating works, Sidbury, for F. A. Perkins, 9, Bewdley Hill, Kidderminster.

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Electrical Auxiliaries on Ships.

APART from using electricity for the propulsion of ships, the problem of its use for driving the various auxiliaries is one which has engaged the attention of electrical engineers for a considerable time past. The amount of power required to operate all the auxiliaries on a ship depends to a large extent upon the nature of the service for which the vessel is designed, but in a merchant ship of the intermediate type carrying both passengers and cargo it can be assumed that the auxiliary power is of the order of about 15 per cent. of the power of the main propelling machinery. Thus on a vessel like the *Viceroy of India*, of 17,000 s.h.p., the auxiliary load would be of the order of 2,000 h.p., representing some 1,500 kW. Actually the auxiliary equipment of the vessel is in excess of this capacity. In these days when economy of operation is of the utmost importance, it is apparent that the auxiliary power must be generated and utilised with the highest efficiency, and it is because of this fact that the electric motor is to be preferred to the small reciprocating steam engine which hitherto has been so extensively employed for driving the auxiliary machinery on board ship, both in the engine room and on deck. Apart from its own inherent inefficiency, the small reciprocator suffers from the great disadvantage that its use involves the installation of bulky and unsightly steam feed and exhaust pipe lines between the boilers to the engine, and they constitute a source of additional loss due to the condensation which must inevitably occur in them, no matter how well they may be lagged with heat-insulating material. The electric motor, on the other hand, obtains its power from a large generator driven by an engine operating under conditions of maximum efficiency, the cables being of small dimensions and capable of being run between the generator switchboard and the motor control panel in unobtrusive casings, the transmission losses being small.

While, however, the electric motor is being very extensively employed on board ship for driving all kinds of auxiliary machinery, it suffers from certain well-defined disadvantages, particularly in cases when the load on the motor is of a rapidly and violently fluctuating nature. When the load is of a steady character, such as when driving a centrifugal

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pump, or a fan, the ordinary constant-voltage type of motor can be, and is being, used with complete reliability, the control gear comprising a simple starting resistance with the necessary no-load and overload cut-outs; but for the steering gear and to a far greater extent for the capstans, the windlasses, and the cargo winches, in which cases the load varies between wide limits, the constant-voltage system has left much to be desired. In particular, for the cargo winches, the control of which may be in the hands of inexpert stevedores who have only been used to handling steam-driven winches, the risk due to sudden overloading of the motors and so on may be very great. We have seen electrically-driven cargo winches of which the control levers and brakes were designed in exact replica of those of a steam winch in an attempt to obtain more careful handling of the motors, but this arrangement, as well as the contactor arrangement which has been adopted by many makers in conjunction with the constant-voltage system of supply, leaves much to be desired when placed in the hands of men inexperienced in handling electrically-driven machinery.

It is in order to overcome these disadvantages that the Austin constant-current system has been developed: in contradistinction to the system hitherto employed, the voltage of the circuit is varied according to the demand for power, the current being maintained at a constant value. This system has been adopted for the various auxiliaries on the new P. & O. liner *Viceroy of India*, as described elsewhere in this issue, and it may be emphasised that the Austin system is of particular value when used in conjunction with motors subjected to considerable variation of load, such as the capstan and winch motors, since it eliminates troubles due to circuit breakers and even when the motor is stalled by overload, as when a cargo lift is run to the top of the derrick, there is no danger to the motor, the power being actually reduced owing to the counter voltage of the exciter. Again, motors operated on the constant-current system can hold their load stationary without the use of a brake, while the energy derived from descending loads, as in the case of cargo winches, can be returned to the line, the motors being regenerative. It is to be noted that the Austin constant-current system is applicable to all types of ship in which there is a considerable auxiliary load, and while it happens that the *Viceroy of India* is electrically propelled, its use is, of course, entirely independent of the system of propulsion employed. On any ship where it is planned to use electricity for driving the auxiliary machinery (the electricity being obtained from the usual auxiliary generators), the Austin constant-current system can be adopted with but little modification of the generating plant, and thus the advantages of the electric drive outlined above can be obtained without the usual disadvantages. We learn that the auxiliary machinery on the *Viceroy of India* has so far proved extremely satisfactory up to the time of the vessel sailing on her maiden voyage on March 28th. We hope that authoritative information will be forthcoming in the near future regarding its behaviour under the more onerous conditions of commercial service at sea and in foreign ports in the hands of inexperienced men.

Extensions or Bulk Supplies?

Attention is once again drawn to the necessity for guarding against any tendency to impede the progress of electricity supply in this country during the transition stages of the Government schemes. Revelations made at a recent meeting of the Epsom Urban District Council suggest that the electricity undertaking is "hard hit," and that there is undue delay in obtaining sanction for new plant, or in securing an alternative supply in bulk. It appears that the present plant in the station, 11,350 kW, has been fully taxed this winter, and at times overloaded. Apparently a Fullagar oil-engne set is being installed at present but it has been realised that it will not be nearly sufficient to meet the load of the 1929-30 winter. Some idea of the growth of the load at Epsom can be gathered from the fact that for four weeks prior to March the energy generated by the undertaking amounted to 332,701 kWh, and that in the corresponding period of last year 230,034 kWh was generated.

In November last application was made to the Electricity Commissioners for sanction to the installation of a second set, but at the time of the meeting referred to sanction had not been received. The gravity of the situation is evidenced by a statement to the effect that if the second set, or an alternative supply, is not available by next winter the Electricity Committee will have to cease to develop the demand for electricity, or to discourage, or stop, the hire of domestic electrical apparatus, and to confine new consumers to lighting only.

Any such suggestion in these days is decidedly "unhealthy," and the fact that it emanates from an undertaking that has increased its output by something approaching 50 per cent. in a year indicates that the responsibility for the position may not rest locally.

It appears also that the undertaking has had an offer of a bulk supply from the London and Home Counties Joint Electricity Authority, but that it does not consider that such a supply can be available in time for the load of next winter. Lack of development, or enterprise, in any one undertaking does not affect that concern only; it reflects on the whole supply industry.

The problem of bulk supply versus local generating plant extension must be solved by the machinery set up under recent legislation, but the vital point is that the curtailment of supply under any conditions should not be allowed. The authorities should see to it that either sanction for extension is given promptly when necessary to progress, or that where the introduction of an outside supply is the "economic procedure," pressure is brought to bear on an undertaking which is reluctant to accept a bulk supply.

French Technical Industries.

From information to hand from a correspondent in France, it appears that there is some perturbation in French commercial circles in regard to the situation of the French electrical and other technical industries. *La Métallurgie* emphasizes the necessity of developing foreign markets, for notwithstanding that French industries enjoy at present a very strong position in their own markets, defence must be organised against two powerful rivals, the United States and Germany. In the United States, industries continue to flourish, and although their own demands absorb practically the whole of their output, since their exports amount to only 10 per cent. of their production, these exports must necessarily develop under American methods of super-production, which tend to reduce costs. These methods are difficult to implant in France. However, if American competition presents a danger for to-morrow, that from Germany is more imminent, for Germany, it is stated, intends to resume the privileged situation which she enjoyed before the war, and even to recapture her former position in the French markets. It is considered that, in order to meet these powerful rivals, France must adopt methods to standardise her manufactures, to encourage the supply of skilled workmen by modifying conditions of apprenticeship, to augment the output of the workmen now available by means of wage bonuses, and to organise factories and plant in such a way as to increase production and reduce costs by every means possible. These remedies are of course to be directed towards ordinary commercial competition, but the payments being made by Germany under the Dawes plan in machinery and electrical apparatus is a form of competition which is the result of questions of national politics, and demands special attention. French industrial leaders assert that they have no wish to kill this mode of payment, particularly in view of their position as taxpayers; but they naturally protest vehemently when they find their own markets flooded with products similar to their own, but of German origin. These are

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the words of Monsieur Dalbouze, president of the Syndicat des Industries Mécaniques Françaises:—"To-morrow the South American, embarking for Europe by a French line of steamers, will travel on a boat built in Germany; disembarking at Bordeaux he will see the port worked with German plant; he will telephone to Paris with German apparatus, and by wire made in Germany; he will enter a German railway coach on a railroad electrified by Germany; if he visits a French workshop the machine tools will be German, driven by electric motors made in Germany; while in a French institute the microscopes will be of German construction." In the opinion of the journal these manufactured goods received from Germany should be sold by France to Anglo-Saxon countries, and a strong propaganda movement should be made in favour of French manufactures. Of course, it is more than probable that electrical people in the aforesaid Anglo-Saxon countries may have other views regarding the flooding of their markets with these German reparations goods. They expressed themselves in no uncertain terms several years ago respecting electrical reparations in kind direct from Germany.

Two Important Committees.

We reported in our last issue that the Electricity Commissioners had appointed two committees, representative of the electrical interests concerned, to consider and report on (*a*) facilities for the hire or hire-purchase by consumers of installations and appliances, with special reference to rural areas; and (*b*) the question of greater uniformity in charges and tariffs for electricity. Both matters are of the greatest importance to the electrical industry, and the constitution of the committees is such that practical proposals, aiding electrical development, are assured.

In urban areas the provision of hire and hire-purchase facilities has already made good progress, but a great deal remains to be done. The rural areas are only now being considered, and it is in this direction that the ingenuity of the committee will be taxed. Rural electrification is very largely dependent upon some satisfactory arrangement for the easy-purchase of installations and appliances by consumers, and the committee is asked to "make proposals for a practical financial scheme for this purpose." The venture will call for a certain amount of courage, but we feel sure that it will form a safe and remunerative long-term investment for suppliers of energy, installations and apparatus, all of whom are represented on the committee.

The task of the second committee is an unenviable one. The electrical industry is badly handicapped by lack of standardisation in all directions, but in no department is there so much variety as in tariffs and charges. Of course, local conditions determine the level of *prices*, but this can hardly be said of the *methods* of charging. The "two-part" system has given excellent opportunities for originality. The ratable value of the premises appears to be the most popular basis of calculation, and it is probably the best in the long run; but other methods are employed, such as a fixed charge per lamp, per room, per sq. ft. of floor space, or on the wattage installed, with many variations. Some undertakings appear to make a purely arbitrary fixed charge while some go to inordinate trouble to ensure that all factors are taken into account. We may appropriately conclude with the following quotation from the recently-published statement of charges in its District by the London & Home Counties Joint Electricity Authority; it applies to one of the companies:—

"Domestic Tariff Telephone System.—A fixed annual charge to be assessed by the Company, plus 2d. per unit up to 20 units per quarter per £1 of annual fixed charge and 1½d. per unit thereafter. The fixed charge is calculated as follows:—1s. 3d. per annum per £1 of ratable value, plus 4s. per annum for each 100 sq. ft. floor area of living rooms, kitchen and bedrooms, plus 1s. 6d. per annum per 20-watt lamp installed except occasional lamps (in passages, cellars, sculleries, bathrooms, &c.) up to one quarter of total connections, less 20 per cent."

This is perhaps the worst of many "horrible examples" with which the Committee will be faced, and shows the need for offering the consumer simpler terms.

Latest Improvements.

There is no doubt that the number of houses being built by private enterprise has greatly increased—at any rate in the London area—and certainly the competition existing among builders to-day is unprecedented. Houses are being sold by the aid of modern selling schemes, advertising campaigns, and so on, and almost without exception the outstanding "pull" used by the builder is "latest improvements."

It is without doubt that electricity offers more in the way of "latest improvements" than any other public service, but the builders cannot be said to take much advantage of that fact. Occasionally one sees "house wired throughout for power," but "gas points in all rooms" is too frequently met with. The problem involves the old question of supply charges, it is true, and in many places the supply undertaking must largely share the responsibility for the lack of provision for full domestic electrical development. But where domestic electricity tariffs are sufficiently low to permit claims of competition with the gas supply for heating and cooking, the builder's apparent preference for gas often prevails.

The solution then lies in "educating the builder." In this connection the Electrical Association for Women is doing excellent work by means of its outlet campaign; but that is not sufficient. To bring the builder into line with modern development the combined forces of all bodies concerned with the advancement of electrical service is required; then with the support of the heavy artillery of the supply undertakings in the form of low domestic charges, the result will be a battle won.

X-Rays in the Foundry.

The X-ray examination of materials has been advocated during the last ten years at least, but although it has been urged on many occasions by authorities that it could be advantageously used for the examination of castings before any machining operations were performed on them, the foundry industry has hitherto never been more than mildly interested in the subject. At the recent conference on steel castings in Glasgow there was considerable discussion about the relative value of X-ray examination, and it was stated by one speaker that "the next best thing is to cut up a casting before proceeding with the bulk." Whilst the cutting up of one casting is effective for repetition work, a large proportion of the total steel castings made are of the one-off kind, and X-rays ought to be more used than they are for the inspection of comparatively thin castings, the class of castings indeed that are most difficult to produce free from defects. That the application of X-rays has limitations of a serious kind must be admitted: they will not penetrate very thick metal, and small defects cannot always be detected by their aid; again, stresses may exist that are not indicated, yet it is significant that a foundry journal should urge that facilities for X-ray examination should be placed at the disposal of individual foundries, either by the Government Departments that purchase steel castings, or by a co-operative organisation supported by the foundry industry. X-rays, or no X-rays, the production of sound steel castings is exceedingly difficult and complex problems in connection with melting practice are involved. At the Glasgow conference already mentioned, an instance was cited of a steel foundry that uses an electric furnace and is turning out perfect castings, and there can be no doubt that were electric furnaces more generally used, the proportion of waster castings would be considerably reduced.

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The Austin Constant-current System.

A brief description of its nature and merits in marine applications, and an outline of an installation aboard a large all-electric passenger liner recently built in this country.

By D. SMEATON MUNRO, M.I.E.E.,

THE separately generated constant-current system as practically applied to drive capstans, winches, forced-draught fans, pumps, and other auxiliary gear on board the new P. & O. liner *Viceroy of India** is of great electrical and shipping interest. This system, which has been already referred to in outline, is a modern development of the Thury high-voltage d.c. arrangement which was designed for long-distance power transmission. To-day long-distance transmission is effected on the a.c. constant-e.h.p. system, and the constant-current method is unsuitable for general town distribution, but it has most attractive characteristics for driving certain classes of machinery within a limited area, such as the confines of a ship. The dynamo generates d.c. of constant value, which circulates in a closed series circuit through the motors, while the voltage varies according to the demand for power. When a motor controller is in the "off" position the motor is short circuited, so that the current is by-passed quite free of the motor windings by means of a simple cam-operated switch. The generators, motors, switchgear, and cables, are all of the design which Gilbert Austin, Ltd., have perfected within recent years. The system gets rid of all the troubles attendant on the use of circuit breakers and fuses for protecting deck motors against overload, as the current limit in the circuits cannot be increased.

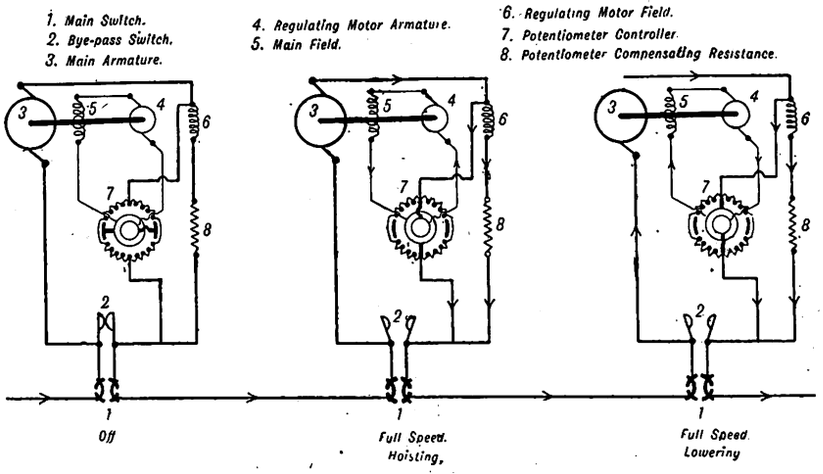

Fig. 1.—Motor Connections.

A constant-current motor, if its normal load is increased, will carry the overload for which it is designed, and if the overload is still further increased the armature will slow down, and even stop, but at the same time it holds on to its load and so prevents harm. A feature of the constant-current motor is that when actually stalled by overload, although the torque is increased, the demand for power is reduced to approximately 1/20 full-load current, which apparent paradox is caused by the stalled motor ceasing to produce a counter voltage and the exciter (which is a feature of the generator) accordingly reduces the voltage of generator. The series circuit has a further safeguard in that the generator itself cannot be overloaded. It can only maintain the full line current from zero up to the voltage for which it is designed; if pressed beyond that limit there is an automatic reduction of current. The main object of the application of the constant-current method to marine work, however, is to provide electric motors that are effective over the utmost speed range and under all loads, having the good qualities of a steam engine, which, when pulled up by overload, consumes little or no steam in the process.

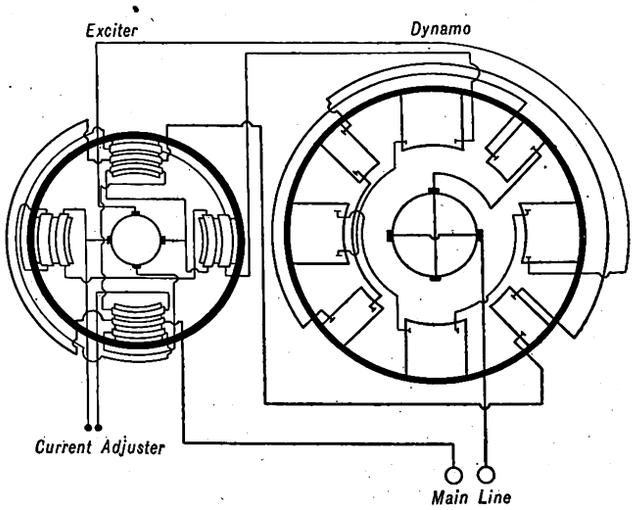

Fig. 2.—Generator Connections.

In practice, the constant-current motors run throughout the unusual full-load speed range of zero to maximum, and may be switched from full speed forward to full reverse with ease and without risk of damage. In

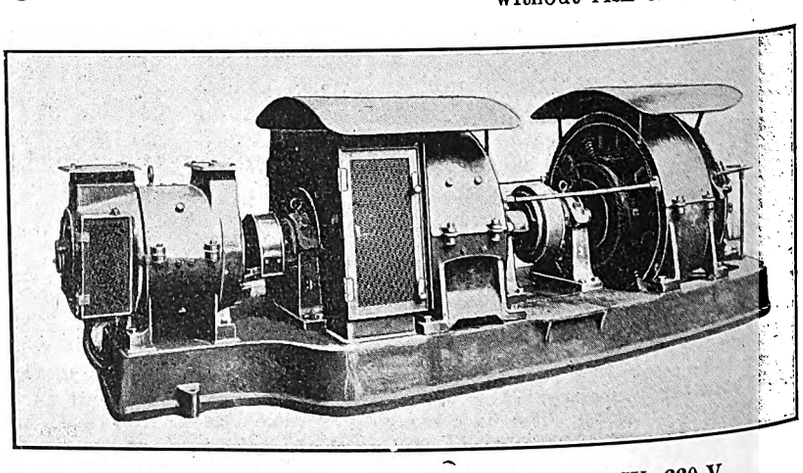

Fig. 3.—Motor-generator and Exciter, 150 kW, 220 V.

* ELEC. REV., March 8th, 1929, p. 414.

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the case of capstans, or winches, the motors will hold their loads stationary without the use of brakes and with only a very small demand on the dynamo. When driving a plunger pump, for which purpose other types of electric motor have notably failed, the discharge valves may be closed without damage to the pump, or to the running constant-current motor. Energy from the descending loads on winches, &c., helps to raise other loads, as the motors are regenerative, so the generator output need be very much less than the total capacity of all the series motors in full operation.

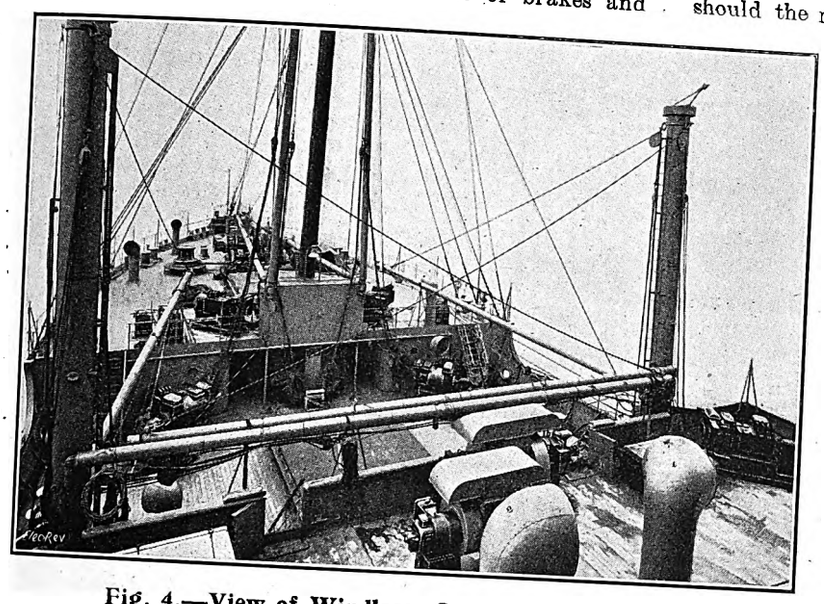

Fig. 4.—View of Windlass, Capstans and Winches.

The Generator.—The interpoled machine is constructed on lines which are practically standard and a separate low-voltage exciter is fitted on a shaft extension. The exciter raises, or lowers, the voltage of the generator according to the varying demands for energy required by the motors, so that the average current is maintained in the system while the pressure varies with the load on the circuits.

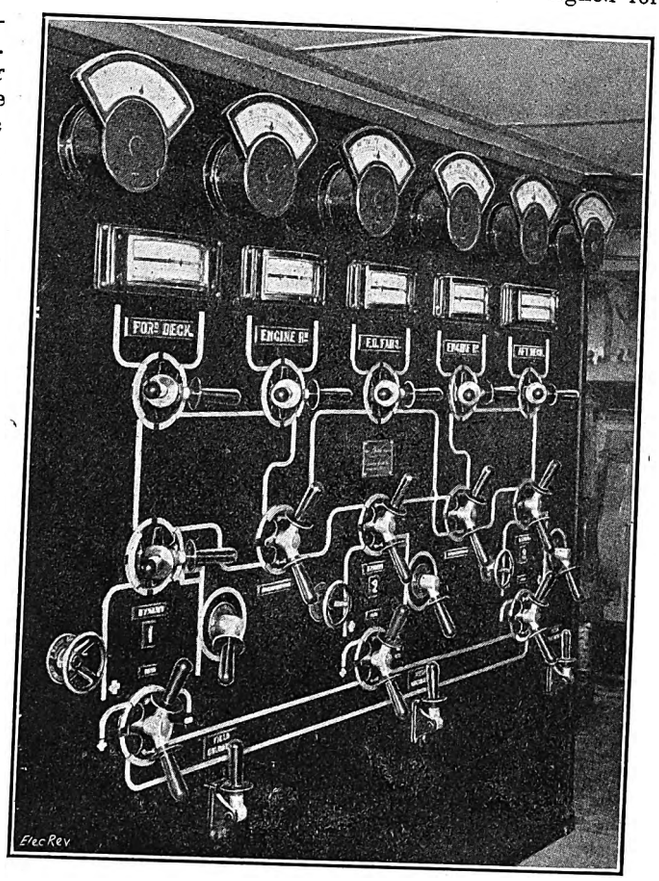

Fig. 5.—Austin Main Control Board.

Reference to fig. 2 will show that the exciter has two sets of windings and two sets of brushes: initial excitation is obtained from the primary brushes under adjustable control by a field rheostat, while the current for the main excitation of the dynamo is derived from the other sets of windings and brushes. The dynamo main-line current passes through coils on the exciter poles and has a balancing influence on the primary excitation. An additional set of windings is provided to impart compounding effects and to balance armature reactions. The machine is started on short circuit, *i.e.*, under no-load conditions, and the rheostat is adjusted until a balance is obtained at the correct line current. On the one hand, should the main current tend to decrease the primary excitation will predominate and quickly restore the balance by increasing the main-field excitation. On the other hand, should the main current increase the exciter action will be reversed and tend to reduce the main-field excitation until the balance is again restored. The action of the exciter is very rapid, and in practice the current remains as steady as the voltage generally does in an ordinary d.c. constant-voltage machine of comparable output.

The Line.—Energy distribution on the Austin system is extremely simple and inexpensive, compared with the usual elaborate networks installed for ships' motors and their controlling gear. All that is required is a lead and return, which take the form of a single-core cable passing from the generator round to all the motors in series and back to the generator. A special type of cable known as "Osmotite," has been designed for marine work by Messrs. Gilbert Austin, Ltd., and is claimed to be proof against osmotic and electrolytic actions. The primary insulation is lead sheathed and a layer of special insulating compound that is impervious to moisture and salt spray and is further protective by tape is interposed between the lead and the outer armour of steel, braid, and compound. The interposed secondary insulation is also of great value in testing.

The Motors.—The machines used consist of a main and a regulating motor mounted on one shaft. When the by-pass switch is opened the line current flows through the main armature and then on to excite the regulating motor field. At each controller a small resistance is inserted in the main line to divert the exciting current through the main-motor field, which is in series with the armature of the regulating motor. Fig. 1 shows the motor connec-

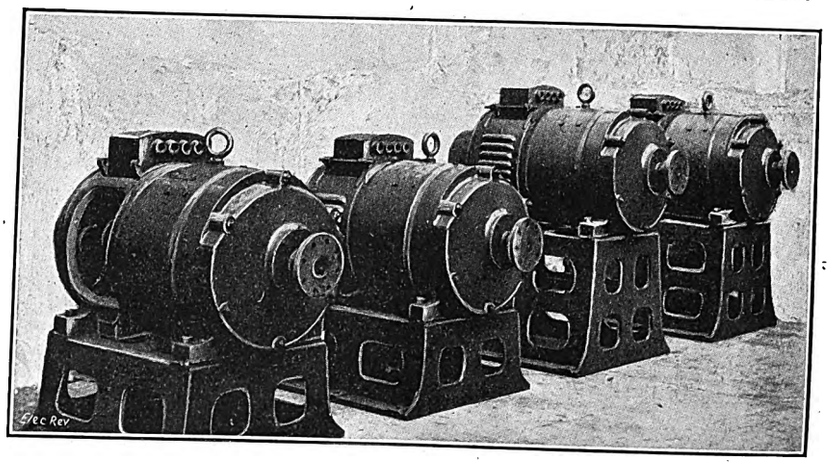

Fig. 6.—Forced-draught Fan Motors.

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tions with a reversing type of controller. As soon as the switch is opened the entering current gives rise to a small voltage difference at the terminals of the controller resistance; that voltage is used to shunt some of the main-line current through the field circuit, and so the field current can be adjusted to any required value. That the speed may be controlled under varying loads, the small armature is connected to oppose the voltage of the controller resistance. At no load the speed rises until the voltage of the small armature is almost equal to that of the controller, and the torque is at a minimum. At full load again the speed falls and the small armature voltage is reduced sufficiently to permit the full-load exciting current to flow through the field windings.

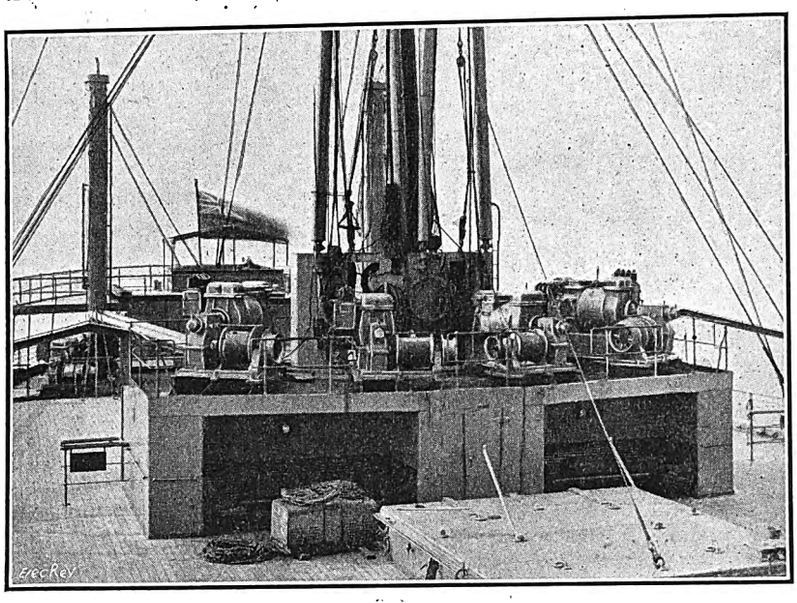

Fig. 7.—Group of Winches on Raised Aft Deck.

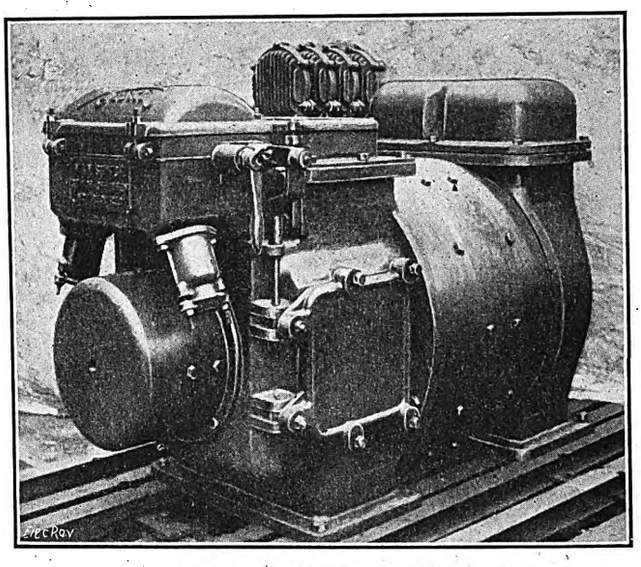

Fig. 8.—Winch Motor and Controller.

Under conditions of overload the small armature does not impart opposition pressure, so the maximum current passes through the field windings. The torque, therefore, reaches its maximum, but the motor's demand on the generator on those occasions is at a minimum. The conditions then have resemblance to the case of a stalled steam engine.

Advantages for Marine Work.—The motor controls are extremely simple, robust, and fool proof, and the manner in which the constant-current motor deals with refractory and apparently run-away loads is astonishing to one accustomed only to the behaviour of the more usual types of electric motor under like conditions. In the case of capstan motors the pull on the hawser is applied without jerk, or overstrain, and is maintained with confidence on stationary armature. The winch motors are well adapted to get the cargo out of the hold with that easy cushioned pull suggestive of a steam-driven winch, but the motor has the advantage of being clean, cool, noiseless, and capable of much greater speeds when the load is on the rise. The virtues of constant-current motors are perhaps most appreciated on the windlass drive: in this case it may be necessary to keep a stress on the anchor until it pulls out of a bed of clay, and then to haul it in rapidly and hold it until secured at the hawse pipe. In the first part of the process the load on the generator decreases as the pull on the cable increases, and when the anchor is above the surface it may be held with the brakes off and with only a nominal load on the dynamo.

For the larger applications in which magnetic brakes are necessary to supplement stationary torque they are controlled by cam-operated switches in the same manner as the by-pass main-motor switches. A notable feature of the electrical control is that changes are affected by very small steps in voltage: as there is only 0.5 volt difference between adjacent contacts, there is no sparking, or burning, of metal and the circuits are not broken, but are merely changed in value over a range of 0 to 10 volts.

Although live parts are guarded with all the precautions specified by Lloyds' Regulations (which permit a maximum of 650 volts on such systems) it has been found that live parts can be uncovered and touched with perfect safety. The system has no earth return, so contact with a positive or a negative set of connections is harmless, as there is little or no chance of leakage with the class of cables used.

Arrangement of plant on the "Viceroy of India."—For the supply of power to the Austin system three motor-generators are placed on the port side of the main power room; one of the sets is shown in fig. 3 and they run at 500 revolutions per minute. The motors are of d.c. pattern, 220 volts, and each develops 230 h.p. Directly coupled to the individual motors are the constant-current generators and their exciters; each generator is of 150 kW and produces a current of the constant value of 250 amperes, the potential range being zero to 600 volts according to the load.

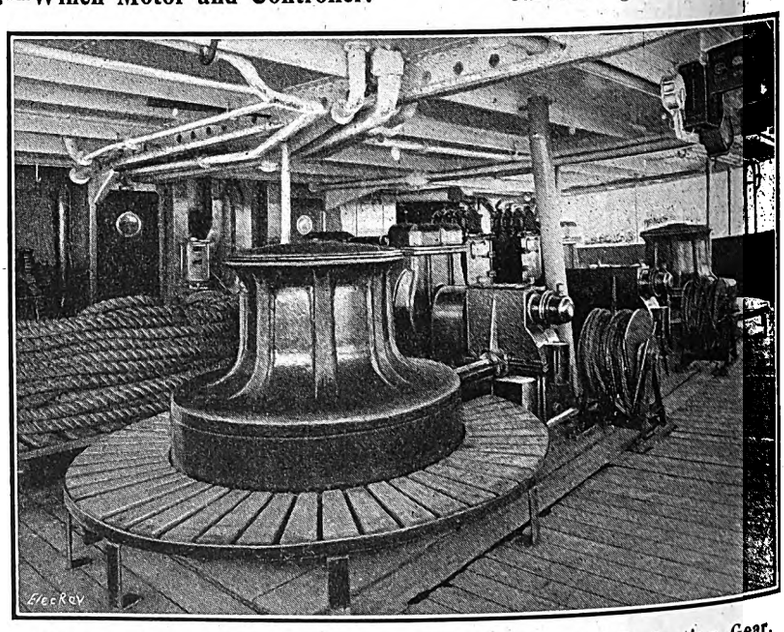

Fig. 9.—Two 16-ton Capstans, C.C. Motors and Reduction Gear.

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The main switchboard for the control of the ship's lighting, heating, and minor constant-potential auxiliaries also contains three feed-control panels for the 220-volt motors driving the Austin plant, and alongside the main board is the compact Austin circuit control board, fig. 5. On the face of the black polished switchboard the circuits are plainly traced with raised aluminium strip. The few simple switches required are housed behind the board in a protected cubicle, and they are operated by "Y" handles on the front panel; the handles carry aluminium quadrants aligned to the diagrammatic strips, and as they are turned clearly show the actual connections.

The main constant-current circuits are arranged respectively for the following motor groups: the forward deck, the engine room, the aft deck, and the forced-draught fans. The engine-room circuit is so connected that it may be split to allow of machinery loading being put part in series (A) with the forward deck and part in series (B) with the aft deck circuits. In the event of two generators working together, should the constant-potential driving motor of one break down, or be shut down accidentally while the generators are still in series, the outgoing generator will be cut out of circuit by automatic unloading gear, while the remaining machine carries on.

The forward deck circuit supplies the combined double windlass and port and starboard capstans, which composite machinery group is of Napier make. The twin Austin motors, each of 100 h.p., are housed beneath the windlass in a self-contained chamber and communicate their power to the gearing above by short vertical shafts. The clutching arrangements are very complete and give the maximum of combinations between the motors and the two capstans and the two cable holders. The forward deck circuit also contains 12 Austin-driven specially designed Napier winches of 2, 3 and 5 tons capacity.

The engine-room circuit (A) supplies the Weir bilge pump and a Hall CO_2 refrigerator. The forced-draught circuit supplies in all six f.d. fans of Howden pattern (a group of Austin motors for these fans is shown in fig. 6) and they have Austin potentiometer speed-control switches. The engine-room circuit (B) contains a ballast pump of Weir make and a second CO_2 refrigerator. The aft deck circuit supplies 10 Napier winches of from 2 to 5 tons loading and two capstans of 16 tons capacity, each driven by Austin motors of 54 h.p. A group of four of these winches is illustrated in fig. 7, and fig. 9 shows the 16-ton after capstans.

[Correction.—With the exception of a few wire heaters in the cabins de Luxe, the heating of the entire passengers', officers', and crew's accommodation is by means of elements made by the Morgan Crucible Co., Ltd.; approximately 800 "Morganite" elements of different loadings have been installed on the vessel, of a total connected load of 550 kW.

Cables and wires made by Siemens Brothers & Co., Ltd., were used throughout the ship.—Eds., Electrical Review.]

A Kinema Installation.

Features of the Lighting and other Electrical Equipment at the new Davis's Theatre, Croydon.

The recently-opened Davis' Theatre at Croydon is claimed to be one of the largest kinemas in Europe, and its many novel electrical features make it also one of the most interesting. The art of colour and effect lighting may still only be in its infancy, but

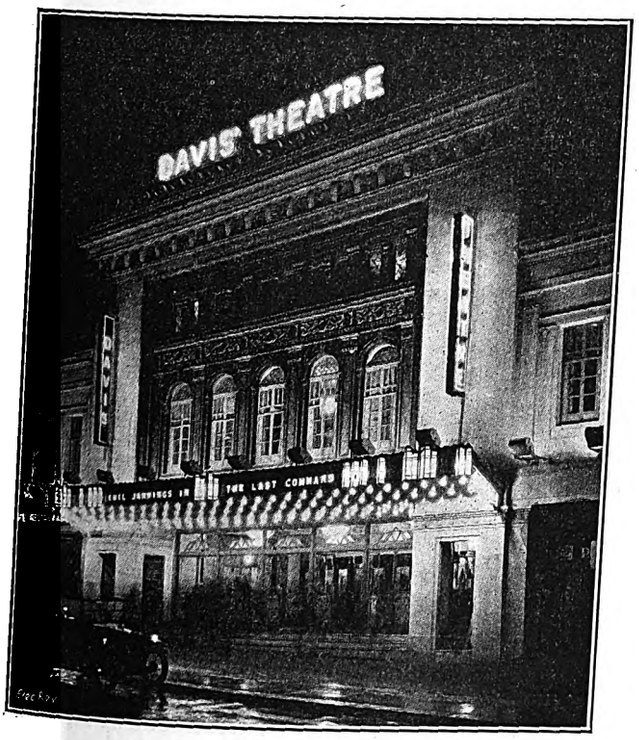

Fig. 1.—Exterior Lighting.

that distinct and creative advances are rapidly being made will certainly be immediately apparent on a visit to this kinema. It is to the initiative and careful designing of Mr. Basil Davis, Grad.I.E.E., who was responsible for the complete electrical and mechanical schemes, and under whose general supervision, Messrs. Troughton and Young, Ltd., carried out the complete installation, that this is due, and Mr. Davis is to be congratulated on the results achieved.

To describe the installation generally it may be said that a high-pressure supply provided by the Croydon Corporation is brought into a special h.p. chamber on site, where it is transformed down to 230 V, single-phase, by means of two 250-kVA transformers. The low-pressure leads are taken through a dividing wall on to the bus bars of a low-pressure open-type switchboard, consisting of eight "Sindanyo" panels on which are mounted instruments and gear for the whole of the supply to the theatre, with the exception of the secondary lighting. A d.p. 1,250-A circuit breaker controls the entire board, except the cooking panel, the whole of the load, other than cooking, being governed by a maximum-demand tariff; outgoing feeders have their own breakers and switches ranging from 750 A downwards.

In front of the switchboard, in the same room, two motor-generators are installed; these consist in each case of a Brook motor directly coupled to a Newton generator, the latter having an output capacity of 250 A at 50/80 V at a speed of 1,450 r.p.m. The motor-generators, one acting as a complete stand-by, are controlled by two d.c. panels nearby. Outgoing mains from the intake room to the various parts of the building consist of paper-insulated lead-covered cables drawn in Doulton stoneware ducts.

As regards the lighting, the auditorium has, in general, six sets of wiring, covering ordinary "white" illumination, three colour effects, and maintained and secondary lighting. The main "white" lighting scheme actually consists of "daylight" lamps mounted in the ceiling and globe fittings, and is controlled from two positions, the projector room and the stage, through a motor-driven dimmer, consisting of 10 banks in parallel on one main, mounted in a specially provided room at the back of the Royal circle, next to the projector room. The dimmers have 60 controls, and to allow for a variation in loading at any time the ten

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sets have been connected in parallel and arrangements made whereby one or any number of sets may be cut out. An interesting feature is a main contactor which takes up the load just before the all-in position of the dimmers is reached, and thus provides the necessary quick-break

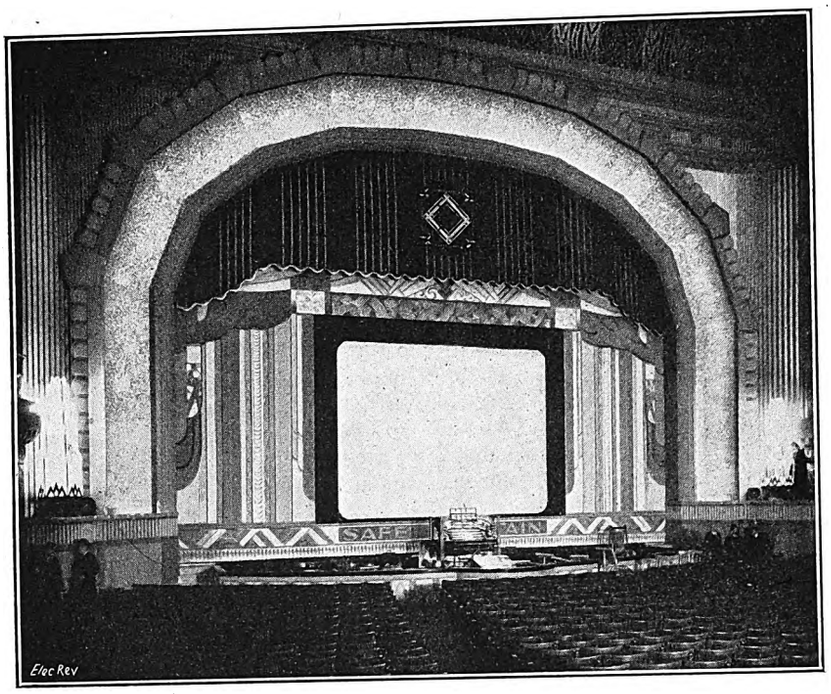

Fig. 2.—Proscenium Lighting.

to save the dimmer contacts. Tumbler switches controlling a contactor breaker, which in case of emergency short-circuits the entire dimmer bank, are placed in the operating room, on the stage, and at various points in the auditorium. The fittings are of the modern style employing pressed and moulded glass as the basic features of their composition.

Round the main and smaller domes and the proscenium arch, and in flutings at each side of the arch, cornices have been left in which special reflectors are mounted. The lamps are connected alternately to three circuits, red, green and blue. The colours were arrived at after much experiment on site. On the visible face of the domes, arch and flutings, a broken silver reflecting surface has been formed which reflects with a wonderful spectacular design of sparkle and "interest" the light falling upon it.

Every colour circuit, of which there are 26 in each case, is brought back to a switch in the dimmer room, and each colour has five main sections, each controlled by a dimmer. These sections comprise domes, proscenium, flutings (two) and fittings, and by means of the 15 dimmers thus installed, different effects are obtained on each section independently and simultaneously; these effects include any intensity of one, two or three colours in combination. No written description can convey the charm of the auditorium when a skilful blend of all the various colours is obtained. The dimmers are wound on porcelain formers and are of the slider type with master "off" control. Pilot lamps installed above each dimmer hand wheel give indication of the depth of colour during operation.

Separate circuits have been taken to each fitting and exit sign for the maintained lighting, the whole of these being brought back to the intake room and controlled on the main board. The main decorative auditorium "windows" are lit by dark-blue lamps on this system, and provide a harmonious and subdued note when the house is generally in darkness.

No alternative supply being otherwise available, the current for the secondary system is generated on site by means of two Crossley oil engines directly coupled to 6-kW d.c. Newton generators, 230 V, one acting as a stand-by. Secondary points are provided in fittings and exit boxes.

Three Gaumont "Eclipse" projectors of the very latest type are installed, and are equipped with safety devices for stopping action in the event of a film breaking or catching fire. In addition there are two spot-lights and a double-arc Stereopticon machine for slides. There is also an arc-projector chamber in the main dome of the roof, carrying three powerful projectors, and a smaller chamber at each side of the auditorium walls also carries a projector. Each of the projector machines is controlled by a flash-type white-enamelled panel equipped with double (on and off) push buttons for actuating a relay for the main lighting, an emergency short-circuiting switch, a voltmeter switch, five steps of 20 A each for the arc resistances and a switch for the motor (for the projector machines only). Four further buttons labelled, respectively, "stop," "close," "open" and "off" control the curtain motor.

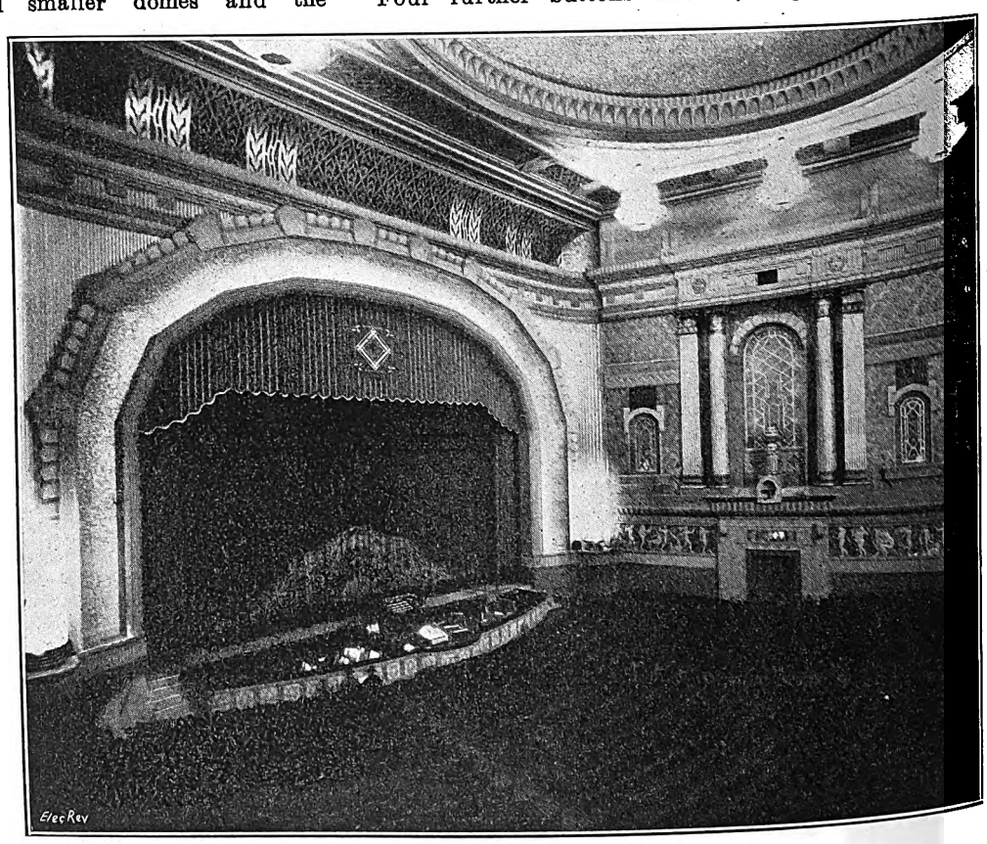

Fig. 3.—General Lighting in Auditorium.

Although primarily intended as a kinema, the Davis's Theatre can be used, as its name indicates, as a theatre, and a complete stage equipment has been installed, in-

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cluding battens, floats, dips and other usual apparatus. The stage switchboard is of the dead-front type, and is mounted on a gallery at the side of the stage. A single-pole clapper switch controls the whole board and is used for "black out," being operated by a small relay and switch on the centre panel of the board. Four master switches control the four colours in the floats and battens, in conjunction with metallic dimmers which are hand operated with a master control, while the dips have liquid dimmers, owing to the varying load that may be employed. The dips are connected to any of the plug boxes on the stage, each of which contains connections to the four colours. The curtain-apparatus controlled from the operating box is mounted on this switchboard gallery.

The exterior of the kinema is generally illuminated by means of 16 500-W flood lights, mounted on ornamental brackets, projecting 3 ft. 6 in. from the wall face and spaced equally distant from each other (about 15 ft. from the ground). Colour effects are obtained by the use of colour screens, and, here again, it was a matter of experiment to produce the best results. Three neon signs, one horizontal at the upper cornice level and two vertical, show the name of the building in red letters surrounded by a blue border. The upper sign is 4 ft. high and the letters, in the vertical sign are 1 ft. 6 in. high. The marquise is illuminated by 150 10-watt lamps and 90 60-watt lamps, and on the front vertical surface glass sign lettering is inserted, giving the name of the current film. The whole of the foregoing apparatus is controlled by means of a distribution board and switches placed just inside the building in the pay office.

The tea room dome consists of ornamental plaster work in the modern style, and four-colour concealed lighting in the cornice gives "effect" to the design. Dimmers are not employed, but arrangements have been made for their insertion at a later date if required. Meanwhile, very considerable variation can be arranged with the four colours, separately and in combination. "Osram" lamps are used throughout.

In accordance with the latest practice the orchestra platform may be lowered and elevated, according to the prominence which is required to be given to the artistes. This platform is operated by a d.c. motor, and to obtain the supply a Hewittic rectifier is installed which has a d.c. output of 68 A at 400 V. A further rectifier supplies current for the passenger lift in the front of the building.

For the convenience of patrons light refreshments are provided, which are produced from an electrically-equipped kitchen. Five electric urns for hot water, tea, coffee, milk and eggs, respectively, are automatically controlled to maintain a steam pressure of 5 lb. per sq. in. gauge, a main contactor being actuated through relay controls. Baking and roasting are carried out in a double-oven range which is fitted with a hot plate, and a double grill and hot closet complete the cooking apparatus. A Frigidaire cabinet serves for the necessary cooling, and washing up is done in an electrically-driven machine in which a pair of brushes revolve rapidly in hot water, the plates or dishes to be cleaned being held between them; a further hot-water sink for cup cleaning contains a revolving vertical spindle on which a number of rubber tendrils are mounted.

The auditorium is warmed and ventilated in winter and cooled in summer on the most modern "downward" system. The whole of the fresh air is introduced at the ceiling levels, whilst the vitiated air is exhausted at the floor levels, in the stalls and in the balconies. The auditorium is ventilated by means of 280 tons of fresh air per hour. This air is thoroughly washed and cooled in summer by passing it through a large chamber filled with finely-atomised water and provided with special arrangements for preventing free moisture from passing into the building. The air is warmed in winter by passing it over steam-heated batteries, the temperature of the air being controlled from a specially designed control board in the boiler room.

Steam is supplied to the air heater and the hot-water calorifier from two dry-back oil-fired steam boilers, the oil fuel being stored in two large tanks under the road adjoining the boiler house. The oil is pumped to the boilers by means of specially designed pumps, and is atomised by compressed air. The whole of the ventilating machinery, which was installed by J. Jeffreys and Co., Ltd., together with boilers, &c., is housed in a special building, detached from the main theatre building, thus minimising the risk of fire, and also risk of noise due to the single-phase motors.

The organ embodies a number of novel features, and the whole of the mechanism is electrically actuated. Some 200 miles of conductor, several thousand electromagnets and approximately 12,000 contacts of specially-wrought metal have been used, and a 15-h.p. motor is required to provide the air. The console contains 61 note claviers and there are 260 stop-keys, crescendo pedal and toe pistons, 68 thumb and finger pistons and a pedal clavier of 32 notes. The tones of the organ enter the theatre through a grille extending the whole width of the theatre above the proscenium arch, whereby a perfect diffusion takes place and no individual department betrays its location.

A system of 30 electrically-controlled Synchronome clocks, with the master clock placed in the entrance hall, gives the time in all parts of the building, and intercommunication telephonic facilities are afforded by the standard telephone automatic instruments.

Figs, 1, 2 and 3 depict, respectively, the exterior lighting, the proscenium lighting, and the general lighting effects in the auditorium. We are indebted to *The Builder* for the illustrations.

B.E.S.A. Publications.

The 1929 edition of the index to British Standard Specifications and Reports has just been issued. It is a complete subject index which, in view of the large number (350) of British standard specifications now available, some of which include provisions for several articles or materials, will be of much assistance to those purchasing engineering and allied material, apparatus and machinery. A numerical list of the specifications is also included. The list covers 33 pages, and shows the wide range of subjects covered by the British Standard Specifications. Copies of the index are available from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 1s. 2d., post free.

The Association has also recently issued a British Standard Specification for phosphor-bronze turbine blading. The requirements specified include the chemical composition of the phosphor-bronze, the method of selecting bars for the preparation of test pieces, the form of the test pieces, and the mechanical tests to be complied with. The dimensions of the bars are not standardised. Copies of the specification (No. 352-1929) may be obtained from the Publications Department of the British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

International H.P. Conference.

It is announced that the International High-pressure Networks Conference will hold its fifth session in Paris between June 6th and 15th. At the 1927 Conference, 28 countries and 544 members from all parts of the world met together. Both French and English will be used for the reports and discussions at the Conference, which will be attended by representatives of makers of machinery, contractors for central stations and networks, producers and distributors of electricity, professors, consulting engineers, and State engineers. At the close of the session two excursions will be made, one to the Pyrenees, and the other to Alsace and the Jura. Further information may be obtained from the secretary, Mr. Tribot-Laspiere, 25, Boulevard Malesherbes, Paris, France.

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Changing Over to A.C.

Notes on the methods of dealing with consumers' apparatus and service equipment adopted by a large electricity supply undertaking during the alteration of the distribution network from the d.c. to a.c. system.

By R. H. RAWLL, A.M.I.E.E., A.M.I.Mech.E.

THERE are many supply undertakings at the present time changing-over parts or the whole of their networks from direct to alternating current. This, in itself, is, of course, no new departure; but, whereas when such a change-over was undertaken a few years ago, very little consumers' apparatus was affected, apart from motive power (assuming the supply pressure remained unaltered), nowadays, since electricity is utilised for such a variety of purposes and in so many different ways, the work involved and the organisation necessary is very considerable when any alteration in the system of supply takes place.

It is not proposed to deal here with the difficulties from a distribution point of view of a change-over from direct to alternating current. This alone is a problem of considerable magnitude, and requires very careful thought and preparation; amongst other things, it is very essential that reliability of supply is ensured to all consumers throughout the whole of the critical period, during which the various lengths of distributors, corresponding to streets, are being changed from the one type of current to the other. The author, however, has recently been responsible for the necessary alterations to consumers' installations and service equipment, consequent on a change from 220/440 volts, 3-wire d.c. to 230/400 volts, 50 cycles, 3-phase a.c., in several areas of a large supply undertaking, and trusts that a description of some of the methods he successfully employed will not only be of interest, but, will also, perhaps, be of some assistance to other engineers engaged on similar work.

(a) Administration and Organisation.

By far the most important and greatest amount of work involved in a change-over is the necessary preparation and organisation, so that on the day an actual change is effected everything goes through without a hitch and with as little inconvenience and interruption of the supply to consumers as possible.

With regard to any particular area to be changed over to a.c., it is a good plan to divide this into sections, each corresponding as far as possible to the district fed by a particular static step-down sub-station or kiosk. Everything must be in readiness for dealing with the whole of a section before any portion of it is touched. In order that everything may be cut and dried, good staff work is essential. This means that close co-operation and conferences between the various departments concerned of the supply undertakings, such as sub-stations, mains, installation, meters, accountant, &c., are highly important. When changing a section of the network to a.c., since reliability of supply is the main consideration of all supply engineers, the various lengths of distributors should be changed-over in quick succession. Apart from unavoidable delays, due to alterations to and provision of network boxes, feeding points, cable work, &c., it is a good plan to tackle a portion of the section, if possible, every other day. This gives one a whole day to clear up and settle the various new points and details, which invariably crop up during the preceding day when the actual change took place, besides presenting an opportunity for final preparations and instructions for the next length of distributor to be taken in hand on the following day.

When a supply undertaking decides to alter the system of supply in any of its areas, it applies to the Electricity Commissioners for the necessary sanction, and usually a legal notice to this effect appears in the local Press, giving details of the roads affected, &c. If the Commissioners give their consent to the proposed change-over, they usually impose several terms and conditions, one of which is that the undertaking shall make the necessary alterations to consumers' apparatus or else pay compensation for loss of use of same occasioned by the change in current. The apparatus so affected is limited to that found connected to the supply mains or in use on the day written notice is given to the consumer of the intended alteration in the system of supply. In order to prevent a consumer from being unduly penalised with regard to installing new plant, which would be affected by the change in current, such as motors, &c., the notice given must not be more than six months. The necessary consent from the Commissioners having been obtained, a representative calls at the premises of each consumer in order to take particulars of the installation and to serve the notice referred to above. Care must be taken, however, that a call must not be made until it is definitely ascertained that the supply to the premises in question will be changed-over within six months.

A list of the consumers in any particular road or street, of course, can be obtained from the records of the undertaking, but in the case of those districts where a large number of new consumers are being connected daily, if such a list is relied upon, a few services may be overlooked. The author, therefore, arranged for a call to be made at every house in each road. Incidentally, it was found that in many cases where gas was used solely for lighting and other purposes, inquiries were often made as to the possibility of an electricity supply being available, its cost of installation, &c. Thus, if the right man is put on this work, quite a number of new consumers can be obtained, and, in addition, it often forms a good opening to explain the advantages of cooker hire schemes and the provision of power plugs in the various rooms, &c., to the existing consumer, who at present only uses electricity for lighting purposes.

The representative is provided with a book containing 100 notices in duplicate, one of which is left with each consumer. The notice reads as follows:—

ALTERATION OF SYSTEM OF SUPPLY.

Dear Sir (or Madam),

It is proposed to change the system of supply to your premises from direct to alternating current within the next six months.

In addition to the lighting, the following particulars of your installation have been noted:—

The Department will make arrangements to ensure that you are given the same facilities with the above apparatus, but will not be responsible for any additional appliances installed after this date.

Yours faithfully,

For Departmental use only—Service details:

A carbon paper is inserted between each duplicated notice, and, on calling at a house, particulars of all

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apparatus installed, including their current consumptions, are written down in the blank space provided. If there are no appliances apart from lighting, the words "lighting only" are inserted. Opportunity is also taken, as a check on the undertaking's records, to obtain particulars of the service cut-outs, the size and polarity of the cable, and the size and number of the meters, with their respective tariffs, all of which are put down in the appropriate space provided at the foot of the notice.

The original notice, being perforated, is torn out and handed to the consumer, the duplicate remaining in the book for the use of the supply undertaking. For convenience sake, the original is coloured white, while the duplicate is orange in tint, so that no mistake is made about where to insert the carbon paper; by this arrangement the representative always knows he must write on white paper.

The value of this method is twofold. In the first place, since the male element of the family in residential districts is usually out when the call is made, experience shows that ladies often omit to show, or forget the existence of, appliances other than those stated in the notice. Consequently, when the head of the house returns in the evening and the notice is shown to him, if any item has been omitted, he very quickly informs the supply undertaking of this. In such a case a further call should be made at once, in order to ascertain that the article in question is *bôna fide* in commission and has not been "planted." The addition is then entered on the consumer's notice and initialled, and the corresponding entry is made in the book of duplicates. Secondly, when the change-over actually takes place, should any dispute arise as to a piece of apparatus affected by the change in current not having been altered to suit the new conditions of supply, the consumer is referred to the absence of this item on the notice, which was handed to him when the particulars of his installation were taken, the copy of which the undertaking has in its possession.

It is also very desirable that all items of the installation should be demonstrated in operation before the representative and in the presence of the consumer, any defects being noted against the particular appliance in the notice. This is most important as regards apparatus not affected by the change-over. Take, for example, a radiator. If, when the change is effected, the consumer reports that the element has been burnt out, unless the above precaution has been taken the supply undertaking cannot prove whether the change in the current caused the trouble or not; and, consequently, has to give the consumer the benefit of the doubt by supplying a new element.

It may be argued that all this work takes time. It does, but, on the other hand, since the system outlined above constitutes a square deal between the consumer and the supply undertaking, the actual change-over takes place smoothly and efficiently, with very little unpleasantness on either side, and is, consequently, well worth the extra work involved. Also, it is surprising, if the right man is chosen, how quickly these house-to-house calls can be made.

In residential districts several houses will be found closed and empty during the day, and in these cases a letter should be sent to the consumer explaining the purposes of the inspection, and a request made for an appointment when the premises will be open. This often means calling in the evening, which is unfortunate for the representative of the supply undertaking. Even when access to the premises has been obtained during the daytime and the installation duly inspected, it is often necessary to make a further call after office hours, in order to interview an enthusiastic wireless amateur, whose requirements as regards supply to his apparatus sometimes cannot possibly be ascertained without a personal explanation from the owner.

The information contained on the duplicates of the notices served on the consumers is then entered into a special book, a specimen page of which is shown in fig. 1. The services to the consumers are arranged in numerical order as regards house numbers in a particular road. This book constitutes a complete record of all work carried out in the change-over from start to finish.

The particulars of load connected and the polarity of each service are sent to the mains engineer for his information, in case he wishes to make any alteration with reference to the balancing of the network when the change to a.c. takes place. Reference is made to the records of the accountant's department with regard to the tariff of each meter. The size of the new a.c. meters and the rates charged are then entered in the appropriate columns, and the list is sent to the meter-issue department, together with the numbers of the old d.c. meters which are to be replaced. Opportunity is also taken of re-arranging any service gear, and a note is made to that effect under the appropriate heading for future guidance.

Then comes the most important item of all, namely, the alterations necessary to the consumers' apparatus rendered inoperative by the change in current. Quotations have to be obtained from the various makers of the different d.c. appliances for the conversion required for working on a.c. The maker of particular d.c. apparatus should, if possible, always be approached, in order that he may retain his goodwill with his customer. This procedure, of course, is always subject to a reliable article being available and a fair price being quoted for the a.c. model. In passing, it may be observed that on more than one occasion when a small motor was driving a machine, the makers have asked an outrageous price for the a.c. replacement, and when it has been pointed out to them that the supply undertaking could fix and supply a similar motor at a much reduced figure, the invariable reply has been that the complete machine was under their guarantee, and that if such a course was adopted, the guarantee would be withdrawn. Naturally the consumer objects, and the supply undertaking, not wishing to be saddled with such a liability, particularly if the machine is of an intricate and specialised nature, has to agree to the demands of such profiteers. This, of course, is not playing the game. In addition, firms quoting for the alteration of d.c. apparatus to a.c. working should always be asked to make an allowance for the old d.c. equipment.

The necessary apparatus having been ordered, it is held in readiness until the date of the change-over. In some cases, however, the existing apparatus has to be returned to the makers for alteration, and although

STREET — .....

CONSUMER	ADDRESS	SERVICE CABLE			CUT-OUTS		METERS					LOAD DETAILS	APPARATUS INSTALLED BY DEPARTMENT	APPARATUS RETURNED TO DEPARTMENT	SATISFIED	REMARKS	DATE OF CHANGE OVER
			SIZE & TYPE	POLARITY	D.C.	A.C.	D.C.		TARIFF	A.C.							
							No.	SIZE		No.	SIZE						

Fig. 1.—Specimen Page from Change-over Record Book.

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this can usually be arranged with a domestic consumer without any great inconvenience, as regards business premises, it is sometimes necessary to arrange a temporary loan of d.c. apparatus while the consumer's own appliance is being altered to work on a.c.

In most cases consumers prefer to have their apparatus altered for use on a.c. by the supply undertaking. There are, however, a few who wish to do this themselves, the supply undertaking paying the cost of the job. The amount quoted in such cases should be carefully examined to see that it is not excessive, and any payment made by the undertaking should be subject to a proviso, in writing, to the effect that the consumer takes full responsibility for the satisfactory working of the apparatus under the new conditions of supply, and that no other claim in respect of this can be entertained or considered.

The connection of new consumers has, of course, still been taking place while the above work has been carried out, and all these must be served with the usual notices, and their names, &c., added to the list in the change-over book. *(To be continued.)*

Pilot-Wire Street Lamp Control.

Relay control of the street-lighting system at Southend has resulted in a saving of £1 5s. per lamp per annum.

By A. C. JOHNSON, A.M.I.E.E.

THE electrical power engineer must be credited with having produced many ingenious devices for the automatic or remote control of almost any kind of machinery connected with the generation and distribution of electricity. He has, however, given little thought to the control of street lamps, and many undertakings still resort to lamp-lighters, who may be seen switching on street lamps in broad daylight in order to complete their rounds before dusk. Further, many

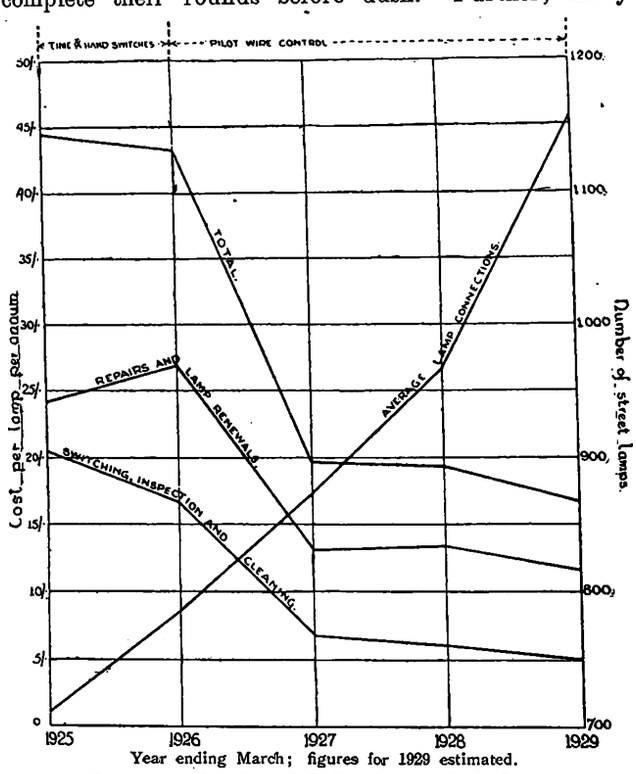

Fig. 1.—Southend P.L. Operating Costs.

undertakings have installed time-switches, and some have reverted to hand control, pending the advent of something better.

We hear of special mains for street-lighting purposes, which involve heavy capital expenditure and, to be effective, should consist of three-core cables—one for the ordinary lamps, one for the all-night lamps and a common return. If the common return is not provided, each lamp service will entail a joint on the main distributor as well as on the street-lighting main. Special mains may be extended indefinitely by means of relay contactors, and thus a large district may be controlled from one point. In addition to high initial cost these have two serious disadvantages: a fault on the mains is liable to leave large districts in darkness; and the lamps at the extremities of the special mains suffer from bad pressure.

The millennium of the lighting engineer will be reached when he can obtain perfect wireless control. Several experiments are being made with light rays or ripples for controlling street lighting, but it is probable that such methods will be costly and unreliable for many years to come.

Another method of control is the pilot-wire system, and it is possible that the ultimate solution lies in that direction. Pilot-wire control enables the switching of lamps from one or more control stations at a moment's notice, a feature which is invaluable, especially in case of fogs. The bugbear is the cost of laying the pilot in made-up streets. It is generally agreed that once installed the pilot wire ensures maximum service at minimum operating cost, but it is too often condemned in advance, without weighing the *pros* and *cons*, because of the pilot wire itself.

It is unfortunate that the pulling up and reinstating of made-up streets is so costly, but once laid, the cables will last a lifetime, whereas time switches have a very short life and require constant attention for maintenance and repairs. The first cost of the pilot wire is not always heavy, and in many cases it is even less than that of a time switch, as will be seen on perusal of the accompanying table. In Southend, several disused telephone and arc-lamp cables were brought into commission, and some pressure pilots were used for the dual purpose of switching the lamps off during the daytime, and of indicating feeder pressures at night. Full use was also made of any available underground ducts.

The table gives the approximate first cost and annual cost of the installation of pilot-wire control per 100-W street lamp, with a spacing of 50 yards. There has been some controversy regarding the use of plain lead-sheathed cables suitably braided and compounded for protection from chemical action. This is certainly a case for the advocates of lead-sheathed cables laid direct in the ground, seeing that the worst that can result from mechanical injury to the cable is the lighting up of the street lamps during daylight hours.

	Cost of pilot wire laid.	Cost of switch-gear.	Loan charges on cables at 7.1%.	Loan charges on switchgear at 10%.	Total annual charges
Bare overhead wires	1 5	1 10	1/9	3/-	4/9
	£ s.	£ s.			
Pilot incorporated in lighting cable ...	0 10	1 10	9	3/-	3/9
Lead-covered pilot laid in open trenches ...	1 19	1 10	2/9	3/-	5/9
Armoured pilot laid in open trenches ...	3 8	1 10	4/10	3/-	7/10
Armoured pilot laid in unmade roads ...	4 10	1 10	6/5	3/-	9/5
Lead - covered pilot laid under slabs ...	7 5	1 10	10/4	3/-	13/4
Armoured pilot laid under slabs ...	8 14	1 10	12/5	3/-	15/5

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The attached graphs, fig. 1, show the Southend operating costs for gasfilled lamps, and it will be seen that the introduction of pilot-wire control in 1927 has effected a saving of 25s. per lamp per annum, which saving far exceeds the annual loan charges on cables and switchgear. In addition, there is a saving of over 20 per cent. in power, as the lamplighters used to take at least 1½ hours on each of their rounds.

Several undertakings have installed pilot-wire control in which the contactor or relay coils are energised in order to switch on the lamps. Three years ago Southend installed a different system in which the relay coils were energised in order to "switch off" the lamps. The difference between the two systems of pilot-wire control is very important. In the Southend system, an earth or open circuit on the pilot wire automatically switches on the street lamps; in the other a fault is liable to plunge whole districts in darkness. Another feature of the Southend system is that three classes of lamps—dusk to midnight, dusk to dawn and midnight to dawn—can be controlled by means of one pilot wire. There is no other system in use in this country which combines the two qualities of reliability and flexibility.

The following is a brief description of the Southend system:—A small combined relay switch and fuse of small dimensions is inserted in each switch casting usually provided on side-street lamp columns, fig. 4. For larger lamps, a contactor is fitted in the base of the lamp column. All the solenoids of the relays and contactors in one pilot-wire circuit are connected in series across the supply mains, as shown in fig. 2. Less than half-a-watt is required to operate a relay of 750 W capacity, so that with one class of lamp only in use and a line resistance of 50 ohms, 400 lamps can be switched off on a 230-V network. Each pilot-wire circuit can be extended indefinitely by means of automatic sub-control boards. An automatic main control board for nine piolt-wire circuits is shown in fig. 3.

The electric water heater of the storage type forms a very useful load for electricity supply undertakings, because of its good load factor. If the supply to the heater is cut off during station peak loads, its value is very much enhanced, especially in these days of bulk supply. The pilot-wire control provides a very simple and inexpensive way of carrying out this desirable operation. Two wires are incorporated in the consumer's service cable at a cost of a few shillings, and a relay of the reverse type to that made use of for street lighting is fixed on the consumer's premises with its solenoid wired in series with the solenoids in the street lamp relays. When a current is dispatched through the pilot wire, the consumer's relay connects the supply to the water heater. A useful feature of the system is that when an open circuit occurs on the pilot wire, the heaters are automatically cut off and, therefore, they will never be in use during lighting-up hours. Such a consumer will never incur kW charges, and he can, of course, be supplied at a very low rate per unit. This feature of the system, of course, touches on the important question of improving the load factor, and is worth the consideration of supply engineers.

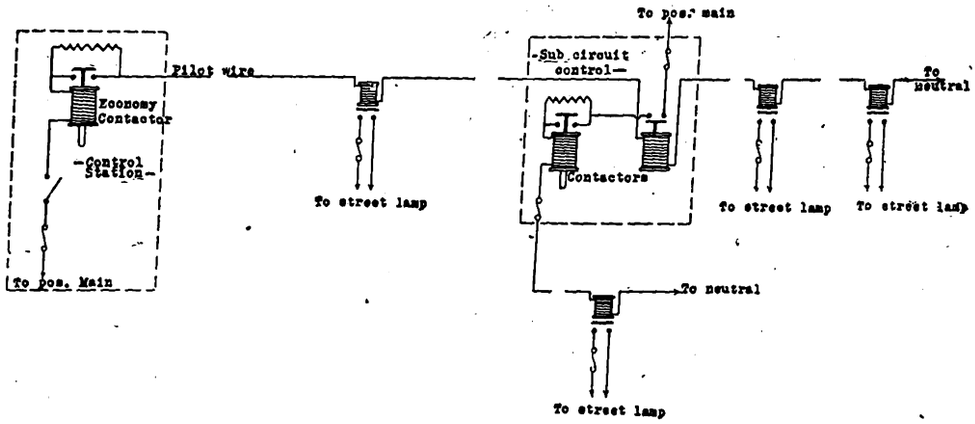

Fig. 2.—Connections for Pilot-wire "Off" Control.

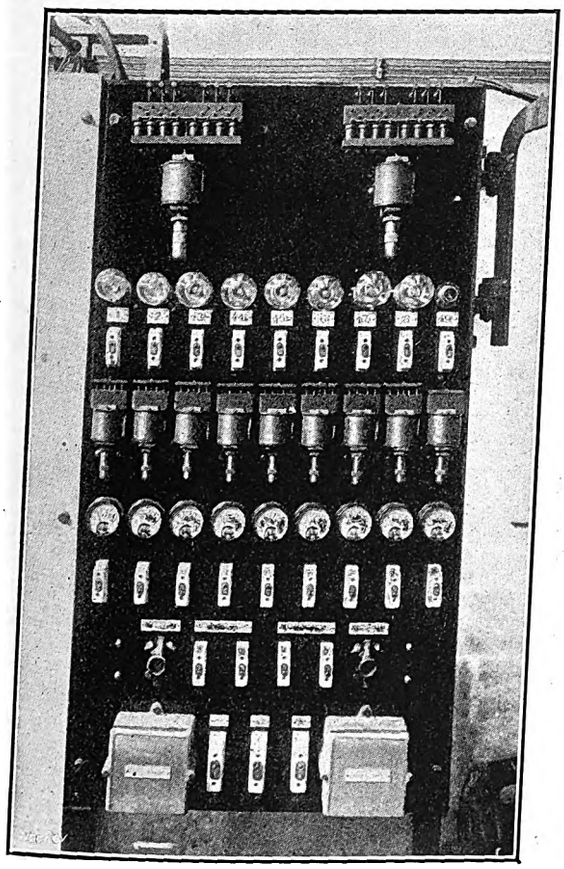

Fig. 3.—Nine-way Pilot-wire Control Board.

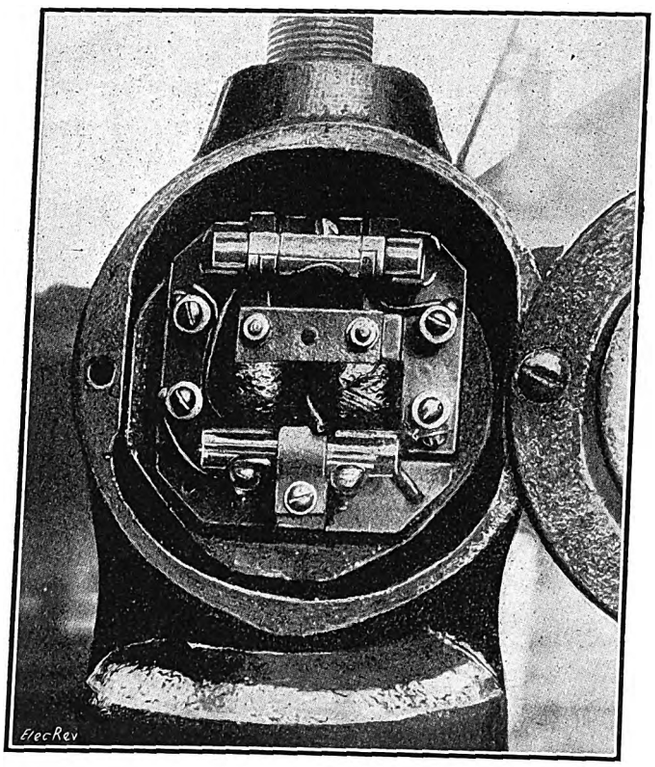

Fig. 4.—Housing of Relay Unit.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Further Central Board Contracts.

Following upon the recent announcement by the Central Electricity Board of the placing of contracts to the value of £3,000,000 (ELEC, REV., March 15th, p. 470), the Board states that further orders to a total value of about £1,500,000 have been given out. These are as follows:—

South-East England Scheme.—66-kV and other transformers in the London area: the Hackbridge Electric Construction Co., Ltd.; the British Electric Transformer Co., Ltd.

Central England Scheme.—132-kV transformers: the British Thomson-Houston Co., Ltd.; the British Electric Transformer Co., Ltd.

North-West England Scheme.—(1) 132-kV transformers: the British Electric Transformer Co., Ltd.; the British Thomson-Houston Co., Ltd.; Ferranti, Ltd.

(2) 132-kV outdoor switchgear: Ferguson, Pailin, Ltd.; the Metropolitan-Vickers Electrical Co., Ltd.

The Treatment of British Tenders in Australia.

Considerably increased attention has been directed to the subject of Australian trade by reason of the visit of the Economic Mission from this country. But some of the Australian publicists are not allowing the grass to grow under their feet while waiting for some practical results to appear as the direct outcome of the Mission's report. For example, the *Industrial Australian and Mining Standard* of February 14th devotes a good deal of space to reasons why British manufacturers have failed to take advantage of opportunities to tender for railway supplies. It seems that Mr. Groves, the Victorian Minister of Railways, has referred in public with "amazement" to the "apparent apathy" exhibited by some British firms in this connection. Our contemporary says that those interested in British production have been frequently "amazed" to find how scant a proportion of Australian business they have from time to time received in comparison with the success of foreign tenderers. And that they have had, in the past, very substantial cause for their surprise is illustrated by certain facts and figures which are reprinted showing that some years ago the Department habitually placed contracts up to £40,000 with foreign firms "without bothering to call for tenders at all." Our contemporary's exposure of this practice in 1912 evoked definite promises of reform, and of fairer treatment to British kinsmen, but the question is again raised as to whether the old system still exists.

"Mr. Grove's 'amazement' suggests that it may still, partially, at least, survive. Than the typical present-day British manufacturer there is no man keener to secure any business that is offering in the Commonwealth. When we hear, then, that the manufacturers of Britain generally are apathetic in tendering for Victorian Railway supplies, it is difficult to avoid the suspicion that recent experience has warned them against being unduly optimistic or eager in tendering."

In Governmental and municipal tendering, Australia is gaining an unenviable reputation in England. "British manufacturers have only too often found themselves, when they have tendered, covertly and most unfairly exploited in the interests of local or foreign competitors. . . . Unhappily, similar miscarriages of justices still occur. During the past eighteen months, indeed, several cases have been reported of British tender prices and quotations having been revealed to their competitors with a view to a revision of the latter's terms. And there is another aspect which should not be overlooked. It is extremely doubtful if we ever get the whole truth regarding the many disadvantages under which the British tenderer is placed. Britain is very far away, and the local agents of her manufacturers are seldom in a position to protest effectively, or to make sustained protests, because, under their agency agreements, the onus of any complaints they might advance concerning local conditions which they may find oppressive or unjust would perhaps be cast upon them personally. This, of course, is a matter that can only be remedied by the manufacturers of Britain, who, we think, should take more interest in selling conditions here, and cease demanding an impracticable and thankless service from their local selling agents. We hope to see this remedied after Sir Arthur Duckham and his colleagues report to the proper authorities in Great Britain."

Employment during February.

The March *Ministry of Labour Gazette* states that employment in the engineering industry improved a little during February, but was still very slack on the whole; it remained fairly good in electrical engineering. Compared with a year ago there was a decline in all sections, the falling-off being most marked in marine and constructional engineering. The number of unemployed in the engineering industries as a whole on February 25th was 90,577 or 9.3 per cent. as compared with 9.6 per cent. in January and 8.8 per cent. in February, 1928. In the electrical engineering section the number was 4,289 and the proportion was 5.4 per cent. against 5.3 per cent. in January and 4.8 per cent. in February, 1928. The number of unemployed in the electrical cable, wire and lamp manufacturing group was 5,583, and the respective percentages were 6.5, 6.1 and 6.1 per cent. The electrical wiring and contracting industry reported 1,194 unemployed, or 7.7 per cent., as compared with 7.8 per cent. in January and 8.1 per cent. in February, 1928.

Moroccan Electrical Imports.

In a recent D.O.T. report upon the economic situation in the French Zone of Morocco, the British Consul-General at Rabat shows that in 1927 dynamos weighing 194 metric tons and valued at 1,893,000 fr. were imported into the Zone, mainly from France and Germany. In 1926 the weight was 470 tons and the value 4,139,000 fr. Insulated wire and cable was imported (mainly from France) to the extent of 414 tons, valued at 3,801,000 fr., as compared with 360 tons (3,481,000 fr.) in 1926.

Electrical Prospects in Bolivia.

A report upon economic conditions in Bolivia has been prepared for the Department of Overseas Trade by Mr. A. W. Robertson, vice-consul at La Paz (Stationery Office, 1s. 6d. net). In the course of this it is stated that proposals are actively under way for making available a general supply of hydro-electric power throughout the country, which should assist greatly towards increasing the mineral production of Bolivia. The demand for electrical equipment, such as motors, transformers, transmission line material and domestic appliances of all kinds, is very likely to be stimulated by the proposed increased supply of electricity and the probable lowering of charges in the larger towns. The demand for stoves and cookers, in particular, is increasing on account of the lack of fuel, and owing to the fact that the public is becoming more educated to their use. Generally speaking, German and Swiss goods are able to compete with American and British products in price, but by no means in quality. Statistics given in an appendix show that in 1927 the imports of "electrical machinery and apparatus for generating light or illumination" amounted to 630,714 kg., valued at 1,040,702 bolivianos (about £78,000), as compared with 805,177 kg., valued at 1,194,282 bolivianos (about £90,000) in 1926. At the same time, imports of "electrical machinery and apparatus for telegraphy" fell from 91,432 kg., valued at 178,431 bolivianos (£13,400) to 3,301 kg., valued at 13,885 bolivianos (£1,000). Great Britain ranks second to the United States in the general import list, but is by far the largest customer for Bolivian products. In this small market business with old-established importing houses is recommended rather than the appointment of an agent.

Great Britain's Radio Exports.

The *Wireless Trader* recently published statistics of our exports of radio apparatus during last year. The total value (excluding re-exports) was £1,109,555, as compared with £1,203,856 in 1927. Although Australia was again the most important market, its share fell from £211,392 to £150,847. The Netherlands market was the second in importance, and in this case the share rose from £80,478 to £89,731. France came next with £75,234, against £45,722 in 1927. Other leading customers were India and Burma, £63,895 (against £86,203); Japan, £51,779 (against £197,297); and the Irish Free State, £51,530 (against £34,526).

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Book Notices.

"The Anglo-American Year Book, 1929" (552 pp.). London: The American Chamber of Commerce. Price 15s. net.—This useful publication treats of all phases of Anglo-American relationships—political, financial, commercial, literary, &c.—and has been brought up to date. A special feature is the alphabetical commercial directory, containing the names of firms, agents, branches, &c., which should be valuable to all engaged in transatlantic trade. Anglo-American trade during 1928 is again reviewed by Mr. Alfred Nutting, and among the new sections is one dealing with "United States Income Tax Affecting British Companies."

"Industrial Electric Heating" (E.D.A. 696). Prepared by the E.D.A. Industrial Electric Heating Sub-Committee and edited by Mr. S. E. Monkhouse, M.I.E.E., this pamphlet is a reprint of the paper read at the World Power Conference, Fuel Conference, 1928, and gives particulars of a number of industrial electric heating applications in use in Great Britain. Members of the Association can obtain further copies at 9d. each.

"Automobile Storage Battery: Its Care and Repair," by O. A. Witte. Copies of this book are obtainable from Fredk. J. Gordon & Co., Ltd., 92, Charlotte Street, London, W.1, agents for the Ambu Engineering Institute of Chicago.

"Economic Conditions in the Republic of Nicaragua," by H. S. London (Chargé d'Affaires at Managua), and "Economic Conditions in the Republic of Guatemala," by W. M. Carse (Vice-Consul, Guatemala City). (Department of Overseas Trade). Stationery Office. Price 1s. 6d. net.—There is little of electrical interest in this combined report. In both cases the small import trade is dominated by the United States.

"Power Resources of the World (Potential and Developed)." Compiled by H. Tingley, for the International Executive Council, World Power Conference. Pp. xii+170. London: World Power Conference. Price 21s. net.

Handbook series of the U.S.A. Bureau of Standards, No. 4—Discussion of the National Electrical Safety Code (to accompany the 4th edition of the code), September, 1928 (price $1.00).

"Steam Turbines," by J. A. Moyer. Pp. 10+557; figs. 231. Price 22s. 6d. net. "Industrial Carbon," by C. A. Martell. Pp. 410; figs. 89. Price 21s. net. London: Chapman and Hall, Ltd.

New Catalogues and Lists.

Mr. Alan Wright, 124, Chancery Lane, W.C.1.—A booklet describing "Inventum" water-heating apparatus, with illustrations and prices.

Messrs. Hopkinsons, Ltd., Huddersfield.—List No. 2120, illustrating and describing the company's "Fullbore" parallel slide valve.

Messrs. Bertram B. Fenn, Ltd., 78-80, Edgware Road, W.2.—A booklet advertising the "Fenbo" anti-dazzle and fog-penetrating automobile lamp. Priced.

N.I.A. Lighting, Ltd., 57-58, Wells Street, W.1.—A catalogue containing illustrations, particulars and prices of alabaster and glassware electric lighting fittings.

The Walker Electrical Service, Annandale Street, Edinburgh.—An illustrated reprint of an article describing the firm's electrical repair workshops.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for March, containing articles on the lighting of the Thames Embankment and other "Osram" installations, and notes on "Gecophone" apparatus and other of the company's products.

The Electric Elements Co., 39, Arkwright Street, Nottingham.—A price sheet of "Elko" earthing clips of various patterns.

Electrical Imports into British Guiana.

Commerce Reports states that during the first ten months of 1928 electrical apparatus valued at $93,041 was imported into British Guiana. Of this, the United States accounted for $43,668, Great Britain for $25,753, and Canada for $12,235. In 1927 the total was $43,937, of which Great Britain provided $20,649, the United States $20,196, and Canada $1,525. The 1928 figures include certain plant which was not taken account of in previous years. The imports during the first half of 1928 were particularly high on account of the renovation of the power plant of the Demerara Electric Co., Ltd.

The American Radio Industry.

It is estimated that there are now over 1,200 factories in the United States devoted exclusively to the production of radio sets and accessories and that 320,000 people are engaged in the industry.

Bids for Shanghai Electricity Undertaking.

The Shanghai Municipality (as we have already reported) is desirous of transferring its electricity undertaking to private enterprise, and several tenders have been received. The highest offer is that of the American and Foreign Power Company, New York, which bid over ten millions sterling. The British Trusts Association, Ltd., London, offered approximately £6,380,000 and submitted a leasing plan. A leasing plan was also submitted by Lord Meston's group, which includes the Power and Traction Finance Co., Ltd., and the English Electric Co., Ltd. The Council is expected to come to a decision in the matter next month.—*Reuter* (Shanghai).

The committee appointed to report on the tenders has recommended acceptance of the offer of the American and Foreign Power Co., which is a subsidiary of the Electric Bond and Share Co. of New York.

Trade Announcements.

Mr. N. D. Blagdon Phillips, M.A.I.E.E., who was for 10 years with Messrs. Siemens Bros. & Co., Ltd., has been established in Vancouver, B.C., since leaving the Army, as representative for electrical equipment. A partnership has recently been formed, under the firm name Phillips-Henderson Company, for carrying on the same form of business.

Mr. M. F. Clark, electrical engineer, of Deal, has transferred his showrooms from 126, High Street to the works in Mill Road.

The offices and stores of the Sterling Varnish Co. have been transferred to Fraser Road, Trafford Park, Manchester. (Telephone: Trafford Park 1753-4.)

The address of Dixonia, Ltd., is now Clifton Street Works, Latimer Road, W.11. Telephone: Park 8942; telegrams: "Dixlecsund, Phone, London."

The business of J. Smith & Son, Brighton, has been converted into a private company—J. Smith & Son (Brighton), Ltd. Mr. H. L. Smith is managing director, and Mr. J. D. Smith retires from active management, but is a director of the new company.

The British Thomson-Houston Co., Ltd., has opened a new "Mazda" lamp stores and trade counter at Sherwood Buildings, South Sherwood Street, Nottingham. (Telephone: Nottingham 260; telegrams: "Asteroidal, Nottingham.")

Sphinx Electric, Ltd., Hatton Garden, E.C.1, announces that it has taken over the sole concession for "Quickfix" galleries and ceiling plates.

United States Foreign Trade.

A review of the external trade of the United States in 1928 has been prepared for the Department of Overseas Trade by Mr. A. J. Pack, Commercial Secretary at Washington (Stationery Office, 1s. 6d. net). The latest figures given relate to 1927, and it is shown that Great Britain is still the United States' best customer, although her share of American exports declined from 26.2 per cent. in 1910-14 to 17.3 per cent. in 1927. Before the war Great Britain secured the largest share of the import trade, the figure being 16.5 per cent. over the 1910-14 period; in 1927 both Canada and Japan supplied a greater proportion—11.4 and 9.6 per cent., respectively, as compared with 8.6 per cent. for Great Britain.

During the fiscal year 1927-28 United States' exports of electrical machinery, apparatus and supplies were valued at $87,200,000, as compared with $83,200,000 in 1926-27. The electrical machinery industry has made regular and progressive strides, although in 1927 there was a slight falling-off in production. Canada is the largest market, having purchased $18,270,000 worth of electrical machinery during 1927. Latin American countries provided a market worth $17,827,000 and Asia purchased $13,760,000 worth. Japan is the principal purchaser in the Orient. In Europe, the United Kingdom is the principal market, purchases in 1927 having amounted to $5,612,000. In the electrical machinery group the British Empire accounted for 42 per cent. of the exports.

In a report upon the American electrical industries, included in the publication, Sir J. J. Broderick, Commercial Counsellor at Washington, says that the output of electricity by public utility companies during 1927 was over 80,000 million kWh, or 676 kWh *per capita*. The total number of consumers was 21,694,000, and the average price for domestic lighting purposes was 7.3 cents per kWh. The total investment in the electricity supply industry is estimated at $8,084 millions.

Electrical equipment manufacturers, particularly those producing wire and cable, have had a prosperous year, both in their domestic and foreign trade, and their prospects for the immediate future are distinctly favourable.

Indian Duties on Wires and Cables.

Our Indian Correspondent states that the Indian Tariff Board has now issued its report on the question of tariff equality in respect of the manufacture of electric wires and cables. It recommends that the duty on electrolytic copper rod known as "black rod" be removed, and that a duty of 5 per cent. be levied on rubber-insulated electric wires and cables other than those specified in article 30a of the tariff schedule. The report observes that the present revenue policy of the Government of India is responsible for the existing inequality in tariff treatment between the Indian Cable Company and its foreign competitors. The imported wires and cables of the sizes generally used for industrial purposes are admitted free of duty, while the company is required to pay duties ranging from 5 per cent. to 30 per cent. on a large proportion of the raw materials used by it in the manufacture of wires and cables. The result is a clear case of tariff inequality handicapping a domestic industry in competition with foreign manufacturers. A disadvantage which has incidentally resulted to the company from the removal of the duty on imported wires and cables is the reduction in orders for repairs and urgent replacements. The business in the bazaar has been further affected recently by the importation of cheap electric wires and cables from the Continent, especially from Germany. These coming in small quantities have steadily exercised a depressing effect on the market. In view of the fact that "black rod" is not manufactured in India at present and

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the Indian Cable Company is practically the only purchaser, it appears unnecessary to retain the duty in the tariff schedule. The Board does not consider a refund of duty or bounty suitable, and recommends a general duty of 5 per cent. on all class of rubber insulated cables, not less than 1/80th square inch in sectional area.

For Sale.

Mr. G. R. Lightfoot will sell by auction on April 11th, at 13, High Holborn, large stocks of electrical and wireless material. Worksop U.D.C. Electricity Department has for disposal 1,650 yd. h.p. cable. (See our advertisement pages to-day.)

Trade Delegation to Russia.

The British Industrial Mission to Russia, organised by the Anglo-Russian Committee, was to leave for Moscow on Monday last. A list of the delegates published in the *Financial News* included the following:— Mr. E. Balmford (National Gas Engine Co., Ltd.), Mr. E. M. Benjamin (Petters, Ltd.), Mr. E. L. Cadwallader (C. A. Vandervell & Co., Ltd.), Mr. F. Creed (Creed & Co., Ltd.), Mr. C. C. Day (Mirrlees, Bickerton and Day, Ltd.), Messrs. L. E. Mather and S. Jarvis (Mather and Platt, Ltd.), Mr. R. B. Lister (R. A. Lister & Co., Ltd.), Mr. H. E. Metcalf (Ruths' Steam Storage, Ltd.), Mr. L. M. Parry (Henry Wiggin & Co., Ltd.), Mr. S. W. Reeve (Reavell and Co., Ltd.), Mr. J. W. Ryan (Clayton & Shuttleworth, Ltd.), and Mr. L. H. Tomkin (Hobart Manufacturing Co., Ltd.).

It will be observed that none of the leading electrical manufacturing companies is represented, practically all of the above-named concerns being of an "allied" nature.

London Electricians' Strikes.

In pursuance of its demand that men engaged on electrical construction work must be members of the Electrical Trades Union and no other, the E.T.U. last week called men out on strike on five London undertakings last week, including the new building of the Underground Railways at St. James's Park. *The Times* says that in four of the five cases the work in progress was lift construction, which, the employers maintain, is a specialised engineering job. In the fifth case the stoppage was said to be due to the intervention of a supervisor to give instructions regarding the working of conduit.

It appears that the hourly rate for the men engaged in lift work is 1s. 4½d., whereas the rate for electricians, whom the Union say should be doing the wiring, is 1s. 9¾d. The strikers have no quarrel with their employers, the electrical contractors, their action being directed purely against the lift construction firms.

On Saturday men engaged on a large block of buildings in Piccadilly ceased work for the same reasons. It was reported on Tuesday that the strikes had been "recognised" by the London District Committee of the E.T.U., but no endorsement had come from the National Executive of the Union.

Social Events.

The annual dinner and prize distribution of the cricket clubs of the concerns with which Mr. C. R. Belling is associated took place at the George Hotel, Enfield Town, recently. The firms represented were Belling & Co., "M.K." Electric, Ltd., Belling & Lee, Ltd., Insulators, Ltd., the Ro-gat Tool Co., Ltd., Wootton & Co., Ltd., and Concrete Utilities, Ltd. Mr. C. R. Belling occupied the chair, and he was supported by representatives of the various companies. The dinner was followed by a vocal and instrumental concert. A silver cup, provided by the directors, was presented by Mr. Belling to the Concrete Utilities Club.

The staff of Messrs. John Shaw & Sons, Wolverhampton, Ltd., held their annual dance recently at the Victoria Hotel, Wolverhampton. The company, numbering close on 200, included the general manager, Mr. V. A. Mattick. The presentation of a number of spot prizes created great amusement.

North-East Area E.D.A. Conference.

The third E.D.A. Conference of the session under the auspices of the North-East Area Committee was held on March 20th at Newcastle. Mr. R. E. Robson, chairman of the Committee, read a paper of considerable local interest, "The Place of the North-East Coast in the Electrical Industry, Past, Present and Future." Mr. W. F. T. Pinkney presided. There was an excellent attendance, and a good discussion followed the paper. Mr. Robson covered the whole of the electrical development of electricity in the North-East Coast area up to the present day, and dwelt at some length on the possibilities of electrical development in the future. Messrs. Falconar, Ward, Gray, Albrecht, Gledson, Adam and Miss Jackson took part in the discussion.

Sir Hugo Hirst Welcomed Home.

A "welcome home" dinner was given to Sir Hugo Hirst, Bt., by the Incorporated Society of British Advertisers at the Hotel Cecil on March 21st. Mr. F. W. Goodenough, who presided, heartily congratulated Sir Hugo and his colleagues upon the report which they had produced after their study of Australian conditions. In the course of his reply, Sir Hugo referred to the need for attracting university and public school men into business, although he pointed out that business was not merely a question of knowledge, but of judgment. He considered that Australia had not kept pace with the advance in other countries, and its contact with the Mother Country was not close enough. The Australians were anxious to be British, but they needed our constant attention. The Australian problem was the problem of the whole Empire. We must help them with British capital and keep them fully acquainted of British developments. Sir Basil Clarke, who also spoke, drew attention to the differences between British and Dominion conditions, and urged that these should be thoroughly realised and studied.

Bankruptcy Proceedings.

A. B. Gregory, 29, St. Albans Road, Seven Kings, Essex, wireless expert.—An application for the discharge of this debtor was heard on March 18th, at the Shire Hall, Chelmsford. The receiving order was made in 1928, when the statement of affairs presented showed liabilities of £418, against assets which had realised £8. No dividend had been paid. The discharge was granted subject to a suspension for six months.

C. K. Wallis, electrical engineer, late of Bedford Street and Longford Road, Bognor.—Bankrupt discharged subject to consenting to judgment for £20 and 30s. costs of judgment. (£20 paid to the Official Receiver in lieu of entering up judgment.)

P. W. Penty (Sackville Electrical Co.), electrical contractor, 38, Mannville Terrace, Morley Street, Bradford.—Trustee, Mr. J. O. Morris, 12, Duke Street, Bradford, released March 8th.

F. H. Barrell (F. H. Barrell & Co.), radio engineer and fancy goods dealer, 2a, 2b, 2c, Church Street, Staines. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C.1, released March 6th.

T. F. J. Truss, electrical engineer, 28, Wincobank Avenue, Sheffield.—First meeting held March 27th, at the Official Receiver's offices, Figtree Lane, Sheffield. Public examination, April 11th, at the County Court Hall, Sheffield.

H. C. Buckley (H. Buckley), 23, Asylum Road, Old Kent Road, S.E.—Adjourned public examination held March 27th, at Carey Street, W.C.

S. Perkins, wireless dealer, 1, Lodge Lane, Beeston, Leeds.—Last day for proofs for dividend April 10th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds.

Company Liquidation.

Kye, Ltd.—Last day for proofs for dividend April 3rd. Liquidator, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1.

Private Arrangements.

S. C. Smith, electrical and wireless dealer, 10, Facade, Devonshire Road, Forest Hill, S.E.—A meeting of creditors was held recently at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C. The statement of affairs submitted showed liabilities of £569 and net assets of £496, leaving a deficiency of £73. The business was commenced by the debtor's father in October, 1927, and was taken over by the debtor in April, 1928. As only rough books had been kept, the usual trading figures could not be prepared. The turnover had been in the neighbourhood of £30 a week, and the drawings had only been about 30s. weekly. The debtor's father had undertaken to withdraw his claim. An execution had been levied, and other creditors were pressing. A resolution was passed confirming a deed of assignment already executed to Mr. W. A. J. Osborne, and it was stated that efforts would be made to sell the business as a going concern. The following are creditors:—

	£		£
Clark & Moir	105	Foster Engineering Co., Ltd.	70
Dulcetto Polyphone Co.	77	Marconiphone Co., Ltd.	28
Eastick, J. & J., & Son	72	Philips Lamps, Ltd. ...	27
East London Rubber Co.	26		

Company to be Dissolved.

Clun Electric Supply, Ltd.—Reg. No. 7917 R. Salop Electric Power Station, Bridge Street, Clun, Salop. The company is to be dissolved by instrument dated March 19th, unless cause is shown to the contrary within three months.

New French Companies.

A company has been formed in Paris (12, Boulevard du Temple) with a capital of 1,200,000 fr. and the title La Société Textile Electrique to manufacture insulating material.

La Société Provinciale de Distribution de l'Energie is the name of an undertaking which has lately been organised in Lyons with a capital of one million francs.

Unemployment.

There was a decrease of 118,530 in the number of registered unemployed during the week ended March 11th. At that date the total was 1,268,800 as compared with 1,387,330 on March 4th, and 1,071,730 on March 12th, 1928.

Polish Foreign Electrical Trade.

During January last Poland imported "apparatus, conductors and other electrotechnical materials" to the value of 8,185,000 zloty (about £190,000). Polish exports of this class had a value of 85,000 zloty (about £2,000).

The British Industries Fair, 1930.

Mr. Douglas Hacking, Parliamentary Secretary to the Department of Overseas Trade, announced last week that the London Section of next year's British Industries Fair will be held at Olympia instead of at the White City. The former building is being reconstructed, and the space available will

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be little less than that at the White City. The Government is again making a grant of £25,000 for publicity purposes in connection with the Fair.

New Showrooms in Limerick.

The Electricity Supply Board of the Irish Free State has acquired premises in O'Connell Street, Limerick, to be used as showrooms for the display of electrical appliances in connection with the Shannon scheme.

French Products in Germany.

The Deutsche Alsthom Gesellschaft has been formed in Berlin to market the products of the Société Alsacienne de Construction Mécanique and the Compagnie Française Thomson-Houston in Germany.

Prices of Raw Materials.

CORRECTION.—In last week's issue, page 522, the price for copper (electrolytic) bars should read £99 10s., £8 inc.

Messrs. F. Smith & Co. report, March 26th: Copper (electrolytic) bars, £112 12s. 6d.; do. do. sheets, no change; do. do. wire rods, £122 12s. 6d.; £13 12s. 6d. inc.; h.c. wire, 1s. 2 15/16d., 1 9/16d. inc.; silicium bronze wire, 1s. 3½d.; 2½d. inc.

Messrs. James & Shakespeare report, March 26th: Copper bars (best selected), sheet and rod, £138; £13 inc.; English pig lead, £28 10s., 10s. dec.

Messrs. Edward Till & Co. report, March 26th: India-rubber, Para fine, 1s. 1d., ½d. dec.

In their letter dated March 23rd, Messrs. James Forster and Co. stated that an unprecedented jump in lead prices occurred on Monday last week, the opening price being about £3 higher. This was due to speculative buying, and it was not surprising to see a drastic setback the next day of 45s. per ton. The market has since been firmer under the stimulus of the raising of the official American price from 7.25 to 7.75 cents per lb. Under present conditions of supply and demand there is no justification for the enhanced values. The rise has killed demand in this country, as consumers are naturally adverse to making any purchases at such a high figure. Supplies meanwhile are plentiful. Consumers should restrict their purchases to a minimum, as sooner or later a severe reaction will be seen to a lower level more compatible with the position of supply and demand.

Lighting and Power Notes.

Australia.—SYDNEY (N.S.W.).—The Sydney Civic Commissioners have decided to spend an additional £1,000,000 on the Bunnerong power house, which is being built to provide electricity for the whole of the metropolitan area. So far over £2,000,000 has been spent on the undertaking. At present the Sydney Council draws largely on the Railway Commissioners' plant to meet the needs of the consumers connected with its service, the cost last year being about £400,000. With the completion of the Bunnerong power house, the Council will be able independently to meet all demands made upon it for electricity.—*Reuter* (Sydney).

Aylesbury.—LOANS SANCTIONED.—The Town Council has received sanction to the following loans: mains and services, £24,271; plant (sub-station equipment), £699; domestic apparatus to be let out on hire, £9,412.

Bedford.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee reports that it is necessary to lay cables and carry out work to allow the l.p. network to be sub-divided into smaller areas than at present. It is also necessary to provide additional transformer sub-stations in various parts of the town, most of which will be fed from a new Scott bank sub-station similar to that erected in Lurke Street. The cost is estimated as follows: Buildings, £1,450; underground mains, £4,800; sub-station equipment, £3,650.

ELECTRICITY CHARGES.—The Committee has prepared amendments to provide for a reduction in the charges for power and the introduction of an alternative method of charging for lighting, heating (except industrial heating), cooking and domestic appliances. The latter is in the form of a two-part tariff. The revisions are equivalent to a revenue of £8,300.

RURAL SUPPLY.—The Town Council has approved a scheme for supplying electricity in rural areas at an estimated cost of £100,000. The scheme provides for the supply of electricity to 31 parishes.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The British Columbia Power Co. has awarded a contract to Messrs. Stuart Cameron & Co., Ltd., and Messrs. Armstrong, Morrison & Co., Ltd., for the construction of a dam near Ruskin, on the Stave River—the site of the company's $7,250,000 power project. Construction of the dam (which will be 180 ft. high, 350 ft. on the crest, and 120 ft. wide at the base) will commence immediately. The contract calls for completion by October 31st, 1930. Other contracts for tunnels, hydraulic and electrical machinery and power plant equipment will be let almost immediately, completion being called for by December 31st, 1930. The Ruskin development, which will be the third in the company's chain of hydro-electric power plants on the Alouette-Stave Falls (Ruskin system), will have an initial capacity of 43,000 h.p. in one unit, provision being made for the addition of another unit of the same capacity when power demands warrant. The ultimate capacity of the plant will be 173,000 h.p.

The Dominion Water Power and Reclamation Service of the Department of the Interior of Canada has issued its annual review of the water-power resources of Canada, developed and undeveloped, as at January 15th, 1929. The total water-power resources of the Dominion are now estimated to be 20,197,000 h.p. under conditions of ordinary minimum flow, or 33,113,200 h.p. ordinarily available for six months of the year, while the total hydro-electric development at the present time amounts to 5,349,232 h.p.

Continental.—ITALY.—Among the concessions recently granted for the establishment of new hydro-electric stations in Italy is one to the Società Trentina di Elettricita to utilise the water power of the River Isarco at Bolzano. It is estimated that about 20,800 h.p. is available.

Droxford.—RURAL SUPPLY.—The Rural District Council has decided to oppose an application by the West Hampshire Electricity Co., for an Order authorising it to supply electricity in the rural area, on the ground that the company has not made sufficient provision for covering the district, and that the price per kWh (10d.) is exorbitant. The Portsmouth Corporation has already offered to supply Hambledon, and the Rural Council has consented to this proposal, and has invited the Corporation to include Soberton in the area of supply.

Edinburgh.—SUSPENSION OF SINKING FUND.—An Order promoted by the Corporation provides for the postponement of payments into the sinking fund required to be provided for the repayment of borrowed money in connection with the extension of the Portobello station for such period or periods and subject to such conditions as the Order may prescribe, and that as regards money borrowed for the said purpose the Corporation may accumulate the yearly interest thereon, and include it in the capital account until the commencement of the sinking fund payments.

Glasgow.—MAINS EXTENSIONS.—The Corporation Electricity Committee has authorised mains extensions at a cost of £5,676.

ELECTRIC WASHERS.—The Committee has instructed the manager to purchase 50 electric washers for sale on the hire-purchase system.

PROGRESS DURING FEBRUARY.—Under the Corporation Electricity Department's scheme 583 houses were wired during February, making the total to date 12,161. Hired appliances numbered 272, the total to date being 18,484.

Hornsey.—NEW PLANT.—The Corporation Electricity Committee has recommended the installation of a 300-kW motor convertor at the Highgate sub-station, at an estimated cost of £3,076, and the purchase of a Hewittic rectifying set for the electricity works at an estimated cost of £3,886.

APPLICATION REFUSED.—The Committee has been informed by the Electricity Commissioners that they are not satisfied that the Corporation would, if consent to extend its plant were given, be in a position to give an adequate supply of electricity to meet the present and prospective demands of the consumers at a cost not greater than that at which it could give it if a supply of electricity was obtained from the London and Home Counties Joint Electricity Authority. The Commissioners have accordingly decided to refuse their consent to the application of the Corporation.

Irish Free State.—ELECTRICITY SUPPLY BOARD.—The Electricity Supply Board has now given notice of its intention to acquire on March 28th the following electricity undertakings owned by local authorities: Dublin, Rathmines, Pembroke, Clonmel, Thurles and Swinford. The price of electricity to consumers will not be affected by the Board's acquisition of these concerns. Other undertakings acquired so far by the Board include Bray, Kingstown, Limerick, Waterford, Wicklow, Enniscorthy, and Edenderry. There remain in the Free State four undertakings owned by local authorities which have not yet been acquired, or in respect of which notice of acquisition has not yet been issued, *viz.*, Navan, Kildare, Dundalk, and Ballaghadereen.

QUEENSTOWN.—The Urban District Council has written to the Electricity Supply Board demanding a reduction in the charge for electricity for lighting, which is at present 10d. per kWh, failing which it proposes to ask the Ministry for Industry and Commerce to hold an inquiry into the existing scale of charges.

Lichfield.—LOANS.—The Town Council has applied for sanction to a loan of £2,990 for overhead cables to give a supply of electricity to Shenstone. Sanction has been received to a loan of £2,100 for house-wiring installations under the hire-purchase scheme, domestic apparatus for hire, and for additional testing instruments.

CHARGES FOR COOKING SUPPLY.—At Whittington, electricity is to be supplied for cookers at a quarterly charge equal to 7½ per cent. for the first £30 of the net ratable value, and 5 per cent. above, plus 1d. per kWh.

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London.—Stoke Newington.—The Borough Council has received sanction to a loan of £10,000 for mains and services.

Lowestoft.—Loans.—The Corporation Electricity Committee has recommended that application be made for sanction to loans of £14,500 for the provision of main and distribution cables for the supply of electricity to premises in the parish of Kessingland, and £5,000 for meters.

Machynlleth.—Electricity Supply.—The Urban District Council after considering electricity schemes submitted by Crompton Parkinson, Ltd., and the Electric Development and Securities Trust, Ltd., has decided to ask the latter if it is prepared to proceed with the Order applicable to the town independent of the support of other authorities mentioned in the Order, and also whether in the event of sanction it would be open to the Council to arrange terms as to the overhead and underground mains.

Manchester.—Progress During January.—During the month of January the Corporation electricity undertaking showed an increase in connections of 1,842 kW, bringing the total up to 372,043 kW; and the number of applications received for supply, including those for additional supplies, was 1,221, representing a total of 3,487 kW. The number of hired cookers connected increased by 56, bringing the total of hired cookers actually on circuit to 5,081. Applications for the hire of cookers totalled 61. Additional plant was installed at five existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 4,217 consumers, work was in progress involving 1,087 consumers, and sanction had been received in respect of an additional 658 consumers.

New Zealand.—Wellington.—The report of the manager of the city electricity undertaking (Mr. M. Cable) for the year ended March 31st last records a total revenue of £339,980, as compared with £283,554 in the preceding year. Working expenses amounted to £144,352, as against £126,500, leaving a gross profit of £195,628 (£157,054). Capital charges absorbed £71,628, and after making various appropriations there was a net surplus of £51,617, as compared with £24,031 in the previous year. The capital expenditure during the year amounted to £52,730, bringing the total spent on the undertaking to £992,196. The electrical energy sold increased from 27,162,109 to 30,212,973 kWh, and the average price obtained per kWh fell from 2.49d. to 2.09d. The maximum supply demanded rose from 11,400 to 12,910 kW.

Oxford.—Purchase of Undertaking.—The Corporation Electricity Committee has recommended that it be authorised to carry on proceedings in order to secure compliance with the notice served on the Oxford Electric Co., Ltd., requiring the company to sell its undertaking, and to engage such counsel and other expert assistance as may be required for that purpose. The Committee is advised by counsel that the Corporation will be entitled to the income and profits of the company from the date of the service of the notice to purchase, unless a different date is fixed by agreement between the parties.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Calne.—Lighting: 7½d. per kWh, with a minimum charge of 10s. per quarter. Power: Varying from 3½d. per kWh for the first 100 kWh per quarter to 2½d. for over 400 kWh, with a minimum charge of 10s. per quarter.

Canterbury.—Heating, cooking, and domestic purposes, other than lighting: From 1½d. to 1¼d. per kWh. Large a.c. power consumers: £6 per kVA per annum, plus ½d. per kWh, electricity used for lighting not to exceed 10 per cent. of the total consumed.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by Electric Development and Securities Trust, Ltd., authorising it to supply electricity in the urban districts of Machynlleth and Towyn, the rural districts of Machynlleth, Ysgubor-y-coed, and Pennal, part of the rural district of Aberystwyth, and the township of Aberdovey.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the West of England Electricity, Ltd., to supply electricity in the borough of Honiton, the urban districts of Ottery St. Mary and Wiveliscombe, the rural districts of Dulverton and Wellington, and parts of the rural districts of Crediton, St. Thomas, Tiverton, Axminster, and Honiton; and Hull Corporation to supply electricity in the boroughs of Beverley and Hedon, the urban district of Cottingham, and parts of the rural districts of Beverley, Skirlaugh, Sculcoates, and Patrington.

Swansea.—Loan.—The Corporation Electricity Committee is to make application for sanction to the borrowing of £2,000 in connection with an assisted wiring scheme.

Turton.—Electrical Development.—The electrical engineer, in a report to the Urban District Council, intimates that at a later date he proposes to draw up a scheme for a better supply of electricity to various districts. This will involve the laying of about two miles of h.p. cable and installing three transformer kiosks. The total cost of this extension will be about £10,000.

Tramway and Railway Notes.

Algeria.—Railway Electrification.—Contracts have been placed for the electrification of the Duvivier-Ould-Keberif section of the railway between Bone and Tebessa. The contact lines and sub-stations will be supplied and erected by the Compagnie d'Entreprises Electro-Mécaniques, of Paris, while the electric locomotives will be supplied by the Société d'Etudes pour l'Electrification des Chemins de Fer Français.

Continental.—Switzerland.—The balance sheet of the Federal Railways for 1928 shows receipts of 170.15 million fr. and an expenditure of 152.4 million fr., leaving a profit of 17.75 million fr., the largest up to the present.

India.—Railway Electrification.—A further step has been taken in the proposals for electrifying some of the sections of the South Indian Railway. *Indian Engineering* states that the South Indian Railway administration has referred to its consulting engineers, Messrs. Robert White & Partners, Westminster, to obtain expert opinion on electrifying the following five lines including the supply of electrical energy to the Golden Rock Railway Workshops: Ootacamund to Mettupalayam, Mettupalayam to Podanur, Podanur to Dindigul, Podanur to Erode and Trichinopoly to Tanjore. Messrs. Robert White & Partners have submitted a report to the South Indian Railway which, together with the proposals of the company, have been sent to the Railway Board for sanction. Meanwhile the long expected decision of the Madras Government on the Pykara hydro-electric scheme for which estimates have been prepared is anxiously awaited by all those interested in railway electrification proposals, as energy for these schemes is proposed to be supplied by the Pykara project. Among the lines proposed to be electrified, Ootacamund to Mettupalayam is a heavy ghat line, Mettupalayam to Podanur and Podanur to Erode will be broad gauge, while Podanur to Dindigul and Trichinopoly to Tanjore are metre gauge sections. It is believed that the main transmission line supplying energy for these schemes will be the longest in the world.

Kingsnorth.—Transfer of Undertaking.—Application has been made to the Minister of Transport by Messrs. Holm and Co., Ltd., for an Order authorising the transfer to a company to be incorporated of the Kingsworth light railway. The title of the company will be the Kingsnorth Light Railway Co.

Lancashire.—Abandonment of Tramway.—A select committee of the House of Lords has considered the Bill promoted by the South Lancashire Tramways Co., to authorise it to substitute railless cars for the present tramway system. The case for the promoters was that they were under obligation to reconstruct the tramway at a cost of £57,000, and they were also faced with the problem of reconstruction of the whole of their system of over 32 miles. If the Bill was passed they would complete the conversion in five years, at a cost of £159,500. The Committee passed the Bill enabling the company to substitute railless cars, but rejected proposals that the company should no longer be required to provide lighting for its track, and for a transport monopoly. It was agreed that the County Council, where it was the road authority, might relay the track after the tramways were abandoned and charge the cost to the company.

London.—Camden Town Station.—Good progress is being made with the work of installing the twin escalators at Camden Town station. The 90-feet escalator tunnel has been bored and a circulating chamber has been excavated at the foot of the tunnel. Four new passage ways will lead to the platforms. Three of these are completed, and the other will be finished shortly. The escalators will be in service about midsummer. Camden Town will be the twenty-ninth station on the Underground system to be equipped with moving stairways, and will bring the total number of escalators up to 85.

Underground Speed-up.—The *Financial News* reports that in consequence of the growth of short-distance traffic during the midday period, the train service on the Central London Railway has been increased from 30 to 35 trains per hour during the midday period. This is the closest interval midday service ever operated on the Underground system.

Middlesex.—Light Railways.—The County Council has applied to the Minister of Transport for an Order authorising it to construct light railways in the parishes and urban districts of Tottenham and Walthamstow.

New Zealand.—Wellington.—We have received from Mr. M. Cable, general manager of the city tramway undertaking, a copy of his report, together with the statement of accounts for the year ended March 31st last. The total revenue amounted to £449,930, and working expenses were 332,467, leaving a gross profit of £117,463. The figures for the preceding year were: Income, £432,222; working expenses, £328,592; gross profit, £103,630. After deducting capital charges and a loss on the motor-omnibus service, there was a net profit of £14,367, as compared with £10,702 in 1926-27. The number of passengers carried increased from 43,963,802 to 45,413,127, and the car miles run from 4,002,448 to 4,164,829. The average receipts per car mile increased from 25.91d. to 25.92d.

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Telegraph and Telephone Notes.

Canada.—TELEPHONE SERVICE.—According to a recent survey, on a per capita basis, an average of 221 telephone conversations per annum take place between telephone users in Canada, as compared with 205.4 in the United States and 137 in Denmark, which hold second and third places, respectively.—*Reuter* (Ottawa).

International Telephony.—SWEDEN AND ESTHONIA.—The new telephone line between Stockholm and Reval, *via* Helsingfors, was inaugurated on March 18th. Communication was quite successfully carried on and it is expected that the new line will shortly be extended to Latvia.—*Reuter* (Stockholm).

Press Telegraph and Telephone Facilities.—GENEVA REPORT.—The Committee of the League of Nations on Communications and Transit has adopted the reports of the Special Committee of Press Experts regarding telegraph and telephone facilities for the Press which are to be considered by the Telegraph Conference in 1930. The Committee further endorsed the recommendation of the Press Experts' Conference regarding greater facilities for communication by wire and wireless between Europe and Eastern countries and North and South America.—*Reuter* (Geneva).

The Telephone Service.—STIMULATING THE DEMAND.—Sir Alexander Roger, chairman of the Telephone Development Association, speaking at the annual general meeting in London, said, according to the *Daily Telegraph*, that the latest figures available showed that at the end of February last there were 1,742,095 telephones, which represented an increase of 124,532 in twelve months. With a view to creating the telephone habit and stimulating a popular demand, Sir Alexander urged that the Post Office should devote 1 per cent. of the telephone revenue to advertising and publicity. On this basis a sum of £180,000 a year would be available for commercial advertising. Simultaneously, new construction work should be accelerated and extended in anticipation of the increased demand that would inevitably follow.

Radio Notes.

Czecho-Slovakia.—INTERNATIONAL CONFERENCE.—A conference of the principal European telegraph departments will be held in Prague from April 4th to 13th, following an invitation from Czecho-Slovakia. Apart from matters relating to international radio-telegraphy, the principal subject to be discussed will be the allotment of wavelengths for European broadcasting, says *World-Radio*. The Union Internationale de Radiophonie will be represented at the Conference.

The telegraph administrations of no less than 26 countries will take part in the Conference, as well as eight private societies.—*Reuter* (Prague).

France.—EIFFEL TOWER WAVE-LENGTH.—The Eiffel Tower wireless station, which for six years has been worked on a wave-length of 2,650 metres, is apparently still undergoing readjustment for 1,465 metres. This wave-length has been chosen to obviate the difficulty of the Eiffel Tower swamping Daventry and Radio-Paris, but very delicate adjustment will be required to prevent interference with the Paris airport of Le Bourget, where specially selective apparatus is to be installed.

Jugo-Slavia.—NEW STATION.—The new broadcasting transmitter at Belgrade, a Marconi 9-kW installation, having satisfactorily completed its tests, was officially opened on March 24th. The signals of this station are well received in England; it has been built by Marconi's Wireless Telegraph Co., Ltd., and is, in appearance, similar to the London station, although not quite so powerful. The whole of the transmitting station is in the centre of Belgrade, in the Academy of Sciences, and three studios will be used in the production of the programmes. The aerial is suspended between masts approximately 80 feet high which have been erected on the top of the building, and the transmitter works on a wavelength of 452 metres with an aerial energy of about 2 kW. There are at present within range of this station about 7,000 listeners with valve receivers, but it is anticipated that the introduction of the modern plant will result in the number of receivers in the district increasing rapidly.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—May 15th. Victorian Railways. One geared 3-phase electric winding engine. (A.X. 7650.)*
April 5th. Rectifiers and storage batteries for power signalling. (B.X. 5166.)* Dwarf electric signal mechanisms. (B.X. 5168.)*

Batley.—April 15th. Electricity Department. L.p. cable. (See this issue.)

Belgium.—HASSELT. April 3rd. Provincial Government authorities. Supply and erection of a h.p. electric power transmission line between Bourg-Leopold and Lommel.

Bridport.—April 15th. Electricity Department. H. and l.p. underground and overhead cables. (See this issue.)

Bulgaria.—PLOVDIFF.—May 20th. Provincial Council. Supply and erection of plant for the Vatscha-Kricim hydro-electric power station. Two Francis turbines to operate under a head of 285 ft., two 5,000-kVA generators, two 5,000-kVA transformers, two 1,000-kVA ditto, and two 150-kVA ditto.

China.—SHANGHAI.—March 30th. Kailan Mining Administration. Two 300-kW turbo-generator sets. (B.X. 5174.)*

Dumfries.—April 17th. Electricity Department. One water cooling tower. (See this issue.)

Dundee.—April 10th. Electricity Department. D.c. and a.c. house service meters. 30,000 pairs arc lamp carbons. (See this issue.)

Edlington.—April 17th. West Riding Education Committee. Installation of electric lighting at new schools and caretaker's house. Education Officer, County Hall, Wakefield.

Egypt.—CAIRO.—May 15th. Ministry of Public Works. 120-kW d.c. Diesel engine generating set and a small electrically-driven cooling water pump. Forms of tender from the Chief Inspecting Engineer, 41, Tothill Street, S.W.

Farnworth.—April 3rd. Electricity Department. L.p. cables. (March 22nd.)

Glasgow.—April 2nd. Corporation. Electric light and heating installation for the new police station at Millerston. Specifications, &c., from office of Public Works, 64, Cochrane Street (£2 2s. deposit).

India.—April 5th. South Indian Railway Co., Ltd. Electrical materials and fittings. Specifications from the company's offices, 91, Petty France, Westminster, S.W.

London.—CENTRAL ELECTRICITY BOARD.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)
April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (March 15th.)
PADDINGTON.—April 8th. Great Western Railway. Stores, including electrical wires and cables, telegraph ironwork, and iron and steel wires. (March 22nd.)
LONDON COUNTY COUNCIL.—The Highways Committee will shortly invite tenders for 150 modern type tramcars.

Manchester.—April 3rd. Electricity Committee. One 8,000-kVA air-cooled transformer. (March 15th.)
April 8th. Two 33,000-V metal-clad switch units. (March 22nd.)

Middlesbrough.—April 10th. Electricity Department. 12 months' supply of cables and meters. (See this issue.)

New Zealand.—WELLINGTON.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

South Africa.—UMTALI.—April 18th. Municipal Council. 1,000-kW turbo-alternator, spray cooling plant, switchgear, transformers, crane, &c. (B.X. 5142-5.)*
JOHANNESBURG.—April 25th. South African Railways and Harbours. Three electrically-driven wheel lathes. (A.X. 7621.)*
May 16th. Electric signalling apparatus. (B.X. 5165.)*

Southampton.—April 30th. Electricity Department. Steel-framed building, steelwork for firing floor, platform carrying induced draught fans, overhead bunkers, &c.; two water-tube boilers with superheaters, economisers, air heaters, mountings, chain-grate stokers, water walls, induced and forced draught fans, sootblowers, steel flues and chimneys, grit arrestors and collectors, &c.; steam feed water and other piping, covering, &c.; water softener. (See this issue.)

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Stoke-on-Trent.—April 12th. Electricity Department. One 22/24-h.p. heavy oil engine for Stallington Hall. (See this issue.)

Uruguay.—Montevideo.—May 6th. State Electricity Works. Electric cables and accessories. (B.X. 5178.)*

Wolverhampton.—May 10th. West Midlands Joint Electricity Authority. One 50,000-kW turbo-alternator with step-up transformers, &c., condensing plant, boiler feed pumps, evaporators, circulating water pumps, &c., main and auxiliary, 33,000-V switchgear with circuit breaker. (See this issue.)
April 5th. Three single-phase, 4,000-kVA transformers. (March 22nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aberdeen.—
Electrical work in connection with the erection of 392 houses at School Road, Aberdeen.—Andrew M'Robb.

Australia.—Melbourne.—State Electricity Commission. Accepted:—
Two 37,500-kV Brown-Boveri transformers for the Richmond terminal sub-station (£19,356).—Gibson Battle (Melb.) Pty., Ltd.
—*Tenders.*

Bedford.—Electricity Committee. Recommended:—
Supply of cable for 12 months.—Siemens Bros. & Co., Ltd.

Croydon.—Electricity Committee. Recommended:—
E.h.p. switchgear (£1,266).—A. Reyrolle & Co.

Glasgow.—Electricity Committee. Recommended:—
Ten a.c. motors (£545).—English Electric Co., Ltd.
Accepted:—Replacement of plant in connection with the change of frequency under the Central Scotland Scheme (Bilsland Bros.). Replacement of 25-cycle plant by 50-cycle plant (£219).—English Electric Co., Ltd.
Switchgear for Langside sub-station (£143).—A. Reyrolle and Co., Ltd.
Tramways Committee. Recommended:—
Trolley wire.—Thomas Bolton & Son, Ltd.
Portable vacuum cleaning plants.—Barr & Co.; Metro-Vick Supplies, Ltd.

Government Contracts.—The following Government contracts were placed during February, 1929:—

Admiralty, Contract and Purchase Department.
Generator boards, &c.—Whipp & Bourne, Ltd.
Brackets, pendants, &c.—Bonnella Bros., Ltd.; Hawkers, Ltd.; W. McGeoch & Co., Ltd.; Player & Mitchell; Gabriel & Co., Ltd.; Revo Electric Co., Ltd.; Veritys, Ltd.
Branch breakers, &c.—Whipp & Bourne, Ltd.
Bridge meggers and resistances.—Evershed & Vignoles, Ltd.
Electric cable.—Anchor Cable Co., Ltd.; British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Edison Swan Cables, Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; India Rubber, Gutta Percha and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; St. Helens Cable and Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.; Liverpool Electric Cable Co., Ltd.
Air compressor.—Reavell & Co., Ltd.
Electric gantry.—Stothert & Pitt, Ltd.
Overhead electric cranes.—Vaughan Crane Co., Ltd.
Electrical installation.—Johnson & Phillips, Ltd.
Engine equipments.—Parsons Oil Engine Co., Ltd.
Ship ventilating fans.—Electro-Dynamic Construction Co., Ltd.; Veritys, Ltd.
Incandescent electric lamps.—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Mica.—Micanite and Insulators, Ltd.; Mica and Micanite Supplies, Ltd.; Dacier, Ltd.
Micanite.—Mica Products, Ltd.; Mica Manufacturing Co., Ltd.
Motor booster set.—Electric Construction Co., Ltd.
Motor convertor set.—English Electric Co., Ltd.
Motor generator sets.—Rotax (Motor Accessories), Ltd.; Veritys, Ltd.
Switches.—A. Reyrolle & Co., Ltd.; W. McGeoch & Co.; Bertram Thomas.
Electric overhead travellers.—J. Adamson & Co.; Cowans, Sheldon & Co., Ltd.

War Office.
Generators.—G. Kent, Ltd.

Air Ministry.
Cable.—Hackbridge Cable Co., Ltd.
Electric motors.—Bull Motors, Ltd.
Valves.—Edison Swan Electric Co., Ltd.

Post Office.
Telegraph apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Creed & Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Ericsson Telephones, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Telephone Manufacturing Co., Ltd.
Testing and protective apparatus.—Automatic Telephone Manufacturing Co., Ltd.; International Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.
Battery stores.—D.P. Battery Co., Ltd.; Ever-Ready Co. (Gt. Britain), Ltd.; Fuller Accumulator Co. (1926), Ltd.; General Electric Co., Ltd.; Pritchett & Gold and E.P.S. Co., Ltd.; Siemens Bros. & Co., Ltd.
Cable bearers.—Bullers, Ltd.
Terminal blocks.—T. De la Rue & Co., Ltd.
Battery boxes.—Ericsson Telephones, Ltd.
Cable.—British Insulated Cables, Ltd.; W. T. Glover and Co., Ltd.; Siemens Bros. & Co., Ltd.
Joint box castings.—General Foundry and Engineering Co., Ltd.; United Steel Companies, Ltd. (T. Butlin & Co.).
Loading coils.—Siemens Bros. & Co., Ltd.
Cords for telephones.—L.P.S. Electrical Co., Ltd.; Reliance Electrical Wire Co.
Electric lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Manchester-Huddersfield: Pirelli-General Cable Works, Ltd. Manchester-Liverpool (No. 5): Standard Telephones & Cables, Ltd.
Telephone Exchange equipment.—Stockport, Park, Western: Siemens Bros. & Co., Ltd. Grosvenor (S.W.): Automatic Telephone Manufacturing Co., Ltd. Aldridge (Walsall Multi-Exchange Area): Ericsson Telephones, Ltd. Sub-contractors: W. Jones & Co., for ringing machines. Birmingham (Midland), Birmingham (Northern), Birmingham (Victoria), Birmingham (Harborne): General Electric Co., Ltd. Sub-contractors: Crompton Parkinson, Ltd., for ringing machines and charging machines. D.P. Battery Co., Ltd., for batteries. Kent Education Committee (Maidstone): Relay Automatic Telephone Co., Ltd.

Crown Agents for the Colonies.
Battery materials.—India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
Electric lamps.—General Electric Co., Ltd.
Insulated fittings.—W. T. Glover & Co., Ltd.
Lightning arrestors.—Siemens Bros. & Co., Ltd.
Sounder sets.—Automatic Telephone Manufacturing Co., Ltd.
Static transformer.—Brush Electrical Engineering Co., Ltd.
Sub-station material.—English Electric Co., Ltd.
Surface condensing plant.—Belliss & Morcom, Ltd.
Telegraph poles.—Bullers, Ltd.
Telephones.—Ericsson Telephones, Ltd.
Train lighting spares.—J. Stone & Co., Ltd.
Turbine feed pump.—G. & J. Weir, Ltd.
Wire.—Whitecross Co., Ltd.

Hornsey.—Electricity Committee. Recommended:—
Troughs and bridges for 12 months.—Doulton & Co., Ltd.
Cables for 12 months.—Standard Telephones and Cables, Ltd., and Pirelli-General Cable Works, Ltd.

Irish Free State.—Dublin.—Department of Local Government and Public Health.
Six months' supply of electric lamps.—Siemens Electric Lamps and Supplies, Ltd.

Leicester.—Sewage Committee. Recommended:—
Three electrically-driven pumps for Belgrave pumping station (£4,097).—Hayward, Tylor & Co., Ltd.

London.—Central Electricity Board.—The Board has placed the following contracts:—
South-East England Scheme—
66-kV and other transformers in the London Area.—Hackbridge Electric Construction Co., Ltd.; British Electric Transformer Co., Ltd.
Central England Scheme—
132-kV transformers.—British Thomson-Houston Co., Ltd.; British Electric Transformer Co., Ltd.
North-West England Scheme—
132-kV transformers.—British Electric Transformer Co., Ltd.; British Thomson-Houston Co., Ltd.; Ferranti, Ltd.
132-kV outdoor switchgear.—Ferguson, Pailin, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
The value of the contracts is approximately £1,500,000.
London County Council.—Education Committee. (Recommended.)
Electric lighting installation for the Bentworth Road School, Hammersmith.—Alpha Manufacturing and Electrical Co., Ltd. (£268).
Wandsworth.—Libraries Committee. Accepted:—
Electric lighting for open access system at libraries: Allfarthing Lane Library (£84), L. J. Godfrey; Putney Library (£135) and Streatham Library (£225), Alpha Manufacturing & Electrical Co., Ltd.

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Macclesfield.—Board of Guardians. Accepted:—
Installing electric light and bells at the casual wards.—Mr. V. Brees.

Portsmouth.—Parks Committee. Accepted:—
Electric light installation at Cemetery Lodge, Milton.—W. J. Lenton.
Electricity Committee. Accepted:—
4,000 yd. of .12 sq. in. twin l.p. cable.—Johnson & Phillips, Ltd. (£1,480). (Accepted.)

Preston.—Electricity Committee.
Supply and erection of 6,600-volt switchgear to control two Preston-Blackpool transmission lines (£5,325).—Metropolitan-Vickers Electrical Co., Ltd. (Recommended.)

South Africa.—Cape Town.—Electricity Committee. Recommended:—
Switchgear in connection with supply to Tiger Oats Co., Ltd. (£1,028).—A. Reyrolle & Co., Ltd.
Twenty-four 1,000-A quick-break knife switches (£310).—Switchgear & Cowans, Ltd.
Motor and starting equipment for the Walmer Brickworks (£285).—S.A. General Electric Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Three double-deck trackless vehicles (£5,908).—Richard Garrett & Sons, Ltd.
Two miles of overhead trolley wire (1s. 1d. per lb.).—Union Cable Co., Ltd.

Spenborough.—Urban Council. Accepted:—
Installing electric light at Council houses.—40 houses (£303), Butler & Horn; 96 houses (£707), Hepworth and England.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Ironclad switchgear (£2,046).—A. Reyrolle & Co., Ltd.

Forthcoming Events.

Institution of Electrical Engineers (Meter and Instrument Section).—Friday, April 5th. Institution, London, W.C. 7 p.m. "Some Technical Considerations concerning Power Factor in Relation to Tariffs." Mr. E. W. Hill.

(London Students' Section).—Tuesday, April 2nd. 2.30 p.m. Visit to the North Metropolitan Electric Power Co.'s supply station, Brimsdown.

(North-Eastern Centre, Students' Section).—Friday, April 5th. Dial House, Northumberland Street, Newcastle-on-Tyne. 7.15 p.m. Annual general meeting.

Television Society.—Tuesday, April 9th. Engineers' Club, Coventry Street, London. W.1. 8 p.m. "Some Notes on Exploring." Mr. J. Cameron Rennie.

Notes.

Improvements in Electricity Meters.

In a recent issue of the *E.T.Z.*, Herr Schachenmeier deals at considerable length with the improvements that have taken place in recent years in the design and construction of electricity meters in Germany. Particularly as regards single-phase meters, marked progress has been made in the reduction of both their size and weight. By using sheet-metal in place of castings, meters of great strength and solidity are now being turned out, while by a better utilisation of the magnetic flux the method of working has been improved and the consumption of current reduced. Various improved methods have been introduced to counterbalance the effects of varying temperatures, some utilising a bi-metallic blade which acts either on a piece of iron which varies the flux across the disk, or directly on the disk itself, while in other cases auxiliary windings with special temperature co-efficients are employed.

Electro-farming in America.

The Governor of Virginia, Mr. Harry F. Byrd, after bringing together representatives of farm organisations, power companies, and State agencies, announced plans for a State-wide farm electrification programme. The principles which have been so successful in this project in Pennsylvania will be carried out, and a special advisory commission has been named, including representatives of farm, power, and State interests, to fix rates, recommend types of machinery, and otherwise obtain the best and cheapest electrical service for the farms.

"Election Houses."

Our local correspondent reports that Alderman H. Kegie, of Gateshead, the prospective Labour candidate, when opening his campaign in the Berwick Division on Saturday, said that if returned to power the Labour Party would cheapen electricity so that the people could have all-electric houses like his own, for which the cost of electricity was 1d. per kWh.

E.P.E.A. Dinner.

The London Local Technical Group of the Electrical Power Engineers' Association held its first social function on March 16th at the New Princes Galleries, Piccadilly. Some 154 members and friends were received by the chairman of the group (Mr. W. J. Jeffery) and Mrs. Jeffery. Dinner was served at separate tables, an arrangement which proved to be very successful, and the function was unique in that there were no speeches; consequently the company had extra time for dancing, which was indulged in until midnight, and members had the pleasure of a private view of the exhibition of water-colour paintings and the miniature portraits with which the walls of the galleries were adorned.

The Batti-Wallahs' Society.

At the annual general meeting the following officers and committee were elected for 1929—President, Mr. H. L. Howard; Vice-President, Mr. H. J. S. Mackay; hon. secretary and treasurer, Mr. M. Whitgift; Committee: Messrs. A. E. Apps, G. M. B. Hilton, H. S. Jacob, W. E. Lang, H. S. May and A. E. Mohring. The following gentlemen have recently been elected Batti-Wallahs; Messrs. E. A. Gatehouse. H. D. Harris. J. W. Porter, E. Stuart Russell, A. A. Campbell Swinton, F.R.S., and Lt.-Col. W. A. Vignoles, D.S.O. The entrance fee for new members has been increased to two guineas.

For the luncheon on April 25th, at which Sir Hugo Hirst, Bt., will deliver an address, tickets (5s. 6d. each) may now be obtained. The large hall at the Hotel Cecil has been engaged, but early application is desirable. The occasion will be used to give a general welcome to Sir Hugo upon his return from Australia.

Therapeutic Light Treatment.

The conclusions of the Medical Research Council on the value of ultra-violet ray treatment, which amounted to a declaration that there was no evidence that it exercised any beneficial effect that could not be obtained by more familiar methods at far less cost (see p. 528, March 22nd issue) has aroused indignation among the manufacturers of apparatus. It is reported that at a meeting held at the London offices of the British Electrical and Allied Manufacturers' Association protests were made against the summary treatment by the report, both of the industry and of the large number of medical practitioners throughout the country who use light-therapy. It was declared that the report simply condemned an industry on the basis of two experiments: one was carried out in 1925 and the other in 1927-28. In neither case was the evidence sufficient or scientifically presented it is claimed.

An Electrically-operated Razor.

An electrically-operated bladeless razor has been invented by a New York firm. It is based on a combination of shearing and nipping by rapid vibration of the inner of two parallel slotted shearing plates. The apparatus, which is only slightly larger than an ordinary safety razor, can be attached to an ordinary lighting socket, no lather is required, and a shave of any desired closeness can be obtained. There being no sharp edges and no moving parts in contact with the skin, cuts and abrasions are impossible.—*Reuter's Trade Service* (New York).

Wages in the Cable-making Industry.

The Joint Industrial Council for the Electrical Cable-Making Industry announces that there will be no cost-of-living variation in wages on the third pay day in April.

Appointments Vacant.

Mains engineer for the Aylesbury Corporation Electricity Department; two second charge engineers for the U.D.C. of Newry Electricity Department; power station superintendent for Stoke-on-Trent Corporation Electricity Department; charge engineer for the Borough of Doncaster Electricity Department; junior technical assistant (£350) for the Air Ministry. (See our advertisement pages to-day.)

Metal Trades Benevolent Society.

The third annual golf competition for the President's Cup, organised by the Royal Metal Trades Pension and Benevolent Society, is to be held at Sundridge Park on May 29th. Particulars can be obtained from the Secretary, 195, Upper Thames Street, E.C.4.

Works Visit.

On Tuesday this week members of the South Midland Students' Section of the Institution of Electrical Engineers paid a visit to the works of the Midland Electric Manufacturing Co., Ltd., Birmingham.

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Public Address Relays.

A political address in the Albert Hall on March 26th was carried to no less than thirteen other towns over an aggregate of more than one thousand miles of special Post Office trunk-lines. This is the latest development in the new system of speech relays and has necessitated the design of special Marconiphones capable of distributing the amplified words evenly over such a considerable area. Great care is necessary to prevent interruption and cross talk, each line being isolated from all exchanges en route, while repeater valve amplifiers at various points ensure adequate volume and clarity. The audiences were as far apart as Southampton, Ramsgate, Norwich, Nottingham and Coventry, and a circle drawn through these outermost towns of the system would embrace no less than twenty thousand square miles.

Constant-frequency Gramophone Records.

The Gramophone Company's electrical experimental department at Hayes has made constant-frequency records specially cut and calibrated so as to produce a series of pure tones ranging over about 8½ octaves on the musical scale. The set consists of 15 double-sided 12-inch records giving 100 different frequencies of 50 seconds' duration each. The waves are sinusoidal in form and, provided that the turntable runs exactly at 78 revolutions per minute, the frequencies are correct to within 1 per cent. of those stated upon the labels, so that they form an excellent source of alternating oscillations over a wide range; the frequencies range from 25.5 to 8,460 cycles. The double amplitudes in inches and the maximum velocities of needle point in a direction perpendicular to the normal line of groove in inches per second have been calibrated, and are printed upon the labels. The records have been cut so as to produce a substantially constant output of a.c. energy at from 250 cycles upwards, whilst below 250 cycles there is a gradual decrease of energy. The exact amount of energy has been calibrated, and is given on the labels in the form of transmission units above, or below, the energy of the 993-cycle note, the transmission unit, or T.U., being a well-known standard of measurement in telephony practice. The records should be useful for experimental laboratories, colleges, and music schools, as well as for gramophone dealers. If used on an ordinary acoustic gramophone they give an accurate response of the output of the machine, and are particularly useful for rapidly and accurately comparing the relative merits of various sound boxes, horns, and machines. If used with an electrical pick-up and valve amplifier they give electrical alternating currents of good wave form and known frequency, and the generated power may easily be measured, so that various pick-ups, amplifiers, loud-speakers, or other telephone and wireless apparatus may be calibrated under normal conditions. For ordinary laboratory and experimental tests the records form a good substitute for an expensive electrical oscillation generator, and will form a reliable means of checking the constancy of speed of gramophone motors and any rapidly rotating apparatus.

Radio Interference.

The Department of Scientific and Industrial Research has issued Radio Research Special Report No. 8 (H.M. Stationery Office, 1s. net) which describes an investigation commenced in 1923 under the direction of the Radio Research Board in response to a request from the Sub-Committee on Technical Wireless Regulations of the Imperial Communications Committee. The Sub-Committee, being engaged in drafting national wireless regulations which might form the basis of proposals for the 1927 meeting of the International Radio Telegraph Convention, asked the Board to consider the utility of certain figures for "equivalent decrement" as a basis for the classification of transmitting stations in respect of their interfering properties, "equivalent decrement" being a quantity defined in Section LXXXII of the Regulations of the Washington Draft Convention of 1920. From experimental measurements at the National Physical Laboratory during 1923-24 it was concluded that "equivalent decrement" was not an adequate criterion of interference in radio communication; experiments made by the Post Office Engineering Department also confirmed this conclusion. During 1926-28 a considerable amount of theoretical and experimental work was carried out at the National Physical Laboratory, but failed to produce a practical and easily applied method of measuring interference. In the meantime, owing to various improvements in the technique of radio communication, the necessity for immediate legislation on the subject had decreased; furthermore, largely as the result of the work carried out in this country and described in the present Report, the International Radio Telegraph Convention held at Washington in 1927 abandoned the use of the quantity "equivalent decrement" and made no alternative suggestion for defining interference. It was decided, therefore, to discontinue this rather unpromising line of research. In view, however, of the probable importance of the problem of interference in connection with the future regulation of radio communication, it was considered desirable to draw up the present Report as a record of the progress made and a statement of the difficulties to be overcome. The distinctive feature of the mutual interference of wireless transmissions and the difficulties which at present lie in the way of its effective control by international regulation is that the source of interference is not the periodic and quasi-stationary element of the transmission, but the non-periodic and transient elements. Periodic phenomena are fairly well understood and a practical technique is ready to hand for their quantitative specification; this is the well mapped field of Fourier's theorem. Interference problems, on the other hand, take one into the relatively unexplored field of Fourier's integral; both theory and technique are comparatively undeveloped, probably because of the less obvious practical significance of those branches of mathematics and electricity, and because of the greater complexity of the theory and the much greater difficulty of the technique involved.

The Oil and Colour Exhibition.

At the second International Oil, Chemical and Colour Trades Exhibition, which was held at the Royal Agricultural Hall, Islington, last week, a few items of electrical interest were to be seen. The advantages of electric driving for the machines used in the trades concerned were apparent, and, as in the more widely-known industries, the built-in-motor feature seemed to have become standardised. It was encouraging to hear manufacturers who cater for all classes of driving say that it paid them now to adopt electric driving as the standard. Two items of particular interest were seen on the stand of Messrs. Thomas Broadbent & Sons, Ltd. One was a 42-in. "Weston" centrifugal machine, embodying novel methods of housing the motor and driving. The motor is a 10-h.p. specially-designed, totally-enclosed vertical machine, housed, of course, on top of the centrifuge without being held rigidly to the frame. Torque-reaction gear in the form of heavy leather belting prevents the stator from revolving. The actual weight of the motor is taken by a conical buffer at the top end of the machine shaft. This method of housing has enabled vibration effects to be neglected, resulting in an acceleration to full load in 80 sec. Complete deceleration to rest is effected in 45 sec. The motor is switched directly on to the line, and has a starting current ten times the running current. The other machine referred to is an electrically-driven hydro-extractor. This employs a specially-designed high-starting-torque motor, directly-coupled and housed under the machine. This motor is also designed for direct switching, and it will, it is claimed, submit to from eight to ten starts per hour without overheating. Paint-mixing machines were featured at the show, and an interesting one was that displayed by Messrs. Joseph Foster and Sons, Ltd., being a four-unit battery, each unit having a capacity of 10 gal. Oil-enclosed gears for the actual mixers are carried overhead and are driven longitudinally through a common shaft by about a 10-h.p. motor. Messrs. Lacy-Hulbert and Co., Ltd., showed an interesting range of electrically-driven air compressors for paint spraying, and so on. The "Boreas Electric Air Blast" shown by this firm is a very neat little machine which should prove useful to the motor-maintenance man for blowing-out operations. A small rotary compressor and the 1-h.p. driving motor are arranged in unit form, complete with the necessary switchgear, hose, and so on. The gross weight of a machine for a.c. supply is 150 lb. Romac Motor Accessories, Ltd., also showed some interesting portable electrically-driven air compressors. A four-cylinder "Romac" compressor driven by a ½-h.p. motor is specially designed for paint spraying. Another "Romac" machine has twin compressors and is equipped with a 1-h.p. motor. Tungstone Accumulator Co., Ltd., showed a 26-cell, 52-V, 7-plate battery with a capacity of 108 Ah. Messrs. L. G. Hawkins & Co., Ltd., featured the "Sprayit Electrically" paint-spraying machines. Alfa-Laval Co., Ltd., showed some interesting electrically-driven clarifiers. A 1-ton per hour De Laval machine is fitted with a separate motor driving through an infinitely variable speed gear.

Electrical Association for Women.

The annual meeting of the South Wales and Monmouthshire branch of the Electrical Association for Women was held at Cardiff on March 19th. Outlining the activities of the branch, Mrs. E. A. Clement said the membership had reached 200.

On March 18th members of the Manchester and Salford District branch paid a visit to the Hyde Road Depôt of the Manchester Corporation Tramway Department.

On March 7th the Birmingham and Midlands branch held a ball at the Grand Hotel, Birmingham, which was a huge success. A party of members of the same branch paid a visit to the Municipal Wash-house, Birmingham, on February 29th, where they saw a large family wash done electrically, including iron and airing, in two hours at a cost of 1s. 3d. On February 21st Mr. J. L. H. Cooper, of the Electric Lamp Manufacturers' Association, gave an enlightening lecture on "Lighting in the Home" to the members of the Birmingham branch. Demonstrations were given in colour lighting.

On March 22nd Mr. R. A. Parsons, A.M.I.E.E., gave a practical demonstration on "Bells and Batteries" before an appreciative audience of the Mid-Gloucestershire branch of the Association.

The last of the E.A.W. evening lectures for the current session was given on March 19th, when Mr. H. Bourne, of the Hendon Electric Supply Co., spoke on "Some Electrical Facts Concerning Electric Motors." The chair was taken by Miss Dorothy Vaughan, and a vote of thanks was proposed by Miss de Buriatte. By arrangement with the Association, Mrs. Hammer gave a lecture before the National Council of Women at Berkhamsted on March 19th, as a result of which members of the N.C.W. at this Centre will pay a visit to the electrical showrooms at Hackney in the near future.

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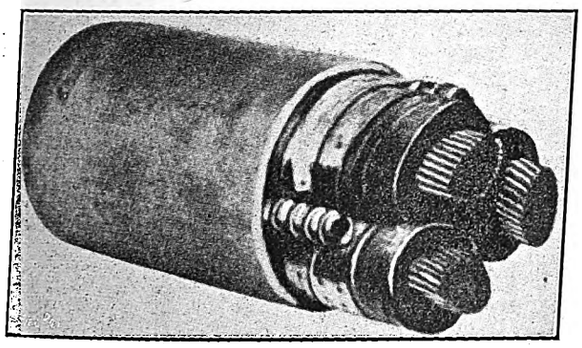
Protein Synthesis.

Dr. Newton Harvey, Princeton Professor of Physiology, addressing the American Institute of Science, New York, predicted that "living light" will be synthesised (*i.e.*, reproduced artificially) in future. After explaining the process by which the firefly provides illumination, he discussed its practical application for future developments. Dr. Harvey, who has made a study of animals endowed with luminescence, said he had found forty groups of the animal kingdom and two groups of plants to be luminous.

A New Oil-filled Cable.

Some interesting particulars are given in an article in a recent issue of the *Electrical World*, by Messrs. G. B. Shanklin and V. A. Sheals, of a new cable of the oil-filled type which has been developed by the General Electric Co. of America and installed in Chicago for operation at 33-kV. The following are the main points of departure from the original oil-filled cable plan. The reels of cable are shipped and installed under oil pressure without draining the oil from the channels; this is made possible by supplying each reel length with a relatively small pressure reservoir. Instead of having the channels in the form of a hollow core inside the conductor, they are placed in the filler spaces, as shown in the accompanying illustration; these channels are consequently at ground potential instead of full-line potential, allowing easy entrance at any point desired for purposes of oil feed, segregation, withdrawal of oil samples, &c. In the case of single-conductor cable the same results are accomplished by placing the channels directly under the lead sheath. With the hollow-core type of cable the points of entrance can be made only by the insertion of "stop joints" of rather complicated design. A type of "semi-stop joint" which is very simple in design and construction is used for connecting the reel lengths of cable in place of the regular joints used in ordinary installations. The purpose of the cork seal or plug placed at each end is twofold: first, during installation it allows work on the joint proper to be done while oil



Three-core Oil-filled 33-kV Cable.

pressure is maintained on the cable, preventing drainage of insulation and entrance of air; secondly, for all practical purposes it segregates each length of cable from adjacent lengths, so that in case one length bursts open in operation, oil is drained only from the defective length without involving other lengths. Each segregated cable length has its own individual reservoir feed. A considerable saving is made by eliminating the reinforced double-lead sheath and using instead a single sheath of the ordinary kind, except that it is made of lead-alloy to obtain greater mechanical strength. As far as can be determined, an alloy sheath should safely withstand a maximum operating oil pressure of at least 15 lb. per square inch. The present installation in Chicago is now adjusted for a maximum pressure of 12 lb. In the cable the three conductors are made up in semi-sector shape, the central part being preformed to a sector shape, around which are stranded 54 wires in three layers, making a total cross-section of 350,000 circ. mils. Each conductor is insulated with 0.280 in. of wood-pulp paper and covered with a 0.75-in. by 0.0005-in. perforated copper tape, put on with an opening between turns not exceeding 0.094 in. The usual centre and side fillers are omitted, and in place of the side fillers copper tubes, 0.4 in. in outside diameter, made up in the form of General Electric BX type conduit, are substituted. These fillers are so made that the oil can flow freely in a lateral direction in or out of them. Thus all the free space between the sheath and conductors is available for oil channels. Over the three conductors and copper fillers is a 1.0-in. by 0.004-in. steel tape put on with a 0.625-in. opening. The lead sheath is applied directly over the steel tape. The sheath is 0.156 in. in thickness and is made of lead alloyed with 2 per cent. tin to give mechanical strength against internal pressure. The cable section which crosses under the Sanitary District Canal, Chicago, is armoured with 48 galvanised-steel wires 0.134 in. in diameter. The lead sheath is first coated with asphalt, then a layer of rubber-filled tape and a second coat of asphalt. The armour wires are put on with a short pitch (approximately 45 deg.) in order to give mechanical support to the lead against the high internal pressures to which it would be subjected in the event of the water in the tunnel shaft being pumped out.

A Big Electric Welding Job.

A pipe-line, 205 miles long, which will carry natural gas from Jal, New Mexico, to El Paso, Texas, in the United States, is now being electrically welded. The pipe is 16 inches in diameter and 27 sets of welding equipment are being used, some mounted on tractors and driven by the tractor engine, and the other mounted on trucks and trailers. The pipe is in 30-foot sections, seven of which are lined up together for welding. One welding crew fixes each section temporarily in position by tack welding, and another completes the job. The tack-welding machines are self-propelled, as the first welding crew is often some distance ahead of the men who complete the operation. The pipe is turned, as the welding progresses, by one man using long-handled tongs. Every seventh joint is an expansion joint, which consists of a short piece of pipe with upset corrugations, adding flexibility to the pipe and also allowing for expansion and contraction when in use. After the 200-foot sections are completed, another crew lines them up with the completed pipe line, using a caterpillar tractor and boom. As the pipe cannot then be turned, the welds are made by the "bell-hole" method, in which the operator moves his own position to weld all sides of the pipe, making the weld on the lower side from an excavation dug beneath for that purpose. By the use of 3/16-in. diameter welding electrodes and a current of approximately 175 to 190 amperes, the greatest welding speed consistent with the highest-quality weld can be obtained. Each operator is able to make approximately 13 welds in ten hours. After the final welding operation is completed, the joints are tested and then treated with a corrosion-resisting compound, after which the pipe is lowered into the channel that has been dug for it.

Fatality.

An inquest was held recently at Gateshead on the body of Wilfred Hughes (16), apprentice moulder, who received a fatal electric shock at Messrs. Clarke, Chapman & Co.'s Victoria Works. Leonard Colman, metal moulder, stated that deceased and he were at work on a gantry above the foundry floor level. Above them was a number of electric travelling cranes, the wiring for which was about 10 ft. above the floor level and was shielded only by asbestos-covered boards, some of which were damaged owing to molten metal having splashed on them. Witness asked the boy to get a "shank," a piece of metal some 10 ft. long, which was standing in a corner beneath an electric crane. The boy hurried away and the next thing witness heard was a shout from one of the workmen. He looked up to see the boy standing rigidly beneath the crane, with the shank gripped to his breast. The crane driver was told to switch off the current, whereupon Hughes collapsed. He was afterwards conveyed to the ambulance station. Arthur Ford, a metal moulder, stated that he thought one end of the shank had touched a "live" wire. The jury returned a formal verdict and urged that more adequate protection be given to the wires.

Manchester Steam Users' Association.

The annual report of the Association, which aims at the prevention of boiler explosions and the attainment of economy in the application of steam, shows that in 1928 the surplus of revenue over expenditure was £1,788, which, being added to the reserve fund, brings the latter to £51,973. The total number of examinations made during the year was 24,501, and no preventable explosion has occurred of any boiler which has been covered by the Association's guarantee and certificate of safety. Since the publication of its last report, the Association has recorded the occurrence, outside its ranks, of 69 explosions in the United Kingdom, which resulted in the killing of thirteen persons and injury to forty-eight others. During the same period reports were received of 61 preliminary inquiries held by the Board of Trade under the Boiler Explosions Acts, 1882 and 1890. There were also eight formal investigations held under the same Acts at which costs amounting to £378 were ordered to be paid by the parties found to be in default. The Association's annual memorandum, which has been issued for the year 1928, contains a consecutive review with illustrations of the various experiments carried out by the Association from time to time to determine weaknesses in boiler construction and material. Hitherto the information thus obtained has been disseminated through separate publications covering a considerable period; the present publication therefore should prove useful as well as interesting.

Company Fined for "Smuggling" Electricity.

An unusual case has just concluded in the Belfort Courts in which the Customs authorities sued an electricity company for 80,000,000 francs (£640,000) for alleged non-payment of import duty on electrical energy obtained from Switzerland. The company resisted the claim, asserting that electrical energy, being imponderable, could not be taxed. The Court decided in favour of the Customs and ordered the unfortunate company to pay to the authorities 40,000,000 fr. (£320,000) as Customs duty, and an additional 40,000,000 fr. as a fine, as well as smaller amounts for costs.—*Reuter* (Belfort).

Scholarships in Science.

The Board of Education will offer in 1930 20 Royal scholarships and 11 free studentships tenable at the Imperial College of Science and Technology, London. These awards are open

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to British subjects of either sex, and there is at present no age limit. The awards will be made on the results of the science scholarships examination which will be held by the Board at various centres, beginning on April 30th, 1930. Applications for entry to the examination must be made on the prescribed form (obtainable from the Board) not later than January 15th, 1930. Candidates may compete in any of the following groups, but in one only:—Engineering, physics, chemistry, biology, and geology. The following scholarships and prizes on the foundation of Sir Joseph Whitworth are offered for competition in 1930 to candidates possessing handicraft experience obtained in a mechanical engineering workshop:—(a) two Whitworth senior scholarships of an annual value of £250 tenable for two years; (b) six Whitworth scholarships of an annual value of £125, which may be increased in special cases, tenable for three years; (c) Whitworth prizes not exceeding 25 in number of the value of £10 to unsuccessful competitors for Whitworth scholarships whose work appears to deserve recognition. The awards will be made on the results of an examination held by the Board in May, 1930. Full details of these scholarships are published in the "Regulations for Whitworth Scholarships, 1928," which may be obtained, price 2d. (by post 2½d.), from H.M. Stationery Office.

New London Tramcar.

The improved electric tramcar of Metropolitan Electric Tramways, Ltd., which was illustrated last week (see p. 505) possesses interesting features. It was built and designed by the Union Construction Co., of Feltham, in conjunction with the engineers of the Underground Railway group, in co-operation with the tramway officials. The car is of *still* lower build, has four motors, special magnetic braking on the rail, and a mechanical attachment to the Ferodo brake shoes on drums (not on the wheels). It is chiefly of all-steel lattice construction and the company is to be congratulated on producing a car 41 ft. by 7 ft. 3 in. double deck, top-covered, vestibule front, to weigh only 16¾ tons with 4-motor control. The height is 14 ft. 10 in., against 15 ft. 6 in., and greater width allows two cross-seats of ample comfort; the extra 4 ft. in length allows roomy staircases. The car has been submitted for approval to the Ministry of Transport and the police. The large platform follows the Continental practice of providing ample space for the short-distance riders; the total seating capacity is 64. The body is carried on a light-weight underframe of steel with pressed-steel solebars and steel body bolsters. The framework of the upper and lower saloons is in one unit, having duralumin gussets, which are employed to reduce noise due to drumming of the body. The exterior panels, including the roof sheets, are of aluminium. There is only one step between the ground and the body floor, representing a total rise of 2 ft. 3½ in., which is six inches lower than the existing standard type of car. The two end lobbies have each an area of 36 sq. ft. The controllers are of a special design adapted to the control of four Metro-Vick 300-volt, 35-h.p., motors and designed to be conveniently operated by the motorman, who sits on a stool. With a view to reducing noise, the brake shoes are lined with Ferodo and have been arranged to operate on a specially designed brake drum, one being fitted to each axle. Braking is effected by magnetic track brakes (operated by the controller) which also apply Ferodo blocks, which are specially protected from the wet, to the brake drums. The drum brake can be operated, if required, by hand independently of the magnetic track brakes, by "Peacock" staffless mechanism. The trucks are of a low-bogie type, the driving wheels being 24 in. in diameter instead of the usual 31¾ in. All axle boxes are equipped with roller bearings. The wheels centres are of cast semi-steel, which has been employed in order to reduce to a minimum the conductivity of noise. The truck frame is carried on the axle boxes by laminated springs. Special attention has been given to the lighting; 40-watt traction lamps at 110 volts are arranged in series of 5; the maximum number of lamps that will be in use at one time when the car is in service is 50. The lamps in the saloons are semi-concealed in the ceilings and a dipping headlight is fitted on each end at the dash, operated by the motorman, so that the beam can be projected on to the track during fog. Each exit step is illuminated by one lamp which automatically comes into operation when the exit door is open. Two trolley poles obviate the necessity for swinging the boom round at the end of each journey; the car is fitted with L.C.C. standard plough gear.

Fires in Coal Heaps.

Some interesting comments on the causes of fires in coal storage heaps were made by Mr. A. J. Hoskin, Purdue University, at the Indiana Fuel Conference last year, according to *Power*. The universally-accepted theory of spontaneous combustion of stored coal is that the coal is heated by its own oxidation. It has been proved that the quantity of heat generated is proportional to the quantity of oxygen involved, regardless of the rate of the reaction. Any fresh bituminous coal exudes a natural gas which is combustible and hence has heat value. This marsh gas is that which causes disastrous explosions in coal mines. Unmined coal is somewhat saturated with this methane, whereas old or weathered coal is practically free from it. The rate of emission is at its maximum when the coal is freshly broken from the seam, and it is higher for the finer grades than for the coarser. This gas, which is part of the so-called volatile combustible in coal, oxidises readily and with the production of heat. Fresh coal heats spontaneously more rapidly than does old coal, and this is attributable to the more rapid emission of this gas by the fresh coal. A mass of coal seldom fires if it survives the early period of storage during which it liberates most of its highly-volatile component. Some operators believe that proper ventilation prevents abnormal heating, while others condemn ventilation as the most potent factor in such heating. Practices in storage based upon these opinions have netted unsatisfactory results. The full-ventilation notion is practically rejected, not because of theoretical error, but because certain limitations in every method that has been tried appear to induce rather than prevent dangerous heating. A medium condition that may be termed restricted ventilation prevails in usual practice. Many kinds of extraneous material find their way into coal during its mining and shipment, or in storage. With the exception of metal scraps these foreign materials have lower ignition temperatures than the coal itself, and therefore ought to be considered as potential kindling. Utmost precaution is required to see that storage coal does not contain bits of wood, paper, blasting fuse, rags, discarded clothing, waste (either dry or oily), charcoal, hay, straw, horse manure, weeds, leaves or twigs from trees, as well as remnants of coal from a former shipment or storage. Each of these types of kindling has been held responsible for coal-heap fires.

The B.E.A.M.A. and Exhibitions.

In the report of the Council of the B.E.A.M.A., issued at the moment of going to press, reference is made to the questions "of exhibitions and exhibition policy." We shall deal with the full report in our next issue, but we extract below the Exhibition paragraphs:—

"During the year an important change was made in procedure under your Exhibition Rule, aimed at general convenience, reduction of expenses and the better carrying out of the Rule. The great majority of electrical exhibitions for the display of electrical heating and cooking apparatus are now promoted by the supply authorities, and a large number of those authorities are members of the Electrical Development Association. That Association has now adopted a form of address to promoters pointing out the need for providing such facilities as will induce the manufacturer to become a willing exhibitor, the main one being that his expenses should be limited to cost of carriage, stall attendance, demonstrators, and reconditioning of exhibits. It is believed that this procedure will win the assent of supply authorities and thereby greatly assist the administration of your Exhibition Rule in so far as heating and cooking displays are concerned. Your Council recently had before them the question as to organising a National Electrical Exhibition in 1931—the year of the Faraday celebrations and other important functions, but decided that the general outlook for trade was not such as to warrant the large outlay necessary. As will be recalled, your Association organised the electrical and allied industries section of the British Empire Exhibition at Wembley in 1924, and it is felt that in view of the large expenditure then incurred (chiefly by members), amounting to over a million sterling, a further period should elapse before your Association again undertakes the organising of a large electrical exhibition. This, however, does not preclude co-operation with the E.D.A. and other organisations in any exhibition covering the applications of electricity rather than a display of generating plant, switchgear, and apparatus."

Institution Notes.

Institution of Electrical Engineers.

Informal Meeting.—At the informal meeting of the Institution on March 18th, Mr. J. F. Shipley was in the chair, when Mr. C. Turnbull opened a discussion on "Method in Invention," and a novel and most interesting treatment of engineering ideas was the result. The predominant note of his opening speech was that one must get rid of the idea that invention comes mainly from inspiration. Mr. Turnbull would have us keep a reference library of ideas, and then endeavour to adapt, or construct, inventions with them. A set of fourteen headings which he called "Operators" suggested the lines upon which ideas might be scheduled, and applied to various problems. The names of some of the headings indicated the ingenuity of the treatment:—(1) the Analytical Operator, (2) the Change of Position Operator, (3) the Addition Operator, (4) the Transference and Analogy Operator, (5) the Converse and Inverse Operator, &c. Mr. D. B. Hoseason explained the organisation and liaisons of a large research department in a modern works; he, too, held the view that much invention was really organised development. Messrs. J. H. C. Brooking, D. A. Christian, W. A. Erlebach, R. L. Grasby, A. N. D. Kerr, G. D. Malcolm, A. Morgan, E. W. Moss, F. Ockenden, A. W. Saulter, W. S. Saville, J. F. Shipley, and H. Wilson also spoke.

Benevolent Fund.—The late Dr. C. S. du Riche Preller, M.I.E.E., of Edinburgh, bequeathed by his will the sum of £100 free of duty to the Benevolent Fund of the Institution.

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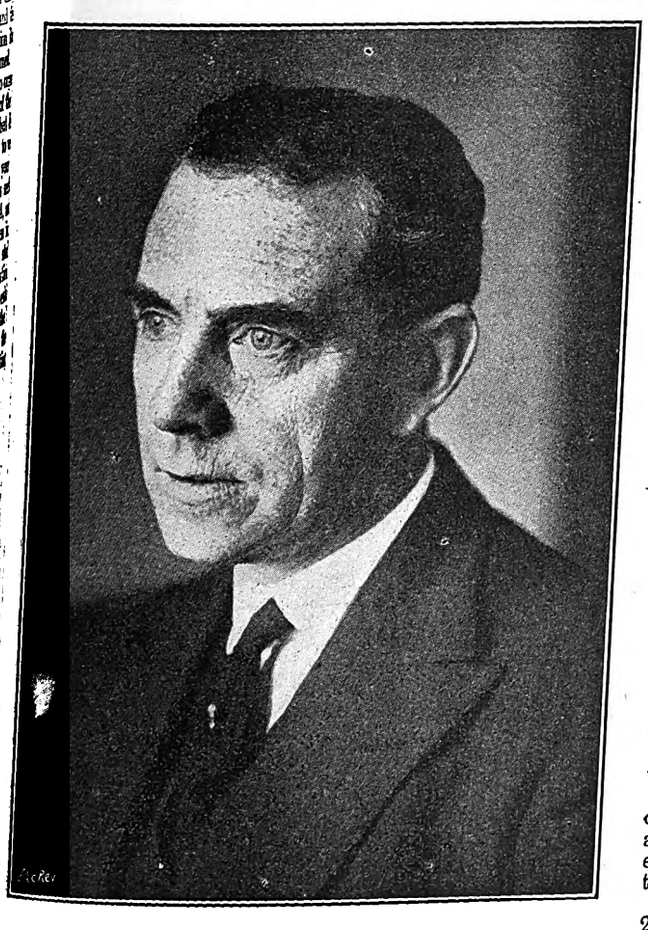
Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

B.E.A.M.A. Council Changes.—At the annual general meeting of the British Electrical and Allied Manufacturers' Association on March 21st, Col. R. K. Morcom, C.B.E., the retiring chairman, presented the report, and made reference to the difficulties of the past year. He announced the result of the ballot electing the following five members to the Council, 1929, to fill the seats vacated under the statutory rule: Brush Electrical Engineering Co., Ltd.; D.P. Battery Co., Ltd.; Electromotors, Ltd.; Ferranti, Ltd.; and Worthington-Simpson, Ltd. At a subsequent Council meeting Mr. Victor Watlington, M.B.E., managing director of the English Electric Co., Ltd., was elected chairman of the Council for the session.

During the past year Mr. H. I. Brackenbury (C. A. Parsons and Co., Ltd.) and Mr. W. O. Smith (Elliott Bros. (London), Ltd.) retired from the Council on account of illness, and their places were filled by Messrs. F. G. H. Bedford and L. W. Smith, respectively. Mr. F. H. Nalder (Nalder Bros. and Thompson, Ltd.) and Mr. A. P. Wood (Lancashire Dynamo and Motor Co., Ltd.) have been in temporary retirement for some months from the same cause, and their places have been taken by Messrs. A. F. Harris and J. G. Shaw, respectively. Mr. A. McKinstry joined the Council in the place of Capt. R. S. Hilton for the Metropolitan-Vickers Electrical Co., Ltd.; and Mr. A. Berkeley (Micanite and Insulators, Ltd.) and Mr. T. C. Pulman (Worthington-Simpson, Ltd.) were co-opted members. Mr. Frank Dudley Docker, C.B., has been appointed a vice-president.

Accompanying these notes we give a photograph of Mr. RICHARD HODDING FOX, solicitor to the Central Electricity Board, who, as mentioned on p. 482 of our issue of March 15th,



Mr. R. H. Fox,
Secretary and Solicitor to the Central Electricity Board.

has been appointed to be Secretary and Solicitor to the Board in place of Sir John Brooke, who has become an Electricity Commissioner.

Mr. ROBERT LEE, electrical engineer at St. Helens, has been recommended for the post of electrical engineer to the Stockport Town Council. Mr. Lee, after being at Stockport for 24 or 25 years, left it last year, when he was deputy engineer, for his post at St. Helens.

The directors of the Gramophone Co., Ltd. ("His Master's Voice") announce the election to the board of Senatore MARCONI and Mr. DAVID SARNOFF, the executive head of the Radio Corporation of America.

Admiral H. W. GRANT has relinquished his position of joint managing director of the Eastern Telegraph Co., Ltd., consequent upon the arrangements under the merger. He retains his seat on the board.

M. ARTH SADZOT has been appointed general director of the Belgian Telegraph and Telephone Department.

The authorities of the Technical High School of Aix-la-Chapelle have awarded the diploma of Honorary Doctor Engineer to Herr HERMANN SINNHUBER of the North German Cable Co. in recognition of his work in connection with electric cable and wireless-telegraphy development.

M. P. L. BOULANGER, director of the French Telegraphs, has been appointed vice-director of the Bureau International de l'Union Télégraphique.

Sir E. WYLDBORE-SMITH has been elected a director of the Metropolitan Railway Co. in place of Sir Harry Verney resigned.

The *Financial Times* says that Mr. LOUIS BEALE, H.M. Trade Commissioner in New Zealand, has been appointed director of the Travel Association of Great Britain and Northern Ireland.

Mr. R. E. JEFFREY has resigned from the staff of the B.B.C. in order to take charge of the Sound Production Department of British International Pictures, Ltd., where he will explore various problems in connection with "talking pictures."

The Walton-on-Thames Urban Council has increased the salary of the electrical engineer, Mr. A. E. ANDERSON, to £600 per annum.

The Bury, Lancs., Town Council has appointed Mr. A. C. FENWICK, engineer and general assistant to the tramway manager at Dundee, as general manager of the Corporation Tramways at a salary of £650 per annum, rising to £750. There were 25 applicants for the post. Mr. Fenwick has been with the Dundee Corporation since 1911.

The Cape Town Electricity Committee has recommended that the City Electrical Engineer be granted three months' vacation leave as from June 7th, and that thereafter he proceed on service overseas for a visit to America and to attend the World Engineering Conference in Tokio, such an arrangement enabling him to resume duty towards the end of the current year.

The Secretary for Mines has appointed the following gentlemen to be members of the Safety in Mines Research Board: Major D. H. CURRER BRIGGS, Mr. G. D. BUDGE, and Mr. THOMAS CAPE, M.P.

Mr. JAMES A. ROBERTSON, M.I.E.E., consulting engineer, has been elected president of the Manchester Association of Engineers.

Mr. A. S. MARKES, A.M.I.E.E., has joined the fittings department of Veritys, Ltd., at King Street, Covent Garden, W.C.2.

Glasgow Corporation Special Committee on Wages and Salaries has approved of the salary of Mr. CHRISTOPHER S. MURRAY being fixed at £340 per annum, on his appointment as principal book-keeper in the electricity department.

Obituary.—DR. L. SELLS.—The death occurred recently, at the age of 52 years, of Dr. Lionel Sells, an X-ray expert. He was admitted to St. Thomas's Hospital suffering from an advanced stage of X-ray carcinomatosis, and death was due to that complaint and loss of blood. The evidence showed that Dr. Sells's death was entirely due to his subjecting himself to the use of X-rays. He knew for years his condition, but persisted in his work as long as he was able. A verdict of "Death from Misadventure" was recorded.

M. PAVIE.—The death recently occurred in Paris of M. Pavie, vice-president of the Compagnie Française Thomson-Houston.

Mr. B. F. TAPSFIELD.—The death has taken place at the age of 42 years of Mr. Bernard Frederick Tapsfield, who was for a number of years on the staff at the Canterbury municipal electricity works. He was previously at the Swansea electricity works for over eight years.

Mr. W. S. ROUSE.—The death is announced at the age of 26 years of Mr. Wilfred Sydney Rouse, who had since 1918 been with the North Metropolitan Electric Power Supply Co. At the time of his death he was assistant electrical engineer to the company at Hoddesdon, Herts.

MR. H. H. GARDAM.—We regret to learn of the death of Mr. Harry H. Gardam, of Messrs. Harry H. Gardam & Co., Ltd., engineers and machinery merchants, of Staines. Mr. Gardam passed away after three days' illness following an operation. We are informed that the business of the company will be continued as usual by his co-directors.

Will.—Mr. R. M. HORNE-PAYNE, founder and chairman of the British Columbia Electric Railway Co., has left £139,125 gross and £116,039 net personalty.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Solaflex Signs, Amalgamated, Ltd.—Registered as a public company March 16th. Capital, £125,000 in 5s. shares (300,000 "A" and 200,000 "B"). Objects:—To adopt agreements (1) with Solaflex, Ltd., (2) with Berry's Electric (1928), Ltd., and H. H. Berry, (3) with the Luna Advertising Co., Ltd., C. Gold, and the Partington Advertising Co., Ltd., (4) with Berry's Electric (1928), Ltd., (5) with Maxwell Hicks and Co., and (6) with Shaw, Loebl & Co.; to develop and turn to account the patents, patent applications and rights, licences and options and stocks relating to daylight signs, and to carry on the business of manufacturers of advertising signs, window displays and the like, electric motors, machinery and plant, electrical installations, &c. The directors are:—W. M. Kirkpatrick, "Terlings," Gilston, Herts., merchant; Sir Maxwell Hicks, C.B.E., 12, Grosvenor Gardens, S.W.1 (chairman of Solaflex, Ltd.): H. H. Berry, M.I.E.E., G2, Albany, Piccadilly, W. (chairman of Berry's Electric (1928), Ltd.); C. Gold, J.P., Stansted, Essex (chairman of Luna Advertising Co., Ltd.). Registered office: 12, Grosvenor Gardens, S.W.1.

British Dominions Power Syndicate, Ltd.—Registered as a private company March 16th. Capital, £50,000 in £1 shares (25,000 "A" and 25,000 "B"). Objects:—To form, promote, and assist companies, syndicates, and partnerships to carry on all or any of the businesses of electrical and general engineers and manufacturers, and maintainers of plant for the generation, accumulation, transmission, and supply of electrical energy for light, heat, power or otherwise, to carry on business as electricians, electrical, hydraulic, mechanical or general engineers and contractors, suppliers of electricity and that of financiers, underwriters, concessionaires, &c. The subscribers (each with one "A" share) are:—E. L. Davies, 1a, Herbert Road, Plumstead Common, S.E.18, clerk; E. J. Burrows, 29, Lyndhurst Road, Highams Park, E.4, clerk. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.

Welding Equipment, Ltd.—Private company. Registered March 18th. Capital, £1,000 in £1 shares. Objects:—To acquire the business now carried on at Yorkshire Street, Salford, as the Welding Equipment Co., and to carry on the business of manufacturers of and wholesale and retail dealers in welding and electrical equipment, &c. The directors are:—G. Davies and H. Davies, both of Chatsworth Road, Ainsdale, Liverpool. Registered office: 20, St. Ann's Square, Manchester.

Park Electric Radio Productions, Ltd.—Private company. Registered March 15th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers and producers of, and dealers in apparatus, instruments, machines and materials of all kinds for use in connection with radiotelegraphy or telephony, &c. The subscribers (each with one share) are:—R. G. Willis, 15, Palace Court, Hampstead, N.W.4, company director; H. R. Ross, 14, Basing Hill, Golders Green, N.W.11, company director. Solicitors: Godden, Holme & Ward, 34, Old Jewry, E.C.

Motor Lamps, Ltd.—Private company. Registered March 16th. Capital, £21,000 in £1 shares. Objects:—To acquire the patents and provisional patents relating to motor lamps and lens belonging to P. Allman and A. W. Pougher, and to carry on the business of manufacturers of, agents for, and dealers in motor lamps, drawn wire, electric cabling, electric lamps, &c. The subscribers (each with one share) are:—P. Allman, 14, West Meade, Chorlton-cum-Hardy, Manchester, technical director; A. W. Pougher, 63, Ayres Road, Old Trafford, Manchester, managing director. Registered office: 17, Balfour House, 119, Finsbury Pavement, E.C.2.

Mavor & Coulson (South Africa), Ltd.—Private company. Registered in Edinburgh on March 19th. Capital, £10,000 in £1 shares. Objects: To carry on the business of engineers and electricians, merchants, agents, dispatch and financial agents, shipowners, warehouse keepers, &c. The directors are:—S. M. Mavor, 47, Redan Street, Mile End, Glasgow, engineer; E. I. Mavor, 47, Redan Street, Mile End, Glasgow, accountant; G. M. Gullick, Richmond Hill, Handsworth, Sheffield, engineer; J. B. Mavor, 79, Oakfield Avenue, Glasgow, engineer; A. W. Davies, The Croft, Carmyle, Glasgow, engineer; W. B. Hird, 86, Talbot Terrace, Scotstownhill, Glasgow, W.3, engineer. Registered office: 47, Redan Street, Mile End, Glasgow.

British Automatic Refrigerators, Ltd.—Registered as a public company March 22nd. Capital, £250,000 in 340,000 10 per cent. participating preferred ordinary shares of 10s. each and 800,000 deferred shares of 2s. each. Objects:—To adopt agreements with the British Automatic Refrigerator Co., Ltd., and others, and to carry on the business of engineers, manufacturers of, and dealers in all articles and appliances for domestic or commercial use, including refrigerators, refrigerating machines, &c. The subscribers (each with one share) are:—E. J. Edwards and S. E. Weber-Brown, 17, Billiter Street, E.C.3, solicitors, and five clerks. Registered office: 82, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

Axuel Time Switches, Ltd.—L. Macandrew, 9, The Avenue, Ealing, W., was appointed receiver and manager on March 11th, 1929, under powers contained in debenture dated March 20th, 1928.

Saunders Electrical Co., Ltd.—R. B. Leech, 23, Warwick Row, Coventry, was appointed receiver and manager on March 9th, 1929, under powers contained in first mortgage dated May 23rd, 1922.

H. Lewis, Ltd.—W. F. Whiting, Bridge Buildings, Nene Quay, Wisbech, ceased to act as receiver and manager on January 31st, 1929.

Gilfillan Bros., Ltd.—C. E. Smedley, Bush Lane House, Bush Lane, E.C.4, ceased to act as receiver or manager on February 16th, 1929.

Belbin & Bowden, Ltd.—A. C. Read, 159, Queen Victoria Street, E.C.4, was appointed receiver and manager on March 8th, 1929, uunder powers contained in debenture dated January 28th, 1929.

Siderman Electrical Supplies, Ltd.—J. Stone, "Legality," Canvey Island, was appointed receiver on February 19th, 1929, under powers contained in debenture dated May 9th, 1927.

English Electric Co., Ltd.—Satisfaction to the extent of £43,600 on October 25th, 1928, of first mortgage debentures secured by trust deed dated September 15th, 1919, securing £1,000,000.

Nefa Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1929. 999 shares taken up. £999 paid. Mortgages and charges, £500.

Shipton Automatic Telephone System, Ltd.—Capital, £100 in £1 shares. Return dated January 11th, 1929. 3 shares taken up. £3 calls unpaid. Mortgages and charges, nil.

Rowlands Electrical Accessories, Ltd.—Capital, £1,000 in £1 shares. Return dated May 25th, 1927 (filed January 25th, 1929). 566 shares taken up. £566 paid. Mortgages and charges, nil.

Credenda Conduits Co., Ltd.—Capital, £50,000 in £1 shares. Return dated November 6th, 1928. All shares taken up. £30,000 paid. £20,000 considered as paid. Mortgages and charges, nil.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated January 13th, 1929. 500 ordinary shares taken up. £500 considered as paid. Mortgages and charges, nil.

Brandes, Ltd.—Capital, £20,000 in £1 shares. Return dated November 14th, 1928. All shares taken up. £10,392 paid. £9,608 considered as paid. Mortgages and charges, nil.

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C. B. King (Magnetos), Ltd.—Particulars filed of £1,100 debentures authorised March 12th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Ernest F. Moy, Ltd.—Capital, £10,000 in 1,500 preference and 8,500 ordinary shares of £1. Return dated October 2nd, 1928. All shares taken up. £10,000 paid. Mortgages and charges, £6,000.

Lancashire Telephone Systems, Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each. Return dated January 4th, 1929. 700 preference and 3,380 ordinary shares taken up. £3.642 10s. paid (being £1 per share on 3,205 ordinary, and 10s. per share on 175 ordinary and 700 preference). Mortgages and charges at date of return, nil. Since registered, £550 debentures (part of a series of £4,000 authorised February 1st, 1929).

International Hydro-Electric Development Syndicate, Ltd.—Capital, £10 000 in £1 shares. Return dated January 2nd, 1929. 2,744 shares taken up. £2,744 paid. Mortgages and charges, nil.

City Notes.

English Electric Co., Ltd.

The annual meeting was held on March 18th, Mr. W. L. Hichens (chairman) presiding. In moving the adoption of the report (*vide* ELEC. REV., March 15th, p. 486), the chairman said that the most striking change during the year was that whereas in 1927 there was a loss of £134,450 and, in addition, provision had to be made for certain exceptional losses, in 1928 there were no exceptional losses to be provided for, and the loss for the year had been reduced to £33.600—a reduction of over £100,000. The trading profit for 1927 had been £66,000 better than in 1926. The improvement therefore had been both substantial and progressive. He did not wish to suggest that the same rate of improvement would be maintained in future years, but there were, he thought, solid grounds for hoping that under normal conditions—that was if prices did not fall below the present low level, and if they were able to secure the same volume of orders as during the past year—they might look forward with confidence to continuing on the up-grade, although progress might be slower. If, however, the electrical industry expanded during the next few years, as many good judges anticipated, and they were able to obtain a fair share of the increased volume of work, then their improvement should be much more rapid. The improvement during the year was not due to an increased output, for the total invoicings for 1928 were lower than in 1927, although the actual orders received were slightly higher. Nor could it be explained by reason of better price levels, for in the heavier classes of electrical plant, with which their business was concerned, prices had fallen during 1928. It was sometimes suggested that prices in the electrical industry were artificially maintained at unreasonable levels, and that the consumer was being fleeced. In actual fact the reverse was the case, and it was the unfortunate electrical manufacturer who was being fleeced, so far as the heavier classes of electrical plant were concerned, whatever might be the case in respect of the lamp business and electrical accessories which were, undoubtedly, more fortunately placed. Speaking generally, there had been a fall during the past year of about 15 per cent. in certain sections of their business, whereas in others the drop had been as great as 30 per cent., and sometimes even 50 per cent.; in some cases prices were below the level of 1914. The value of the British export trade in electrical machinery had increased year by year. In 1928 the actual value was 31 per cent. above the actual figure for 1920, and if prices were equated to the level of 1920 the increase worked out at no less than 190 per cent. In view of the steady fall in the exports of some of the basic industries, it was satisfactory to note this expansion of the electrical industry, since foreign competition was very keen, and the wages paid in this country were higher than those of their Continental rivals. The company had secured an important share of this foreign business. At the last annual meeting he had referred to the large foreign orders that had been secured for them by the Power and Traction Finance Co. The 45,000-kW power station, which was under erection in the neighbourhood of Athens, and for which the English Electric Co. were the sole contractors, was nearing completion and, it was hoped, would be in operation in June this year. Considerable progress had also been made with the 65,000-kW power station which they were constructing in collaboration with Messrs. Ganz at Banhida, in the neighbourhood of Budapest. The Power and Traction Finance Co. had various other schemes under consideration, both abroad and in this country. It was promoting Bills at the present time in connection with two large hydro-electric schemes in Scotland, one in Galloway and the other in the West Highlands. It was to be hoped that those Bills would be as successful as the Lanarkshire Hydro-Electric Bill, promoted by the same company in 1924. It was clear that the improved results of 1928 were due not to better prices or a bigger turnover, but to greater efficiency. Important economies were introduced during the latter part of 1927, the full effects of which were felt in 1928. The overhead expenses of the company could not be cut much lower than at present without impairing efficiency, but there was still much to be done in the way of improving equipment and studying cheaper methods of manufacture and design. Much had been done in these directions during the past year, and it had contributed materially to the improved results. Having referred in detail to the figures in the balance sheet, nearly every item in which showed some improvement, the chairman said he thought that the conclusion was justified that the position of the company had been materially strengthened during the year, and a feeling of confidence in the future was warranted. Sir Charles E. Ellis seconded the motion, which was carried.

Enfield Cable Works, Ltd.

The annual meeting was held on March 20th, the Earl of Verulam (chairman) presiding. In proposing the adoption of the report for the eighteen months ended December 31st, 1928 (*vide* ELEC. REV., March 15th, p. 486) the chairman said that so far as the profit and loss account was concerned, a profit in eighteen months of £162,000 was equivalent to a profit in twelve months of £108,000, as compared with £102,000 to June, 1927, and £116,000 to June, 1926. After reviewing the accounts, he said that their investment in the Enfield Rolling Mills was still one which had not yet paid them a dividend, but the company was to-day earning a profit and proving itself to be a satisfactory investment. Apart from that they had all along had the benefit of sure supplies of copper rod at lowest prices, and this alone had made their Rolling Mill venture very well worth while to them. The Australian subsidiary had had another good year. There was a new item in the balance sheet, investments in other companies at cost, and whilst it was not expedient to specify the nature of the investment further than to say that it represented a holding in a cable company, he might say that the policy referred to in the report, of acquiring certain holdings in allied cable businesses, was resolved upon as following a tendency of the times and as being desirable if the Enfield company was to maintain its relative position in the cable-making world. It was not possible to stand still in a world where everything was in a constant state of flux, and he had no hesitation, therefore, in recommending to them the step which they were proposing to take. The return on their money should be satisfactory, and the benefits they might reap from the investment should be well worth any risk which might be involved. The investment, moreover, might prove to be only a step in the general evolution of business in this country. In consequence of this decision they were in need of a certain amount of new money. Had it not been so it would have been open to them to have issued, say, 50,000 new shares as a bonus free of cost. The alternative plan which they had adopted was to issue 100,000 new shares at £2, and this proposal he had no hesitation in recommending to the shareholders. Sir T. O. Callender seconded the motion, and the report was adopted. An extraordinary meeting followed, at which a resolution was agreed to increasing the capital to £800,000 by the creation of 350,000 new ordinary shares of £1 each. The chairman explained that the directors wanted to issue 100,000 new shares, partly for the purpose of obtaining fresh money and partly for the purpose of giving a bonus to the shareholders. They thought they would take the opportunity of creating 350,000 new shares, putting 250,000 of them aside for the time being.

Telegraph Construction and Maintenance Co., Ltd.

This company's report for 1928 was reviewed in our last issue (p. 533). The annual meeting was held on March 21st, when Lord Selborne (chairman) in the course of his address said that at the last meeting he had stated that the volume of their submarine cable work had been largely affected by the negotiations proceeding between the Government and the wireless and cable companies. Those negotiations had led to the merging of the various interests concerned, but as some time was necessary for the maturing of the plans the company's position had not yet altered materially. It was certain, however, that the cable systems would have to be maintained in full efficiency and that, in turn, meant the laying of loaded cables, which had fully proved their worth. Lower rates and increased use of letter-telegrams would necessitate more fast-working cables. The Western Union Telegraph Co. had realised this; in the autumn they manufactured a cable for that company which in addition to high speed was capable of being duplexed. The cable had been successfully laid between Bay Roberts and the Azores by the c.s. *Dominia*. Research work had now definitely established the fact that a long loaded telegraph cable of the ordinary type of construction could be adapted not only for telephony but for the far higher requirements of facsimile telegraphy. They had developed a method of dealing with their usual gutta-percha insulating material whereby its electrical characteristics rendered it suitable for those purposes. In order to test those advantages the International Standard Electric Corporation had given the company an order for two cables, one to be laid between Tenerife and Gran Canaria, and the other between Algeciras and Ceuta. Facsimile telegraphy was likely to become the most important form of communication in the future. The cable ships had been well employed during the year, and although their submarine-cable manufacturing business had been quiet they were in a satisfactory position owing

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to provisions made in the past for contingencies and to their efficiency of production. Although the transition period had not yet passed, there were welcome signs of a revival in the demand for cables.

New Issue.

Berry's Insulating and Building Products, Ltd.—This company was recently formed with an authorised capital of £175,000 in 5s. ordinary shares to acquire the share capital of Berrite, Ltd., and to manufacture and sell electrical and heat insulating materials, bricks, tiles, &c. The chairman is Mr. A. F. Berry, chairman of the British Electric Transformer Co., Ltd., and Mr. F. E. Berry is also on the board. Last week the company made an issue of 528,000 shares at par; the balance of the shares (together with £55,000 in cash) are allotted to the vendor, Mr. A. F. Berry. The prospectus stated:—"An outlet for the company's products is assured for years to come by the rapid increase in the demand for electrically-equipped houses, especially for the 'Tricity' houses, each equipped with the latest adaptations of electricity to lighting, heating and cooking appliances, providing also cold storage, and each calling for upwards of 20,000 bricks and tiles in building, as well as other of the company's products. The Elthorne Works are in close proximity to the well laid-out Elthorne Heights Estate, which comprises over 800 freehold building sites, and is being rapidly developed, a large proportion of the houses being now built with up-to-date labour-saving devices. Some 300 houses have been built and sold on this estate during the last few years, and the demand is at present such that these 'Tricity' houses are being sold as soon as built."

Folkestone Electricity Supply Co., Ltd.

The annual meeting was held on February 22nd. In presenting the report and accounts (*vide* our last issue,, p. 533), the chairman (Ald. G. Spurgen, J.P.) referred to the issue of 35,000 new ordinary shares and 2,500 co-partnership shares made during the year. Their capital expenditure increased year by year, showing that the company was progressing, and this was confirmed by the growing maximum demand and output. After reviewing the accounts, the chairman said that the depreciation fund was being steadily built up to a figure commensurate to the, at present unknown, claims that might be made upon it. The employés' superannuation scheme was now in being, and they hoped in course of time to make the fund solvent for all their employés, no matter what their length of service was. The board had lodged an appeal against the re-assessment of their properties which showed an increase of some 350 per cent., as compared with a general increase of about 20 per cent. With regard to the future, it appeared that there was nothing to interfere with the steady progress of the company.

City of London Electric Lighting Co., Ltd.

Presiding at the annual meeting on March 20th, Mr. J. B. Braithwaite (chairman) said that under the London Electricity (No. 1) Act, 1925, the Electricity Commissioners had fixed the company's standard prices to private consumers at 3.069d. per kWh, and for street lighting at 0.794d. per kWh. The consumers' benefit during the three years which had elapsed since the passing of the Act had amounted to nearly £600,000. The output showed an increase of 8,400,000 kWh, as compared with an increase of 5,000,000 kWh in the preceding year. In 1921 the average price charged was 4.37d. per kWh, and this had been gradually reduced to 2.23d. in 1929—a reduction of 49 per cent. The gross revenue from private consumers was reduced by £7,417, in spite of the increased output, but this was due to reductions made in the electricity tariffs. The connections had increased by 4,768 kW to about 10,000 kW. The company's Bankside power station had been chosen by the Central Electricity Board as one of the "selected" stations. The report and accounts were adopted.

Newcastle and District Electric Lighting Co., Ltd.

The annual meeting of this company, whose accounts for 1928 were reviewed in our last issue (p. 533), was held on March 22nd. The chairman (Col. F. R. Simpson) said that the sales of energy had increased by 8 per cent. during the year, which was satisfactory in view of the fine summer and mild autumn. The proceeds of the issue of 150,000 £1 shares made during the year were to be devoted to redeeming the 6½ per cent. third mortgage debentures, repaying temporary loans, and to the development of the company's business. The directors had reduced the charge for electricity for domestic purposes, and this and the forthcoming North-East Coast Exhibition should lead to increased consumption. The chairman regretted that the company would derive no relief from the new Rating Act; the amount paid in rates last year was £10,000. Over £36,000 had been spent on capital account, of which £22,000 was represented by mains.

Para Electric Railways and Lighting Co., Ltd.

The net revenue and interest received for the past year amounted to £71,192, against £69,832 in 1927. After deducting debenture interest, &c., and London expenses, there is a credit balance of £28,804 (against £27,662). To this is added £5,698 brought forward, making £34,502. The usual charges are met and the balance of the preference dividend is paid, leaving £5,001 to be carried forward.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Acme Radio Valve Co., Ltd.
B. Barnett (Electrical Engineers), Leyton, Ltd.
Burke Electrical Manufacturing Co., Ltd.
Chase Electrical Manufacturing Co., Ltd.
Codd Arc Lamp Co., Ltd.
Electric Distributing Co., Ltd.
International Radio Manufacturers, Ltd.
Johnson Radio Co., Ltd.
Lang Squire Wireless Manufacturing Co., Ltd.
Little-Carden Power Units, Ltd.
Northern Wireless Schools, Ltd.
Premier Electrical Supplies, Ltd.
Yera Electrical, Ltd.

Official Notice *re* Company.

The name of the undermentioned company will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Forward Electric Co., Ltd.

County of Durham Electrical Power Distribution Co., Ltd.

The report for the year ended December 31st, 1928, shows a profit of £59,299, against which interest has been charged on debenture stock, loans, &c., amounting to £26,862, leaving a balance of £32,437. Adding the balance of £886 brought forward from 1927 there is a total available profit of £33,323, which the directors recommend should be appropriated in payment of a dividend of 6 per cent. on the ordinary shares, which will absorb £32,100, and in carrying forward £1,223. The additional capital expenditure has amounted to £69,507. The accounts show that the company's holding of 45,910 shares of £10 each in the County of Durham Electric Power Supply Co. is valued at £367,395, and the revenue received from that company was £30,989.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Ever-Ready Co. (Great Britain).—296,000 ordinary shares of 5s. each, fully paid, Nos. 1,680,001 to 1,976,000.

International Telephone and Telegraph Corporation.—243,200 shares of capital stock of $100 each.

North Metropolitan Electric Power Supply.—325,000 ordinary shares of £1 each, fully paid, Nos. 1,275,001 to 1,600,000.

Northampton Electric Light and Power.—100,010 ordinary shares of £1 each, fully paid, Nos. 522,491 to 622,500.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The directors' report for 1928 shows a net profit of £28,470, as compared with £28,348 in 1927. To this is added a net amount of £15,044 brought forward, making £43,514. The dividend on the ordinary shares is again 8 per cent. (2½ per cent. having been paid in August last), and £17,914 is carried forward. The output of the power stations in operation during the year was satisfactory. The Newport station has now been handed over to the Newcastle-upon-Tyne Electric Supply Co., Ltd., under the terms of the agreement with that company. The Tees Bridge station has been dismantled owing to the permanent closing down of the furnaces from which the waste heat was obtained.

Foundation Co., Ltd.

An extraordinary meeting was to be held this week to consider resolutions providing for the cancelling of the participating rights of the 8 per cent. cumulative preference shares; and raising the capital to £500,000 by the creation of 150,000 additional 8 per cent. cumulative preference shares. As compensation for the loss of their participating rights the holders of the old and new preference shares are to receive one ordinary share for each five preference held. The ordinary shareholders were to be asked to surrender sufficient shares to enable the arrangement to be carried out.

Radio Corporation of America.

The total gross income from all sources rose from $65,418,620 in 1927 to $101,851,603 last year, and the net income from $11,799,650 to $23,661,989. The amount carried to surplus after meeting all charges was $19,834,798, as compared with $8,478,319 in 1927, when $750,000 was put to reserve. The report states that for the first time the communications business earned sufficient to meet the preferred stock dividends. The Corporation has already entered the gramophone business, and proposes to participate in the domestic telephone field.

Atlas Light and Power Co., Ltd.

From the proceeds of the sale of the company's Argentine properties it is proposed to redeem the whole of the outstanding debenture stock amounting to £2,567,600. The stock will be repaid at 105 per cent., plus accrued interest, on May 1st. The holders will be given the option of exchanging their stock

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for new 5 per cent. debenture stock. This will be offered on the following terms: £111 of new stock for each £100 of the old; or £100 of new stock and a cash payment of £10 5s. for each £100 of old stock.

Ericsson Telephones, Ltd.

The directors report a profit of £31,011 for the year ended December 31st, 1928, as compared with £27,004 in 1927. The profit was arrived at after writing down the value of stocks and expending £15,605 on the maintenance of plant and buildings. An ordinary dividend of 5 per cent. is recommended, as for 1927, the reserve again receives £5,000, and £18,235 is carried forward. The report states that trading conditions improved slightly, although prices continued to be very competitive. Meeting: April 3rd.

Einstein's Electro-Chemical Process, Ltd.

At the statutory meeting on March 20th the chairman (Col. the Master of Sempill) referred to the "ill-informed criticisms" of the company and maintained that in the Einstein process the company had a valuable commercial proposition. An announcement was issued after the meeting that as the company had ample cash resources for its immediate needs the final call of 5s. on the preference shares would be postponed for the present.

Greengate & Irwell Rubber Co., Ltd.

The net profit for the past year amounted to £87,607 (as compared with £91,632). The addition of income from investments and £24,379 brought forward makes available £117,506. It is proposed to pay a final ordinary dividend of 1s. 6d. per share, making 2s. 6d. for the year (against 2s. 3d. for 1927); £20,000 is again placed to reserve and £22,506 remains to be carried forward.

Scottish Tube Co., Ltd.

To a credit balance of £1,523 for 1928 there is added £20,819 brought forward, making £22,342. After meeting debenture interest, &c., and transferring £15,000 from reserve, the 5 per cent. preference dividend is paid and £6,530 is carried forward. The directors state that the results do not justify the payment of an ordinary dividend.

J. Stone & Co., Ltd.

The past year's profit amounted to £243,459 (against £234,555 in 1927), and a balance of £128,388 brought forward is added, making £371,847. The reserve again receives £50,000, and the ordinary dividend is raised from 15 to 20 per cent., leaving £162,767 to be carried forward.

Bogota Telephone Co., Ltd.

The directors announce that in view of the reconstruction programme at present in hand, and of the non-settlement of the tariff question with the Bogotà municipality, they have decided to defer consideration of the payment of a dividend until the accounts of the current year's working are available.

Associated Telephone and Telegraph Co.

The following quarterly dividends have been declared:—First preferred stock, $1.75 per share; Classes "A" and "D" stock, $1 per share; Class "C" stock, $0.75 per share.

Ward & Goldstone, Ltd.

Our reference in our issue of March 22nd to this company's dividend should have read: Interim dividend of 3½ per cent., namely, at the rate of 7 per cent. per annum.

Direct Spanish Telegraph Co., Ltd.

The dividend for 1928 on the ordinary shares is again 10 per cent., free of tax. An interim distribution of 4 per cent. was made in October last.

Montreal Light, Heat and Power Consolidated.

A dividend of 60 cents per share has been declared on the common shares for the quarter ending March 31st.

Montreal Tramways Co.

The gross receipts for 1928 amounted to $14,938,678 and the net receipts to $3,435,363.

German Companies.

The *German Atlantic Telegraph Co.* recommends the payment of a dividend of 7 per cent., as for 1927. The traffic is reported to have increased further, especially on the line between Emden, the Azores and New York. The question of the laying of a further cable between Emden and the Azores is under consideration.

The *Voigt and Haeffner Co.*, Frankfort-on-Main, after setting aside 780,000 marks for depreciation in 1928 as against 550,000 marks in the previous year, reports net profits and balance forward amounting to 809,000 marks as compared with 730,000 marks in 1927. It is proposed to pay a dividend of 9 per cent., against 8 per cent. for 1927.

Rangoon Electric Tramways and Supply Co., Ltd.

A final ordinary dividend of 1 rupee 4 annas has been declared, free of Indian income tax, making 1 rupee 12 annas for the year, as in 1926-27.

Stocks and Shares.

MONDAY EVENING.

THE Stock Exchange does not expect to be busy in the week before Easter, and in this present year various reasons conspire to deepen the quietude which prevails in Throgmorton Street. The position as regards the money market is anything but happy. Loan rates in America have risen into two figures, and there is still a lurking fear lest the Bank of England may have to increase its minimum of 5½ per cent. People seem to think that the General Election will take place on May 30th, although rumours of a postponement have been current.

Cable Boomlet.

An outstandingly pleasant feature in our lists this week is shown by the Eastern Cable group, very considerable rises having occurred on the expectation that the details are to be made known directly after Easter in respect of the new stocks that the three companies—the Eastern, Eastern Extension and Western—will be given in exchange for the present securities. Eastern ordinary gained 10 points. The others in the quartette are 15s. to £1 higher. The amount of stock that was purchased could not be described as substantial, although its effect proved to be so material. Marconis went 1/16 better, to 4⅛, on the same assumption, and Marconi Marines at 3¼ are also harder, allowing for deduction of the dividend. Canadian Marconis lost 3s. 9d. at 35s. Reverting to the cable issues, Great Northerns at 32½ have regained their last week's loss. The Direct Spanish Telegraph has declared 10 per cent. dividend on its preference shares, less tax, and on its ordinary shares, free of tax. The former stand at 7½, and the latter at 103¾. Both are £5 shares.

New York's Telephones.

The New York Telephone Company, in its report, says that additional funds needed were borrowed from the American Telephone and Telegraph Company, and refers to the inauguration of a Transatlantic service by the latter company and the British Post Office in 1927. The New York Telephone Company remarks that it is now possible for customers to communicate with 85 per cent. of the telephones in the entire world. The average number of daily calls handled during 1928 was 11,393,000, an increase of three-quarters of a million. The dividend on the common stock for last year is 8 per cent. The company's 4½ per cent. bonds are quoted in London at 99. International Telephone and Telegraph stock is 24 points better on the week, at 249. American Telephone and Telegraph at 219 is somewhat reactionary, having been up to 223.

Electricity Supply.

Rumours have been current to the effect that the British Shareholders Trust, Limited, is preparing a new issue of shares from the Midland Counties Electric Company, and at the time of writing, details are awaited with considerable interest, the company being one around which lively public attention revolves. The price of the shares is 6d. better at 28s. Midland Electric Power lost 3s. 9d., at 36s. 3d., as a sequel to disappointment with the dividend of 8 per cent.. The effect of the spring dividend declarations has been almost negligible in the London group of companies. The County of London announcement, making 10 per cent. for the year, was regarded in the market as being satisfactory, and a mild decline in the price was soon recovered. It was asked, by some, whether holders had expected a bonus issue of shares, and no doubt something of this sort has been in mind for some time past. The dividend itself, 2½ per cent. better than that of 1927, is supplemented by an appropriation in respect of the company's extra-London interests, and the same announcement is made in regard to the South Metropolitan Electric Light and Power, where the dividend of 5½ per cent. makes 8½ per cent. for the year.

At the meeting of the City of London Electric Lighting Company, the Chairman (Mr. J. B. Braithwaite) showed that the company already had an increase of over 6 million units as compared with the corresponding period of last year. On this announcement, City "Lights" ordinary and preference regained the dividend deductions that had been made.

The Clyde Valley Electrical Power Company announces a profit of £304,300 for 1928, being about £16,000 better than that of the previous year. The dividend on the ordinary shares is maintained at 8 per cent., and the price of the shares rose 1s. to 41s. Electric Supply Corporation ordinary eased off to 55s. Yorkshire Electrics lost 1s., at 34s., people selling these, apparently in order to take up the new shares.

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G.E.C.

The General Electric affair continues to attract attention, although the excitement and the heat engendered by the company's previous action have given way to a calmer feeling now that the company has consented to negotiate with the American interests. The price of the shares has gone back to £3, which shows a fall of 5s. on the week. American Utilities have been flat by reason of the monetary situation in New York, which led to free selling on the other side. London is not an eager buyer of dollar stocks at present, the consequence being that a few of the principal issues are down on the week. Power Corporation of Canada at 105 are 10 points lower. Shawinigan common shares shed 6 points, being lowered to 81½. British Columbia Power "A" show a fall of 2, at 51, and the "B" drooped to 31. Mexico Tramways gave way to 47½. The 5 per cent. bonds are down 6 to 71½. Mexican Light and Power issues keep tolerably firm. Sidros at 15¾ are easier. Brazilian Tractions lost 6, at 61, and the preferred fell to 210. Montreal Light and Power at 107 is 3 lower.

Associated Electrical.

Prices of shares in the manufacturing division are slightly better. British Aluminium ordinary strengthened to 47s. 6d. on the issue of the report for 1928, the profit of £441,383 being £9,200 up. The dividend of 10 per cent. is maintained, and the carry-forward increased to £33,843. Callenders improved to 4⅜. India-rubber shares rose ⅛ to 13s. 9d. English Electrics gave way to 7s. 6d. Further contracts for work, approximately £1,500,000, have been placed by the Central Electricity Board in connection with three of its schemes. The most active shares in the manufacturing section are those of the Associated Electrical Industries, Ltd. A week ago the price was 33s. Since then, it has been run up to 38s. on urgent American buying. Out of the company's authorised ordinary capital of £5,025,000, in shares of £1 each, £3,498,000 has been issued. There are also 616,525 8 per cent. cumulative preference shares of £2 each in issue, out of an authorised 685,000 shares. The company holds a controlling interest in Metropolitan-Vickers, British Thomson-Houston, Edison Swan and Ferguson Pailin.

Para Electric.

The report of the Para Electric Railways and Lighting Company exhibits a moderate increase in net revenue at £71,200. The company is paying 3 per cent., making the full 6 per cent. for the year, on its preference shares. A month ago, the ordinary stood at 4s., and the preference at 17s. The current prices are 6s. 6d. and 20s., respectively, both lower than the figures of a week ago.

Home Rails and Traction.

Without much business afoot in the Home Railway market, prices keep firm, and Underground Incomes show a gain of 2. The shares strengthened to 25s. before easing off to 23s. 6d., which is ex dividend. Districts are better at 76½. Metropolitan Surplus Lands bonds dropped to 76. A fall of 75 points in British Electric Traction deferred stock would look more spectacular were it not for the pyrotechnical rises that the price enjoyed, week after week, in the earlier part of this year. London United Tramway's preference continue at 8s. Metropolitan Tramways ordinary last changed hands, ten days ago, at 5s. 6d.

Stocks and Shares on Offer.

A couple of thousand Charing Cross Electric 4½ per cent. preference can be bought at 18s., to pay 5 per cent. on the money, and in their class they are practically gilt-edged. General Electric 7½ per cent. "B" preference are available to the extent of two or three thousand shares at 26s. 9d., these yielding £5 12s. 3d. per cent. Dividends are due at the end of June and December. Good cover exists for 500 Isle of Thanet Electric Supply 6 per cent. preference, which stand at 26s. 6d., and yield 4½ per cent. on the money. The attraction here is that the shares rank equally for dividend with the ordinary after the latter receive 6 per cent. For 1928, the ordinary shares were paid 4 per cent., and expectation looks to the preference becoming entitled to participation rights within the next few years. Scottish Power 6 per cent. preference can be bought at 22s. 9d., to pay £5 5s. 6d. per cent. on the money.

Miscellaneous.

Ever-Ready shares have rallied to 22s. 3d. Kolster-Brandes at 13s. 9d. show ⅛ decline. Burndept Wireless have been changing hands around 5s. 6d. The iron and steel group has hardly budged; Vickers are still dullish at 11s. 7½d. Rubber shares weakened on account of another shrinkage in the price of the produce. Business in them has dwindled once again to a minimum.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 25 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	14†	15	65.9	−1/16	... ...
Brompton Ordinary	1	8⅜	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8 1/7	8 1/7	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 8
City of London	1	10	10	32/-xd	+9d.	4 7 6
do. do. 6% Pref.... ...	1	6	6	23/-xd	+6d.	5 4 4
Clyde Valley	1	8	8	41/	+1/-	3 18 1
County of London	1	7 1/7	7½	53/-	—	2 16 7
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	+6d.	5 12 0
Elec. Supply Corporation	1	11	11	55/-	−1/16	4 0 0
Kensington Ordinary	1	8	8	26/6xd	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/-xd	—	5 3 8
Metropolitan	1	8	9	2⅛	—	4 4 8
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	28/-	+6d.	4 12 10
Mid. Elec. Power	1	—	15	36/3	−3/16	4 2 9
Newcastle on-Tyne Ordinary ...	1	5	6	1¼	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/-xd	−9d.	5 3 3
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	44/6	—	... ...
Westminster Ordinary	1	8⅝	8⅝	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6xd	−9d.	6 7 8
Yorkshire Elec.	1	8	8	34/-	−1/-	4 14 2

†4% of which was tax free.

Home Rails.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 25 1929.	Rise or fall	Yield p.c.
Central London Ord. Assented	...	Stock	4	4	72	—	5 11 1
Metropolitan	...	,,	3	3	60	—	5 16 8
do. District	...	,,	8½	4	76½	+½	6 10 9
Underground Electric ...	...	£1	1½	5	23/6xd	—	5 19 2
do. do. Income	...	Bonds	6	6	113	+2	5 6 1

Telegraphs and Telephones.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 25 1929.	Rise or fall	Yield p.c.
Anglo-Am. Tel. Pref. ...	...	Stock	6	6	103	—	5 16 6
do. Def.	...	,,	1½	1½	24	—	6 3 9
Automatic Telephone ...	...	1	10	10	2 3/16	+1/16	5 14 2
Eastern Extension	...	10	10	10	27	+¼	*3 14 1
Eastern Tel. Ord.	...	Stock	10	10	270	+10	*3 14 1
Globe Tel. and T. Ord. ...	...	10	10	10	26½xd	+¾	*3 15 3
do. do. Pref. ...	...	10	6	6	11½	—	5 9 0
Great Northern Tel. ...	...	10	20	20	32½	+½	... ...
Indo-European	...	25	10	10	55½	—	*4 10 0
Marconi	...	10/-	5	*10	4⅛	+1/16	... ...
Marconi-Marine	...	1	8¾	12½	3¼xd	+⅛	4 12 4
Oriental Telephone Ord. ...	...	1	12	12	3	—	... ...
Western Telegraph	...	10	10	10	26¾xd	+1	3 14 8

*Interim.

Home and Foreign Trams, &c.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 25 1929.	Rise or fall	Yield p.c.
Anglo-Arg. Trams First Pref.	...	5	5½	5½	3 11/16	−⅛	7 9 3
do. do. 2nd Pref.	...	5	6	6	3 15/16	−1/16	7 12 4
do. do. 5% Deb.	...	Stock	5	5	72½	−1½	6 18 0
British Electric Traction Def. Ord.		,,	—	—	850	−75	... ...
do. do. Pref. Ord.		,,	8	8	128	—	6 5 0
Brazil Traction	...	100	6	7	61	−6	3 5 6
Brit. Columbia Elec. Rly. Pce.	...	Stock	5	5	95½	−1	5 1 7
London & Sub. Trac. 5% Pref.	...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb.	...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds ...	...	—	5	5	71½	−6	6 19 10
Mexican Light Common ...	...	100	Nil	Nil	80	—	... ...
do. 7% Pref.	...	100	Nil	7	76½	+1	9 3 0
do. 1st Bonds ...	...	—	5	5	79	—	6 6 7
Yorkshire (West Riding) ...	...	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		Nom. £	Dividend. 1926.	Dividend. 1927.	Price March 25 1929.	Rise or fall	Yield p.c.
Assoc. Elec. Ord.	...	1	—	—	33/-	—	... ...
Babcox & Wilcox	...	1	13	15	3 7/16	—	*4 7 3
British Aluminium Ord. ...	...	1	10	10	47/6	+1/16	*4 4 2
British Elec. Transformer Pref. ...		1	7	7	15/-	—	9 6 8
British Insulated Ord. ...	...	1	15	15	4 11/16	—	3 3 3
Brush Ord.	...	1	10	10	27/6	—	7 5 6
Callenders	...	1	15	15	4⅜	+1/16	3 9 0
do. 6½% Pref.	...	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.		5/-	—	—	1	—	... ...
do. 8% Pref.	...	1	—	8	25/-xd	—	6 8 0
Edison-Swan 1st Pref.	...	1	7½	7½	27/9	—	7 1 2
do. 5% Deb.	...	Stock	5	5	86½	—	5 15 7
Electric Construction	...	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	...	1	20	20	5xd	−¼	4 0 0
English Electric	...	1	Nil	Nil	7/6	−9d.	... ...
do. do. Pref.	...	1	8	Nil	9/6	—	... ...
Gen. Elec. Pref.	...	1	6½	6¼	24/6	—	5 6 1
do. Ord.	...	1	7½	10	3	−7/6	6 8 8
Henley...	...	1	25	25	6	—	4 1 8
do. 4½% Pref.	...	5	4½	4½	4¼	—	5 6 0
India-Rubber	...	1	Nil	Nil	13/9	+⅛	... ...
Johnson & Phillips	...	1	12½	10	1 11/16	—	5 8 1
Siemens Ord.	...	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction		12	10	10	25½	—	*4 14 3

* Dividends paid free of Income Tax.

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Belgium's Foreign Electrical Trade.

Statistics for 1927 and 1928 Compared.

THE Belgian Government now publishes monthly statistics of the country's foreign trade in considerable detail, and with the publication of the December issue it is possible to survey the import and export trade in electrical machinery and apparatus during the past two years. Belgium's balance of trade in dynamo-electric machinery has changed. Whereas between 1926 and 1927 there was a decrease in imports and an increase in exports, the latter being the greater, the tendency last year altered, with the result that imports were the greater. The exports of telegraph and telephone apparatus are still increasing and the imports are comparatively small. There is a large quantity of unspecified electrical apparatus purchased abroad. Below are given the weights of electrical goods imported and exported in 1927 and 1928, with notes of increases or decreases :—

Imports.

	1927. Thous. kg.	1928. Thous. kg.	Inc. or dec. Thous. kg.
Dynamo-electric machines—			
Total	2,595	3,773	+1,178
From France	832	1,100	+ 268
,, Germany	655	1,059	+ 404
,, Sweden	221	524	+ 303
,, United States	116	64	− 52
,, Switzerland	318	432	+ 114
Dry batteries—			
Total	198	240	+ 42
From France	26	11	− 15
,, Denmark	93	134	+ 41
,, Germany	57	68	+ 11
Accumulators and plates—			
Total	213	320	+ 107
From United States	53	192	+ 139
,, Great Britain	17	—	− 17
,, France	28	59	+ 31
,, Germany	21	31	+ 10
Cables, submarine and underground—			
Total	491	536	+ 45
From Germany	393	136	− 257
,, Holland	46	354	+ 308
Insulated wire and cable, other—			
Total	435	552	+ 117
From Germany	303	347	+ 44
,, France	43	86	+ 43
,, Holland	33	23	− 10
Carbons for electrical purposes—			
Total	346	434	+ 88
From Germany	116	110	− 6
,, United States	148	237	+ 89
Insulators of porcelain, glass, &c.—			
Total	472	1,065	+ 593
From Germany	108	162	+ 54
,, France	324	837	+ 513
Insulating tubes, not metal covered—			
Total	13	36	+ 23
From Germany	7	31	+ 24
Insulating tubes, other, with junction boxes, &c.—			
Total	139	349	+ 210
From Germany	123	312	+ 189
Metal-filament lamps—			
Gas-filled (mainly from Holland)	37	65	+ 28
Vacuum, total	65	332	+ 267
From Germany	12	139	+ 127
,, Hungary	10	21	+ 11
,, Holland	36	150	+ 114
Wireless valves—			
Total (mainly from Holland)	5	16	+ 11
Measuring instruments and parts—			
Total	226	255	+ 29
From Germany	78	96	+ 18
,, France	39	46	+ 7
,, Switzerland	85	99	+ 14
Telegraph and telephone apparatus—			
Total	138	205	+ 67
From Germany	29	64	+ 35
,, France	49	58	+ 9
,, Great Britain	25	38	+ 13
Electrical and electro-technical apparatus and parts not elsewhere specified—			
Total	1,871	2,816	+ 945
From France	588	1,014	+ 426
,, Germany	662	908	+ 246
,, United States	158	228	+ 70
,, Holland	150	143	− 7
,, Great Britain	70	122	+ 52
,, Sweden	68	168	+ 100
,, Switzerland	140	210	+ 70

Exports.

	1927. Thous. kg.	1928. Thous. kg.	Inc. or dec. Thous. kg.
Dynamo-electric machines—			
Total	3,064	2,600	− 464
To Belgian Congo	550	288	− 262
,, Argentina	139	132	− 7
,, Brazil	159	153	− 6
,, Great Britain	549	615	+ 66
,, Holland	213	565	+ 352
Dry batteries—			
Total	88	183	+ 95
To Holland	50	98	+ 48
,, Great Britain	32	81	+ 49
Accumulators and plates—			
Total	657	667	+ 10
To Belgian Congo	9	—	− 9
,, Argentina	288	264	− 24
,, Holland	46	104	+ 58
Insulators of porcelain, glass, &c.—			
Total	99	122	+ 23
To Belgian Congo	36	15	− 21
,, France	26	13	− 13
Cables, submarine and underground—			
Total	4,839	6,699	+1,860
To Belgian Congo	210	282	+ 72
,, Germany	696	1,067	+ 371
,, Argentina	*	649	—
,, Great Britain	1,470	2,757	+1,287
,, Holland	487	535	+ 48
Insulated wire and cable—			
Total	2,719	3,652	+ 933
To Germany	118	171	+ 53
,, Belgian Congo	114	42	− 72
,, Brazil	192	155	− 37
,, Great Britain	647	682	+ 35
,, Holland	342	480	+ 138
,, Argentina	35	*	—
Insulating tubes—			
Total	446	411	− 35
To Germany	4	19	+ 15
,, Egypt	167	196	+ 29
,, Greece	63	18	− 45
Metal filament lamps of all kinds—			
Total	75	99	+ 24
To Congo	3	—	− 3
,, Great Britain	21	10	− 11
Measuring instruments and parts—			
Total	27	34	+ 7
Telegraph and telephone apparatus—			
Total	2,585	2,654	+ 69
To China	33	*	—
,, Spain	123	19	− 104
,, Australia	99	*	—
,, France	75	819	+ 744
,, Italy	89	86	− 3
,, Norway	72	*	—
,, Holland	91	177	+ 86
,, Switzerland	64	*	—
,, New Zealand	89	57	− 32
,, Mexico	480	512	+ 32
Electrical and electro-technical apparatus and parts not elsewhere specified—			
Total	966	1,202	+ 236
To Belgian Congo	40	240	+ 200
,, Germany	46	12	− 34
,, Egypt	165	39	− 126
,, France	80	135	+ 55
,, Holland	78	201	+ 123
,, Syria	28	*	—
,, Siam	44	*	—
,, Great Britain	9	*	—

* Not specified.

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Cadmium Electrodeposition.

One of the most important of the recent developments in the electro-plating industry is the use of cadmium, primarily as a rust preventive of ferrous material, the increasing application of the deposit indicating that it is generally considered to fulfil its function satisfactorily.

By S. WERNICK, M.Sc.

(*Extracts from a Paper read before the* ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY.)

THERE has been marked divergence of opinion as to the efficiency of cadmium as a rust preventive, particularly as compared with zinc. Cadmium deposits may, however, differ widely in their physical properties, which largely affect their protective capacity, and it is probable that statements which are apparently contradictory might often have been rendered compatible were such details as the composition of the solution used, conditions of deposition, and thickness of the deposit indicated in each case. Assuming the use of reasonably homogeneous and non-porous base metal, effective preparation of the material before plating, &c., are postulated, then the protective capacity of the resultant plating will depend largely upon the fineness of the deposit (which is intimately bound up with the composition of the solution, and the electrical, mechanical, and thermal conditions employed in plating), the amount of cadmium deposited per unit area (*i.e.*, the thickness of the deposit) and the distribution of the deposit over the cathode area (which depends largely on the throwing power of the solution).

Composition of Solutions.—The composition of cadmium plating solutions recommended by different authorities diverge widely, and there can be little doubt that they must be productive of deposits possessing fundamentally different characteristics. Most cadmium solutions have an inherent tendency to alter in composition, tending, with few exceptions, to "build up" their metal content and reduce the free cyanide concentration, so that there is, in addition, progressive variation in the characteristics of the deposit as the solution ages. Apart from this, the inconvenience and cost of managing such a solution is an important item to the plater.

The ideal stabilised solution is one in which the anode and cathode current efficiencies are each 100 per cent. The anode efficiency of the average cadmium solution exceeds the cathode efficiency appreciably; the excess may be as high as 25 per cent., *i.e.*, the electrode efficiency ratio may reach 1.25. The ratio may be decreased by using insoluble anodes, as well as cadmium anodes, in the same solution. The effect of decreasing the effective cadmium area upon the electrode efficiency ratio is shown below in the case of one solution, the area of anode and cathode being identical:—

Per cent. insoluble anode area.	Electrode efficiency ratio.
0	1.21
50	1.07
75	1.04

The effect is due to a reduction in the overall anode c.d., although the reduction is by no means in proportion to the ratio of soluble anode area. This method of stabilising the cadmium solution is widely used; it appears to be fairly effective, though not ideal. In practice, there is a progressive change in the ratio soluble/insoluble anode area due to the gradual solution of the cadmium. Usually the "insoluble" anode is steel, but to a small extent it is soluble, and introduces an undesirable ingredient into the solution. It has also been stated that it decomposes the ingredients of the solution, although others attribute a beneficial effect, suggesting that the tendency to build up carbonate in solution is lessened.

A study of the effect of the concentration of the principal constituents of the solution upon the electrode efficiency ratio undertaken by the author yielded the results outlined below.

(*i*) The cadmium content may vary from about 5 to over 30 grams per litre. Satisfactory deposits are obtainable at the lower concentrations and considerations of economy in the case of such an expensive metal as cadmium have often led to their adoption. However, a progressive decrease in the electrode efficiency ratio occurs with increase in cadmium content, being appreciable even with double the lower limit quoted above, and approaching unity at about 30 grams per litre. At the same time, there is a marked rise in the conductivity of the solution, amounting to almost twice its original value at this figure. Deposits having a very fine crystal structure are obtainable with a cadmium content in excess of 30 gm. Due to deficiency in free cyanide, "fouling" of the anode occurred with solutions of low cadmium concentration, but to a decreasing extent with increase in the cadmium content, the anode remaining clean (except for a natural darkening) when the cadmium content reached 25 gm. and over.

(*ii*) Free cyanide is another constituent which varies widely; from 6 to 60 grams per litre has been recommended. It is stated to have a very pronounced effect on the solution of the anode, but, using a solution having a cadmium content of approximately 30 gm., upon which figure the free cyanide is calculated as percentage (not as per cent. present in solution), increasing the free cyanide content increased only very slightly the electrode efficiency ratio, even when the concentration reached 125 per cent. At higher concentrations, however, there is a marked increase in the electrode efficiency ratio. Free cyanide must, therefore, be rigorously controlled at higher concentrations, excess beyond a given limit resulting in rapid building up in metal content. It is possible that at certain concentrations of cyanide polarisation of the anode may occur.

The conductivity of the solution very pronouncedly increases with progressive increase of free cyanide. Quite a substantial increase is, however, attained with a content of about 100 per cent., and although better conductivity is obtainable with more cyanide, that is a safe figure to maintain. The effect of increasing the free cyanide content upon the deposit is distinctly noticeable, there being a marked reduction in the grain size, the deposit also becoming white in colour. A further drawback of a high free cyanide content is the increase in gassing which results, particularly in the early stages of deposition, possibly due to the higher hydrogen over-voltage on cadmium, as compared with iron, causing the gas evolution to slacken and eventually cease almost entirely when the cathode is well covered with cadmium. The anode corrosion obtainable, with resultant cleanliness of anode surface, is quite efficient in solutions of comparatively low free cyanide content.

(*iii*) The alkali constituent is usually added as a means of increasing the conductivity of the solution; it is not essential, being completely omitted from some formulæ. Experiment has, however, indicated that the presence of a caustic alkali is of definite value, having a marked tendency to bring the electrode efficiency ratio nearer to unity. It is possible, too, by its use to standardise the alkalinity of the solution. The ratio decreased progressively as the alkali content (caustic soda was employed) was increased from 1.5 to 30 gm. per litre, but, contrary to expectation, the conductivity was not appreciably affected. The free cyanide content of the solution used was 50 per cent., calculated on the combined cyanide present. The addition of the caustic soda also had a markedly beneficial effect on the deposit, the grain size of which was progressively reduced, becoming "structureless" at the upper limit, and the colour decidedly whiter. The tendency towards streaking and patchiness at the cathode that occurrs occasionally also ceased when caustic soda was present. There is little gassing at the anode, which is rendered a dark-grey colour, remains unfouled, and is uniformly corroded. Slight gassing occurred at the cathode only with the highest caustic soda concentration.

To summarise, the conditions best suited to the attainment of a deposit of small grain size, a solution of optimum conductivity, and a solution of maximum stability, *i.e.*, having an electrode efficiency ratio as near as possible to unity, appear to be as follows:—

(*a*) For metal content a relatively high concentration is best; a 30 gm. per litre cadmium content gives good results.

(*b*) Free cyanide may vary within fairly wide limits, about 100 per cent. (over the combined cyanide content) giving most favourable results; appreciable excess beyond this figure markedly affects the stability of the solution.

(*c*) Caustic alkali is a desirable constituent; from 15 to 30 gm. per litre is a useful range, the upper limit giving superior results.

(*d*) High temperatures of the solution are best avoided.

(*e*) C.d. of from 10 to 15 amps. per sq. ft. gives best results.

A solution made up on these lines yielded an electrode efficiency ratio slightly in excess of unity and high conductivity; the deposit being "structureless" and the condition of the anode satisfactory.

Protective Properties.—The superior corrosion resistance of a cadmium deposit, as compared with zinc, is undoubtedly largely due to its lesser chemical reactivity. It is the ideal protective agent for ferrous material in so far as it is nearest to it on the anodic side of the electrochemical series, whereas the p.d. between zinc and iron is quite appreciable. While, therefore, the intrinsic protection afforded by zinc is higher than that which cadmium can give, due to its greater solution pressure, its rate of preferential, or sacrificial, corrosion is also higher for the same reason, and a smaller amount of cadmium, or a thinner deposit, provides the protection afforded by a comparatively thick zinc deposit.

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Thicker cadmium deposits give appreciably better protection: a deposit 0.4 mil. thick, for example, compared with 0.3 mil., provides protection considerably in excess of the ratio of the thicknesses. For efficient protection, a thickness of 0.4 mil. is a desirable standard to adopt in commercial work, and it is suggested that the more generally advocated 0.2-mil. deposit be reserved for precision work, &c., when the thicker deposit cannot be entertained.

Composite Deposits.—Cadmium plating as an under-coating for more pleasing finishes of less protective capacity is in use commercially. Nickel is far more readily deposited upon a cadmium surface than upon zinc, but the composite deposit is quite inferior to cadmium alone as a corrosion preventive. The cadmium must continue to function as a protective by virtue of its own sacrificial corrosion, or the very purpose for which it was applied would be defeated. At pores in the nickel, or other superposed finish, the cadmium accordingly reacts with the corrosive elements to form a cadmium corrosion product. The first stage in the corrosion of the composite plating is the appearance of a white salt at the weakest points in the nickel surface, at the centre of which, after the cadmium is totally "sacrificed," rusting of the underlying ferrous metal invariably occurs. Before rusting, the material presents a decidedly unsightly appearance. In the case of a superposed enamel finish, the same white corrosion product appears, causing the enamel to flake away, probably because of the increased volume occupied by the cadmium salt. The thickness of the superposed nickel plating is an important factor in prolonging the time before corrosion occurs, due to a reduction of porosity, but since this remedy rests upon the efficiency with which the exposure of the cadmium to the atmosphere is prevented, it is obviously of negative value. Underlaying nickel with copper showed little, or no, improvement, while heat treatment of the cadmium after deposition was similarly ineffective. To sum up, while the composite cadmium-nickel deposit is superior in its protective capacity to nickel alone, its protection is considerably less than that of a cadmium deposit alone.

Fig. 1.—50-ton Electric Locomotive.

Mechanical Properties.—Mechanical defects of the deposit have a marked effect upon its protective capacity. Cadmium deposits are particularly prone to blistering, to avoid which it is important to ensure a chemically clean surface and also that cathodic gassing is at a minimum.

Relatively high c.d. and elimination of preliminary "flashing" favour the ultimate development of blistering. In the case of composite cadmium-nickel deposits, G. B. Hogaboom suggests that blistering may be due to the oxidation of the underlying cadmium. The adhesion of a good cadmium deposit is of a high order; comparatively thick cadmium deposits show considerable flexibility and perfect adhesion in twisting, bending, and coiling tests, when applied to wire as thin as 0.25 in. in diameter. Although cadmium ordinarily becomes embrittled at 100 deg. C., nevertheless the deposited cadmium does not appear to be greatly affected when subjected to subsequent heat-treatment at that temperature, at least in so far as its flexibility is concerned.

The composite cadmium-nickel deposit subjected to these tests showed a marked decrease in flexibility, as well as an increase in brittleness, probably depending to a great extent on the hardness of the deposited nickel. Although no signs of parting of the composite plating occurred in the case of plated sheets under a cupping test, flaking readily occurred when the cadmium-nickel was applied to wires, both in twisting and coiling tests, although it showed up well in the bending test. The quality of the nickel deposit is largely the determining factor, since the cadmium undercoat appears to remain little affected.

Discussion.

The chairman, Dr. G. D. Bengough, said this paper alone was worth about 5 years' subscription to the Society. There was a great field for cadmium plating for resisting alkalies and ammonium chloride, which presented big problems in industry. The author's defence of the salt-spray test for metal coatings was reasonable; it had its practical uses, but must not be used too widely, and only for comparative purposes.

Mr. E. A. Ollard said the author had shown that cadmium could be definitely superior to zinc if care was taken in its deposition. Often a finer deposit was obtained in a barrel vat than in a still vat; addition agents were necessary in the latter. Yellow dextrin gave good results. Could not anode solubility be overcome by reducing the anode area? The salt-spray test was not representative of outdoor exposure.

Mr. S. E. Weill said that cadmium was really more plentiful than was thought, but prices were kept up. Cadmium was a fairly simple metal to deposit, though, of course, the quality was important. Although cadmium was as good, if not better than zinc, as a rustproofing material, it was no good at all as an undercoat. Nickel and enamel above cadmium gave way in 6 months.

Mr. G. E. Gardam said that the ferroxyl test showed no reaction with iron when in contact with cadmium, even when large areas were exposed. Owing to the high atomic weight of cadmium, it was deposited much more rapidly than zinc; it was, however, soft.

Mr. A. E. Boulter said that sometimes the cadmium deposit was patchy, showing shades of white and yellow. What available supplies of cadmium were there?

Mr. L. Goring, with regard to the composite coat, found it advantageous to put nickel under cadmium and then overlay it with nickel again. It was very important to wash thoroughly owing to a tendency to spotting out; dilute acids were useful. The character of the deposit often varied with the addition agent used, there being different degrees of whiteness. If caustic soda were used in the solution, it was best to use the solution cold.

The author then replied to the discussion.

Railway Electrification in New Zealand.

The Main-line scheme from Christchurch to Lyttleton was officially opened recently.

The official opening took place recently of the electrified main railway line in New Zealand from Christchurch to Lyttleton. The line includes the Lyttleton tunnel, through which passes the whole of the traffic between the north and south islands. The contract for the work was awarded to the English Electric Co., Ltd., and, in common with other similar contracts, it included electric rolling stock, the sub-stations and the track equipment.

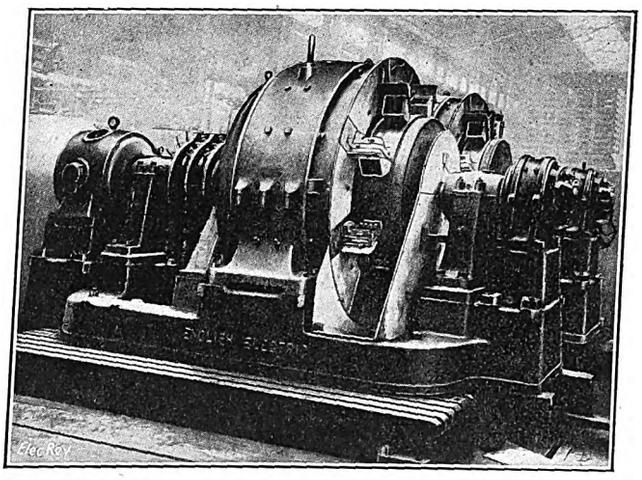

Fig. 2.—1,350-kW, 1,500-V Rotary Convertor.

The system adopted is 1,500-V d.c., with overhead collection, and the principal items of the contract were six 50-ton locomotives, fig. 1, with camshaft control, two 1,350-kW, 1,500-V rotary convertors, fig. 2, complete automatic and supervisory switching equipments for these machines, and the structures and all material for the overhead line.

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Ministers of the New Zealand Government and representatives of the departments concerned expressed their complete satisfaction at the record time achievement in the running of the first train. The rotary-convertor plant and the automatic switching equipments functioned perfectly. The rotary convertors are of the "English Electric," single-armature type, and it is understood that on test six short-circuits were successfully cleared on the d.c. line, and that both convertors continued to work satisfactorily through two heavy surges on the 11,000-V supply.

It may be recalled that a few years ago the same company carried out the electrification of the Arthur's Pass tunnel section of the New Zealand Government Railways, and furnished, in addition to a complete power-station installation, the overhead line with feeders and cables, the tunnel lighting and six locomotives.

The Institute of Metals.

An account of the meetings and social functions held in London in celebration of the coming-of-age of the Institute.

At the twenty-first annual general meeting of the Institute in London on March 13th and 14th, Dr. W. Rosenhain, president, who was re-elected, presented the report of the Council for the year 1928-29, which indicated that the membership had grown in 20 years from 355 (on December 31st, 1908) to 2,003; last year's increase was 100 members. The fact that the Institute has gained in such a comparatively short space of time world-wide recognition in its particular sphere of metallurgy is an indication that it enters its third decade with every prospect of increased usefulness to the sciences and industries that it serves.

The opportunities of service to members were increased in many ways during the past year, notably as a result of the large extension in the library and office accommodation. A still more important development has been envisaged recently by the Council: the proposal has been made that the Institute should co-operate in a scheme which has for its object the securing of a suitable site and building to accommodate a number of institutions and societies having somewhat similar aims, so as to secure economy by co-operation in certain services and by the use of a common meeting-hall, library, and committee rooms. The sudden expansion of premises resulted in the surplus of income (£150) over expenditure (£7,591) being somewhat small, but invested funds have been increased to £4,986. The six British local centres continue their excellent work, and the growing overseas membership is now one-third of the total; the *Journal* is regularly purchased by 162 public libraries and institutions in 23 countries.

Autumn Meeting.

The Council has in hand arrangements for the next autumn meeting, to be held in Dusseldorf, Germany, from September 9th-12th, 1929, by the invitation of the Verein Deutscher Ingenieure and of the Deutsche Gesellschaft fur Metallkunde. Steps are also being taken in connection with the visit of the Institute to America in 1932.

Exhibition.

Dr. W. Rosenhain was presented with a bronze plaque as a "twenty-first birthday" gift, and in the evening presided at the dinner at the Trocadero Restaurant.

On the next evening a conversazione took place at the Science Museum, South Kensington. The president and Mrs. Rosenhain received the guests, refreshments were served, and a selection of music was electrically amplified and reproduced by loud-speaker from "H.M.V." gramophone records. A metallurgical exhibition, which consisted of 20 separate displays, proved to be of considerable interest; amongst the exhibitors were:—

British Aluminium Co., Ltd.—Set of articles covered by the anodic process as used on airships; various types of joints used on steel-core aluminium overhead conductors; bare conductor after 11 years in an industrial atmosphere and busbar subjected to salt spray for a fortnight; joints between aluminium overhead lines and house-service leads; aluminium winding of traction motor with oxide insulation; methods of soldering and welding aluminium kettle spouts.

Bureau of Information on Nickel, Ltd.—A nickel-iron storage battery illustrated one of the many different applications of nickel itself, an application which makes use of the high electrical conductivity of pure nickel used in the form of extremely thin flakes which are produced by electro-deposition on copper and the subsequent dissolving of the latter metal.

Chemical Research Laboratory, Teddington (Dr. W. H. F. Vernon).—Atmospheric tarnishing and corrosion of metals: in the case of copper the formation of protective oxide films, either so thin as to be practically invisible or sufficently thick to refract light and hence give rise to characteristic interference ("temper") colours was illustrated, as was also the existence of a critical film-thickness (within the "invisible" range) below which protection against tarnishing is no longer afforded; whereas a film of oxide is protective, a film of sulphide actually promotes further oxidation.

Corrosion Research Committee (R. May, A.R.S.M., investigator).—Jet test apparatus for testing samples of condenser tubes for resistance to impingement of sea water.

Mr. S. Cowper-Coles.—Specimens with photomicrographs of electrolytic copper deposited under varying conditions.

Dr. C. F. Elam (Mrs. Tipper).—The application of X-rays to the study of metals, and examples of alloy crystals.

National Physical Laboratory.—Pure metals and elements and electric furnaces.

W. G. Pye and Sons.—X-ray photogoniometer.

Sir John Cass Technical Institute.—Apparatus for electrogravimetric and potentio-titrimetric chemical analysis.

Synopses of Papers.

Amongst the papers presented and discussed at the March meetings were the following:—

Refining Kettles.—Mr. H. C. Lancaster dealt with "The Importance of Design, and Setting of Large Kettles Used for Refining and Low-melting-point Alloys."

In the subsequent discussion Mr. D. F. Campbell said that quite recently he had had to consider the problem in connection with a works in Algiers at which cables were to be manufactured, and also in connection with another works in France. The problem of heating them by means of electricity was being studied; in that case the temperature of the source of heat was very much lower than flame temperature, and in consequence there was less strain on the metal than when a flame was used. Was there any possibility of the adoption of electric heating, in spite of the higher cost, bearing in mind that with electricity one could secure even heating, and the temperature of the source of heat was probably about 1,000 deg. maximum, whereas flame temperature was very much higher? Further, the electrical method lent itself very well to the provision of suitable arrangements for supporting the pots, and one could absolutely control the temperature; the latter was a very important factor in connection with lead in cables.

The President suggested the use of electrical immersion heaters. The temperatures involved were not very high, and it would not be difficult to construct a heater which could be immersed in the molten metal, so that the whole of the heat would be generated within the metal and would not have to pass through the pots. It appeared that that would relieve considerably the duty to which the pots were exposed.

Mr. A. H. Mundey said that the immersion-heater principle was adopted quite considerably in the trade in which he was interested.

Battery Zinc.—In a paper on "The Solution of Plain and Amalgamated Zincs in Electric Batteries," Mr. J. Newton Friend, D.Sc., Ph.D., showed that for use in electric batteries with dilute sulphuric acid, or with saturated ammonium-chloride solutions, plan high-grade 99.9 per cent. zinc could not satisfactorily replace the amalgamated metal; neither was there any material advantage in using amalgamated pure zinc instead of amalgamated ordinary commercial 98 to 99 per cent. zinc.

Electro-deposits on Aluminium.—Mr. G. B. Brook and Mr. G. H. Stott, B.Sc., outlined in "Note on the Testing of Electro-Deposits on Aluminium" investigations carried out during the past year on a considerable number of samples of commercial electroplating on aluminium. Most of them were finished in nickel as being the commonest metal used for securing a finish in general commercial practice. This contribution was not concerned with the actual plating of the material, but confined to the development of a test, or tests, which would indicate the stability of the deposit from the user's, rather than from the producer's standpoint.

Electric Furnaces.

Amongst the papers submitted and discussed were two (one of which is referred to below) relative to the use of electricity for industrial heating purposes.

Dr. W. Rosenhain, F.R.S., and Mr. W. E. Prytherch, M.Sc., of the National Physical Laboratory, described an improved form of electric resistance furnace for which advantages are claimed with regard to higher available working temperatures (up to 1,400 deg. C.), durability, and freedom from oxidation of the carbon resistor. The heating element of this type of furnace consists of carbon or graphite pellets, or short rods placed end to end, in a refractory sheathing tube which fits easily over them. Heating occurs by contact resistance.

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and the sheathing tube prevents the access of air sufficiently to avoid any appreciable burning of the carbon.

In the subsequent discussion, Dr. MAX HAAS, after emphasising the need for a laboratory furnace for use at high temperatures, asked if it were possible to use a furnace of 5, 8, or 10 cm. diameter of the type mentioned by the authors for the purpose of heating a crucible to 1,500 deg. C.

Mr. A. GLYNNE LOBLEY, referring to the authors' statement that no actual measurements of change of resistance with time had been carried out (up to the time the paper was written), asked if figures had been obtained since. That matter was of extreme importance, because, if there were changes of resistance in one part as distinct from another, hot spots would occur.

Mr. A. B. WINTERBOTTOM said that his firm had been interested in the carbon-contact resistance when Dr. Rosenhain first described it. They made an electric fire with a carborundum glow bar in a parabolic reflector, but had wanted something with a longer life and were attracted by the possibilities of making a variable-load heater. They had made some heaters on the same principle, using vitreosil tubes with small carbon pellets 1/32 in. long and of about ¼ in. in diameter; with 400 of them in a tube they had got about 100 volts across without getting too large a current, and had got it operating at temperatures from 900 to 1,200 deg. C. Had the authors experience of different qualities of carbon? He had used a sort of arc carbon and it had stuck together for some time; afterwards he had used a plain carbon, and it did not appear to have suffered any change at all.

Mr. W. B. CLARKE referred to some granular-carbon resistance furnaces with which he had been concerned, which reached extremely high temperatures. He gathered that the furnace described by the authors was not intended to reach extreme temperatures. What was the difference between the alternating- and direct-current effects on the resistance of the pellets in the furnace He imagined there would be a considerable difference between the two.

Dr. W. ROSENHAIN, president, replied to the discussion. With regard to the remark that the furnace was not intended to reach the extreme temperatures which could be obtained in electric carbon-resistance furnaces, he said there were two other requirements for that: one was permanence of the resistor material, and the second was the absence of anything more than traces of carbon-bearing gases in the furnace atmosphere. One of the fundamental differences between a furnace of that type and the granular-carbon resistance furnace was that the resistor in the former was, relatively speaking, permanent; in that connection he spoke conservatively, because the authors had not yet discovered the length of run of which one of those resistances was capable. Oxidation was so slow that after hundreds of hours running at temperatures round about 1,300 deg. C. one could not see any appreciable effect upon the appearance of the pellets when they were removed from the carbon sheet. The reason was interesting; it was not necessary to attempt to make the sheet gas tight, or to have any gas-tight fitting between the resister and the sheet. There was a capillary air space to begin with, and later on a space filled with gases in equilibrium with the hot carbon, and that was quite sufficient to act as a protection from the external atmosphere. The viscosity of carbon dioxide at high temperature was very high, and the rate of diffusion was, therefore, quite slow. The consequence was that the capillary space acted as a perfectly satisfactory seal for that purpose, and left the resistor pellets and electrodes at the ends free to move and maintain contact. The authors would not attempt, and did not recommend, any method of varying the pressure for regulating the temperature of such a furnace; any attempt to regulate by that means resulted, in his experience, in irregularity. One could increase the pressure, but could not decrease it again uniformly throughout the column, and there resulted uneven contact pressures and hot spots. They worked with a constant pressure. He ventured to say that the limit of time, or temperature, at which the furnace could be used depended upon the refractory material of which the sheet was made. The authors had used a German product ("Pythagoras" porcelain), which was very satisfactory up to a certain point, but it would certainly not withstand temperatures as high as 1,500 deg. C. It would stand very high temperatures for a long time, provided it was well supported, but he considered 1,400 deg. C. was quite the upper limit. On the other hand, it was not impossible to make special refractories for this purpose which would stand much higher temperatures, and some of his colleagues were engaged on that work, but he did not think they would be able to exceed temperatures of about 1,800 deg. C. at reasonable cost yet; at the moment, that temperature had not been reached. He could not give data about the change of resistance with time, but might be able to do so when the discussion was printed in the Institute's *Proceedings*.

(*To be continued.*)

Boiler Feed-water Circuits.

Modifications of the working-fluid cycle that are calculated to raise the thermal efficiency of steam power stations.

By J. G. WEIR, C.M.G.

(*Abstract of a Paper read before the* INSTITUTION OF MECHANICAL ENGINEERS.)

THE fundamental cycle traversed by the working fluid in all steam-power installations is from boiler to power generator, from power generator to condenser, and from condenser back to boiler. Superimposed on this simple circuit there are generally a number of subsidiary heat exchanges.

The closed-feed system naturally depends for its success as a preventative of corrosion on the efficiency of the condenser as a de-aerator. Feed-water can be de-aerated if the water be boiled, and this can be done at any pressure and temperature. The first apparatus to make use of this fact was the "Weir" direct-contact heater. This heater works in conjunction with a simple type of open-feed system; the simplest form of this type of installation is that used on the majority of steamships, in which the feed-water is passed from the open feed tank through a spray valve into a chamber where it mixes with exhaust steam. The pressure in the chamber is maintained close to the equivalent boiling point of the mixture by a small connection to the condenser, through which the liberated air is withdrawn. A water level is maintained in the base of the chamber by means of a float which, in the case of water-tube boilers, controls the delivery of water from the feed tank into the chamber.

In order to increase the thermal efficiency of any practical feed cycle, various arrangements of feed-heaters may be incorporated. A common arrangement has one stage of exhaust-steam heating and two stages of bled-steam heating. By selecting the correct number and kinds of auxiliaries to be steam driven, the quantity of auxiliary exhaust can be arranged to give an outlet feed temperature from this heater of about 160 deg. F. to 170 deg. F.

Another important influence on the feed circuit is the make-up water, which is generally supplied by the evaporation of raw water at a suitable pressure datum. The correct pressure datum to employ depends upon the particular circumstances of the lay-out. It is, however, generally preferable to have the datum low down on the temperature-pressure curve. This is advantageous, primarily because of the soft scale which results from low-temperature evaporation and from the relatively larger temperature differences at the low end of the scale. This may be seen by considering the comparative temperature differences at, say, 100 lb. per sq. in. gauge steam pressure and, say, 5 in. vacuum; for a 5 lb. per sq. in. pressure difference in each case the comparative temperature differences are 11 deg. F. and 24 deg. F. This means that for the same transmission rate in each case the low-pressure evaporator need only have a surface 11/24th of that of the high-pressure evaporator; owing to the smaller transmission rate normally obtainable at low pressures this is not strictly true, but even when the lower transmission rate is allowed for, the surface reduction permissible is very considerable. It is occasionally found when working out heat balances that too much exhaust steam is available; in such cases the multiple-effect evaporator is advantageous. This evaporator may be double-, triple-, or quadruple-, or even sextuple-effect, the last two mentioned being primarily suited for the higher steam pressures. The ratio of production to steam used from the multiple-effect evaporator is approximately as follows: simple effect, 0.8 to 1; double effect, 1.3 to 1; triple effect, 2.6 to 1; and sextuple effect, 4 to 1. It is, however, only rarely that anything more than double effect is necessary for normal power plant.

Wide fluctuations in load adversely affect the performance of a boiler plant, and for this reason various forms of heat accumulators have been devised for insertion in the feed circuit. The principle involved is that of storing heat in a large quantity of water, under pressure and at saturation temperature, and releasing that energy in the form of steam under decreasing pressure. A Ruths steam accumulator may be arranged in the normal feed circuit of an industrial plant, where a proportion of the steam is used for electrical generation and the remainder for process work.

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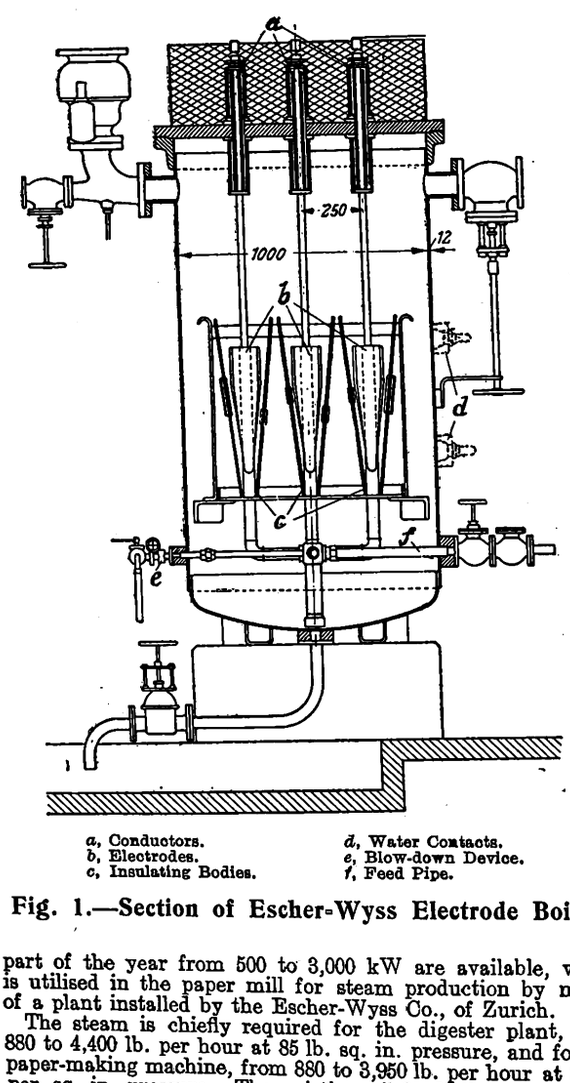
The use of boilers at two pressures in a combined circuit has recently become fairly common, and in this way it is possible to modernise plant by superimposing high-pressure boilers cascading into the system. To obtain the full thermal advantage of polytropic steam generation, it is necessary to put the boilers in series on the flue-gas side. The high-pressure boilers are preferably of the water-tube type and the low-pressure boilers of the capacity type. An interesting arrangement has two water-tube and one capacity-type boilers arranged for polytropic steam generation. On both steam and flue-gas sides the boilers are arranged in series. With this arrangement no air preheaters are required, as the low-pressure boiler will reduce the flue-gas temperature to the same level as in a normal air preheater. Similarly, no economisers are required, but single-stage regenerative feed-heating can, if desired, be incorporated in the system. The feed-water for the intermediate- and high-pressure boilers is taken from the low-pressure and intermediate-pressure boilers, respectively. The low-pressure boiler is fed in the normal manner with condensate. The arrangement of boilers in series at varying datum is an alternative to the more common scheme incorporating a single high-pressure boiler with air preheater, economiser, and multiple-stage feed-water heating.

When the fundamental conditions of maximum efficiency in a steam cycle are investigated, it is clear that steam is not entirely suitable as a working fluid. Various alternatives have been tried, the most successful being the superimposing of a mercury circuit on a steam circuit. The binary-fluid system has already been tried with a mercury turbine developing 1,200 kW, with results sufficiently encouraging to warrant the construction of a larger set of 20,000 kW, which consists of a 10,000-kW mercury turbine and a 10,000-kW steam-turbine, and is estimated to have an overall thermal efficiency of 32.5 per cent., which compares favourably with the best Diesel performance. It is claimed that a modern steam station with a boiler pressure of 350 lb. per sq. in. can have its thermal efficiency increased by 50 per cent. by the addition of a mercury-vapour installation.

Electric Steam Generation.

Some Details of the Escher-Wyss Plant Installed at the Padalarang Paper Mill in Java.

With the development of water-power resources corresponding quantities of surplus energy not infrequently become available, either because the new power stations cannot fully dispose of their total output for some time to come, or because energy is only required at certain times of the day or year. Within recent years so-called "waste" energy has been increasingly utilised for heating purposes in a number of industries, including raising steam. A case in point is the Padalarang paper mill in Java, which is located near a State-owned power station whose output is utilised only during the main lighting period, *i.e.*, from 6 to 9 p.m.; during the remainder of the day and for the greater part of the year from 500 to 3,000 kW are available, which is utilised in the paper mill for steam production by means of a plant installed by the Escher-Wyss Co., of Zurich.



a, Conductors.
b, Electrodes.
c, Insulating Bodies.
d, Water Contacts.
e, Blow-down Device.
f, Feed Pipe.

Fig. 1.—Section of Escher-Wyss Electrode Boiler.

The steam is chiefly required for the digester plant, from 880 to 4,400 lb. per hour at 85 lb. sq. in. pressure, and for the paper-making machine, from 880 to 3,950 lb. per hour at 36 lb. per sq. in. pressure. The existing oil-fired plant consists of two Lancashire boilers, each of 965 sq. ft. heating surface and 115 lb. per sq. in. operating pressure. The two principal places of consumption are 430 ft. apart, so that it was decided to erect two sets of plant in order to avoid so far as possible radiation losses in the piping. One plant has been erected in the existing boiler house near the digester plant, the other being located adjacent to the paper machine; both are interconnected by means of an existing steam pipe.

In the boiler house the steam produced in the electrode boiler is admitted to the lowest point of the water chamber in the two Lancashire boilers, and thence conducted through the existing piping to the points where it is utilised, an arrangement which allows the Lancashire boilers to be used as heat accumulators to compensate for the considerable fluctuations in the steam consumption of the digester plant. At the same time the boilers are always under pressure, and may therefore, in case of a breakdown of the electrical plant, be brought into action within a few minutes, equivalent to the time required for starting up the oil burners.

At least one of the boilers has to be put into service every evening between 6 and 9 p.m., when no energy is available. This daily service of three hours with oil firing prevents the complete cooling of the masonry, and the heat losses of the two boilers when serving as accumulators are therefore very small. Contrary to the digester plant, the steam consumption of the paper machine for a certain quality of paper is constant, and on no account may the steam supply fail: to avoid this with the electric boiler plant a separate accumulator boiler was erected to receive during short stoppages of the paper machine the excess steam, it being capable of giving off 5,500 lb. of steam at from 114 to 36 lb. per sq. in. pressure over a period of 1½ hours, *i.e.*, an interval of time which suffices to repair a breakdown, or to start the spare boilers. The electrode and accumulator boilers have been erected in a separate room in the immediate vicinity of the paper machine, the valves of the steam distributor being controlled from the machine room, in which also the gauges for the two boilers are fixed.

Since the digester plant and the paper machine have the same maximum steam consumptions, it was possible to provide two boilers of equal size, which relieves the spare-part problem. The boilers are equipped with stationary electrodes fixed to the removable cover. The conductors which pass through the latter have no stuffing boxes, but automatically seal themselves by reason of the internal pressure. The principle of utilising the water in the electrode boilers as the heating resistance has been developed to the extent that the output of the boiler can be varied by altering the depth of immersion of the electrodes. A safety device prevents the live electrodes protruding above the water level, which, at 6,000 volts, would give rise to arcing. The main circuit breaker is operated by means of a contact in the circuit of the no-voltage coil so soon as the water level in the boiler drops below a certain point; the pump is also automatically switched off when the main circuit breaker operates, or in the event of the water level becoming too high. The supervision of the electrode boiler is very simple, being confined to a brief inspection every one or two hours by *personnel* employed on other work.

To compensate for the fluctuations of the steam consumption in the digester plant, the two Lancashire boilers are used as buffers. The steam produced by the electrode boiler is led to the lowest point of the water chambers of the boilers. The escaping steam condenses and gives off its heat to the water, the steam being extracted at the dome.

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Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

Domestic Appliances in Schools.

During the past few years Barnsley Corporation has launched general schemes for the development of the use of electricity for domestic purposes, including the hiring of electric cookers and hire-purchase of electrical domestic apparatus. A hired-wiring scheme for the supply of electricity to cottage property has also been introduced. In connection with the propaganda regarding the use of electrical domestic apparatus, the domestic centres of eight local elementary schools have been equipped with a total of 12 electric cookers, 15 electric wash boilers, and 130 electric irons, and the scholars receive instruction in the uses of the equipment.

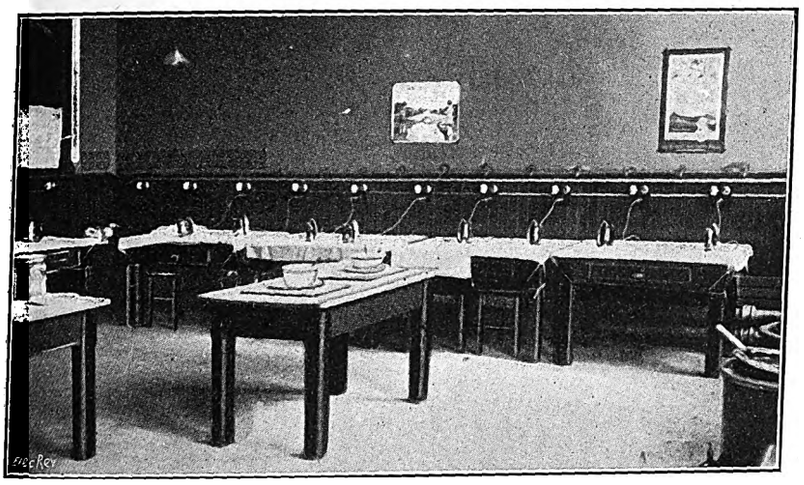

Fig. 1.—Electric Ironing Section.

The following are extracts from a report by the Barnsley education authorities on the result of the electrical equipment of the elementary school domestic centres:—

In effecting the reorganisation of elementary schools on the lines of the Hadow Report, Barnsley Education Committee made a determined and successful effort to overcome all obstacles that would hinder or delay the full operation of the scheme, and after providing new buildings or adapting existing buildings to the requirements of the "New Prospect," it gave its most careful attention to the provision of facilities for practical instruction in post-primary departments. The subjects of instruction are not vocational in the narrow sense of the word, but are treated in such a manner as to bring them into direct relationship with the facts of daily life, and the industrial interests of the town. The centres have been equipped with electrical apparatus, and the schemes of work have been so designed that the average girl, who is the home-maker of the future, will leave school with more skilled knowledge and a more intelligent grasp of the essentials of the ideals and standards of effective and successful house management than she could possibly obtain under the former arrangement. The domestic science rooms have been transformed into model centres; electric cookers and boilers now replace ranges and other apparatus of an older type. The conical iron heaters, with their tendency to discharge unpleasant fumes into the classroom, are removed, and an electric iron complete with its accessories is provided for each girl. The children are instructed in the care and use of the electrical equipment, while the teaching of the careful consumption of electricity provides still another means of emphasising the importance of preventing waste and of exercising wise economy in all forms of home management. The electrical equipment and fittings provided are similar to those which are already installed in a large number of working-class homes, on advantageous terms under a scheme connected with the Council's electricity undertaking. The Committee is satisfied that the installation of this modern equipment will lead to greater efficiency and pride of work, two factors which will do much to raise the status of the housewife, and will in time produce a realisation that the science of conducting and managing a household efficiently requires trained intelligence combined with a certain degree of technical skill. The training given to the girls on these lines will have its influence upon the management of their homes, and if added comfort, better conditions of home life and improved health accrue to the benefit of the members of the household, the Committee feels that one of the principal objects of providing practical instruction for girls will have been achieved.

The accompanying illustrations, figs. 1, 2, and 3, show some of the equipment in one of the Barnsley school domestic centres.

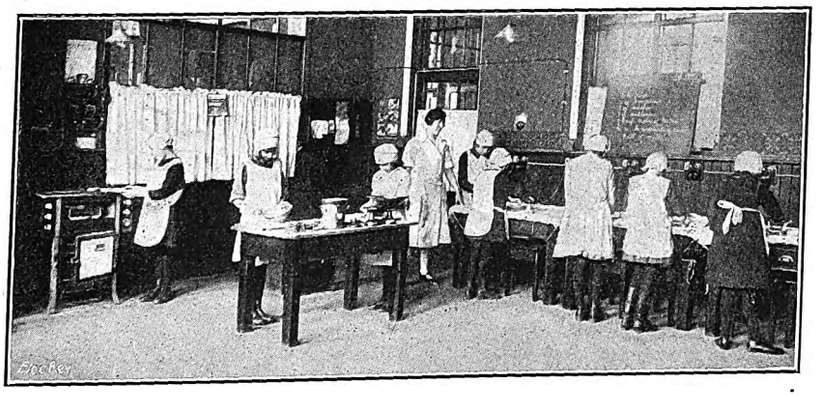

Fig. 2.—A Lesson in Electric Ironing and Cooking.

A Hospital Installation.

The administrative committee of the County Mental Hospital at Prestwich has adopted a scheme involving the electrification of a large portion of its bakery and kitchen, and has placed with the Metropolitan-Vickers Electrical Co., Ltd., a contract for the apparatus required. The installation will be notable as one of the largest of its kind in the country, its service being to cater for patients and staff totalling in all about 1,200 people. The equipment to be supplied includes two electric baking ovens, each capable of baking 400 lb. of bread at a time. They will be of the "Metrovick" conveyor type, each oven having a loading of 50 kW. The ovens will be equipped for automatic temperature control. The installation will also include a kitchen range, three roasting ovens, a fish fryer, and two hot closets and carving tables. These items will be supplied by Messrs. Moorwoods, Ltd., on a sub-contract.

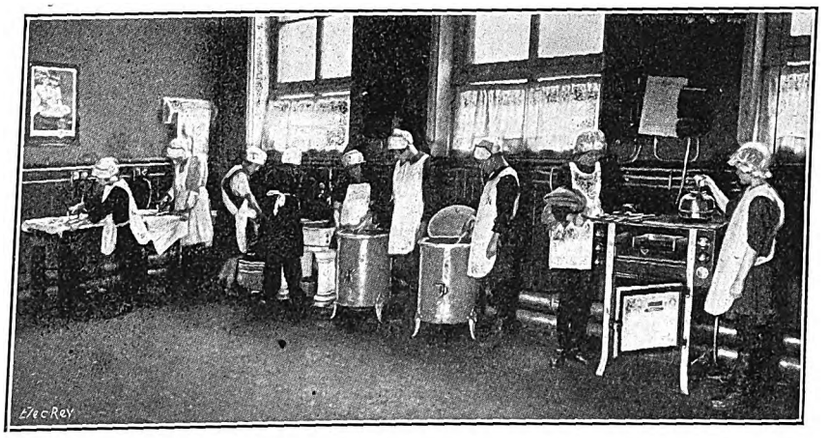

Fig. 3.—Studying the Art of Using Electrical Equipment.

The kitchen range will have two ovens, each with a cooking space of 22 in. by 22 in. by 22 in., with a loading of 5 kW. The top of each range will be fitted with one 3.2-kW and four 1.6-kW boiling plates, while beneath the top will be a grill

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toaster rated at 3 kW. Each item is to be 3-heat controlled. The fish fryer will have two pans, each 24 in. sq. by 5 in. deep, with a hot closet below and perforated shelves, drip trays, and a hood above. Each pan will be rated at 7 kW, and the hot closet at 4 kW. Three-heat control, a pilot lamp and fuses will be provided for each circuit.

The roasting ovens are each to have a baking space of 4 ft. by 2 ft. by 2 ft. 4 in. deep, and each chamber will be capable of being divided into two by a suitable heat-insulating shelf, the heating elements in each section being separately controlled. The loading for each oven will be 12 kW.

The hot closets and carving tables will be heated by separate groups of elements at the top and bottom, rated, respectively, at 4 kW and 2 kW. It is interesting to note that the M.V. patented form of magnesium-oxide insulated elements encased in steel tubes has been adopted for heating the oven chambers of the above apparatus, except the baking ovens, which are of course, heated by the usual type "C" elements. Fig. 4 shows a conveyor oven which is precisely similar to those referred to above.

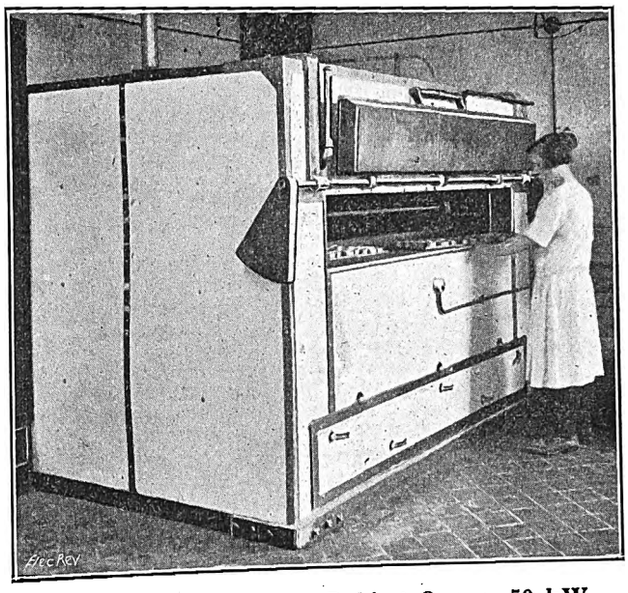

Fig. 4.—Conveyor-type Baking Oven; 50 kW.

Chromium-plated Iron.

A recent development in the United States is the production of an electric iron, the base of which is chromium-plated. It is claimed by the manufacturers that the amount of energy required to push an iron with a chromium-plated base across an ironing surface is 30 per cent. less than with the ordinary polished base.

An Electric Washing Machine.

The "Beatty" electric washing machine, fig. 5, a development of Messrs. Beatty Bros., Ltd., 55, Holborn Viaduct, E.C.1, is fitted complete with a reversible wringer, and a positive agitator which is claimed to be the latest and fastest type of mechanism for the thorough cleansing of clothes. The apparatus will deal with an ordinary household wash in an hour with only the aid of hot soapy water. Ball-bearing castors allow of easy movement of the washer, which does not take up much room. The reversible wringer can be swung and locked in seven different positions, and is fitted with rubber-rollers. A quick-release is provided which instantly releases pressure on rollers. The loading for the machine is claimed to be less than that of an ordinary electric iron.

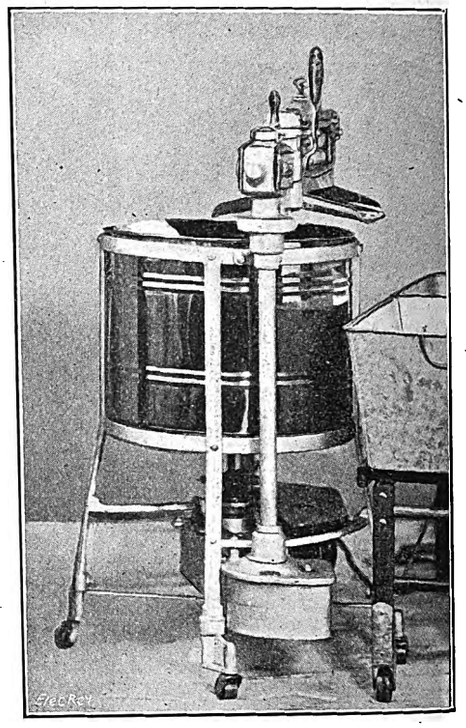

Fig. 5.—The "Beatty" Electric Washing Machine.

Mechanical Research.

Small-scale models are capable of demonstrating physical effects of a general character and of providing numerical data which can be applied in full-scale practice with considerable confidence.

By F. C. JOHANSEN, B.Sc. (Eng).

(Extracts from a Paper read before the INSTITUTION OF MECHANICAL ENGINEERS.)

AGAINST the favourable aspects of small-scale apparatus must be set the difficulty, with laboratory equipment, of simulating the working conditions which operate on the large scale. In probably the majority of cases precise representation is impossible; for the most part, however, sufficiently good reproduction to ensure accurate information can be secured by the experienced technician, although the methods of approximating to the required conditions, and of estimating the corrections necessary before the results may confidently be applied to the full scale, call for a high degree of mechanical ingenuity and a thorough knowledge of the physical principles involved.

Tube Trains.—Increased speeds and greater intervals between stations may make the air resistance of tube trains a most important subject for small-scale research. The results of some full-scale trials on the Hudson and Manhattan Railway, U.S.A., show that at speeds of about 30 m.p.h. the air resistance of a train in a tube one mile long is about 60 per cent. greater than that of the same train in the open. The resistance increases rapidly with the length of continuous tunnel, and is probably 20 per cent. less for concrete-lined tunnels than for iron tubes with projecting flanges. At first sight tube-train resistance might appear an obvious subject for wind-tunnel research; the problem is complicated, however, by the large mass of air set in motion by the train; and the determination of the air speed corresponding, in the small-scale experiments, to any stated train speed could hardly be made except by a series of full-scale tests with little promise of accurate results.

In view of the useful service rendered by the trains in ventilating tube railways, the reduction of their air resistance is not an unmixed blessing. With no data as to the magnitude of that resistance, however, it is impossible to decide in what circumstances the installation of ventilating fans would be an economical proposition, nor what length, near the entry of an iron tunnel, it would be economical to smooth over with concrete.

Vibration of Rotors.—Many simple cases yield to mathematical analysis, but small-scale research may prove less laborious than mathematical treatment, and there is scope for research in checking theoretical predictions and in indicating the extent to which such assumptions as underly the theory are admissible.

For the simulation of torsional fluctuations in a model rotor electromagnetic methods appear to offer the greatest facility

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in application and control: for example, if each crank be fitted with an iron armature and rotated between the poles of an electromagnet, an impulse, whose frequency is directly controlled by the rotation of the experimental shaft, may be given every one or two revolutions in imitation of the power stroke of the piston. Under these conditions the effects of shaft rigidity, the general inertia of the rotor and the angular position of the cranks at the instant when the external impulse is applied, on the production of torsional vibrations appear to be capable of very close examination. From the main results of such a research it should be possible to lay down the general principles to be followed in designing a machine free from dangerous vibrations.

Turbine Disks.—A type of small-scale research somewhat similar to the last occurs in connection with the vibrations of turbines. There is evidence that failure of turbine disks may be originated by forced vibrations intensified by resonance; mathematical treatment of the problem is so far restricted to very simple cases of disks of uniform thickness, and its results are only remotely applicable to design, since such practical features as curved profiles, shrinking and clamping at the central shaft with their accompanying initial stresses, and the forces due to inertia and reaction at the blades can be only very imperfectly taken into account in the analysis.

In small-scale research on this subject an alternating-current electromagnet fed by a variable-speed motor-generator suggests itself as a suitable means of forcing vibrations of definite and variable frequency in a steel wheel. Exploration of the wave phenomena in a rotating wheel may be carried out by magnetic coils in close proximity to the wheel; one set of coils is stationary in space, whilst the other rotates with the wheel. Variations of the air gap between these coils and the wheel due to vibration of the latter induce periodic fluctuations of current which, after amplification, may be transmitted to an oscillograph and photographically recorded. This type of apparatus has hitherto been employed mainly on full-scale research, but it appears to be equally suitable for small-scale work.

As an example of the use of model turbine wheels of reduced elasticity, for illustrating the vibration phenomena which call for investigation, reference may be made to some preliminary experiments by the General Electric Co. of America. A series of rubber disks, loaded at the circumference to simulate the effect of bucket blades, were rotated and their vibrations examined by intermittent sparks; these and similar observations paved the way to a recognition of the dangerous condition in which waves stationary in space (*i.e.*, travelling backwards at the speed of wheel rotation) occur in turbine wheels. Further experiments on a model wheel fitted with buckets and driven by compressed air demonstrated the production and maintenance of travelling waves due to the feathering action of the buckets. From these experiments it appears that determination of the frequency is an easier matter than the measurement of the deflection of a vibrating body. Both the resonator and the induction-coil oscillograph indicate critical conditions by the relatively large amplitude of recorded vibrations, although the amplitude is not actually measured; the merit of reduced elasticity models lies mainly in the production by such means of measurable, sometimes readily visual, amplitudes.

Torque Vibrations.—An exceedingly interesting application of small-scale apparatus is described in a report* on research on the torque fluctuations in certain types of electric locomotives in which coupled driving wheels are rotated through cranks and connecting-rods. The rotors, represented on the reduced scale by massive disks, were belt-driven by a small electric motor, their motion being transmitted to the coupled driving wheels by variable arrangements of connecting mechanism. By means of a suitable form of torsion-meter fluctuations of turning moment were chronographically recorded. From a specimen chart reproduced in the report it is evident, not only that the frequency and amplitude of the torque fluctuations could be readily measured, but also that critical ranges of speed accompanied by excessive fluctuation, extending between well-defined limits, were clearly exhibited.

Parliamentary News.

(By Our Special Parliamentary Reporter.)

"Beam" Telegram Charges.

On March 19th, Lord Wolmer informed Mr. Wellock that a general reduction in the charges for "Beam" wireless telegrams was contemplated at present.

Electricity Schemes.

On March 19th, Colonel Woodcock asked the Minister of Transport what arrangements were being made by the Central Electricity Board for the South-West England Scheme; and whether any contracts had yet been placed.

Colonel Ashley said that the scheme for South-West England and South Wales was in course of preparation by the Electricity Commissioners, but had not yet been transmitted to the Central Electricity Board.

Telephone Exchange Fire.

On March 19th, Mr. Scrymgeour asked the Postmaster-General if his attention had been called to the fact that during the recent fire at Llandudno post office a Post Office engineer prevented a fireman from spraying the switchboard with water, "thus averting serious explosions," and if he would state what steps were taken to avoid such a possibility occurring in offices having a large amount of electrical gear.

Sir W. Mitchell-Thomson said that the Post Office engineer prevented the fire brigade from spraying the power plant with water in order to minimise damage, but there was no risk of an explosion. At all telephone exchanges of comparable size, engineers were continuously in attendance.

The Aldershot Co.'s Bill.

On March 20th, the Unopposed Bill Committee of the House of Lords passed the Bill promoted by the Aldershot Gas, Water and District Lighting Co. to extend its area of supply, to enable it to acquire gas and electricity undertakings, and to change its name to "The Southern Power Company."

Lancashire Electric Power Co. Bill.

The Unopposed Bill Committee of the House of Commons passed this Bill for third reading on March 21st. The Bill empowers the company to raise £1,000,000 by the issue of new ordinary shares and to borrow a further amount of £1,000,000.

Metropolitan Railway Bill.

This Bill which empowers the company to raise £500,000 additional capital for improvements has been remitted to the Unopposed Bill Committee of the House of Commons, the opposition to it having been withdrawn.

Co-ordination of London Passenger Traffic.

The Bills providing for the joint control of London's passenger transport services, which are being promoted by the London County Council and the Underground Group, came before a Select Committee of the House of Commons on March 19th. The hearing was a public one, and there were 28 petitions against the Bills, eight of them from Metropolitan borough councils.

Opening the proceedings, Sir Lynden Macassey, K.C., for the Underground Group, and Mr. E. Charteris, K.C., for the L.C.C., said that they intended to call only one witness. Sir Lynden Macassey outlined the provisions of the Bills which, broadly, were to consolidate the services while securing a sufficient measure of public control to protect the interests of the public. Any agreement entered into would be presented to the Minister of Transport to lay before Parliament, and if thought fit by Parliament objections to the agreement could be heard. The promoters were prepared to insert a clause enabling any other transport-owning authority to be admitted as a party to the agreement on suitable terms.

On March 20th, Lord Ashfield gave evidence in support of the Bills. After referring to the success which had attended the operation of the Underground Companies' common fund, he said that his undertakings were unable to proceed with necessary extensions of their systems until they had some measure of protection, such as was afforded by these Bills. It was proposed that the tramway authorities—municipal and company—should form a board which should meet concurrently with the boards of the common fund companies and that the same person should be chairman of each of the boards. It was not proposed to set up a separate common fund for the tramways.

On March 21st, Lord Ashfield was cross-examined by Mr. Stafford Cripps, K.C., on behalf of a number of Metropolitan borough councils, whose main objection was that the Bills lacked two essential features—provision for the publication of an agreement, and the right of objectors to be heard before the agreement was submitted to Parliament. The witness pointed out that arbitration was provided for in a number of circumstances, but he was confident that they could get along without constant resort to arbitration.

A report from the Minister of Transport then came before the Committee. In this the Minister suggested that the question of the reasonable return on ranking capital should be subject to his approval, and that he should be empowered to order a public inquiry if he thought fit.

Mr. Tyldesley Jones, K.C., said that while the promoters agreed that the formula or formulas should receive the approval of the Minister, they did not consider that the matter would be an appropriate one for a public inquiry. Mr. Jones also agreed to a proposal that the local authorities concerned should be enabled to make representations to the Minister with regard to alterations in fares, &c., and that the Minister, after inquiry, should be enabled to prohibit such alterations.

Mr. Charteris, on March 22nd, outlined the recent history of the movement for the proper regulation of transport in London, including the report of the London and Home Counties Traffic Advisory Committee. Subsequently evidence was given by Sir John Gatti, ex-chairman of the L.C.C., and vice-chairman of the Special Traffic Committee of the Council. He pointed to the need for the restriction of uneconomic competition. He said that the London tramway system was the

* Forschungsarbeiten, 1924, No. 266.

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most rapid of its kind in the world, and there was no other transport system which would give the tramway's advantages without the disadvantages. Although, as an ideal, he would have preferred control by a public body, in the present circumstances he thought that the Underground group was the best body to operate a monopoly. He said that a distinction should be drawn between the operating authority and the regulating authority.

Legal.

Alleged Nuisance from Power Station.

Because of the disagreeable powder and objectionable smell said to emanate from the pulverised fuel plant of the Wallasey Corporation, the Health Committee has decided to issue a summons against the Electricity Committee. The chairman of the Electricity Committee recently stated that exhaustive experiments had been made to overcome the discomforts to people living in the vicinity of the power station. To abate the nuisance to some extent, one of the pulverised fuel plants had been put out of use and the old fuelling system restored.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

In the Chancery Division on March 19th, Mr. Justice Romer approved the reduction of this company's capital by writing off £9,499,688, reducing the loan capital to £3,363,986, and making other arrangements. Although there was opposition to the proposals, his Lordship pointed out that very large majorities of the holders of shares and debentures had approved the scheme.

The "Deion" Circuit Breaker.

Brief details of an American electric switch of unusual design.

Hailed as one of the electrical industry's most important developments of recent years, the invention of a switch based on a new method of interrupting an electrical circuit was publicly announced for the first time at the annual meeting of the American Institute of Electrical Engineers on January 30th in New York City.

Three papers then read revealed the character of the device, which is called the "Deion" circuit-breaker, the name being derived from the essential feature of its operation, which is "the deionisation of an electric arc." Dr. Joseph Slepian, whose invention the device is, read one of the papers, dealing with its theoretical and mathematical aspects. Dr. Slepian is a member of the research staff of the Westinghouse Electric and Manufacturing Company.

In accomplishing the deionisation process, the new circuit-breaker is said to drive an electric arc over a metallic path at the rate of 2,400 miles per hour, much faster than a rifle bullet; the arc itself has a temperature of 5,000 deg. F., yet in spite of such heat, the speed of the arc is so great that a cotton thread held directly in its path is not even scorched, it is declared.

Its name implies its function. The circuit-breaker essentially consists of two metallic contacts which can be drawn apart, and the device is called upon to play the dual roles of Dr. Jekyll and Mr. Hyde, for when the contacts are together the breaker must be a "perfect" conductor; when they are separated it must be a "perfect" insulator. When the circuit is broken while carrying large power, the intervening gap is spanned by an electric arc, and the best method of extinguishing the arc heretofore known to engineers, and that now in general use everywhere, is to immerse the separating contacts in oil; thus, when the metallic contacts are drawn apart, the oil is supposed to stop the formation of, or "quench," the arc. That such an assumption is by no means justified has, however, recently been proved by British research.*

Dr. Slepian's "Deion" method eliminates entirely the use of insulating oil. No attempt is made to "quench" the arc, but, when the arc has formed, it is driven at high speed over a circular track until it dies of exhaustion.

When assigned by the Westinghouse Co. to undertake research on circuit breakers, Dr. Slepian began with an intensive study of the formation and structure of electric arcs; knowing that an arc is essentially a stream of ions, he conceived the idea that if the ions could be removed there would be no arc, but it took him five years to discover a method of using a magnetic field to drive an arc at the rate of 2,400 miles an hour. When travelling at ordinary speeds, if an arc comes in contact with metal it will melt the metal rapidly and use the metal's ions to prolong its own life. At the "Deion" breaker's extraordinary arcing-speed, however, that process is reversed: the arc is driven into a series of copper plates where it is broken up into a series of small arcs, and the copper, "rather than give up its ions, removes ions from the arc instead." If one of the so-formed small arcs should come to a stop for one-twentieth of a second, the copper plates would melt instantly and fuse together. The copper plates into which the arc is driven are circular in shape, and the magnetic field which drives the arcs causes them to follow a circular path around the plates; thus, when an imprisoned arc has made the circuit of the plate 30 or 40 times, "it is so completely drained of ions that its life is snuffed out," we learn.

Circuit-breakers embodying the "Deion" principle have been made in a variety of forms, and the Westinghouse Co. seems to be confident that the principle can be extended to solve a great host of difficult switching problems. The list of applications to date includes small safety switches, electromagnetic switches for starting and stopping motors, small circuit-breakers for 2,500-volt service and large breakers for 15,000-volt service.

An outstanding feature of the new circuit-breaker is said to be its ability to stand repeated short-circuit tests without the need of maintenance, or attention. One of such breakers was recently made to operate 100 times at current values ranging from 5,000 to 15,000 amperes without any maintenance whatever. The speed of the circling arcs churns the air into such a turbulent state that special openings in the arcing chamber are used to give the switch the necessary ventilation.

Electric railroads and tramway systems should benefit greatly by the new development, it is declared, as the installation of "Deion" breakers will make for greater reliability of generating stations, while their development may also spell the doom of the light fuses which stand as sentinels over the wiring systems of residences; for rather than replacing a blow-out fuse when a current overload occurs, it will only be necessary to push the handle of a small circuit-breaker to reinstate the circuit.

*Elec. Rev., Dec. 28th, 1928, p. 1132.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Climate and Overhead Lines.

I was interested to read the letter from "S.C.B." on March 15th, and am obliged to him for the figures showing the damage done to Post Office lines. Will some of our power company engineers oblige with the corresponding figures for overhead electricity supply lines? I think it is exceedingly unlikely that they will, because my own inquiries to a number of responsible officers in various parts of the country brought me replies which may be summed up in the words "No trouble experienced." "S.C.B." is evidently not a member of the Overhead Lines Association (may we hope shortly to welcome him); when reading my paper, I described in detail the blizzard of March, 1916, and drew attention to the much greater liability of telegraph and telephone lines to damage. With regard to the American loading regulations, the following remarks will be found in the "Discussion" of the National Electric Safety Code, 1928: "The loadings specified for the several localities are not intended to represent the actual pressures and loadings to be encountered in these particular regions, nor can the relative values of the loadings be expected to conform to the assumed values given in these rules. They are, however, quantities chosen after careful consideration of local weather conditions for use in making computations of working stresses. The assumed loadings are not chosen to represent the most severe conditions which are likely to be encountered in the various locations, but are values which have been selected after full consideration of present accepted practice and of the several influences which tend to modify, or diminish, the stresses which might be expected to result from the actual loadings." In other words, it is not an economic proposition to build lines strong enough to withstand extraordinary conditions which occur rarely.

In the 1925 report of the National Electric Light Association, Mr. F. F. Fowle, discussing "Coincident Glaze and Wind Data" from ten U.S. weather bureau stations in or adjacent to Illinois, says, "heavy loading of ½ in. of ice coincident with 8 lb. of wind per sq. ft. is not justified. The actual loading does not exceed one half of 'heavy loading' at most."

The same laying of the ice-ghost is found in the French publication, "Syndicat des Producteurs et Distributeurs d'Energie Electrique; Arrete Ministeriel du 30 Avril, 1927" (translation) "there is no need, in most cases, to consider the possibility of a coating of ice on the conductors, as this occurs much more rarely on power lines than on telegraph or tele-

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phone lines, because of the heat produced by the current. However, it is possible, in some districts, *e.g.*, in mountainous country, for deposits of ice glaze to form on the lines; one must allow for this in special cases only."

Major T. Rich pointed out in a paper in December, 1927, that in France there is no record of accident due to conductor breakage.

In Japan severe loading conditions are laid down only for specified districts where snow and ice are experienced. In Japan, also, the gale season comes two months before the snow.

Cav. G. Semenza, who is acknowledged as one of the greatest living overhead-line experts, deals with the question as follows, in his book on the "Graphical Determination of Sags and Stresses for Overhead-Line Construction": ". . . as a rule, the conditions for maximum wind velocity and pressure do not occur at the same time as the conditions for the formation of ice coverings. . . . In Italy it is only in the high portions of the Alps and Appenines that coverings of sleet and ice are formed on electric wires. . . . In the United States it is customary to make allowance for sleet covering in calculating transmission lines, though sleet is rarely experienced. This is probably due, as elsewhere, to the static repulsion of the particles of water from the conductor, caused by the high electric stress, thus preventing the accumulation of water on the conductor surface necessary for sleet formation." He refers also, at some length, to the heating effect preventing ice formations. "A rise in temperature of even only one degree above the atmosphere might make the formation of sleet impossible. Sleet has been known to form at times on high-voltage lines in America, but rarely more than a thin film in thickness. In mountain regions, in still, damp, cold weather, a light frost fabric has been observed to form on conductors at certain critical elevations on the mountains. This, however, is a light open crystalline structure, although it has been observed to form to a thickness of as much as two inches round the conductor. It is, however, thrown off readily by any agitation due to wind."

A study of the Overhead-line Regulations of all countries brings out very clearly the fact that in no other country but our own is it the practice to lay down one set of loading conditions for conductors of all sizes, irrespective of local conditions. "S.C.B." sums up the matter admirably when he says "if light-gauge wires are erected with a proper factor of safety, then the larger gauges of wire will have an unnecessarily high factor of safety." That is exactly the point I intended to lay stress on in my paper, that power lines do not require the same high safety factors as very-light-gauge lines. An amendment of the Regulations for conductors of, say, 0.03 sq. in., or over, would surely have the effect of cheapening construction. I recently had occasion to work out wind pressures for overhead lines in the county of Lincolnshire, and found that the assumption of the loading given in the Commissioners' Regulations had the effect of allowing for a load which, according to the size of the conductor, was from twice to three times the maximum loading which has ever been known to occur in that county during the last 50 years. On top of that, one has to allow for a safety factor of two, giving a true safety factor of four to six. How is it possible to build really cheap overhead lines for rural areas under such conditions?

May I sum up the points I have been trying to make?

(1) When power lines are concerned, we can neglect the ice bogey, except in high mountains, of which we have practically none in this country.

(2) Any tendency for ice to form on lines would be counteracted in the case of h.p. lines by static repulsion, and in the case of l.p. lines by heating.

(3) For real progress in the economical design of power lines, we need to make a sharp distinction between light-gauge communication circuits of, it may be, 40 or 50 wires, strung up somewhere near the elastic limit, and heavier-gauge power circuits, of which one seldom finds more than six lines on one pole, and those erected with what is, taking into consideration the true climatic conditions, an enormous factor of safety.

Every overhead-line engineer knows, of course, that the specified ice loading is an artificial way of describing the permissible stress in a wire; but, if we have got to continue with this, could not the loading be suitably graded according to the size of wire and the locality in which the line is erected?

G. Molle, A.M.I.E.E.

London, *March 18th*, 1929.

London Trunk Power Cables.

Reverting to my recent correspondence and also to Messrs. J. Baldwin & Co.'s letter of the 8th inst., I would like make it clear that I am in agreement with Messrs. Baldwin at interlocking tiles are, in my opinion, quite as satisfactory concrete slabs, and I am sorry if my previous letter did t support that view.

Resident Engineer.

March 22nd, 1929.

Reviews.

Pioneers of Wireless. By Ellison Hawks, F.R.A.S. Pp. xix+304; 24 plates and 45 diagrams. London: Methuen and Co., Ltd. Price 12s. 6d. net.

Mr. Hawks goes far back in history for his first pioneers; in fact, Clerk Maxwell is not reached until halfway through the book. This means that the purely wireless, or, more accurately, radio, portion of the book is shortened, but it has the advantage of presenting a more detailed description of the earlier work on conduction and induction methods, work which is not now so widely known.

A summary of the work of the great electrical pioneers from Gilbert to Joseph Henry occupies the first 60 pages, and the next 100, including an interesting chapter on the discovery of the telephone by Bell, take us through the work of the pioneers of signalling without wires by conduction and induction. We notice that the author puts a "please" into the famous first telephone message, though Dr. Watson himself is wont to quote it as: "Mr. Watson, come here, I want you," the form usually given.

The next 50 pages lead us from Hughes through Clerk Maxwell (misspelt throughout with a hyphen), Hertz, Lodge, Branly, Tesla, Popoff to Marconi. We are glad to see how adequately the author deals with the work of Hughes, but we are surprised that no mention is made of the pioneer work of Commander Jackson, R.N. His work was not recognised for some time as its details were contained in confidential reports to the Admiralty, but it is long now since it was publicly known, and three years ago the Royal Society awarded the Hughes Medal to Admiral Jackson "for his pioneer work in radiotelegraphy and its application to navigation."

The last 80 pages give an excellent account of Marconi's early work, and a short summary of the work of other pioneers which led up to the establishment, two years ago, of a wireless telephone channel across the Atlantic. This summary could, of course, be expanded almost indefinitely, but it is clear that the author feels that the real pioneer work closed with Marconi's first tests across the Atlantic. On the whole, we should have preferred an expansion of this later work even if it had entailed a curtailment of the pre-radio period.

In this final section we note that Major Armstrong is mentioned as the discoverer of the regenerative principle, the book was published before the Supreme Court of the United States had upheld the claims of Dr. de Forest in this connection.

The author has done a service to the general reader by putting in the forefront the human side of the history of wireless, and indeed he gathers up the whole subject into a most interesting story. But the book will not only be welcomed by the general reader. Mr. Hawks has taken pains to be accurate in his statements, and his book should prove useful, as well as interesting, to that ever-expanding body of wireless workers, professionals and amateurs alike.

Electrical Transmission and Distribution. Vols. III and IV. By R. O. Kapp. Pp. vi+viii+479–1003. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. each volume.

The subject of switch and control gear is dealt with in the third and fourth volumes of this series. Vol. III is generally descriptive in character, and forms a useful and well illustrated review of modern practice in the field of switchgear for all voltages. Switchgear for use on super-generating voltages is dealt with by Mr. W. Anselm Coates. The first section dealing with this branch is concerned with the layout of large equipments, and representative examples of outdoor structures are described and illustrated, whilst modern armourclad gear is fully dealt with. The second section deals with the components of equipments for super-generating voltages. The author considers the physical and electrical properties of insulating materials, and the details of the construction of insulating fittings for super-tension work. Modern oil circuit breakers for this class of duty are described and illustrated, as are the various types of lightning arrestors in common use. It is somewhat surprising to find the now obsolete expression "potential transformer" on p. 613.

Dr. C. C. Garrard contributes the section dealing with switchgear for a.c. generating voltages. Representative examples of modern gear of this class are described, and there is a useful paragraph on bus-bar reactances or on the elementary theory underlying their use.

The section dealing with switchgear for d.c. and low-pressure a.c. circuits has been written by Mr. J. M. Goodall. Here we find well illustrated descriptive matter relating to switches and circuit breakers for this class of duty, although the omission of any account of the high-speed circuit breaker from this section is somewhat surprising. It is intimated, however, that this class of breaker will be described in a future section dealing with automatic switchgear. Typical lay-outs of low-pressure switchboards are illustrated in this section, and a number of detailed schedules of equipments for various circuits, both a.c. and d.c., are included.

Vol. IV is generally of a more practical character than the one preceding, in that it contains two valuable sections dealing with the care and operation of switchgear and with protective gear for a.c. systems. The first of these sections, from the pen of Mr. V. A. Brown, contains a large amount of good

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and useful matter relating to the maintenance of switchgear, although there is some descriptive matter which overlaps that in the previous volume. Directions are given for the routine testing of protective gear. This is somewhat more perfunctory in character than so important a subject demands. We find, for instance, that in describing the test for the balance of the transformers in a Merz-Price circulating-current system for an alternator, it is stated that no reading will be obtained with a low-resistance milliammeter in the relay circuit. As a matter of fact, of course, a small reading is usually obtained, and the matter of importance is the maximum safe value of the extraneous current for given circumstances.

The middle section of this volume, from the pen of Mr. Goodall, deals with ironclad switchgear of the industrial type, for voltages up to 3,000. The treatment is generally descriptive, and, beyond recording that the subject seems adequately covered, this section calls for no particular comment.

The last section, by Mr. B. H. Leeson, covers the subject of protective gear, and occupies one half of the volume. This section is very penetrating, and will well repay careful study by all who are concerned with, but not thoroughly versed in, the developments of modern protective gear. The author arranges various types of protective gear in logical sequence, and we are pleased to see that the system of distance protection, involving the use of impedance relays, receives adequate attention, especially in view of the adoption of this system for the new transmission schemes now in process of development in this country. There appears to be a tendency in this section to lay stress on certain systems of protection, whilst others for similar duty are dismissed with a passing mention. We notice, for instance, that no description is given of the important B.T.H. system of parallel feeder protection which embodies the unique feature of differential leakage protection with a light setting. The author makes considerable use of what he calls stability diagrams, which seem to be based on the assumption that the extraneous relay currents in differential systems increase proportionally to the straight-through current. It is very questionable if this simple relationship actually holds.

These two volumes will be very acceptable to engineers concerned with the maintenance and operation of such stations, and also to the general engineering reader. As works of reference they would have been more useful had fuller indexes been provided.

Practical Primary Cells. By A. MORTIMER CODD, F.Ph.S. Pp. viii+127; figs. 53. London: Sir Isaac Pitman & Sons, Ltd. 1929. Price 5s. net.

The number of books dealing with primary cells has become very numerous in recent years, and as the general features of cells in design and construction have to a considerable degree become standardised, there must necessarily be some degree of sameness in the treatment of the subject and in the information given by the various authors. The volume under review, however, will certainly rank highly amongst the literature on the practical aspects of primary cells. The author of this work has produced a book which should be of service to all having to do with the working details of primary cells, both from the laboratory and commercial standpoints. The initial chapters of the book deal with the simple voltaic cell; the later chapters deal with dry cells, two fluid cells and the maintenance of batteries.

The care of batteries, particularly where there is a large number of cells, is essential to economical working. Generally speaking, batteries should be installed under such conditions that they can be kept at a cool, fairly constant temperature, and are easily cleaned and ventilated. Extreme variations in temperature lead to excessive differences in the internal resistance of the cells, a complaint to which some types of cells are extremely susceptible. Cleanliness and ventilation are also necessary in order to avoid leakage through creeping and discontinuities due to corroded terminals. The author has included in the form of an appendix, a highly serviceable list of a large number of voltaic cells which have been invented since Galvani's discovery in 1786; the basis of the selection is either historical interest, first invention, or practical utility.

A certain amount of information has been forthcoming of late years on cell manufacturing processes. One would have appreciated, where possible in a volume of this type, a little fuller treatment of the actual production of cells, together with diagrams of plant used. The volume is, in general, a useful contribution to the literature on the subject, though little attempt is made to weigh up the advantages and disadvantages of the various types of cells. With this reservation, the book will be found to be a serviceable and reliable guide. The volume has been written in a clear and incisive manner, the type and illustrations are good, the line drawings being particularly clear. The style in which the book is issued contributes a share to the attractiveness of the volume.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Automobile-lighting Time Switch.

To provide means of switching on the lights of motor vehicles when standing unattended in public roads or places where it is necessary to "light up" at the proper time, SETALITE, LTD., 1-4, Morley House, Regent Street, W.1, have introduced the "Setalite," fig. 1. This takes the form of a novel clock time switch which is automatically wound up

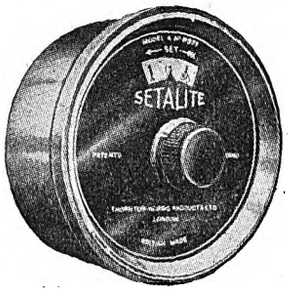

Fig. 1.—The "Setalite."

in the setting operation. The setting, which is effected by a centre knurled knob, is arranged according to the length of the period, hours and minutes, from the time of setting until lighting-up time. The apparatus has a maximum working range of six hours. Provision is made for either housing the instrument in the cubby hole or fixing it to the dashboard.

A New Switch Fuse.

The 4-pole "Safetee" switch-fuse is a recent introduction of Messrs. L. WEEKES (LUTON), LTD., Luton, Beds., and has been specially developed for use on 2- and 3-phase, 4-wire systems. Briefly, it consists of two d.p. fuse and switch contact carriers, which move along large machined guides and are operated by toggle mechanisms, all mounted on the lid, the fixed contacts and cable connections being mounted near the bottom of the switch case. All the current-carrying parts are secured on mica-insulated steel supports, and will carry, it is claimed, 50 per cent. overload indefinitely. The lid cannot be opened or closed with the switch in the "on" position. When open, the whole of the interior is very acces-

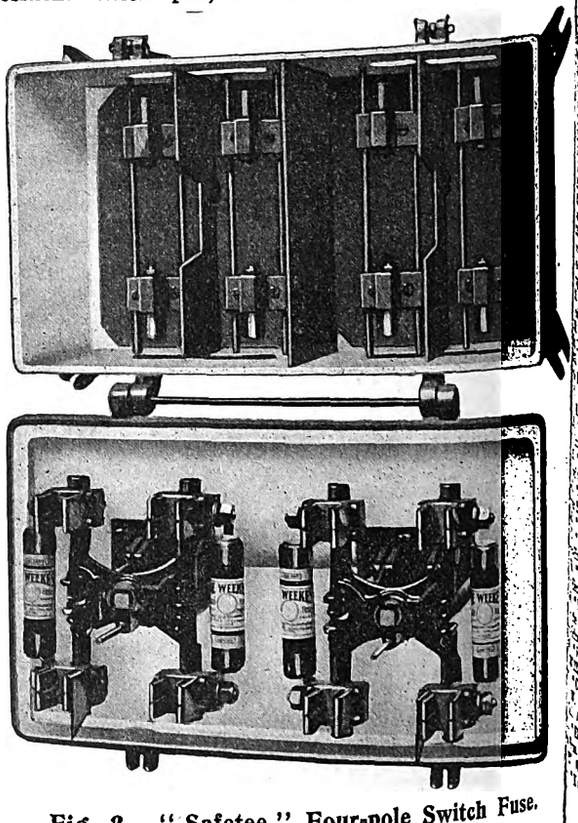

Fig. 2.—"Safetee" Four-pole Switch Fuse.

sible. There are two breaks per pole, and quick breaking is made by powerful pull-off springs, the impact being taken up

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by suitable buffer springs. After the contacts open, the quick-break functions independently of the handle. Suitable springs and carefully machined parts make the switch pleasing to operate. Micanite carriers are provided between phases, and if required the switch-fuse can be supplied mica lined throughout. By a slight modification the apparatus may be used as a d.p. change-over switch, the operating handle being made to engage with either mechanism, the change being made in the "off" position. Fig. 2 shows the standard equipment, which is made in sizes for loadings from 100 A to 500 A at 500 V. Similar mining-type and water-tight switch-fuses are made to order.

Adhesive Insulating Cord.

We have received from the Friho Manufacturing Co., Ltd., 283, City Road, E.C.1, some samples of "Ikfama" adhesive insulating cord, which, it is claimed, is equal in quality to the best insulating tape. and is clean to handle. It is made in three widths and lengths: 2-strand or 1-mm., about 132 yards long; 4-strand or 2-mm., about 66 yards long; and 6-strand or 3-mm., about 44 yards long. It can be supplied in black, white, grey, red, pink, yellow, green, blue and brown. The cord is wound on metal reels, and each reel is placed in a metal box which serves as a holder during use.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be numbered and abridged, and all subsequent proceedings will be taken.

1927.

22,652. "Light-sensitive apparatus for producing or amplifying alternating currents." J. Neale. August 29th, 1927. (307,086.)

23,116. "Submarine telephone cables." W. S. Smith, H. J. Garnett, and H. C. Channon. September 2nd, 1927. (307,087.)

25,176. "Gramophones, loud-speakers, and the like acoustic instruments." A. A. Linsell. September 23rd, 1927. (306,915.)

25,290. "Means for connecting electrical pick-up devices for gramophones and the like with radio receivers." A. Andrews and Dubilier Condenser Co. (1925), Ltd. September 26th, 1927. (306,855.)

28,608. "Means for supporting electrical sound-recording or sound-reproducing or other like electrical vibratory devices." W. E. Clifton. October 27th, 1927 (307,091.)

29,129. "Electrical regulators." British Thomson-Houston Co., Ltd. November 24th, 1926. (281,243.)

29,545. "Electrolytic cells." R. Edgeworth-Johnstone. November 4th, 1927. (307,093.)

31,382. "Cone diaphragms for sound amplification or reproduction." F. Brinkmann. June 24th, 1927. (292,569.)

31,383. "Hornless loud-speakers." F. Brinkmann. June 24th, 1927. (292,570.)

31,385. "Hornless loud-speakers." F. Brinkmann. June 24th, 1927. (292,571.)

31,387. "Magnet systems of telephone instruments." F. Brinkmann. June 29th, 1927. (292,989.)

31,495. "Enclosed electrical apparatus." British Thomson-Houston Co., Ltd., and H. C. Heath. November 23rd, 1927. (306,862.)

31,831. "Frequency-responsive apparatus." F. G. Dyrna. November 25th, 1927. (306,865.)

31,863. "Electric controllers." Electrical Apparatus Co., Ltd., and R. H. Barbour. November 26th, 1927. (306,868.)

32,065. "Electric switches." J. A. Crabtree. November 29th, 1927. (306,919.)

32,079. "Means for the winding of electric flex extensions." F. F. D. Davidson. November 29th, 1927. (306,920.)

32,127. "Thermionic valves." Radio-technique. December 31st, 1926. (282,727.)

32,158. "Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., C. Lambert, and W. G. Patterson. November 29th, 1927. (306,922.)

32,161. "Induction motors." Dr. B. Schwarz. November 29th, 1926. (281,344.)

32,253. "Headlamps for motor-cycles and the like." British Thomson-Houston Co., Ltd., and H. N. Sporborg. November 30th, 1927. (306,987.)

32,284. "Testing devices for impulse senders." Automatic Telephone Manufacturing Co., Ltd., and T. P. Preist. November 30th, 1927. (306,990.)

32,285. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. Saville. November 30th, 1927. (306,991.)

32,288. "Colloidal diaphragms for electrolytic cells." G. F. Jaubert. December 1st, 1926. (281,674.)

32,395. "Load-sharing arrangements for dynamo-electric machines." A. Reyrolle & Co., Ltd., and G. E. Grace. December 1st, 1927. (306,995.)

32,409. "Manufacture of photo-electric cells." General Electric Co., Ltd., and N. R. Campbell. December 1st, 1927. (306,996.)

32,420. "Manufacture of electron-emitting bodies." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. December 1st, 1927. (307,099.)

32,425. "Cycles and similar light vehicles adapted for laying telegraph wires and the like." R. H. Smith. December 1st, 1927. (306,999.)

32,431. "High-tension electric cables." Siemens-Schuckertwerke Akt. Ges. December 2nd, 1926. (281,692.)

32,453. "Galvanic cells." Dr. A. Schmid. December 2nd, 1926. (281,698.)

32,581. "Electromagnetic acoustic devices, such as loud-speakers." British Thomson-Houston Co., Ltd., and A. P. Young. December 2nd, 1927. (307,106.)

33,370. "Regulation of asynchronous alternating current machines." English Electric Co., Ltd., and G. Schroedl. December 9th, 1927. (307,121.)

33,490. "Method of, and means for preventing faulty action due to the effect of the magnetic field of the current circuit in cable protective devices." Siemens-Schuckertwerke Akt. Ges. December 14th, 1926. (282,386.)

33,649. "Electric fires or radiators." F. J. Wineberg. December 13th, 1927. (307,127.)

34,013. "Cord grips for electric fittings and appliances." W. V. Butterfield, A. W. Butterfield, and S. Butterfield (trading as Mycromet Manufacturing Co.). (Patent of addition not granted.) December 15th, 1927. (307,131.)

34,711. "Electromagnets and electromagnetically-operated devices." Siemens Bros. & Co., Ltd., T. S. Robertson, and W. E. Goodwin. December 2nd, 1927. (Cognate application, 7,696/28.) (307,138.)

34,954. "X ray tube shields." A. F. Pieper. December 23rd, 1927. (307,143.)

1928.

1,449. "Protective device for plugs for electric plug contacts." P. Ratzsch and E. Stracke. January 16th, 1928. (307,158.)

2,735. "Evacuation of closed vessels." Westinghouse Lamp Co. February 4, 1927. (284,623.)

3,020. "Methods of insulating the exposed parts of the metal bridges of the tumbler type of electric switch." C. L. Arnold and M.K. Electric, Ltd. January 31st, 1928. (307,173.)

3,811. "Wireless receiving systems." A. R. Jones. February 7th, 1928. (307,177.)

4,017. "Apparatus for controlling the exposure of a unit to a source of electric light." Pictorial Machinery Ltd., and B. Cook. February 8th, 1928. (307,181.)

4,416. "Combined clock and wireless loud-speaker." H. T. Stott. February 11th, 1928. (307,192.)

4,885. "Head lamps for motor road vehicles." S. Masson. February 16th, 1928. (307,197.)

5,028. "Manufacture of insulating tapes or the like." International General Electric Co., Inc. February 18th, 1927. (285,497.)

6,610. "Electro-dynamometers." Siemens & Halske Akt. Ges. March 3rd, 1927. (286,308.)

6,698. "Cleats for supporting electric conductors." Callender's Cable and Construction Co., Ltd., and F. H. Simkin. March 3rd, 1928. (307,210.)

6,717. "Junction boxes for electrical cables. A. Chalmers. March 3rd, 1928. (307,211.)

7,418. "Method of producing moulded articles, such as sheets and the like, suitable as insulating material for electro-technical purposes, from filling materials and artificial resin." Schieferwerke Ausdauer Akt. Ges. March 10th, 1927. (286,732.)

7,649. "Electric speed-indicating apparatus." G. Mombur. March 12th, 1927. (287,074.)

7,707. "Automatic stopping devices for electric lifts." Smith, Major and Stevens, Ltd., and P. H. Stevens. March 13th 1928. (307,217.)

8,162. "Boiling plates for electric cookers." A. J. Howard and L. V. Turner. April 28th, 1928. (307,221.)

9,580. "Electric speed-indicating apparatus." G. Mombur. April 8th, 1927. (Addition to 287,074.) (288,285.)

9,813. "Star-delta method of starting alternating-current motors." Naamlooze Vennootschap Hengelosche Electrische en Mechanische Apparatenfabriek and A. Booden. March 31st, 1928. (307,231.)

10,733. "Radio receiving systems." L. Mellersh-Jackson (Federal Telegraph Co.). April 11th, 1928. (307,237.)

11,375. "Picture telegraph and the like apparatus." Etablissements E. Belin. April 27th, 1927. (289,431.)

11,586. "Apparatus for measuring a low gaseous pressure such as that of a vapour-electric discharge device." British Thomson-Houston Co., Ltd. April 21st. 1927. (289,059.)

14,387. "Electric heating devices." P. A. Klinge and O. E. Borgstrom. May 16th, 1928. (307,249.)

15,299. "Thermal regulator for electrically-heated devices." P. A. Klinge and O. E. Borgstrom. May 24th, 1928. (307,252.)

15,973. "Dirigible headlights for automobiles." A. E. Daly. June 23rd, 1927. (292,585.)

16,418. "Multiple thermionic valve for a frequency-changing receiver." W. Kunze and Radiofrequenz Ges. December 18th, 1926. (Divided application on 282,444.) (291,735.)

35,776. "Coupling devices for use in wireless telegraphy and telephony." Nederlandsche Telegraaf Maatschappij Radio-Holland. December 6th, 1927. (301,831.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 20th:—

Clarostat. No. 492 651. Class 8. Variable electrical resistances.—Claude Lyons, Ltd., Old Hall Chambers, 76, Old Hall Street, Liverpool.

Sarezite. No. 498,496. All goods in Class 8.—P. Kay, Ltd., 183, Old Street, London, E.C.2.

Dualite (lettering and design). No. 491,953. Class 13. Lamps (ordinary) and lighting fittings. No. 491,954. Class 18. Lighting installations, heating apparatus for buildings, and cooking stoves.—Dualite, Ltd., 18, Bartlett's Buildings, E.C.4.

Magniflect. No. 498,588. Class 13. Lamps (ordinary) and reflectors.—Astra Dynamo Co., Ltd., 124, Victoria Street, S.W.1.

Sunbeam. No. 484,296. Class 18. Electric lighting, power and ignition sets, all being parts of motor cars.—Sunbeam Motor Car Co., Ltd., Moorfield Works, Wolverhampton.

Weather Charts by Wireless.

That daily weather charts are to be transmitted by wireless was announced by Mr. R. A. Watson Watt, superintendent of the radio research station at Slough, in the course of the G. J. Symons Memorial Lecture delivered by him before the Royal Meteorological Society. The subject of his lecture was "Weather and Wireless," and according to the *Financial News*, Mr. Watt said that experimental transmissions would be made from Daventry on the Fultograph system. Wireless as a means of communication, he said, was essential in modern meteorology because it alone was capable of giving sufficiently rapid interchanges of data over wide areas. Atmospherics might be counted arriving at the rate of 3,000 or 4,000 per second in a tropical night. The average atmospheric was 100,000 times as strong as a readable signal. Atmospherics had been known to disturb broadcast reception up to 4,000 miles from their place of origin. The predominant source of the world's supply of atmospherics at any moment was usually in a land where it was summer afternoon. The average atmospheric received in England was of such strength as would be sent out by a thunderstorm 2,000 miles away. Visual direction-finders had accurately located thunderstorms in progress at places 1,000 or 2,000 miles away. Extensions of the applications of wireless telegraphy in meteorological communications might well include the transmission of three-colour charts, in which the fronts were indicated in distinctive colours. The detection and location of thunderstorms by wireless direction finding on atmospherics had been tested, and further experimental work was likely to lead to applications of this method in the meteorology of air routes.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABINGDON.—Extensions, Radcliffe Infirmary, with electrical department (£120,000), for the directors; secretary.

AYR.—Corporation housing scheme (£21,760); burgh surveyor.

BARNES (Surrey).—Extensions, Kew Works, Mortlake Road, for Kent Bros., and E. H. Phillips, Ltd.

BEXLEY (Kent)..—Houses (67), Woodlands estate, for S. H. Alabaster. Mission hall, Station Approach, Welling, for William Grubb.

BIGGLESWADE.—Re-erection (after fire) of works, The Baulk, for P. C. Kidman.

BROADWAY.—Housing scheme (52), for Evesham R.D.C.; R. J. Atkinson, surveyor, 64, Port Street, Evesham (returnable deposit of £2 2s.).

BURNLEY.—Enlargement of Victoria Hospital; secretary.

BURY.—Housing scheme (about 200), Huntley Brook, East Ward and Lower Chesham; borough engineer.

BURY ST. EDMUNDS.—Senior girls' school (£25,000), Grove Park estate, for the Voluntary Schools Fund Committee; A. R. Ryan-Tenison, architect, 21, Great Peter Street, London, S.W.

CHESTERFIELD.—St. Augustine's Church (£11,000); Rev. C. Mudford.

COLEFORD (Glos.).—Re-erection (after fire), of Clearwell Castle, seat of Lieut.-Col. C. G. Vereker (£40,000).

COMPTON MARTIN (Bristol).—Re-erection (after fire) of Hazel Manor (mansion), residence of Charles Tucker.

DAVENTRY.—Electric lighting installation, Institution, for the Board of Guardians; clerk.

DROITWICH.—Spa, with concert hall, kinema, hotel, &c. (£250,000), for the Droitwich Development Co., Ltd.; secretary.

DUKINFIELD.—Housing scheme (32), Lord Street site (deposit £2 2s.). Housing scheme (54), Lodge Lane site (deposit £2 2s.).; borough surveyor.

ECCLES.—Housing scheme (82), Anson Street and Lane End; T. Elce, borough engineer.

FALKIRK.—136 houses, for Corporation (£18,200); burgh surveyor.

GLASGOW.—X-ray department at Western Infirmary (£18,000); the medical superintendent. Cabinet factory (£90,000), for Scottish Co-operative Wholesale Society, Shieldhall; the manager Wash-houses at three sites (£100,000); city engineer.

GRANTHAM.—Additional 50 houses, for the T.C.; borough surveyor.

HALIFAX.—Development of Bull Green site, with offices, shops and library, for the T.C. (£24,000); A. C. Tipple, borough engineer.

HALSTEAD (Essex).—Housing scheme (36), for the U.D.C.; W. A. Nicholson, surveyor.

HARPENDEN.—Housing scheme (50), Westfield estate, for the U.D.C.; surveyor.

HASTINGS.—Re-building station (£202,000), for the Southern Railway Co.; engineer.

HELENSBURGH.—Church hall (£5,500), for Park U.F. Church; H. Mitchell, architect.

HORNCHURCH (Essex).—Bank, High Street; Westminster Bank, Ltd. Houses (59), Slewins estate, for Standen Bros. Houses (44), Osborne Road, for C. A. Piper.

IRISH FREE STATE (Cork).—Bishop's Palace, Farranferris; J. R. Boyd, architect, 61, South Mall.

(Dublin).—Electrically-driven pumping plant at Stillorgan; city engineer, 28, Castle Street.

(Enniskillen).—Boarding school, for Convent of Mercy (£14,200); J. Donnelly, architect.

KILMARNOCK.—Extensions, Longpark Pottery, for J. and M. Craig.

LEEDS.—Secondary school, Far Headingley (deposit £2 2s.); Architect's Section, Education Department, Calverley Street.

LEWES.—Bazaar premises, Cliffe High Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

LEXDEN AND WINSTREE.—Additional 50 houses, for the R.D.C.; surveyor.

LICHFIELD.—Cinema,, Friary Road, for the Inter-European Film Syndicate, Ltd., 37, Walbrook, E.C.4.

LONDON (Hackney, E.).—Housing scheme, 42 acres, Eastern Arterial Avenue; borough engineer. Five blocks of flats, Southwold Road; Gee, Walker & Slater, Ltd.

(Ilford, E.).—School, Goodmayes (500 places), for the borough E.C.; Adam Partington, clerk.

(Islington, N.). — Extensions, Northern Polytechnic (£65,000); governors.

(Willesden, N.W.).—Secondary school, Dollis Hill; Middlesex Education Committee.

(Deptford, S.E.).—Blocks of dwellings, Oliver Goldsmith estate (£92,000); L.C.C. architect.

(Fulham, S.W.).—375 tenements and 14 shops, Fulham Road (£271,000); borough engineer.

(Kensington, S.W.).—Shops, West Kensington station, for L.M.S. Railway Co.; A. P. J. Ball.

(Putney, S.W.).—Extensions, Huntingfield School (£16,000); L.C.C. architect.

(Wandsworth, S.W.).—Rehousing scheme, Wandsworth Plain area (£180,000); borough engineer.

(Wimbledon, S.W.).—Restaurant (£10,000); A. E. Chapman, Wimbledon Hill Hotel, North Wimbledon.

(Ealing, W.).—Factory at Northfield Avenue, for Ideal Cleaners and Dyers, Ltd.; W. S. Grice, architect, 7, Gray's Inn Place, W.C.1.

(W.C.).—Extensions, Civil Service Supply Association, Strand; Simmons & Simmons.

LYMINGTON.—Housing scheme (50), for the T.C.; borough surveyor.

MANCHESTER.—Proposed housing scheme (200), Moston; H. Price, city architect, Town Hall. Police offices, near South Street; H. Price, city architect, Town Hall.

MITCHAM.—Secondary school; Surrey Education Committee.

NEWTON.—Technical school (£31,200), for Lancs. E.C.; Thomas Taylor & Co., builders, Littleborough.

NORTHALLERTON.—Roman Catholic church, Thirsk Road; Priest-in-charge.

OXFORD.—Chapel and lecture room, Bishop King's Palace, Rose Place; Prof. Francis de Zulueta.

PAISLEY.—Church for St. Mirin's R.C. congregation (£25,000); priest-in-charge. School (electric lighting); clerk, School Management Committee. Nurses' home; Committee of Management, Paisley Infirmary.

PEEBLES.—Housing scheme (48); burgh surveyor.

PERTH.—Hospital block at James Murray's Royal Asylum (£18,000); Smart, Stewart & Mitchell, architects, 42, Tay Street.

PORTSMOUTH.—57 houses, off Teignmouth Road; R. J. Winnicott. 150 houses, off London Road, Cosham; Dockyard Employés' Housing Association, Ltd. 32 houses, Green Lane, Copnor; S. Brittan. Tram depôt, Eastney; tramway manager. Berth extensions, Camber Dock (£4,200); city engineer.

SHORNCLIFFE.—Regimental institute (£10,000); R. J. Barwick, builder, Dover.

SLOUGH.—Theatre (£50,000); H. D. Bowyer, builder.

STRANRAER.—Housing scheme (30); borough surveyor.

SUNBURY.—School (500 places), for Middlesex E.C.; H. M. Walton, secretary, 40, Eccleston Square, London, S.W.

SURREY.—Clinics at Dorking, Epsom, and Lingfield; County architect.

SWANSEA.—Aerodrome; borough engineer. Civic centre buildings, Victoria Park (£300,000); Special Corporation Committee. 103 houses, Townhill estate; C. Sansom, Bridgend.

THORNABY-ON-TEES.—Houses (50), for the T.C.; H. E. Pitt, builder, Sunderland.

TILEHURST (Reading).—Church, Norcot estate; A. H. R. Tenison, architect, 21, Great Peter Street, Westminster.

TORQUAY.—Cinema, for the Burlington Picture House (Torquay), Ltd. Extensions, Hotel Regina, Victoria Parade, for A. J. Plumb. Rebuilding bazaar premises, Union Street, for Marks & Spencer, Ltd., London. Houses (45), Teignmouth Road, for R. Riggs. Isolation hospital (£11,600), for the T.C.; borough surveyor. Extensions to Babbacombe Cliff Hotel, Babbacombe; J. H. Scoles, architect.

WATERLOO-WITH-SEAFORTH.—Housing scheme (33), Holden Street (deposit £1 1s.); surveyor to U.D.C., Town Hall.

WEST HARTLEPOOL.—Extensions, Cameron Hospital; secretary.

YEOVIL.—Shops, flats, garages, Peter Street and Union Street, for C. L. Norman.

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The

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Industrial Heating.

TWO of the papers which were presented and discussed at last month's meeting of the Institute of Metals are of importance as indicating the rapid strides which electricity is making in the comparatively new field of industrial heating. They are worthy of careful study by electricity supply authorities, industrial users, and electrical engineers in general, for the information they contain upon developments which should be the means of considerably widening the demand for electricity in many areas. The number of working results which is available upon electric furnaces is few, compared with their vast possibilities, but results are growing steadily both in number and significance, and such papers as that referred to on another page are to be welcomed for the double reasons of furnishing authoritative facts for the guidance of potential consumers and for keeping before supply authorities the possibilities of developing this load.

Among the many points raised by Mr. D. F. Campbell is the material influence which pouring time has upon the determination of the size of furnace to be installed for a given output: a point which can be easily overlooked, though it is possible to instance cases in which the necessity for pouring into a large number of small moulds is sufficient to affect the total day's production to such an extent as to necessitate doubling the capacity of the furnace to compensate for it.

Turning from furnaces designed for metal melting to the oven and muffle type used for heat-treatment, it is particularly striking to note that for certain purposes, such as annealing brass and carburising, the cost of power for electric furnaces per ton output is in many cases less than average results with gas. In the case of carburising, a heavy and lengthy operation which has hitherto been regarded as particularly suited for gas furnaces, the electric furnace can now produce results over a lengthy period showing a monetary saving in the use of electricity, as compared with gas. In this connection, the furnace consumption has to be considered under three heads; that is, heating up from cold, maintenance over a period, and heating up the charge contained in the furnace. In the particular instance referred to, it was purely as a result of the saving

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effected under the second head (that is, a minimum heat loss in the maintenance of temperature) that the apparatus was able to show economies over a gas-fired furnace of up-to-date design. This point of economy in favour of electric furnaces needs stressing: it is a feature in which a large proportion of gas-fired furnaces does not show to particular advantage, as there must be thousands of them installed up and down the country discharging the products of combustion without recuperation straight into the atmosphere through numerous flues at a temperature which is to all intents and purposes the same as the working temperature of the furnace. The size of furnace used in the example of case-hardening quoted was 8 ft. 6 in. by 7 ft. 6 in. by 2 ft., and a system of electric heating which will maintain a temperature of some 900 deg. C. in a heating chamber of 127 cu. ft. with a consumption of only 30 kWh (costing 1s. 9d.) needs little further explanation, or argument, on the subject of its efficiency, or insulation.

In general, the position of electricity in the field of industrial heating may be compared with the position occupied by gas about twenty years ago. It has secured a definite footing in industry in spite of the competition of other methods of heating, both cheaper and of longer establishment, and it promises to become a formidable competitor in future with existing interests. Its growing development is indicated in a variety of ways, both by the increase of the number of makers specialising in electric furnaces, and even more so by the fact that (as anyone who has opportunities of access to up-to-date works may quickly discover) the installation of a single electric furnace is quickly followed by other applications in the same works. We may further not unreasonably expect the development of electric furnaces to be the more rapid because, by the very nature of the apparatus used, its design is in the hands of designers of specially good training. Neither the grate-fitter, nor the bricklayer, or even the small jobbing foundryman, is likely to turn his attention to the design and erection of electric furnaces in the same way as he has been known to tackle other forms of heating equipment, and in this fact is undoubtedly to be foreseen a more rapid extension upon safer lines than would otherwise be the case with a comparatively new system.

Exhibitions and the B.E.A.M.A.

The annual report of the British Electrical and Allied Manufacturers' Association was referred to briefly in our last issue. We extend our good wishes to Mr. Victor Watlington who succeeds Col. R. K. Morcom as chairman of the Council and hope that he will have a successful period of office. As mentioned last week, the Council does not favour the organisation of another large national electrical exhibition for several years to come, and we may say that such events, if they are to be impressively run, are not wanted by the majority of manufacturers because of the heavy expense of pre-occupation they occasion at a time when the industry is engaged upon many important problems. We agree that exhibitions such as can be run either under the control, or with the co-operation, of E.D.A. demonstrating the applications of electricity are wanted, rather than are big displays of generating plant, switchgear and apparatus. In our opinion our present exhibition policy should be to place E.D.A. in a strong position to run really good popular and educative displays for particular trades, to support the exhibition held at the I.M.E.A. conventions, and to give still further support to the British Industries Fair—a short-run business show. We are not sure that a good popular and fascinating electrical show at Olympia in the late autumn would not draw a host of the public, possibly to the tune of half-a-million people from the extra metropolitan area. That could be made to draw the domestic mind and the trade, and the investor as well. If the radio trade can do it surely there is enough fascinatingly attractive appeal in affairs electrical to make a really fine show!

Changing over to A.C.

Mr. R. H. Rawll's article under the above title, the second portion of which will be found elsewhere in this issue, will, we believe, prove to be of considerable help to many supply engineers who are at present, or will be in the next few years, engaged in changing over their systems of distribution from d.c to a.c. Dealing with the consumers and their apparatus before and during a change-over involves much work which is rather off the beaten track of the supply engineer, and even of the mains and distribution engineer, and the experiences gained as a result of the alterations in areas of the City of Birmingham's electricity undertaking, which, we believe, were carried out with conspicuous success, will make a valuable addition to engineering literature.

Mr. Rawll makes it clear that in order to arrive at the high degree of organisation necessary for a change-over job, close co-operation between all concerned must be the keynote. A wise engineer will make it his business to instill in the minds of all under him who are to be engaged on the job, the spirit of co-operation. A thousand-and-one minor difficulties crop up during the "critical" period, mostly of a local nature which cannot, at least in the early days, be foreseen, and many of them, in order to ensure continuity of supply, demand prompt action on the part of the workmen, or junior supervisors; such prompt action demands that confidence which can only be born of co-operation.

Another aspect which calls for serious consideration is that of maintaining good relations with the consumers, existing and prospective. A well-planned change-over scheme may prove an excellent advertisement for the supply undertaking, and the interest aroused by the usual legal notice of the Electricity Commissioners' consent offers an excellent opportunity to the right man for business-getting when calling on consumers.

The author of the article in question draws attention to the machine maker who asks an extortionate price for necessary replacements. Such narrow practice cannot be condemned too strongly. While in such cases there seems to be no way out, except for the supply undertaking to satisfy the profiteers' demands, for the sake of the reputation of the undertaking and the supply industry, the consumer should be acquainted with all that has happened, and its meaning.

Problems in Lighting.

The great advance in the efficiency of illuminants during the present century is common knowledge. What, however, is even more interesting is the steady progress being made in the application of artificial light. Many developments take place so persistently that they almost escape notice, and it is only when one recalls the conditions of a few years ago that one becomes aware of the change.

Problems in lighting are, in fact, in constant course of solution, yet new problems are continually arising. Some interesting instances were mentioned in a discussion before the Illuminating Engineering Society in March. Two of the problems then discussed were concerned with the lighting of kinema theatres—one of the few types of buildings that are designed exclusively for use under artificial light; the "atmospheric" treatment of such interiors is still in its infancy, but it has obviously great possibilities. Another instance of continual progress is the lighting of the new underground railway Piccadilly station. The adoption of indirect lighting by pedestal units for the escalators and adjacent landings is an original and, on the whole, successful experiment; but that is only one instance of novel lighting effects which are being constantly introduced on the Underground system. We might mention, for example, the bold plan of the railways executed on the large illuminated glass panel let into the wall of the Charing Cross tube station, and the ingenious expedient of employing coloured lamps to guide passengers. Few people stop to consider that without electric light the whole underground railway system of London would be brought to an immediate stop.

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Woodworking Machinery.

Recent developments in the methods of electrically driving machine tools employed in the timber trades, embodying the built-in principle and specially designed motors.

THE Machine Tool Exhibition at Olympia in 1928 heralded the triumph of electrification in yet another field of industry, as was evidenced by the wide application of direct electric driving in machine-tool design. Since the previous exhibition of 1924 great strides have been made possible by the collaboration between the machine-tool designers and electrical manufacturers, and to-day many machine-tool makers build complete ranges of self-contained electrically-driven machines with which it is possible to equip practically any machine shop.

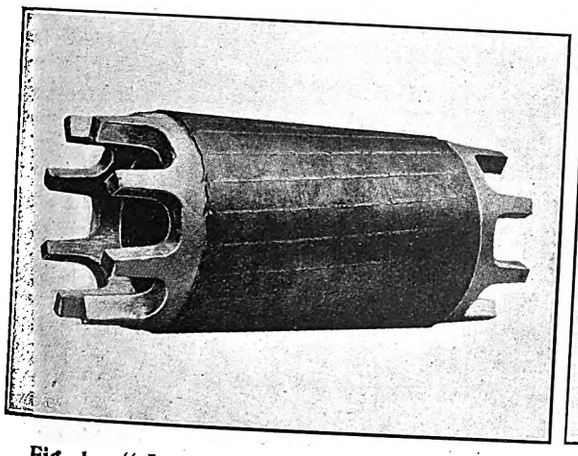

Fig. 1.—" Loose " Rotor for Built-in Motor.

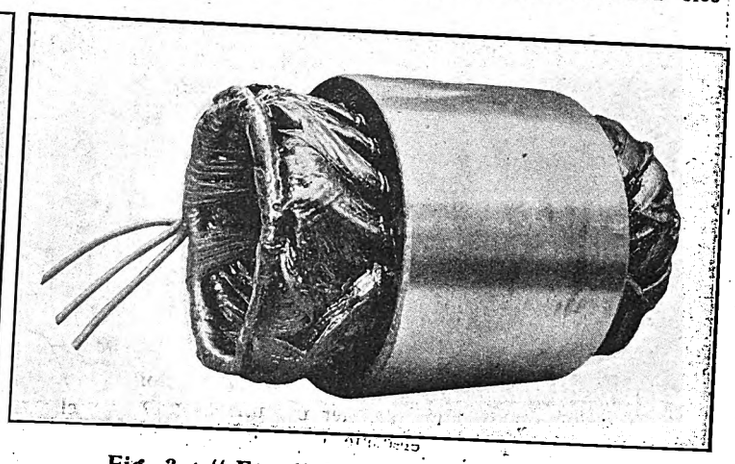

Fig. 3.—" Free " Stator for Wood-machine Motor.

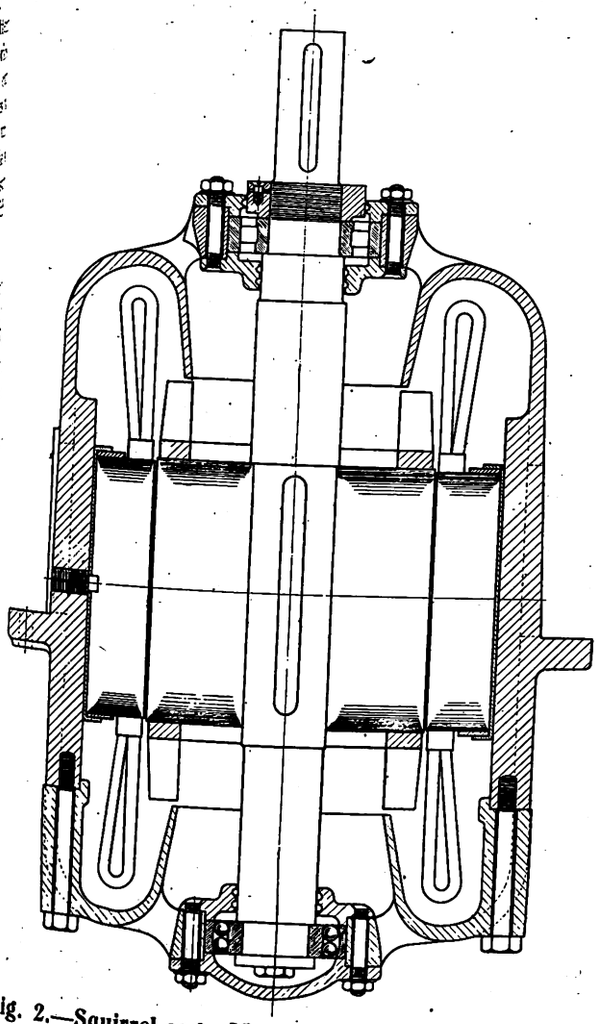

Fig. 2.—Squirrel-cage Motor for Mortising Machine.

With the self-contained electrically-driven machine-tool, line-shafts, pulleys, belts, and striking gear are completely eliminated, thus effecting a considerable saving in the initial capital outlay. In addition, the elimination of line-shafting belts results in a large saving in power which would otherwise be absorbed by transmission losses. Further outstanding advantages of the electrically-driven machine are that there is no

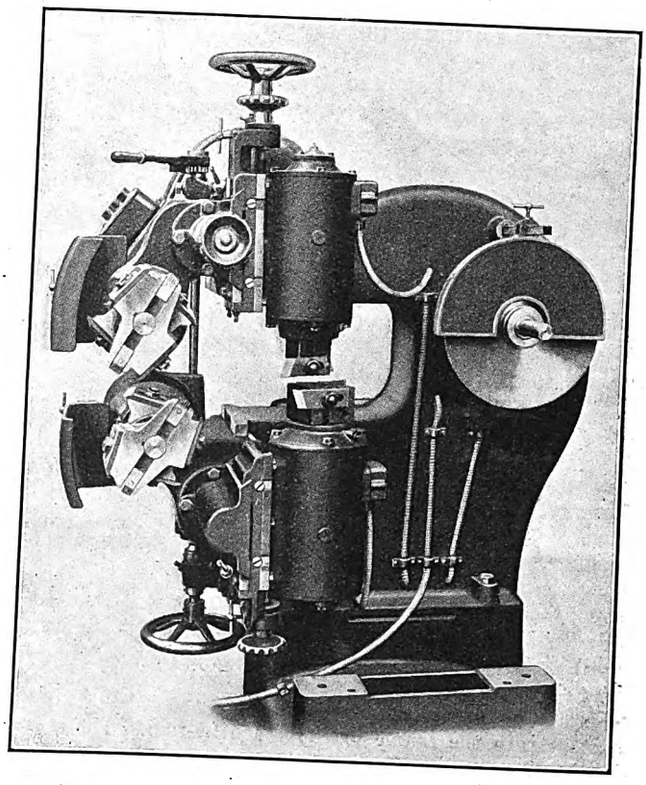

Fig. 4.—Tenoning Machine Without Table.

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obstruction to the lighting of the shop, each machine being a separate or individual unit, power charges cease as soon as each machine is stopped, the machines are neater in appearance and occupy less floor space, and higher cutting speeds are possible than with any other method of driving. The last-mentioned point is of decided advantage in the case of wood-working machines.

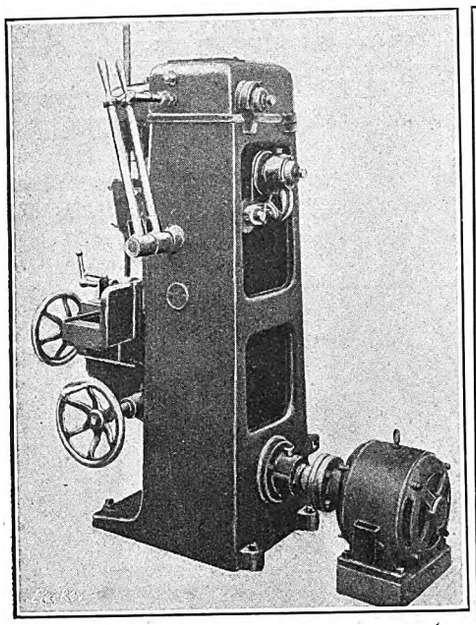

Fig. 6.—Mortising Machine with Separate Motor.

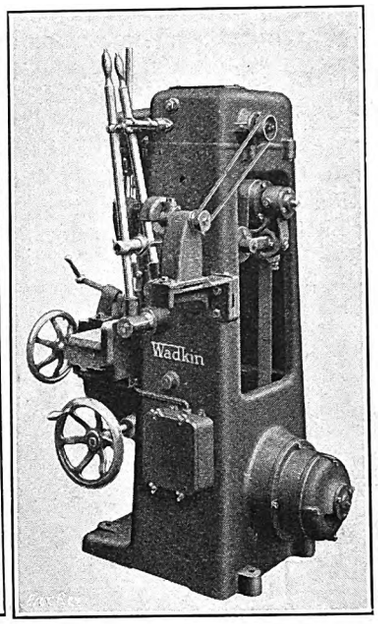

Fig. 5.—Mortising Machine with Built-in Motor.

The machines at the last Olympia exhibition were noted to be in varying stages of transition, from the belt to the motor drive. In many instances the fast and loose pulleys of the belt drive had merely been displaced by a coupling connecting a motor to the machine, with the control gear mounted on a nearby wall or pillar, making the machine-tool, motor and control gear three separate units. Other machines were in a more advanced stage of development, being designed with the motor and control gear as an integral part of the whole unit, thus making the machine entirely self-contained.

Some outstanding and remarkable examples of design were seen in connection with wood-working machine-tools, and it is proposed to limit the scope of this article to a description of some of these machines. As usually only constant speeds are required, the type of motor most suited to meet the general requirements of the wood-working machine is the squirrel-cage induction motor, because of its very simple and robust construction and its comparative freedom from breakdown.

In the development of self-contained wood-working machinery, an important part in this country has been taken by Messrs. Wadkin & Co., and this firm has evolved a range of wood-working machines employing stator and rotor units specially designed by the British Thomson-Houston Co., Ltd. These units consist of loose rotors and stators without shell, bearings, or shaft, as shown in figs. 1 and 3. The rotors can be built directly on to the cutter spindle and the stators into the frame of the machine-tool. The stator laminations are built up into a pressed-steel cylinder between two clamp plates, the steel cylinder then being spun over whilst the laminations are under pressure. The stator windings consist of former-wound coils securely held in semi-enclosed slots by wedges, and are suitably impregnated with moisture-resisting compound. The compound unites the end-turns into one solid mass, so preventing the movement of individual turns and readily radiating any heat which may be generated in the windings. The stator leads are usually left two or three feet in length, so that if necessary they can be taken direct to the starter without splicing. The leads make half a turn round the stator end windings, the soldered connections being left under the compounding, thus relieving the connections of any strain. The outside of the stator is accurately machined and ground to fit into its housing.

The squirrel-cage rotor consists of built-up laminations with centrifugally-cast aluminium alloy bars and end rings. With this form of construction, which is carried out by a patented process, there are no joints to give way, and the rotor is practically indestructible under service conditions. The end rings have fan fins cast on for assisting ventilation. The rotor bore and keyway is broached, and the rotors are statically and dynamically balanced. Fig. 2 is a sectional view of one of these units built into a frame specially designed for use with a mortising machine. The rotor is pressed on the shaft, and the stator has a light driving fit in the shell and is held in position by two set screws. It can easily be removed in the event of breakdown. The ventilation is radial, air being drawn in at either end and exhausted at the centre. Fig. 5 shows a chain and chisel mortising machine with the driving motor built in. The improvement in this method of drive over that obtained by merely replacing fast and loose pulleys by a coupling and a standard motor can be readily observed by referring to fig. 6. The motor in fig. 5 is of 4-h.p. capacity, and the standard method of starting is to switch it directly on the line by means of a triple-pole remotely-controlled contactor. The contactor is of Brookhirst manufacture. Push-button control is provided, and the red stop button is prominent and projects through the lid, so that it can be operated quickly if necessary by the palm of the hand. This feature is important; many stop buttons can only be operated by the point of the finger, and so do not lend themselves to use in cases of emergency. The start

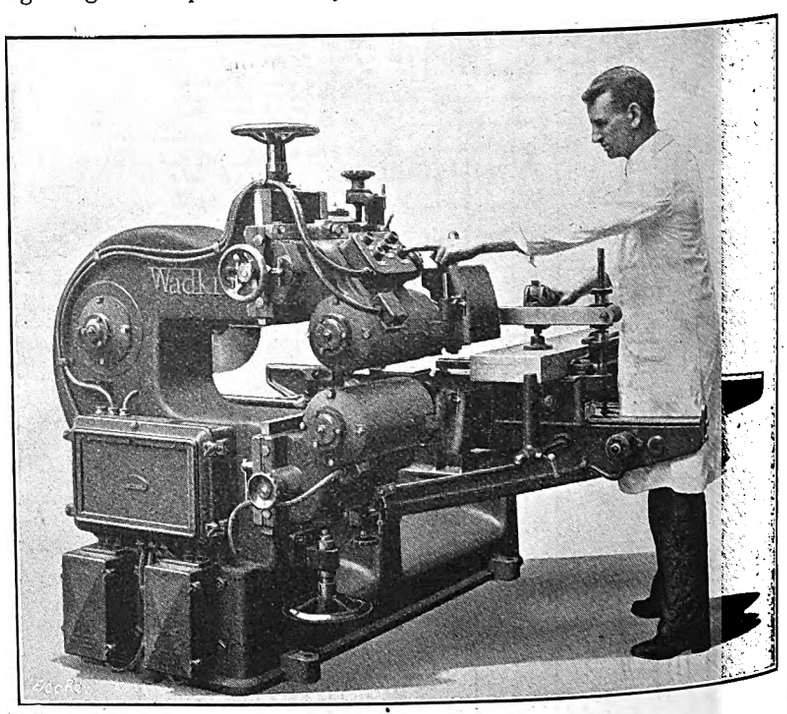

Fig. 7.—Five-motor Tenoning Machine.

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button is set back and protected by the lid of the push-button station, so that it cannot be operated accidentally.

Fig. 7 shows a modern motor-driven tenoning machine, clearly depicting the advantages of built-in motor driving. On this machine are five individual motors with cutterblocks mounted directly on the

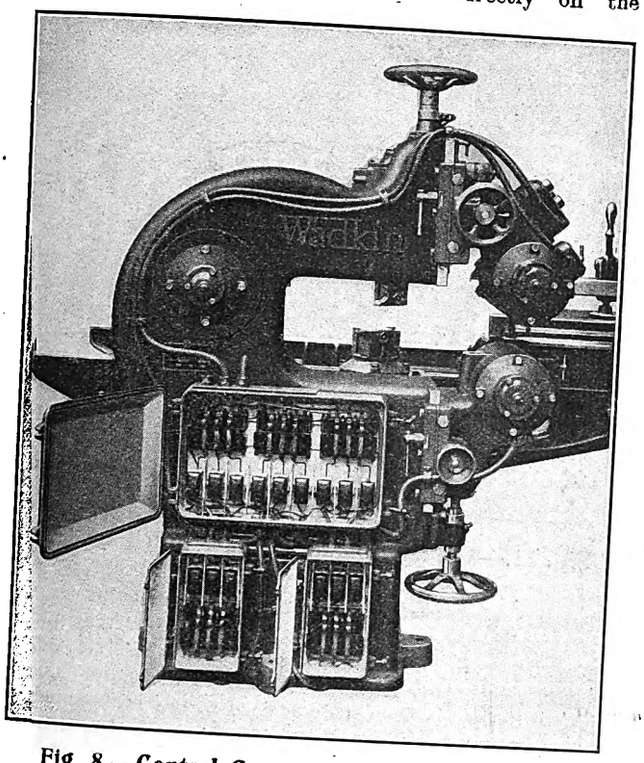

Fig. 8.—Control Gear on Tenoning Machine.

spindles. Fig. 4 shows the same machine with the table removed. On the left are the top and bottom heads mounted on the shaft ends of their respective motors, which can be vertically adjusted independently of each other. The top motor is also adjustable horizontally for cutting tenons, having unequal shoulders; the motors can be locked in position when finally adjusted. There are two cutter blocks mounted on each shaft end, each making a shear cut 3 in. wide, thus giving a maximum width of tenon of 6 in. The spur cutters, which are set slightly in advance of the tenoning cutters, give a clean and accurate finish to the shoulders of the tenon, and are clearly seen in the illustration. The cutter blocks can be removed from the motor-shaft ends and replaced by grooving heads or saws for special work. The vertical motors carry the scribing cutter blocks, and being attached to the main tenoning motor slides are adjustable with them. In addition, they have independent vertical and horizontal adjustment. These scribing cutters cut the shoulder of the tenon to the shape desired. The bottom motor can be fitted with a wobbling saw in order that the machine may be used for cutting double tenons. To the right of fig. 4 is shown a cross-cut saw which is mounted on the shaft end of a horizontal motor. This is used to trim off the tenons to the required length.

From fig. 7 it will be seen that the timber to be tenoned is placed on the table against a fence and secured by two lever clamps. The table is then pushed along the runways past the cutters. The control gear is mounted on the machine, as shown in fig. 8, and consists of triple-pole contactors with fuse overload protection. The contactors are remotely controlled from push-button stations. Each motor can be started independently from the push-button station, shown in both figs. 7 and 8, and a stop-button station is also mounted on the table runways, one button stopping all the motors. The contactors were manufactured by Cantie Switches, Ltd. The cabling is three-core cab-tire sheathed and drawn into flexible steel tubing firmly fixed to the machine by stout straps, and held at the contactors and motors by means of brass glands fitted with rubber packing rings which grip the flexible tubing, the cable passing through into the motor or contactor terminal box.

Remotely-controlled contactor starting is an ideal form of control for machine-tools, because nothing is left to the operator, who, owing to the simplicity of control, can give his undivided attention to the work and, in cases of emergency, can disconnect his machine from the lines almost instantaneously. Should the supply fail, his contactors fall out, and as he is not called on to open a switch, which duty may be ordinarily overlooked, all danger of his machine starting when the supply is resumed is eliminated.

Planing and spindle-moulding machines present a rather more difficult problem to direct driving, as these machines require to run at 4,000 r.p.m. and over. It is, of course, possible to install frequency-changing apparatus, but this is an expensive proposition, particularly if only one or two machines are required. The position is further complicated by the fact that spindle moulders frequently require to run at higher speeds than, say, planing machines, which would necessitate two sets of frequency-changing apparatus. In addition, a spindle moulder is required to run at different speeds for various classes of work, which demands motors of the change-speed type. Various forms of high-speed gearing were tried in the research department in the Leicester works of Messrs. Wadkin & Co., but they met with very little success.

The difficulty of a direct high-speed motor drive without frequency-changing apparatus was eventually overcome in a clever yet simple manner by a specially-designed motor which has all the characteristics of a squirrel-cage induction motor. A sectional arrangement of this motor is shown in fig. 10. The machine consists of two stators and two rotors, the inner stator being wound on the inner periphery of the outer rotor, which is free to rotate independently of the shaft, and is fed through slip rings from the line. The inner rotor is mounted directly on the shaft. The outer stator is wound with four poles and the inner stator with two

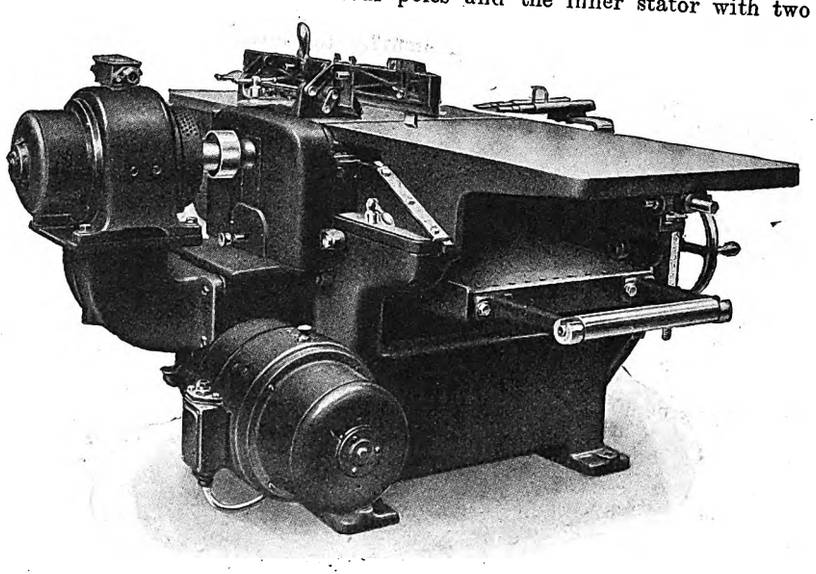

Fig. 9.—Machine with Double-stator and -rotor Motor.

poles. When the inner stator is connected to a 50-cycle supply through its slip-rings, the inner rotor will rotate at 3,000 r.p.m. If the outer stator is now connected to the 50-cycle supply the outer rotor will rotate at 1,500 r.p.m., and with it the inner stator. If this is revolving in the same direction as the inner rotor the speed of the inner rotor will be 4,500 r.p.m., because it is

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running at 3,000 r.p.m. with respect to its stator, which is itself running at 1,500 r.p.m. Therefore, in effect, the motor consists of two squirrel-cage motors working in parallel.

An example of this motor driving the cutter block on a planing and thicknessing machine is shown in fig. 9. The motor at the bottom of the machine operates the feed mechanism, and is a change-pole squirrel-cage induction motor mounted by means of a skirt bracket. The two-speeds give two rates of feed to the rollers, which carry the timber under the cutter block. The timber is passed over the table for planing, and then under the cutter block to be planed to its correct thickness.

For a directly-driven spindle moulder a motor is used by Messrs. Wadkin & Co. which embodies the same principle as the cutter-block motor on the planing machine. In this case, however, as previously mentioned, a change-speed motor is necessary, therefore the outer stator winding is arranged to be reconnected through the controller as a two-pole winding, thus giving a speed of 6,000 r.p.m. from a 50-cycle supply. Further, arrangements are made to mechanically lock the inner stator and rotor, and to connect only the outer stator to the supply; when connected two-pole the machine runs at 3,000 r.p.m., and when connected four-pole the machine runs at 1,500 r.p.m., so that a four-speed motor is obtained with speeds of 6,000, 4,500, 3,000 and 1,500 r.p.m. All the speeds mentioned are, of course, synchronous, and are all obtained from a 50-cycle supply.

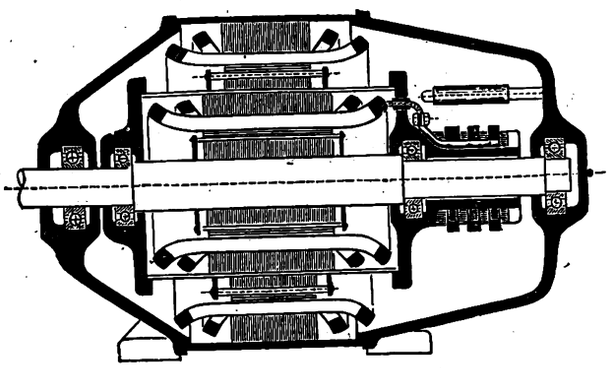

Fig. 10.—Double-stator and -rotor Motor; Section.

Fig. 11 shows a vertical-spindle moulder embodying a four-speed motor. The cutters are mounted on the shaft end of the motor, which is of vertical construction, and the machine is designed primarily for circular, irregular and straight moulding, but naturally a tool of this nature can be used for many other purposes.

As an example of the built-in drive carried to its ultimate limit, it is interesting to note that the same

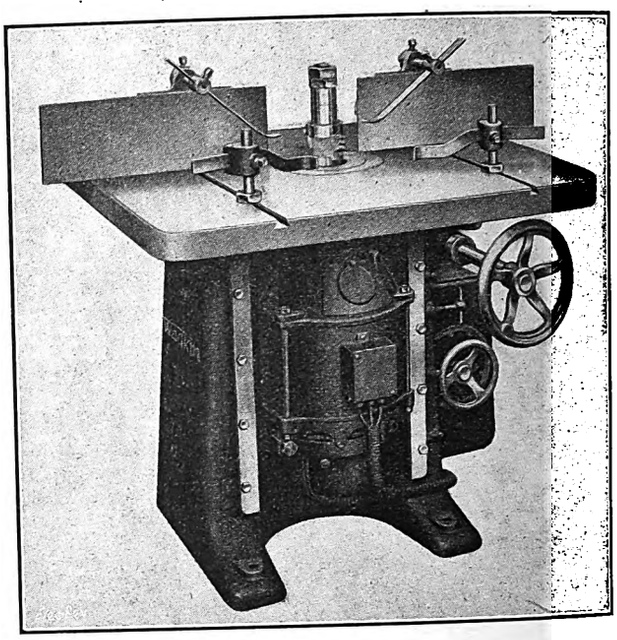

Fig. 11.—Vertical-spindle Moulder with 4-speed Motor.

firm has at present in course of manufacture a new electrically-driven sanding machine, the driving pulley of which will be the outer case of an electric motor. With this arrangement an external-rotor motor is used, the stator being wound on a core which is mounted on the shaft. The squirrel-cage winding is on the inner periphery of the pulley which drives the sanding belt. The shaft is held stationary and a.c. is supplied to the stator; the external rotor then revolves and drives the sander belt. The machines described above are only selections from a range of wood-working machinery, but they serve to give an idea of the development which has taken place, and to show what can be done by close co-operation between wood-working machinery and electrical engineers.

In conclusion, our thanks are due to Messrs. Wadkin and Co., and the British Thomson-Houston Co., who have both given free access to their technical information, and have kindly allowed the use of the accompanying illustrations.

Developing Electric Farm Service.

A Review of the Organisation and Methods of the Wisconsin Power and Light Company.

By W. FENNELL, M.I.E.E.

THE report of the Rural Electric Service Committee of the National Electric Light Association of New York, for December, 1928, relating to farm service in the State of Wisconsin, is the first of a series dealing with different areas, and should be of great assistance to those who are dealing with rural development.

The area of the territory is 12,500 square miles, containing 50,000 farms averaging 125 acres each; 80 per cent. of the farms are owned by the farmers, which is a great advantage to the supplier. In this country the percentage would be much lower—say 20 per cent. on the average. The area is chiefly dairy farmed, averaging 12 cows per farm. There are 32,500 silos—*i.e.*, 2 silos to each three farms (these are rare in England). The chief products are milk, cheese and butter, eggs (600 dozen per annum per farm), and pork (there are 589,000 pigs); 33,000 acres are cultivated for canning peas, 18,000 acres for tobacco, and 8,500 for drying beans.

There were on July 1st, 1928, 7,292 farms connected, with an average consumption of 624 units per annum, or a total of over 4½ million units per annum. The maximum farm load is not stated; it is probably mixed with the general load in the records, but the figure would be most interesting. Apart from farms the Company supplies 250 towns and villages.

The Company appears to be a "merger" of numerous small undertakings, and in January, 1926, there were 69 different tariffs in force for farms. The Company then took steps to evolve a "farming rate" and approached the Railroad Commission of Wisconsin (equivalent to our Ministry of Transport). As a result of opposition from farmers, who appear to

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be much the same all the world over, the project was held up. The Company conceived the idea of asking the farmers to assist in framing a tariff, and 100 delegates were appointed for a conference. This was reduced to a working committee of five, having power to act.

There appears to have been a regular "Price War" agitation during the following six months, both inside and outside the Committee, but in June, 1926, the 100 delegates approved a scale put before them by the Committee and the Company. This was soon accepted by the Railroad Commission, and there is now one uniform farmers' two-part tariff. As is often the case where opposition is met frankly, the chief opponents have become enthusiastic supporters.

It is interesting to note that the system of rural supply is single-phase, 6,600 volts, and that a separate transformer is assumed for each farm consumer. The fixed charge on the two-part tariff is based upon the transformer capacity, as under: the British equivalent is taken to be one-third less than the exchange rate, as the general cost of living is less in England:—

kVA	Dollars per month.	£ per an. at 5 dollars to the £. £ s. d.	Probable British equivalent. £ s. d.
Up to 1½ ...	3	7 5 0	4 16 8
From 1½ to 3 ...	4	9 12 0	6 8 0
From 3 to 5 ...	5	12 0 0	8 0 0
From 5 to 7½ ...	6	14 8 0	9 18 0
From 7½ to 10 ...	7	16 16 0	11 5 0

It is not stated how the kVA of "transformer capacity required" is arrived at, or how the rather sharp steps in the fixed charge are made acceptable.

Here we have the equivalent of from £3 to £1 5s. per kWh per annum of maximum local demand as the fixed charge, the former applying to lighting and the latter to mixed lighting and power, with presumably a greater diversity factor.

The "unit charge" is 7½ cents per unit for the first 50 units per month and 3½ cents for the remainder, with a discount of ½ cent per unit, cash 14 days. These figures equal (literally) 3¾d. and 1¾d. per unit, or allowing for cost of living, &c., say 2½d. and 1¼d. in England. Both the fixed and unit charges are therefore about equal to British practice, under "rateable value," or similar two-part tariffs in rural districts, but the important difference is that there is now in rural Wisconsin *no alternative flat rate*. The Company would probably have been unable, in this country, to secure a legalised two-part tariff with no flat-rate alternative, and development of farm supply would have been more difficult.

The absolute necessity for a "telephone" system of charge is apparent when it is realised that the Company extends its lines to any consumer or consumers when the average cost does not exceed 400 dollars per farm, say £80, or £55 under English conditions. This assumes "small-farm" consumers to be a quarter of a mile apart, at lowest British lines costs, excluding transformer costs, and these cannot be obtained if any large proportion of those *en route* do not take the supply or if they are not required to pay a fairly heavy minimum charge, far exceeding the 13s. 4d. per quarter provided for in British Special Orders. It is strange that while in Great Britain the Government Telephone Department has been allowed to fix a compulsory two-part tariff with a heavy fixed charge and low "call rate," electricity supply authorities, having similar conditions, are prevented by Government bodies from following the Government telephone practice.

The probable revenue from the 7,292 farms would be as follows in British values:—

	£
Fixed charge, 7,292 farms at £5 p.a. (say) ...	36,460
4,562,208 units at 2d.	38,018
	£74,478

Assuming the capital cost of supplying each farm to be £55, we get £400,000 outlay, so that the annual revenue approaches one-fifth of the capital cost of the mains. This is a sound basis for a new venture, which is rarely improved upon, even in suburban and town supply, for several years after a commencement is made. The number of farms served in 1925 was 2,750, and in 1927, 7,292—a truly wonderful increase of 165 per cent. in two years.

The organisation adopted to build up and supervise this farm load is worthy of consideration. The first essential laid down by Mr. G. C. Neff, the Vice-President of the Company, was that those dealing with the farmer should really believe that farm electrification would pay its own way. One may surmise from this and one's own observation that the ordinary officials are townsmen who had little rural enthusiasm in America, as in Britain. Mr. Neff therefore established a Rural Service Department which dealt directly with three new "Divisional Rural Service men" in the Eastern, Central, and Southern areas, who in turn each had direct access to five or six new "District Service men," working each under the established District Managers (eight in number). The Rural Service men were thus specialists in main divisional and district farm organisation, each keen on his job, in direct touch with each other, and therefore unhampered by the older-established townsmen above and below them in the organisation. This clever scheme, while leaving the District Manager still in full charge of his district, does not rely upon him or his divisional chief entirely in rural matters at the commencement. When the Rural Service Department has proved its equality with the others as a revenue earner, this duplicate organisation can cease, because anyone will give fair play to a successful undertaking.

The activities of the Rural Service Department's "local man," as indicated in the report, involve canvassing, lay-out of installations, and purchase of accessories for farmers. They also make a monthly call, ostensibly to read the meter, but really to have a chat with the farmer, to see that his plant is in order and keep him moving in the direction of an extended use of electricity wherever economy will result. The whole basis, then, is to keep one enthusiastic man in touch with each block of rural consumers and to avoid worrying and confusing them. The service men and the engineers are also in close touch with each other, as there are regular conferences.

On the engineering side there is some strange reading! The Engineering Department, for instance, has to arrange for "joint poles, transpositions, moving telephone lines, &c."; in other words, electricity supply is recognised as a service at least equal to telephones, and to be, in fact, a welcome neighbour, even on the same poles. There is also apparently co-ordination with the "State highway man," meaning the road surveyor. This takes the place of our British policy, under which the surveyor's aim is to keep the poles off the highway or its verges. May we hope that British supply authorities will be able to secure real co-operation with the telephone and highway authorities in the near future? There is already close working in many areas in England between reliable contractors and the supply authority, similar to that indicated in the report.

In conclusion, it is rare that any electric motor exceeds 5 h.p., and no reference is made to the presumed high cost of single-phase motors. The "Unscientific American" is dealt with as such in the first stages of development, and ploughing, electroculture, ultra-violet light treatment, &c., are not mentioned. The list of uses includes pumps, milkers, separators, "fanning mills," corn shellers, feed mills, hay hoists, concrete mixers, saws, &c., and especially the electric range, iron, ironer, heater (presumably radiator), incubator, brooder, washer, refrigerator, drill—all of which are offered on a two-years hire-purchase system.

The further reports on American rural schemes will be followed with interest.

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Bournemouth Pavilion Lighting.

An electrical illuminating scheme embodying specially-made fittings designed to produce excellent decorative effects with efficiency.

THE new Pavilion at Bournemouth, which was opened on March 19th by H.R.H. the Duke of Gloucester, K.G., presents some interesting developments in decorative lighting. The building, fig. 1, which has cost about £150,000, and has taken four years to construct, houses under one roof a large concert hall (the stage of which is 45 ft. wide) capable of seating 2,500 people, a dance hall capable of accommodating 800 persons, a first-class restaurant with a seating capacity of 500, besides many sumptuously-furnished lounges, tea rooms, promenoirs, soda fountains, and the like. The exterior of the pavilion is of white, cream and gold, with a roof of red pantiles, surmounted by a golden dome. Running alongside, but a hundred feet above the Winter Gardens, is a number of spacious tea terraces, and below these provision is made for a large illuminated waterfall whose torrents will wend their way down to the artificial river which runs through the gardens. Outside the main entrance a large artificial lake has been constructed, from the centre of which an illuminated fountain will cause its waters to play amid a setting of ever-changing colour. The entire lighting scheme was planned carefully before the building operations were commenced, the architects, Messrs. Home and Knight, closely co-operating with the contractors responsible for the work, Messrs. Aish & Co., and the fittings designer.

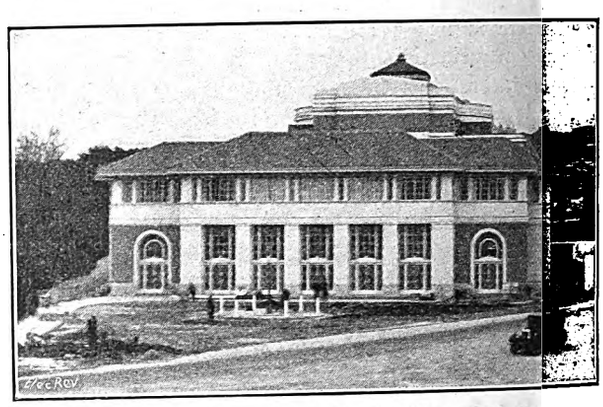

Fig. 1.—New Bournemouth Pavillion; End View.

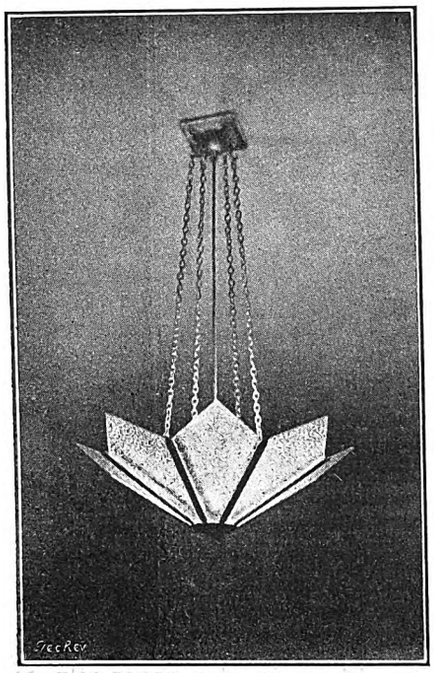

Fig. 2.—" Promenoir " and Lounge Unit.

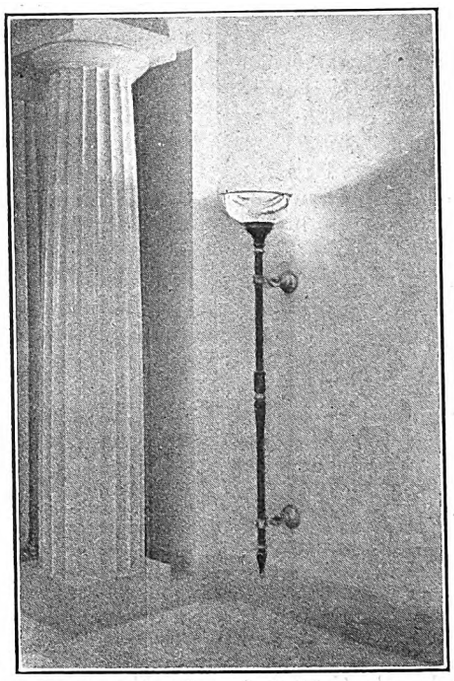

Fig. 3.—" Torchiere " Unit in Main Vestibule.

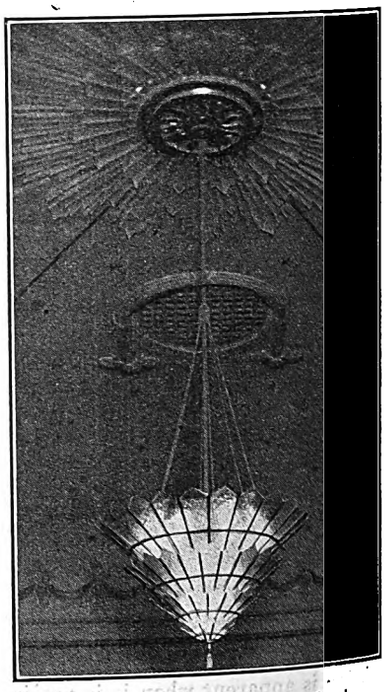

Fig. 4.—Central Pendant in Concert Hall.

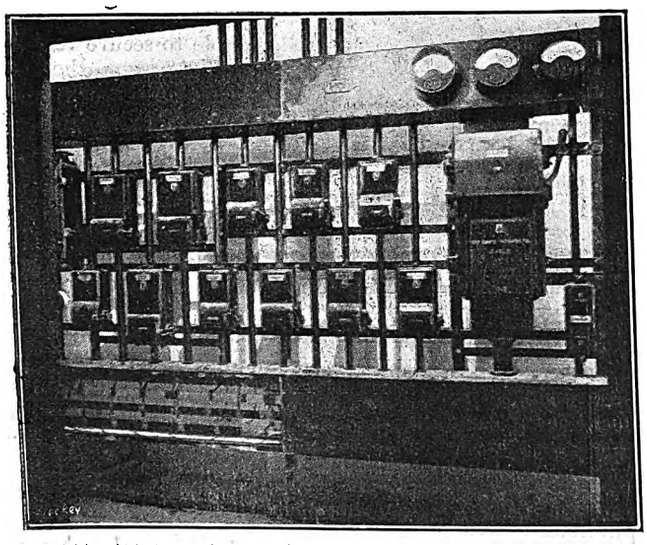

Fig. 5.—Power and Lighting Switchboard.

The originality and refinement of the architecture is such as to rule out the use of ordinary electric light fittings, and special apparatus of suitable design and character has been introduced, so as to result in complete harmony with the surroundings, both in form and colour, and also in the retainment of the dignified architectural and decorative treatment of the interior under artificial illumination. Careful selection of the tinted glassware and of the colour finish of the metal-work em-

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ployed in the lighting units contribute to the success of the scheme.

The imposing lanterns in the main entrance vestibule are octagonal in shape and glazed with amber-tinted glass panels, giving very pleasing indirect lighting. Around the walls several cast-brass brackets, fig. 3, are fixed with long shafts, finished bright red and relieved with gilt, surmounted by 16-in. English alabaster dishes lined with white opal glass reflectors, each unit being equipped with "pearl" gas-filled lamps. The staircases left and right of the main hall are illuminated with handsome octagonal lanterns suspended from the centre of the glazed dome above. From four short bracket arms fixed in the body of each lantern are suspended four 6-in. diameter "Equiluxo" globes, equipped with orange-sprayed lamps to colour tone the illumination of the lower staircase and the floor below. Passing through the fluted arches from the main hall into the corridor around the concert hall the keynote of the lighting scheme in the hall itself is revealed. The main ceiling, promonoir and under balcony of the concert hall are illuminated by handsome glass fittings of simple and dignified design, which are in harmony with the decorative treatment and colour scheme of the auditorium. In the centre of the spacious domed ceiling is a gilded "sun burst," and from the centre of this is suspended a four-tier glass fitting, eight feet in diameter, designed on plan to form a multiple pointed star, fig. 4. The colour of the diamond raindrop glass panels is graded from white at the top to pale, medium and deep amber at the bottom. Four smaller two-tier fittings, each four feet in diameter, surround the central pendant, and under the balcony and around the promonoir single-tier fittings, smaller according to their positions, complete the installation. The beauty of this lighting is beyond description. Some 230 "pearl" lamps provide the light sources in these units. Fig. 2 shows a promonoir and lounge unit.

Fig. 6.—General View in Dance Hall.

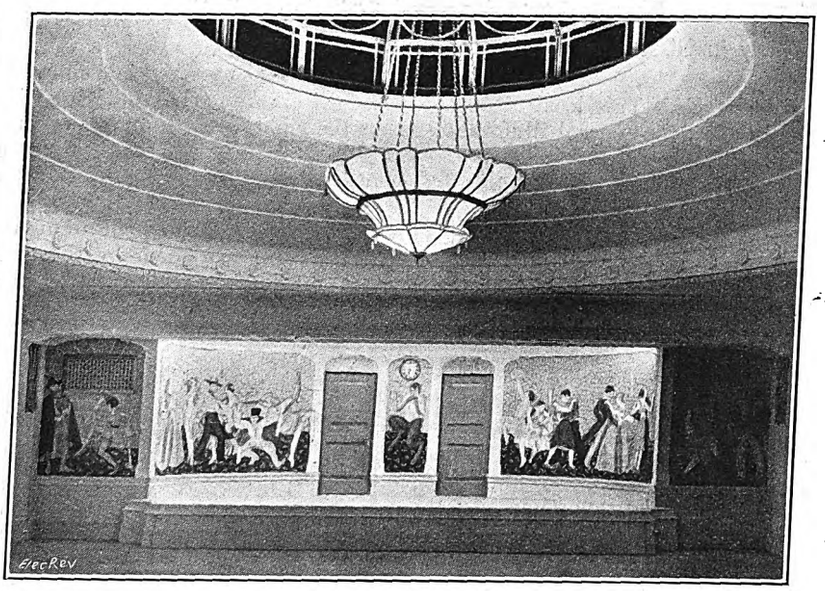

Fig. 7.—Dance Hall; Illuminated Stage and Centre Unit.

As an example of illumination with decorative multi-coloured lighting units, the scheme in the large tea room and dance hall, fig. 6, is perhaps unique. The room is very spacious, and the fittings have been carefully designed and proportioned to avoid accentuating the comparative lowness of the ceiling and to give variety in size and form. The main lighting feature is the fine pendant suspended from the centre of the dome, fig. 7. This is six feet in diameter and glazed with bent panels of diamond raindrop glass in pale and medium amber, finishing at the bottom with deep amber flat-glass panels. The remainder of the fittings vary in diameter from 4 ft. to 2 ft., and are glazed with flat-glass panels to match. Each unit is equipped with lamps of three distinct colours, blue, orange and pearl, and there are nearly four hundred of these lamps installed in this room. The variety of colour effects obtainable by dimmer control is endless,

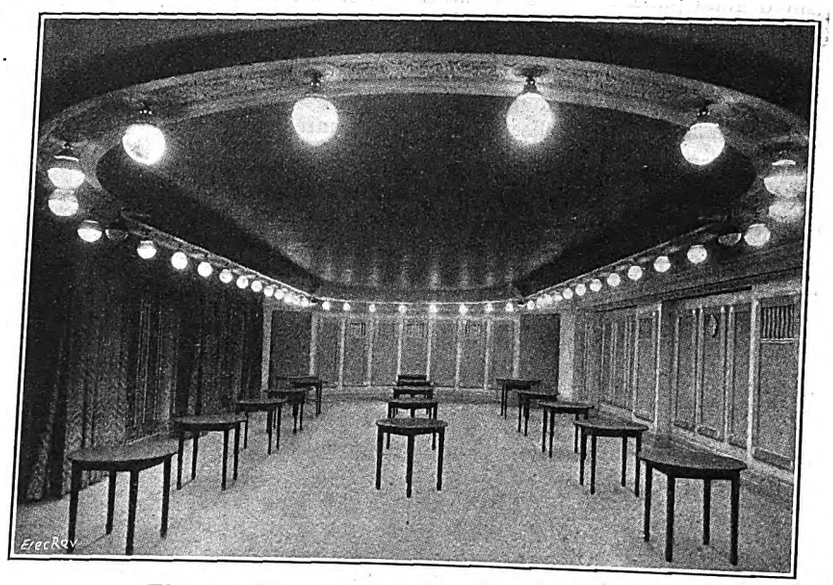

Fig. 8.—General Lighting in Lucullus Room.

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and the effect on the raindrop diamond glass panels when the white lights are used is remarkable. This is explained by the fact that the glass is prismatic and picks up the light from all directions, while the white lights, being surrounded by colour-sprayed lamps, enable light to be projected through these, throwing varied and soft

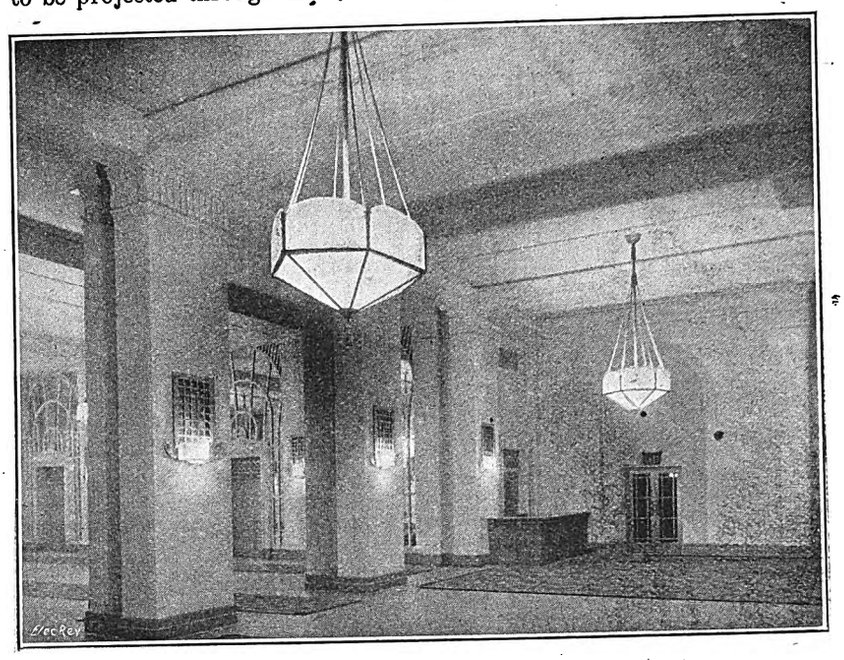

Fig. 9.—View in First-class Restaurant.

colour tones on to the glass panels. This local colour, however, does not materially affect the general illumination, which remains white.

The Lucullus Room, fig. 8, has a very effective lighting scheme, though of the simplest character. As the ceiling is low, it is planned with a shaped beam surround, relieved with a guilloche ornament. Small ceiling plates and galleries carrying some forty-four 6-in. "Superlux" globes, half-screened horizontally, with green-and white-opal covers, are fixed in the centre of the ornaments with about 2 ft. 6 in. spacing intervals. The repetition of these unpretentious units has a very pleasing effect, and furthermore they are in complete harmony with their surroundings.

The first-class restaurant, fig. 9, is a lofty and spacious room of beautiful design and proportion. In it are installed handsome pendants suspended from the centres of the ceiling panels on silk-covered rods and cords. These fittings are hexagonal in shape, four feet in diameter, and glazed with pale- and medium-amber tinted glass panels. The metalwork is simple and unobtrusive, which enables the ample unmasked glass surfaces to flood the whole interior with a brilliant warm amber glow. Around the walls demi-coupe brackets to match are fixed in a number of shaped panels, giving a pleasing decorative effect on the wall mirror-glass panelled surfaces, and so resulting in space and variety effects by reflection. Fig. 10 shows a wall fitting in the principal restaurant, which is designed to be effective in conjunction with a decorative ventilation panel. The fittings in the second-class restaurant are somewhat similar. Five large pendants provide the main illumination, while over the bars and in the alcoves are five small lantern-shaped units to match.

Some sixty specially-designed "Internalite" signs are also installed throughout the building to give clear and prominent exit and directional notices, while the entrance vestibules, staircases and lounges are equipped with handsome fittings of varying designs.

Reference must be made to the stage-lighting equipment in the concert hall. This is representative of the most modern practice, and embodies a number of novel features. The battens, sometimes known as border lights, consist of strong metal housings divided into compartments, fitted with specially-shaped silvered-glass reflectors. They are so arranged that the whole of the large stage can be flooded with any of four colours at will. The footlights, which are of similar design and control, permit of either the centre, right, left, or the whole of the stage being illuminated as required. Atmospheric effects are contrived by a special batten of colour floods, which permit of any colour being directed on to the white back cloth. This arrangement permits of a combination of colour tones being used in conjunction with any musical theme. Other stage-lighting apparatus includes a spotlight batten, perch spotlights, wing floods, and powerful front-of-house projectors. The combined stage switchboard and dimmer bank, fig. 5, is of unusual design, each unit of the lighting equipment being under independent control. The general lay-out of the board is in three sections. The right and left sections are slate panels, 1½ in. thick, on which are mounted the sub-circuit switches and fuses, also the colour master shafts carrying the dimmer control handles. "Sindanyo" panels are fitted on the centre section and carry the push-button controls, batten pilot switches and footlight change-over switches. These change-over switches are of the radial contact type, and form a special feature of the board. Their function is to allow the use of one set of dimmers only to control either of the footlights, as both are never used simultaneously. The stage footlight circuits are sub-divided into three sections, so that the right, centre, or left of the stage can be illuminated at will. The dimmers are of the G.E.C. 60-contact radial lever open-coil type, and are constant rated throughout. They may, therefore, be left in check on any position for any length of time. Specially-wound dimmers are provided for the stage plugs, which will cater for loads varying from plus 33⅓ per cent. to

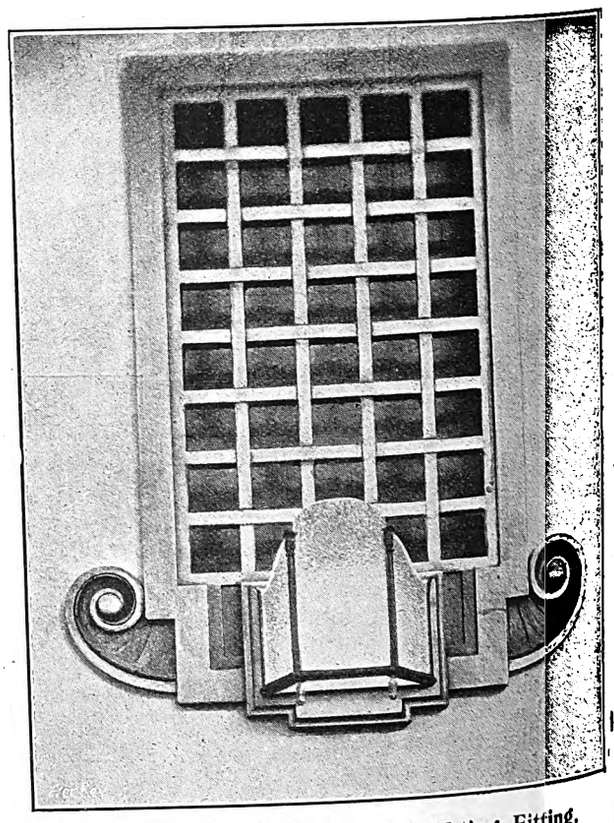

Fig. 10.—Ventilation-panel Lighting Fitting.

minus 33⅓ per cent. over and under normal load. The dimmer handles are provided with clutches which are self-releasing at the top and bottom of the stroke. The fittings referred to above were all specially designed in conjunction with the architects, and were manufactured by the General Electric Co., Ltd.

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Changing Over to A.C.

Notes on the methods of dealing with consumers' apparatus and service equipment adopted by a large electricity supply undertaking during the alteration of the distribution network from the d.c. to a.c. system.

By R. H. RAWLL, A.M.I.E.E., A.M.I.Mech.E.

(*Continued from page* 562.)

Everything being in readiness, the date of the change-over has to be arranged in consultation with the other departments concerned. In determining this date, due consideration must be given to any consumers using electricity for business purposes, and such persons should be interviewed, if possible, in order to ascertain a day when an interruption in the supply will cause them minimum loss and inconvenience. This having been settled, the following notice is then posted to each consumer about a week beforehand:—

ALTERATION OF SYSTEM AND PRESSURE OF SUPPLY OF ELECTRICITY.

Dear Sir (or Madam),

Referring to the notice in the Press in

I have now to intimate that the change of system of supply (sanctioned by the Commissioners) to your premises will be effected on The alteration will not interfere with the supply except for a short period during the morning of that day, and everything possible will be done to avoid putting you to any inconvenience.

Will you please give facilities for entrance to your house on the date named for the purpose of changing meters, &c.

Yours faithfully,

Replies and telephone messages invariably come to hand within the next few days, stating the inconvenience of the date and also requests for it to be post poned. They, of course, cannot be entertained. A personal, verbal communication with such consumers usually puts this right. Information also arrives from consumers as to where keys of closed premises can be obtained.

The day before the change-over, all the a.c. meters and any new service gear are delivered to the consumers' premises, or, when closed, to the house next door, if possible. The next day, the d.c. supply is cut off (usually about 9 a.m., in order to enable consumers possessing electric cookers, kettles, &c., to utilise them for breakfast purposes), and the work started of changing all the meters. Experience has shown that nine service fitters and their mates can usually satisfactorily cope with about 100 consumers. A list of the names of the consumers is given to these men, containing the numbers of the old d.c. meters. This number is checked as the meter is removed, and that of the new a.c. one replacing it is filled in the blank space provided. This list is afterwards checked against that in the meter-issue department, and, subsequently, the numbers of the new a.c. meters are entered in the change-over book in the column reserved for this.

Since in the majority of cases the actual change-over, so far as the distribution side of it is concerned, is merely a question of opening and closing links in the network, the a.c. supply can be given directly all the d.c. meters have been removed, thus reducing the inconvenience to consumers as much as possible.

During the day, the alterations to the consumers' apparatus are completed, and a receipt for any new plant installed should be signed by the consumer on its delivery.

The a.c. supply being available, a call must be made at each house to ascertain if everything is working properly. This can usually be done by the man who installed the new meter, with the exception of those cases where apparatus has been altered or replaced. These, of course, require special inspection. Any complaints from consumers about apparatus not functioning, &c., should be duly noted and reported to the engineer in charge. As has been already stated, the following day is utilised to deal with these little snags, which invariably arise however careful may be the preparation before the change-over.

The changing of prepayment meters requires special arrangements being made, and is somewhat of a problem, in that it usually involves the handing over to the consumer of any money remaining in the old d.c. meter which has not yet been consumed in current.

Arrangements must also be made for all the meters, duly labelled, to be collected and returned to the meter department.

From the foregoing, it is fairly evident that it is often midnight before the engineer in charge of this work leaves the scene of his activities.

After about a fortnight has elapsed from the date of the change-over, the following form is delivered to each consumer who has had any apparatus altered or replaced, with a request for his or her signature to be appended to it:—

CHANGE OF SYSTEM OF SUPPLY.

Dear Sir,

The apparatus you have recently fitted on my premises, viz.:—

is giving satisfaction.

Yours faithfully,

Experience has shown that if this is sent through the post, it is usually forgotten by the consumer. The best plan is to arrange for a representative to personally deliver the form, and to ask for it to be signed there and then; or, if this is impossible, owing to the absence of the consumer, to intimate that a further call will be made for its return, duly signed, during the next day, or when convenient. These signed "satisfaction forms," as they are termed, are then filed away, after their receipt has been duly recorded in the change-over book.

As regards the financial side of the change-over, it is advisable not to pass for payment any invoice for replacements, alterations, &c., until the consumer to whom it refers has signified his satisfaction of the work by returning the signed form referred to above. Also, since most modern and up-to-date supply undertakings possess some form of costs system, care must be taken that all labour, invoices for goods ordered, transport, &c., which have been required in connection with the work of the change-over, are charged to a separate allocation and not confused with the ordinary routine allocations of the undertaking.

(b) Technical Considerations.

Instructions should be given to the men installing the a.c. meters that they must be careful to ascertain

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that the current coil of each single-phase meter is connected to the live phase wire of the supply. Otherwise, should the connection be made to the neutral wire, in the event of an earth fault developing on the consumer's wiring in the future, the leakage of current will not be registered by the meter.

In those cases in which access cannot be obtained to the premises of consumers in order to change the meters, &c., when the change to a.c. is effected, it is by no means necessary to open the ground to temporarily cut off the supply, by disconnecting the service cable until such time as an entrance can be obtained. A little thought will show that the cost of opening the ground and cutting the cable, and eventually rejointing the latter and reinstating the former, is infinitely more than the probable damage due to putting a.c. through a d.c. meter. When a meter has been so treated, a special label indicating this should be attached to it before returning it to the meter department. The most likely damage caused to d.c. meters of the ampere-hour type is the demagnetising action of the a.c. on those meters which possess a compensation or correction winding on the magnet system.

In those premises which are under the jurisdiction of the Home Office as regards the Factory Acts, since the change to a.c. brings most installations within the scope of the regulations applicable to medium pressure, *i.e.*, over 125 volts a.c., such alterations as earthing or insulating switches, lampholders, &c., will have to be carried out in order to comply with these requirements. In ordinary dwelling houses, where such regulations do not apply, although the installations have been carried out according to the I.E.E. Regulations for the Electrical Equipment of Buildings, rendering them equally safe on a.c. as d.c., yet it may be necessary on the part of the supply undertaking to make such alterations as are deemed advisable in the interests of safety, owing to the undoubted increased danger on a.c. should accidental contact be made with live metal. It should also be borne in mind that, although there is no legal liability on the part of a supply undertaking, when changing over the supply from d.c. to a.c. to a domestic installation, to make these alterations as regards safety, yet there is a decided moral responsibility for so doing, in that should an accident subsequently take place due to exposed metal becoming alive the undertaking would undoubtedly be blamed for its occurrence. While on the subject of the increased danger of shock from a.c., it may be mentioned here that although it is not the general practice of supply undertakings to earth their meters, yet it seems to the author that such types as prepayment ones, which are frequently handled by the public, should be most decidedly earthed, and particular attention should be drawn to this point when changing such meters for a.c. supply.

With regard to the actual work involved in changing or altering consumers' apparatus in order to work on a.c., those selected for consideration here are the most common in use at present. It will, of course, be realised that certain special pieces of apparatus require individual attention before it can be decided which is the best method of conversion.

Motors.—It is proposed to deal with these very briefly, because sufficient knowledge and experience is already to hand. There are, however, one or two important considerations which should be borne in mind. The speed of a suitable a.c. motor may not be identical with that of the d.c. one it is replacing, and, in such cases, special pulleys, gears, &c., may have to be obtained. Also, the starting torque of a squirrel-cage motor is not the same as the d.c. variety, this being very important when the machine driven is directly-coupled. The maximum starting current per phase permitted by the mains engineer raises another point. If the d.c. distribution is 3-wire, and the motor is fed by a twin service cable (outer and neutral), the supply on changing to a.c. becomes single phase, and it is possible that a squirrel-cage motor under such conditions would take an excessive starting current, which would cause severe fluctuations in the supply pressure in the neighbourhood. The best remedy for this, of course, is to replace the 3-core distributor, which is now working with two phases and neutral, by a 4-core main and install a 3-phase motor. This is always done in those situations where a number of motors are installed, but in the case of an isolated motor, this may involve a very long 4-core cable at great expense. For such a case, provided the starting torque is not seriously decreased, starting apparatus which reduces the initial current to reasonable proportions usually provides an effective and practical solution of the difficulty. The use of repulsion motors is also helpful in this respect, but these, of course, in the larger sizes, are somewhat more expensive than ordinary squirrel-cage motors.

Accumulator Charging.—Before the advent of broadcasting, accumulator-charging was usually confined to garages, where car batteries were re-charged. Nowadays in a garage one finds, in addition to these, both l.t. and h.t. wireless batteries. For such places, a small motor-generator set, having a d.c. output of about 5-10 amperes at 100 volts, is very adaptable. The method employed is to connect the generator to the existing d.c. charging board, which usually consists of lamp resistances, and to replace these by 100-volt carbon-filament lamps of various sizes. The reason for deciding on 100 volts is that if the generator output voltage is any higher, considering the fact that there are the losses in two machines to be taken into consideration, in such circumstances this would result in a greater consumption of energy per quarter than before the change in the supply took place; which is to be avoided at all costs, because it leads to endless discussions between the supply undertaking and the consumer, who would consider that the change-over was only a means to obtain more revenue from him. Such motor-generators should also be provided with shunt-regulators, so that the voltage can be reduced to suit the load, thus providing further economy in current consumption. The use of lamps as a charging resistance is preferable to a wire-wound variable resistance, not only from the point of view of cost, but also because most garage attendants are already familiar with their use on d.c.

The amount of accumulator charging which is carried out in the home at the present time is really remarkable. This is mainly on account of radio receiving sets. For l.t. batteries up to 6 volts, a trickle charger, consisting of a step-down transformer combined with a patent metal rectifier, is admirable for this purpose. A metal rectifier can also be obtained to charge h.t. batteries. There are also on the market l.t. and h.t. chargers embodying the vibrating-reed principle, and, alternatively, those utilising gas or vacuum-type thermionic valves. The choice of these various appliances depends not only on price, but on reliability of performance; consideration should also be given in this respect to the advisability that all such apparatus should possess as few moving parts and components liable to be easily damaged as possible. Many consumers are suspicious that these a.c. chargers take a lot of current. The reverse, of course, is true. The best plan is to switch on, say, a 60-watt lamp, and then point out the rotation of the meter disk. Then switch off the lamp and connect up the charger, and indicate by the comparative speeds of the disk how very little current is being consumed. It will be seen, therefore, that as regards battery charging, the supply undertaking is unfortunately losing revenue on changing the supply from d.c. to a.c., but the author is a firm believer that a satisfied and contented consumer is indirectly the best advertisement a supply undertaking can possess, in that a disgruntled consumer can do untold harm by prejudicing his friends against taking advantage of the many conveniences which electricity offers in the home.

(To be concluded.)

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Flame-proof Electrical Apparatus.

Some Features of the Design of Pressure-release Enclosures.

By PROF. I. C. F. STATHAM.

(*Abstract of a Paper read before the* MIDLAND INSTITUTION OF MINING ENGINEERS.)

THE paper reviews the results obtained in the routine testing of apparatus, particularly in relation to the release of pressure from flameproof enclosures, and, in addition, some of the more common defects and important features of design are discussed.

The only method of ensuring the safety of electrical apparatus is to enclose all parts that are likely to give rise to potential danger of ignition. The requirements may be satisfied (1) by total enclosure of the whole of the apparatus, or such parts as are likely to give rise to danger; (2) by the use of enclosures embodying some form of flame-proof pressure-relief device. About 60 per cent. of the apparatus tested at the University of Sheffield has been of the totally-enclosed type, the remaining 40 per cent. being enclosed in casings with provision for release of pressure.

In so-called "totally-enclosed" apparatus the principle of flange protection is almost invariably employed, the joints between the various parts of the casing being made by smooth-machined flanges that allow of slight release of pressure. The basis of flange protection is that the hot gases or flame produced by an internal explosion are so cooled by contact with the metal surfaces of the flanges and by expansion that they emerge from the flanges at a temperature too low to ignite an external explosive atmosphere. As the result of research, it has been established that a flange with metal-to-metal surfaces at least 1 in. wide will, in all cases, prevent the passage of flame, and this is regarded as the minimum permissible width of flange for flameproof enclosures having an unoccupied volume of 60 cu. in. or over. For smaller enclosures, narrower flanges have proved safe, and in such cases the minimum width has been fixed at 0.75 in.

The cooling of the flame by contact with the cold surfaces of internal fittings, together with release of pressure at the flanged joints, leads to lower maximum pressures in commercial apparatus, as compared with those obtained in sealed spherical bombs as used for research. Tests have shown that when total enclosure is adopted, the casings must be of robust design and the covers must be securely bolted in position, giving metal-to-metal contact at the flanges. The use of gaskets and packing-rings should be avoided.

Various methods are employed to provide for deliberate release of pressure from flameproof enclosures. For types of apparatus which do not require ventilating and cooling, the spring-relief bolt, properly applied, possesses the advantage that the casing is normally closed so that ingress of dust is avoided.

Considerable ingenuity and inventive genius have been exercised in the development of flameproof pressure-relief devices, so that any desired degree of release of pressure may be obtained, with safety, under experimental and test conditions. This naturally raises the question as to the extent to which relief of pressure is desirable and justifiable in apparatus for use in coal-mines. Two reasons may be given for the application of some form of venting device to such apparatus. First, they allow the use of lighter casings, and, secondly, most types permit of a certain amount of ventilation and cooling of the apparatus. In considering the problem, however, it should be borne in mind that apparatus for use in mines must be of robust design and strongly made in order to withstand the rough usage to which they are invariably subjected. It must also be remembered that not infrequently the maintenance of such apparatus in a flameproof condition is entrusted to men with little or no knowledge of flame propagation. It would, therefore, appear that for units for use at or near the face total enclosure offers the safest and most satisfactory solution of the problem, and the use of flameproof pressure-relief devices on such units should be discouraged.

Out of 97 units designed for the interruption or control of electric currents, and submitted for test, 60 were of the air-break type and 37 of the oil-immersed type.

With oil-immersed gear safety can be attained only by the use of totally-enclosed casings of sufficient strength to resist the pressures developed by the explosion of hydrogen-air and acetylene-air mixtures. These pressures, although similar in magnitude, are much more severe than those produced by firedamp-air mixtures, as they are developed much more rapidly. Very little is known of the magnitude of the pressure developed within the oil in the region of the arc, but it is known that the sudden release of energy in an incompressible fluid like oil results in the development of enormous stresses, which are transmitted to the sides of the containing-vessel. There is little doubt that these stresses are much greater with oil-immersed than with air-break gear, so that stronger casings are necessary. In the past, oil-immersion alone has frequently been regarded as a sufficient precaution against ignition of firedamp, and the flameproof enclosure of oil-immersed gear has often been considered an unnecessary refinement; this is a mistake. Ignitions of firedamp due to an insufficient quantity of oil to cover the contacts to the required depth, or to the exposure of contacts by tilting of the casing, show that confidence in such gear has been misplaced.

It cannot be too strongly emphasised that oil-immersion alone does not provide a safeguard against the ignition of an external firedamp-air mixture. Even oil-immersion combined with enclosures designed to prevent the passage of the flame of a firedamp-air explosion does not meet the case. Nothing short of total enclosure in specially strong casings can be considered as an adequate safeguard with oil-immersed gear.

Discussion.

The president, Major D. H. CURRER BRIGGS, said that in a pit the large majority of people could be very foolish at times, and it was desirable to safeguard against their possible actions at those times. With regard to the flange type of relief, it seemed to him that whether they had specially-arranged gaps or whether they tried to make a totally-enclosed vessel, they were always up against the same difficulty of the man who took the apparatus to pieces in the pit and left some grit in it; he should have thought it was almost impossible to understand how they could get something that was definitely safe.

Professor DOUGLAS HAY, referring to the question of the danger of pressure-piling where two compartments were in communication, asked what limits the author would place upon the character of the communication between those two compartments. Quite frequently in coal cutters they found the switch compartment and the compartment containing the motor communicated with one another by an opening through which the leads passed from the starter to the motor, and that opening might sometimes be a comparatively large one, about 4 in. square. He also asked if the author had tested any units with ball bearings, and whether the ball-bearing housing as normally fitted to motors nowadays was in itself flameproof. He was very glad to see that Professor Statham considered the specification for coal-cutter plugs and sockets recently issued by the British Engineering Standards Association to be a safe one, and it was very regrettable that certain makers had refused to adopt that plug. The author had mentioned alternatives in the method of bringing the cable into a casing; what was Professor Statham's view about the use of ordinary flameproof trifurcating boxes? He thought that air-break switchgear was more satisfactory than oil-immersed gear. He had not been able to find anyone who made auto-transformer or star-delta starting gear for large squirrel-cage motors, such as one normally used for pumps up to about 150 or 160 h.p. He would be very glad to hear of any firm that did make such equipment, because he was perfectly certain that it would remove danger.

Mr. J. A. B. HORSLEY, H.M. Electrical Inspector of Mines, said that a good deal of his difficulty during the last few years had been experienced in persuading users that total enclosure did not mean necessarily flameproof enclosure. Total enclosure, with reference to motors, had a particular significance, which would be familiar to most of them, but it did not mean flame proof enclosure. He suggested that the two types should be broadly distinguished as vented and unvented, and the vented could be sub-divided, if necessary, into those with intrinsic and those with extrinsic vents. As to whether the entry of the external-circuit conductors should be direct or indirect, he thought direct entry, as practised and advocated by the United States Bureau of Mines, was impracticable in many cases under British colliery conditions. It was a simple matter to take a cab-tire-sheathed cable directly into a flameproof enclosure and to make the entry safe by means of a long sleeve and packing gland, but it was a very different matter, however, if one had to deal with a three- or four-core armoured cable. He had known of a number of cases where oil-break switchgear had exploded or had in some other way come to grief, but it was generally due to some obvious misuse.

Mr. N. E. WEBSTER thought that electrical interlocking was equally subject to the ingenuity of the person attending to it, as was the mechanical interlock. A few years ago Mr. Horsley persuaded him to fit what he thought was, at that time, the only d.c. electrical earth protection gear. It had worked very well afterwards, but at first the leading electrician carefully arranged that it should not operate at week-ends by means of a little matchstick put underneath it.

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The Lots Road Power House.

A brief outline of the extensions and improvements that have been carried out at the electricity generating station of the London Underground Electric Railway Companies.

During recent years, extensions of the London underground electric railway lines, increased train services and more powerful rolling stock, new and remodelled stations, and so on, have necessitated an increased supply of electricity, which has been met to some extent by the installation of further new machines at the Lots Road power station. The probability of further extensions of the system in the near future, still further improvements in the train services, and other improved facilities, decided the London Underground Electric Railway Company to increase the capacity of the station and at the same time to completely overhaul and modernise the equipment. Plans were at once laid, and for many months past a gradual transformation has been taking place. In brief, the scheme of improvement involved nine modern turbo-alternators, 32 modern boilers, a new and improved switchboard, the increase of the condensing water supply, and the provision of an ash-removing plant and grit arrestors. The turbo-alternators will be each of 18,750 kW maximum continuous capacity, and will bring the total number of machines to nine. The new ones will be of the same pattern as the later machines now in use, and will bring the installed maximum capacity of the station to 168,000 kW. The remaining 6,000-kW machines dating from 1906 will all be scrapped.

The 64 old boilers will all be scrapped, their places being taken by a smaller number of boilers of some four times the capacity; they will work at a higher steam pressure and temperature to secure improved efficiency with the modern turbo-generators.

The present control switchboard is located in an open gallery of the engine room. A new and larger board has now been built in a special room, and is equipped, amongst other devices, with a system of automatic red and green lamps to indicate the switch positions (open or closed); above the lamps are meters which show the load on each sub-station at any moment, and there is also electric signalling equipment, similar to a ship's telegraph, providing direct communication between the control board and each turbo-alternator.

In addition to changes and improvements in the present condensing water arrangements, a new tunnel of 9 ft. diameter is being provided which extends from the power house to the middle of the River Thames bed, where there is a concrete "bell-mouth," ensuring an ample supply of condensing water for the enlarged power house at all states of the tide. Five million gallons of water per hour will be used for condensing purposes; it is drawn from the River Thames and is strained to remove dead leaves, &c., of which large quantities float down stream, particularly in the autumn. Apparatus has been installed whereby a certain quantity of chlorine is added to the water as it comes in from the river, which is intended to destroy all minute animal life contained in the slime, and thus prevent the formation of the harmful film which impairs the efficient working of the condensers.

The boiler furnaces at the Lots Road power station produce 54 tons of ash per day, much of which is mainly used for the manufacture of breeze slabs used for building purposes. To carry the ash from the boiler house, new hydro plant is being installed, whereby the ash will be carried along a channel of running water, a great improvement upon the old system of employing tip wagons under the boilers, and it will reduce to a minimum the inconvenience of fumes and flying dust and grit which their use involved. To eliminate dust from the flue gases, grit arrestors of a special type are being fitted in the boiler flues. In addition to the foregoing improvements, a system of indicators has been installed in the boiler house, by means of which it is possible for the stokers to read at any moment the temperature of the flue gases and of the incoming water supplies. Other devices indicate the amount of steam generated by each boiler, also the efficiency of combustion in the furnaces.

The rehabilitation of the Lots Road power house cannot be completed for some time yet; progress is necessarily slow in that the improvements and additions must be so introduced as not to cause interference with the normal operation of the station, a task more difficult than that of building a new power house, and so far it has been carried out without a hitch. A few interesting facts about the reconstructed power house are that 925 tons of coal is consumed daily by 32 boilers, delivering 1,100,000 lb. of steam each hour to nine turbo-alternators, which carry 100,000 kW of load and have an output of 1,300,000 kW-hours daily, at a pressure of 11,000 volts. Some 431 miles of h.p. cable deliver the energy generated to 43 sub-stations, ranging from 1,800 to 10,000 kW capacity, and supply 91 miles of railway and 49 miles of tramway, which carry 2,000,000 passengers daily.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Lamp Price Reductions.

The Electric Lamp Manufacturers' Association announces reductions in the prices of the "Pearl" internally frosted and opal lamps made by its members. The reductions are designed to encourage the use of the simplified range of "Pearl" lamps in the place of the many clear glass sizes, and a notable departure is the special reduction of a penny in the case of lamps for the standard voltage—230 V. The new prices represent a reduction of 2d. or 3d. in the case of the 15- and 25-W "Pearl" lamps; 3d. or 4d. in the case of the 40- and 60-W sizes; and 9d. or 10d. for the 100-W size. For the 40- and 60-W opal lamps the reduction is 1½d. or 2½d., and for the 100-W opal 7d. or 8d. Reductions have also been made in a number of other instances, such as the 100-W clear gasfilled lamp and certain special lamps. The makes affected by the alterations, which took effect as from April 2nd, are as follows: "Cosmos," "Cossor," "Cryselco," "Elasta," "Foster," "Mazda," "Neron," "Orion," "Osram," "Philips," "Royal Ediswan," "Siemens," "Stearn," "Stella," "Tungsram," and "Z." Pamphlets announcing the new prices and giving particulars of the simplified "Pearl" range have been received from the British Thomson-Houston Co., Ltd., the General Electric Co., Ltd., Tungsram Electric Lamp Works (Great Britain), Ltd., Pope's Electric Lamp Co., Ltd., and Philips Lamps, Ltd.

British Meters in Australia.

Mr. E. E. Sharp (Venner Time Switches, Ltd.) has recently returned from a visit to Australia and New Zealand. While in Auckland he addressed a meeting of the Electric Power Board with regard to the prices of British products. He pointed out that there was not much difference between British and Continental charges; indeed, in the case of his own company, some of the products were actually cheaper than similar Continental articles. British taxation was very heavy; actually his company worked two and a half months in each year for the Government. He believed in the principle of the eight-hour day, considering that no more work was done if the day consisted of ten hours. Mr. W. J. Holdsworth, the chairman of the Board, remarked, after examining time switches of various patterns submitted in connection with a large contract, that it was discernible, even to the lay mind, that various parts of the British article were superior.

Swedish Trade and Industry.

The February *Swedish Economic Review* states that during the latter part of last year satisfactory employment was reported for the Swedish iron and steel industry and for the mechanical workshops and shipyards. Only the electrical branch exhibited a decline during the third quarter of the year. Certain electrical exports have shown considerable progress during the past few years. Thus the exports of electrical machines have been as follows:—1925, 21,026,000 kr.; 1926, 27,687,000 kr.; 1927, 34,750,000 kr.; 1928, 43,755,000 kr. Similarly, shipments of telephone and telegraph apparatus have expanded. In 1925 the total value was 7,010,000 kr.; in 1926, 7,434,000 kr.; in 1927, 9,992,000 kr.; and in 1928, 13,541,000 kr. (£1=18 kr. approx.)

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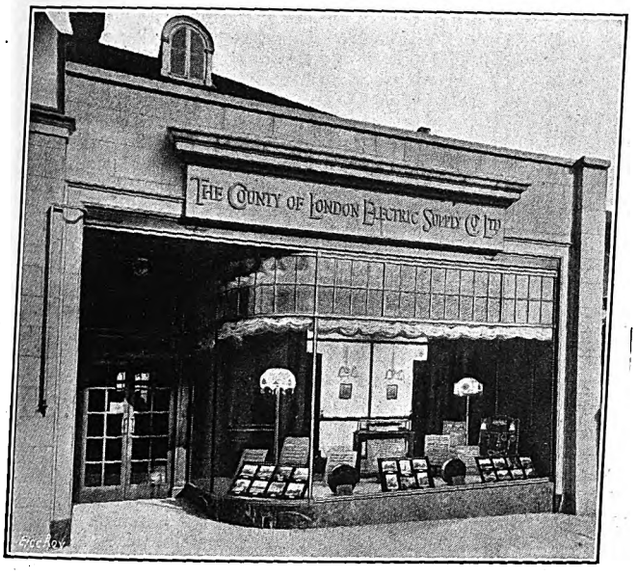
Calendar.

Just in time to relieve our anxiety, the new wall-calendar for the year April, 1929-30, superseding one that has provided full delectation for the past year, has reached us from the Metropolitan-Vickers Electrical Co., Ltd. We quite forget what we said a year ago—but what a delightful relief to monotony these new faces bring!

The subject this year is Miss Joan Lockton, of "Lumber Love." By the way, this is the fifteenth of this series of "Girl" calendars.

A Henley Wiring System Display.

The accompanying illustration depicts the window of the Romford showroom of the County of London Electric Supply



A Henley Wiring System Display.

Co., Ltd., upon the occasion of a special display of the Henley wiring system. The background of the window consists of panels to represent the interior of a room. The wires are carried round the door frames and are practically invisible. In the foreground are drums of wire, samples of the fittings employed in the system, and photographs of large buildings which have been wired on the Henley system.

More Hopeful Trade Outlook.

In a recent speech Mr. Douglas Hacking, Parliamentary Secretary to the Department of Overseas Trade, said (as reported in *The Times*) that our share of the world's export trade had fallen from about 14 per cent. in 1913 to about 12 per cent. in 1928; this was due to the recovery of Europe being slower than that of the new countries. There had been some progress in the volume of our exports; last year they were between 6 and 7 per cent. greater than in 1923. Although he did not regard the present position in this respect as satisfactory, recent reports received from the overseas officers of his Department indicated clearly that our trade position was gradually being recovered. The present position of industry was much more satisfactory than it was 12 months ago. A good index was the coal industry, which has made rapid strides during the past two months. The decrease in the unemployment figures showed a better average of work throughout the country. He saw no reason why the improvement should not continue. Costs of production were increasing abroad, which was all to our good. We were competing now with several foreign manufacturers who 12 months ago could, and did, underquote us every time.

Recent Contracts.

The Birmingham area, which has been served hitherto entirely by manual exchanges, is to have automatic telephones (Northern, Victoria and Harborne). Orders for three automatic exchanges and also for a tandem exchange, have been placed with the General Electric Co., Ltd. The initial equipment to be provided on the automatic exchanges is for a total of 9,700 lines, the ultimate capacity being 20,200. The tandem exchange will provide for routing all junction traffic in the area, and will be equipped with keysender positions for use during the change-over. It is anticipated that the exchanges will be brought into operation during 1931.

An important contract has been awarded to the British Thomson-Houston Co., Ltd., Rugby, by the Municipal Council of Rotterdam, for 25,000-V, three-phase, 50-cycle switchgear required in connection with its new power station. This contract is for 39 B.T.H. isolated phase equipments incorporating oil circuit breakers of the most modern construction and having an interrupting capacity of 1,500,000 kVA. The ultimate capacity of the station is to be 252,000 kW, and the switchgear will be so arranged that the equipment for each phase is housed in an entirely separate gas-proof building, in a similar way to the practice widely adopted in the United States. The order was obtained in the face of severe competition, especially from Continental manufacturers. It follows closely on the order for two 42,000-kW turbo-alternators secured by another British company, the Metropolitan-Vickers Electrical Co., Ltd. In this case also similar conditions as regards competition and engineering investigations were encountered.

The British Thomson-Houston Co., Ltd., has also received an order from the Metropolitan Electric Tramways Co., Ltd., for 140 "Type B.T.H. 509" lightweight traction motors. With this repeat order the total number of motors of this type ordered by the M.E.T. is 354.

American Communications Deal.

It was reported last week that the International Telephone and Telegraph Co. had acquired the Communication Co. (a subsidiary of the Radio Corporation of America) for £20,000,000. *Reuter* reports that the Radio Corporation and the International Telephone and Telegraph Co. issued a joint statement on March 29th saying that the agreement reported to have been reached between the two companies was merely an accord as to the desirability of a consolidation of their communications interests and a tentative plan under which this might be accomplished when the law so permitted. The management was aware of what had taken place in the British Empire, France, Germany and Italy in the unification of communications, and believed that it would be to the interest of the United States and the American people to have a corresponding unification there.

Trade Commissioner for the Irish Free State.

The Department of Overseas Trade states that it has been decided to establish a Trade Commissioner post (Grade I) in the Irish Free State, with headquarters in Dublin, and to appoint Mr. W. Peters, C.M.G., to the new post. Mr. Peters has served in a similar capacity in Russia, Sweden, and Denmark. He expects to leave England for Dublin about the middle of April.

Social Event.

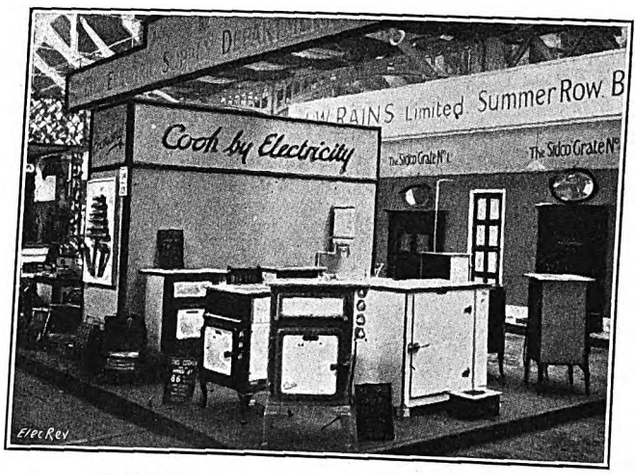
The annual dinner of the Blackpool Electricity and Tramway Employés' Institute was held last week. Mr. C. Furness, electrical engineer, presided, supported by the Mayor (Ald. J. Potter, J.P.), and members of the Corporation. The "Whittaker" swimming trophy and medals and the "Furness" Shield and medals were presented.

Clix Terminals.

Messrs. Lectro Linx, Ltd., of 254, Vauxhall Bridge Road, S.W.1, have sent us samples of some recent additions to their range of Clix terminals (hook and ring respectively), having an alternative wiring device which later will be employed on their spade terminals.

The National Trades Exhibition, Birmingham.

The Birmingham Corporation Electric Supply Department has a large stand at the National Trades and Industrial Exhibition which is being held in Bingley Hall, Birmingham, from March 18th until May 11th. One end of the stand, which is illustrated herewith, is devoted to cooking and water-heating.



A Birmingham Corporation Exhibit.

Several examples of the electric cookers which the Department lets out on hire are on view. The other end of the stand bears a collection of fires and miscellaneous domestic appliances. A special feature is a "bathroom" equipped with a "Creda" bath-water heater.

New French Company.

A new company has just been formed at Chambre (Savoy) with a capital of three million francs and the title La Compagnie Française d'Electrolyse, to establish works for the electrolytic production of metallic salts.

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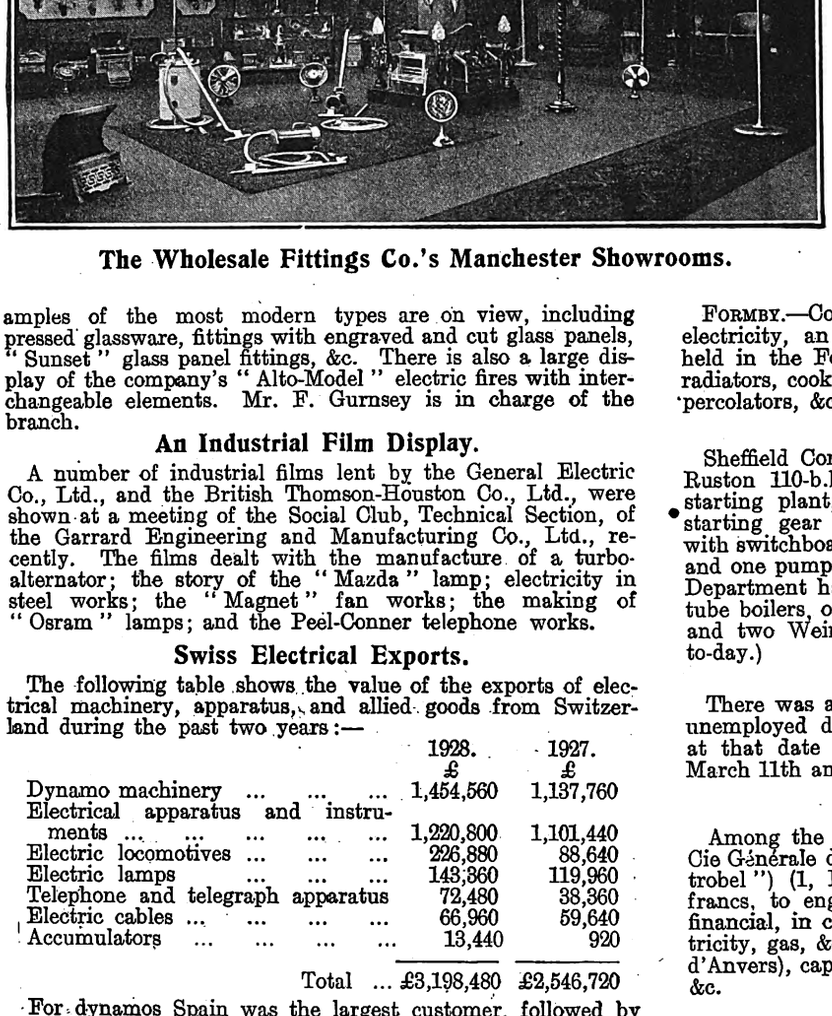
Mavor & Coulson (South Africa), Ltd.

A company bearing this title has been registered in South Africa to foster the business of Messrs. Mavor & Coulson, Ltd., Glasgow, in the Union. The new company will work in close co-operation with the Johannesburg branch of the Consolidated Pneumatic Tool Co., Ltd., and its principal business will be to supply coal-cutting machines for the South African mines.

Extended Manchester Showrooms.

The branch of the Wholesale Fittings Co., Ltd., at 78-80, High Street, Manchester, has recently been extended and the showrooms have been entirely rearranged. The greater part of the showrooms is devoted to lighting fittings and many examples of the most modern types are on view, including pressed glassware, fittings with engraved and cut glass panels, "Sunset" glass panel fittings, &c. There is also a large display of the company's "Alto-Model" electric fires with interchangeable elements. Mr. F. Gurnsey is in charge of the branch.



The Wholesale Fittings Co.'s Manchester Showrooms.

An Industrial Film Display.

A number of industrial films lent by the General Electric Co., Ltd., and the British Thomson-Houston Co., Ltd., were shown at a meeting of the Social Club, Technical Section, of the Garrard Engineering and Manufacturing Co., Ltd., recently. The films dealt with the manufacture of a turbo-alternator; the story of the "Mazda" lamp; electricity in steel works; the "Magnet" fan works; the making of "Osram" lamps; and the Peel-Conner telephone works.

Swiss Electrical Exports.

The following table shows the value of the exports of electrical machinery, apparatus, and allied goods from Switzerland during the past two years:—

	1928.	1927.
	£	£
Dynamo machinery	1,454,560	1,137,760
Electrical apparatus and instruments	1,220,800	1,101,440
Electric locomotives	226,880	88,640
Electric lamps	143,360	119,960
Telephone and telegraph apparatus	72,480	38,360
Electric cables	66,960	59,640
Accumulators	13,440	920
Total ...	£3,198,480	£2,546,720

For dynamos Spain was the largest customer, followed by Italy, Poland, Argentina, and Bulgaria. France, Great Britain, and Spain were the best markets for electrical apparatus, Spain for electric locomotives, Holland for lamps, and France and Italy for telegraph and telephone instruments.

New Catalogues and Lists.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive List No. 1105-A, dealing in an interesting manner with large h.p. steam turbines. The illustrations include views of actual installations of the company's turbine plant. Also Descriptive List No. 3305, dealing with B.T.H. metal-clad vertical plugging switchgear.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—As the company finds that some electrical retailers are only interested in certain sections of its large general catalogue, it has produced sections of this bound in stiff paper covers for their use. These sections include electric fires, display and industrial lighting equipment, lamps, switch and fuse-gear, domestic appliances, &c. Also an illustrated folder containing details and prices of the "Wylex" fuse unit.

Messrs. James Bourlet & Sons, Ltd., 17 and 18, Nassau Street, Mortimer Street, W.1.—A well-illustrated catalogue of artistic "period" lighting fittings and mirrors, prefaced by an article on "The Psychology of Colour." Priced.

Messrs. Veritys, Ltd., Aston, Birmingham.—A folder illustrated in colours advertising the "Orbit" fan. Priced.

The Tungstone Accumulator Co., Ltd., Salisbury Square, E.C.4.—A folder drawing attention to points in the manufacture, &c., of "Tungstone" accumulators.

Local Exhibitions.

S.W. & S. Electric Power Co.—The Shropshire, Worcestershire and Staffordshire Electrical Power Co., has this year already held demonstrative exhibitions at Bewdley, Bridgnorth, Ledbury, Winchcombe, Ludlow, and Broadway; the next is arranged to take place in the Town Hall, Oldbury, from April 16th to 20th.

Wiltshire.—In connection with the series of village exhibitions which the Western Electricity Supply Co., Ltd., is arranging in its West Wilts. area, exhibitions have recently been held at Holt and Lacock. The exhibitions, which were devoted mainly to lighting and the domestic uses of electricity, were very successful in bringing electricity to the attention of the rural population.

Preston.—Among the standholders at the recent electrical exhibition were:—Carron Company; the Credenda Conduits Co., Ltd.; Metro-Vick Supplies, Ltd.; Burnley Components, Ltd.; the British Hanovia Quartz Lamp Co., Ltd.; W. E. Beardsall & Co., Ltd.; Belling & Co.; Frigidaire, Ltd.; the Revo Electric Co., Ltd.; the General Electric Co., Ltd.; Siemens Electric Lamps and Supplies, Ltd.; Ed. Dewhurst, Ltd.; A. Williams and Son; Mayor & Crozier; the Ashton Electric Co.; the Carwin Electrical Co.; T. Cross and Son; Norman, Harrison & Co.; W. Martindale & Co.; J. R. Hodgson, Ltd.; Wilkinson's Wireless Service Co.; R. Marsden & Sons, Ltd.; and Thermega Distributors. Mr. F. B. Fych, of the General Electric Co., Ltd., on March 27th, delivered a lecture on "Electric Bakery." During the period of the exhibition films were shown and demonstrations given of the utility of electrical fittings in the home.

Formby.—Coinciding with a recent reduction in the price of electricity, an exhibition of domestic electrical fittings was held in the Formby Council offices. The exhibits included radiators, cooking apparatus, vacuum cleaners, electric kettles, percolators, &c.

For Sale.

Sheffield Corporation Water Works invites offers for three Ruston 110-b.h.p. horizontal engines, with compressed air starting plant, three G.E.C. 500-V d.c. dynamos, electrical starting gear and main switchboard, one automatic booster with switchboard, one 3-wire balancer, 5-ton overhead traveller, and one pump and motor. Poplar Borough Council Electricity Department has for disposal two Stirling marine type water-tube boilers, one Clarke, Chapman "Woodeson" type boiler, and two Weir feed pumps. (See our advertisement pages to-day.)

Unemployment.

There was a decrease of 86,340 in the number of registered unemployed during the week ended March 18th. The total at that date was 1,182,500, as compared with 1,268,840 on March 11th and 1,066,077 on March 19th, 1928.

New Belgian Companies.

Among the companies recently formed in Brussels are the Cie Générale d'Entreprises Electriques et Industrielles ("Electrobel") (1, Place du Trône), with a capital of 33 million francs, to engage in operations, industrial, commercial and financial, in connection with the production and use of electricity, gas, &c.; and the Establissement Bekso (141, Chaussée d'Anvers), capital 175,000 francs, to construct electric furnaces, &c.

New Italian Companies.

Among the companies recently formed in Italy are the Società Fabrica Isolanti Elettrici in Bakelite Giorgi e Vinci, Milan, capital 1,250,000 lire; La Società Industrie Elettrotechniche Nazionale, Milan, capital 90,000 lire; and La Società Italiana Materiale Elettrico Alluminio, Rome, capital 150,000 lire.

The London Electricians' Strike.

The strike of electricians in various parts of London in an endeavour to secure that men employed in lift installation work should be paid the same rates as are paid in the electrical contracting industry, continued up to the time of our going to press. A conference of employers and E.T.U. representatives was to be held to-day (Friday).

Trade Announcement.

From to-morrow (April 6th) the address of the Greenwich Cable Works, Ltd., will be Mitcham Road, Croydon. (Telephone: Thornton Heath 2882). The new works is thoroughly up-to-date and capable of extension.

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The North-East Coast Exhibition.

Considerable progress is being made with the completion of the North-East Coast Exhibition, Newcastle-upon-Tyne. The main buildings are now complete and the pavilions in the grounds will be ready for occupation before long. In the Palaces of Industry and Engineering workmen are busily employed getting everything into order. The stands are being rapidly put together and by the middle of April many exhibits will have been placed on the stands. One of the features of the two palaces will be the amount of machinery which will be seen in operation. Unless something unforeseen happens, the Exhibition will be in every respect complete for the official opening by the Prince of Wales on Tuesday, May 14th.

A Robust Lamp.

The Edison Swan Electric Co., Ltd., has sent us a copy of a letter received from a firm in South-West London. This reports that the firm's shop front was badly smashed when a collision occurred between a fire engine and a 'bus recently. An "Ediswan" lamp in a heavy-ribbed glass shade fitted to a pendant remained unharmed by the shock, although the shade was shattered. It is still in use after two years' service.

Hull Accepts a German Tender.

The *Yorkshire Post* reports that on March 27th the Hull Corporation Telephones Committee accepted a tender for cable of German manufacture. Mr. J. Townend, who had proposed the acceptance of the lowest British tender, said he could not understand the policy of the Corporation. They had appointed a Development Committee in the hope and expectation that they would be able to induce new industries to come to Hull, and it had been decided to hold a Civic Week to benefit Hull trade. Yet the Telephones Committee accepted tenders for goods that were not of British manufacture. That was not the way to reduce unemployment in this country.

Bankruptcy Proceedings.

L. H. Lawrence, trading as Henry F. Lawrence, 43, Canterbury Road, Margate, electrical engineer.—The public examination was held on March 19th at the Guildhall, Canterbury, when a statement of affairs was lodged showing a deficiency of £484. The debtor commenced trading on his own account in 1923, taking his present premises in 1924. His turnover during 1928 was £1,600, and although there was a gross profit of 25 per cent., his wage bill absorbed it all. It was pointed out that the debtor was losing at the rate of £200 per annum. The examination was closed.

B. Smith (H. Worton), electrical engineer, 43, Stonegate, Spalding.—Receiving order made March 23rd on debtor's own petition. First meeting, April 5th at the White Hart Hotel, Spalding; public examination, April 26th at the Law Courts, Peterborough.

H. Holmes, electrical contractor, &c., 60, Ward's End, Loughborough.—Receiving order made March 25th, on debtor's own petition. First meeting April 10th, at the Official Receiver's office, 1, Berridge Street, Leicester. Public examination May 3rd, at the Castle, Leicester.

R. Horsfall (Harrison & Horsfall), electrical engineer, 24, Commercial Street, Barnsley.—Trustee, Mr. C. H. Baker, Standard Buildings, City Square, Leeds, appointed March 20th.

M. J. Scott (M. J. Scott & Co.), electrical engineer and contractor, late of 100, Jermyn Street, W.—Last day for proofs for dividend, April 20th. Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C.

Company Liquidations.

Electromotors, Ltd.—Winding up voluntarily for the purpose of amalgamation with Laurence Scott & Co., Ltd. Liquidator, Mr. F. S. Abbott, 40, South King Street, who is authorised to carry into effect the agreement made by Sir Benjamin Longbottom on behalf of the company and Laurence Scott & Co., Ltd. A meeting of creditors is called for April 11th at the liquidator's offices. Particulars of claims by April 30th. (This notice is formal; all creditors will be paid in full.)

Zone Wireless Co., Ltd.—A petition for the winding up of the company has been presented to the High Court by Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C., creditors, and will be heard in London on April 15th.

Dissolutions of Partnership.

McBride & Nuttall, electrical and mechanical engineers, 7, Sheil Road, Fairfield, Liverpool.—Mr. J. McBride and Mr. T. H. Nuttall have dissolved partnership. Mr. Nuttall will attend to debts and continue the business.

Auto Electric Services, electrical engineers, East Street, Petworth.—Mrs. M. Streeter and Mr. G. Boyd have dissolved partnership. Mrs. Streeter will attend to debts.

Book Notices.

"Practical Railway Painting and Lacquering," by H. Hengeveld, C. P. Disney, and W. J. Miskella. Pp. xxv+242; figs. 164. New York: Simmons-Boardman Publishing Co. Price $3.50.

"Commercial Accumulator Charging and the Efficiency of A.C. Rectifying Equipment," by H. G. Wilson. Published by Partridge, Wilson & Co., 217a, Loughborough Road, Leicester. —This is the second edition of a handbook containing brief advice on the handling of accumulators, and notes on charging with the aid of motor-generators, commutating rectifiers and valve rectifiers. The firm offers to send a free copy to *bona fide* traders.

"*Journal* of the American Institute of Electrical Engineers," Vol. XLVIII, March, 1929. New York: The Institute. Price $1.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price April 2nd.	Fortnight's inc or dec.
a Acid, Oxalic ...	per lb.	5¾d.	...
a Ammoniac, Sal ...	per ton.	£60	...
a Ammonia, Muriate (large crystal)	"	£52	...
a Bisulphide of Carbon ...	"	...	...
a Borax ...	"	£25	...
a Copper Sulphate ...	"	£25 10s.	...
a Potash, Chlorate ...	per lb.	8½d. to 4d.	...
a " Perchlorate ...	"	5½d.	...
a Shellac ...	per cwt.	£18 10s.	...
a Sulphur, Commercial ...	"	£11	...
a " Roll ...	"	£11	...
a Soda, Chlorate ...	per lb.	8d.	...
a " Crystals ...	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	8¼d.	...
METALS, &c.			
b Aluminium, Ingots ...	per ton.	£95 to £100	...
b " Wire ...	per lb.	1/1 to 1/9	...
b " Sheet ...	"	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metal—			
Grade I ...	per ton net.	£204	...
Grade II ...	" "	£142	...
Grade III ...	" "	£79	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/0⅞	...
c " Tubes (solid drawn) ...	"	1/8¼ to 1/8½d.	1d. inc.
c " Wire, basis ...	"	1/0⅞	1½d. inc.
c Copper Tubes (solid drawn) ...	"	1/6¼	⅜d. inc.
c " Bars (best selected) ...	per ton.	£138	1¾d. inc.
c " Sheet ...	"	£138	£13 inc.
c " Rod ...	"	£138	£13 inc.
d " (Electrolytic) Bars ...	"	£111	£11 10s. inc.
d " " Sheets ...	"	£148 10s.	...
d " " Wire Rods ...	"	£121	£11 10s. inc.
d " " H.C. Wire	per lb.	1/2 11/16	1 1/16d. inc.
f Ebonite Rod ...	"	2/8 to 2/6	...
f " Sheet ...	"	2/8 to 2/6	...
n German Silver Wire ...	"	2/2	...
h Gutta-percha, fine ...	"	nom.	...
h India-rubber, Para fine ...	"	1/0½	...
l Iron Pig (Cleveland No. 3.) ...	per ton.	67/-	¾d. inc.
l " Wire, galv. No. 8, P.O. qual.	"	£21	...
g Lead, English pig ...	"	£27 15	...
g Mercury ...	per bot.	£22 2s 6d. to £22 5s.	25/- dec.
e Mica (in original cases) small ...	per lb.	8d. to 8/-	...
e " " medium	"	4/- to 8/-	...
e " " large ...	"	10/- to 20/- & up	...
p Phosphor Bronze, plane castings	"	1/8½	...
p " " drawn bars & rods	"	1/5	...
p " " rolled strip & sheet	"	1/4¼	...
p " " wire...	"	1/6½	...
o Platinum ...	per oz.	£18 17s. 6d.	...
d Silicium Bronze Wire ...	per lb.	1/5	4d. inc.
r Steel, Magnet. in bars ...	"	7¾d.	...
n Tin, Block (English) ...	per ton.	£219 5s. to £219 15s.	£5 5s. to £5 15s. dec.
n " Wire, Nos. 1 to 16 ...	per lb.	8/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Sydney Bribery Charges.

It will be recalled that some months ago, following the sentence imposed on Mr. S. Y. Maling, deputy manager of the Sydney (N.S.W.) Electricity Department for accepting a bribe in connection with a power plant contract, the company involved, Babcock & Wilcox, Ltd., was fined £1,000 and ordered to repay about £10,000 to the Sydney City Council. The company appealed against this judgment and on March 28th the Court allowed the appeal. The company was exonerated from responsibility for the action of its Sydney representative, which, it was said, occurred without the company's knowledge or consent.

English and Metric Conversion Scales.

Mr. William H. Grant, of the experimental department of Barr & Stroud, Ltd., says the *American Machinist*, has designed a cursor for use on rules which show both English and the corresponding metric measurements. The cursor is a simple rectangular metal frame which slides along the rule, enclosing it. The cursor has a pointer at the top and bottom by means of which the dimensions can be read. In this way inches and fractions can be readily converted into mm., or *vice versa*. The cursor device is double-sided, that is, it applies to both sides of the steel rule. Therefore, should the rule be marked in inches with the corresponding tapping sizes and spanner sizes, the latter can be read at once. The device should prove useful to draughtsmen, pattern-makers, engineering workmen, and so on.

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Lighting and Power Notes.

Argentina.—New Power Station.—The new power station of the Cia. Argentina de Tramways y Fuerza, Ltda., was inaugurated on March 15th by the Governor of Sante Fé.

Barnard Castle.—Overhead Lines.—The Electricity Commissioners have forwarded to the Urban District Council maps showing the overhead system proposed by the Cleveland and Durham County Electric Power Co. with the observation that they thought the company had taken reasonable steps to meet the Council's wishes. The Council has decided to allow the company to proceed with the work, and it is hoped to have the system in operation by the autumn.

Brentford.—Electricity Supply.—The Urban District Council has approved an application by the Chiswick Electricity Supply Corporation, Ltd., for permission to lay a cable to meet an increased demand at the works of Messrs. Whitbread and Co., and to improve the general distribution of the area, for which a feeder pillar is to be erected in Essex Square.

Bridgwater.—Overhead Lines.—In connection with the scheme to supply the outlying portions of the borough and rural district with electricity, the Town Council has consented to the erection of overhead lines on steel towers by the Bridgwater and District Electric Supply and Traction Co., Ltd.

Brighton.—Loans.—The Corporation Electricity Committee is applying for sanction to the borrowing of £10,000 for h.p. and l.p. overhead mains, switchgear, &c., in connection with the proposed sub-station at Warren Farm schools, £50,000 for mains and services, and £15,000 for cable connections required for the extension of plant, &c., at Southwick works. Sanction has been received to a loan of £9,317 for the lighting of London Road, Dyke Road and Lewes Road.

Supply to Housing Estate.—The Corporation Lighting Committee has authorised the engineer to carry out mains extensions at a cost of £1,185, for the supply of electricity to the Bevendean Valley Housing Estate.

Canada.—Hydro-Electric Development.—The annual report of the Hydro-Electric Power Commission of Ontario, for the fiscal year ended October 31st last, shows that the revenue from the municipal electric utilities, and other power customers, was $24,287,296, and operating and other expenses were $16,489,620. After placing $6,857,012 to sinking fund, there was a surplus for the year of $940,638. The total reserves of the Commission amount to $37,500,000, which added to the reserves of the local hydro-electric utilities bring the total up to $75,545,583. The total capital investment of the Commission in power undertakings, &c., is over $300,000,000. The steady growth of the system is shown by the increase in the distribution of power, the total volume of 20-minute peak h.p. distributed during the year being 1,032,500, as compared with 949,700 for the previous year. The work of extending the system into the rural districts was continued, about 1,000 miles of new transmission lines being constructed, bringing the total mileage of rural lines up to 4,103, supplying 31,063 customers.

Cannock.—Amendment of Order.—The Urban District Council has applied to the Electricity Commissioners to amend the Cannock Electricity (Extension) Special Order, so as to add the parish of Lapley.

Chelmsford.—Inquiyr into Charges.—The Corporation is to apply to the Electricity Commissioners for an inquiry to be held with a view to obtaining a reduction in the charges for electricity, and to make representations as to the inadequate supply of electricity in the borough generally.

Continental.—Portugal.—The Minister of Commerce has nominated a commission of engineers to examine the whole question of the exploitation of the water power of the Douro, from the mouth of the River Huebra to Oporto. At the same time the General Administration of Water Services will examine the proposals already submitted for the exploitation of the hydro-electric power of the Douro, in order that the Government may take whatever steps it considers necessary to develop the zone reserved to Portugal under the terms of the convention concluded with Spain in 1927.

Switzerland.—The Society des Forces Motrices Bernoises has asked permission from the Confederation to export energy to the French Société Electrique du Jura at Besançon. The amount to be exported to Besançon measured at Bassecourt will be a maximum quantity of 192,000 kWh daily, and in no case must the power exceed 11,000 kW. In winter the energy may be reduced when circumstances are unfavourable. This exportation is to begin during 1929 and the contract is for 25 years.

Coventry.—Loan.—The Corporation Electricity Committee is applying for sanction to a loan of £16,635 for the replacement of plant.

Croydon.—Cooling Towers.—The Corporation Electricity Committee has had under further consideration the question of the supply from the Central Electricity Board and the possible extension of the generating station to meet the requirements of the Board. The chairman of the committee and the borough electrical engineer have had an interview with the Board and obtained a promise that within two months it will either give an undertaking to provide the supply required from the "grid" in the winter 1930-31, or will sanction an immediate extension of the generating plant. The borough electrical engineer has reported that to meet the demand on the station for the coming winter it is necessary to provide further cooling towers. In the event of the station being extended either in 1930-31, or at a later date, it will be necessary to provide additional towers equivalent to 14 of the existing wooden towers. The immediate requirement is the equivalent of three of the existing cooling towers, and the extension of the main water-cooling system. He states that a new type of tower built of ferro-concrete is now being constructed at some stations, which will do the work of three or four wooden towers and would have at least double the life of a wooden tower. The committee has recommended obtaining alternative tenders for three wooden towers and one concrete tower and will further consider the question and report to the Council as to which form of tower should be adopted, when the tenders have been obtained.

Devizes.—Electricity in Small Houses.—The Rural District Council has decided to install electric lighting in the whole of its 42 houses at Potterne, Market Lavington, and Rowde, and tenders are to be invited for the work of installation.

Dover.—Estimates for 1929-30.—The Electricity Committee has submitted estimates to the Corporation for the year ending March 31st, 1930. The receipts are estimated at £51,905, and expenditure on revenue account £31,625, leaving a gross profit of £20,280. After providing for capital charges, there is an estimated surplus of £8,403. The surplus for the year just completed is estimated at £7,778.

Formby.—Revision of Charges.—Revised charges for electricity have been introduced by the Urban District Council. The new rate for lighting is 6½d. per kWh, and for power 1½d. per kWh. Consumers have also the option of availing themselves of an alternative tariff based on a charge of 5 per cent. on the ratable value of the house up to £60 plus 1d. per kWh for all purposes. Arrangements have also been made for the hiring of electric cookers at a rental of 7s. 6d. per quarter with free maintenance and free wiring up to 50 ft.

Guildford.—Mains Extensions.—The Corporation Electricity Committee is to extend mains at a cost of £3,377 to supply the Longdown Road, Warren Road and Worplesdon Road districts.

London.—Battersea.—The Borough Council Electricity Committee has decided to install prepayment meters when desired, without additional charge. It has also decided to install prepayment meters when desired in connection with the rental wiring schemes and to charge a flat rate of 6d. per kWh to cover both the fixed quarterly charge and the "unit" charge for electricity consumed. The Housing Committee has recommended that the gas fires installed by the Council in the bedrooms of the tenements on the Latchmere, Heathwall and Savona Street assisted housing estates should be replaced by electric fires.

Plymouth.—Hire-purchase of Radiators.—The Corporation Electricity Committee has adopted a scheme for the hire-purchase of electric fires on the same terms and conditions as are now in operation in respect of electric cookers, but for the present the scheme is to applv only to hotels and boarding houses, its extension to private houses being under consideration.

Mains Extensions.—Cable extensions have been authorised in 19 streets in Plymouth, Devonport and Stonehouse.

Electricity Extensions.—The Committee estimates an expenditure for the year of £155,000 on mains and plant.

Preston.—New Water Inlet.—The Electricity Committee has recommended that the principle of an additional water inlet be adopted, and that application be made for sanction to borrow £52,000, the estimated cost of the inlet, for condensing water purposes at the Ribble power station, including the requisite aqueducts and screening chamber.

South Africa.—Cape Town.—The *South African Engineer* reports that one of the most important items of work carried out in the development of the City Council's electricity undertaking during the past few years has been that of reconstructing and extending its system to meet the ever-increasing demand for electricity, and the following figures relating to 1928 indicate the amount of work of this nature which is being performed year by year. During the year the overhead distribution system was reconstructed in standardising the 220/380 V, 3-phase, 4-wire system over a route length of 57 miles, which involved the planting of 2,740 poles and the erection of 162 tons of copper conductors with 25,716 insulators supported on 6,320 cross arms. In conjunction with the reconstruction of the overhead network, it has been necessary also to provide additional transformer sub-stations and to alter and augment the plant and equipment contained in previously existing sub-stations, in which connection during the year 85 12,000-V and 101 380/220-V metalclad switch panels, 30 transformers and 40 induction voltage regulators were installed at various points, while four rotary convertor sets were erected and put into commission for d.c. supplies to the Capetown and Camps Bay Tramways Companies. This work has included also the laying of 27,947 yd. of 12,000-V, and 17,453 yd. of l.p. cable, as well as 26,071 yd. of telephone and pilot-telephone cables between sub-stations. Excluding trans-

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former pillars and kiosks, 62 sub-stations controlled by the department were in commission at the end of 1928, and six more were in course of construction.

The requirements of consumers in the Cape rural district are increasing at such a rate, and the question of maintaining supplies free of interruptions has become of such importance during the last twelve months, that the Commission has found it necessary to commence at once the construction of additional overhead 33,000-V transmission lines, so as to be able to give supplies to all of the principal centres through alternative routes.

Southend-on-Sea.—Electricity Supply.—The Town Council has adopted a scheme prepared by the electrical engineer providing for h.p. ring mains to permit of a.c. distribution in the north-eastern, north-western and western areas of the borough. The scheme provides for the laying of 11,000-V mains, with transformers, kiosks, and section boxes, and the estimated cost is £48,516.

United States.—Electrical Development.—The Pacific Gas and Electric Company has announced plans for the enlargement of Station "A" in San Francisco, the work to begin at once. When completed the new station will be the largest electric generating plant on the company's system. It will be operated by steam and will cost more than $11,000,000. At the present time the largest plant on the company's system is Pit. No. 3 on the Pit River in Northern California, rated at 82,000 kW. The plant will take five years to complete, and work on the first units, two 52,500-kW steam turbo-generators, will begin at once. Three large boilers are being designed to supply steam for these units. The boilers will operate at 1,400 lb. The first unit will be placed in operation early in 1930. The second unit, of the same rating as the first, will be ready six months later. When this work is completed, the station, with changes in some of the old machinery, will have a capacity of 131,000 kW. Other units will go in as needed, and at the end of 1934 the station will have a capacity of 225,000 kW.

Wallasey.—Electricity Supply Progress.—According to the budget statement made in the Council Chamber, the electricity undertaking is expected to yield a surplus of £33,049 on the current year's working. There has been a saving in expenditure of £8,715, due to more economical working. Twelve months ago it was estimated that the fuel consumption per kWh would be 2.25 lb., whereas the actual figure is 1.94 lb. As a result of recent extensions to the power station a further saving in fuel is anticipated. This undertaking has a constantly growing revenue and last year's estimates have been exceeded by £5,740 in spite of a reduction of ½d. per kWh made for private lighting supplies.

York.—New Plant.—The Corporation Electricity Committee has voted the following estimates: Boiler plant, generating station, £5,400; h.p. mains, feeders, &c., £35,747; mains and services, £30,000; and Linton Lock Station, £1,000.

Tramway and Railway Notes.

Argentina.—Railway Construction.—The Ministry of Communications is considering detailed plans for further railway extensions to the more densely-populated parts in the north of Argentina. The plans include an extension of the electrified suburban lines leading out of Buenos Aires to industrial and residential suburbs, townships, &c., rendered necessary by the increase in population.—*Reuter's Trade Service* (Buenos Aires).

Canada.—Railway Electrification.—A report by Mr. F. Palmer, engaged by the Dominion Government of Canada, has been published on proposed new terminal facilities for the Canadian National Railways on the Island of Montreal. His proposals include the entire electrification of Montreal Island lines, and the development of rapid transit suburban traffic, which, it is hoped, will attract between 100,000,000 and 200,000,000 passengers per annum, if the lines are linked up to a central station. He states that Montreal is ideally adapted for the institution of "belts" and "circles," similar to those which have proved so useful and so remunerative to European railways. Included in the $47,355,000 estimate for Canadian National passenger traffic improvements alone is $2,000,000 for electrification. The passenger terminal cost is estimated at $15,350,000, and other items include elevated track and extensions and rearrangement of facilities, grade separation, &c.

Continental.—Russia.—Work has recently been commenced on the electrification of the railway between Moscow and Mitischy. Other lines which it is proposed to electrify in the near future are the Moscow-Leningrad, Moscow-Kasan, Moscow-Kursk, Moscow-Baltic, and the Moscow-Kharkoff railways.

Germany.—During the past year the work of electrifying 107 main line and 70 miles of city and suburban railways was completed by the German State Railway authorities. There are now 804 miles of main lines and 140 miles of local railway on the German State Railway system on which electric trains are working.

Glasgow.—Abolition of ½d. Fares.—Mr. Lachlan Mackinnon, general manager of the Corporation tramways, has submitted a report to the Finance Sub-Committee in which he recommends the abolition of ½d. fares, on the ground that they are not profitable. The Committee recommends the withdrawal of this fare, as from April 15th next.

Liverpool.—Light Railways Order.—The Minister of Transport has recently made the Liverpool Corporation Light Railways Order, 1929, authorising the construction of a light railway in the City and in the rural district of Sefton.

Manchester.—Tramcar Improvements.—The *Daily Dispatch* reports that after viewing a new type of tramcar embodying many improvements, the Corporation Tramways Committee has decided to recommend that 50 tramcars be converted to correspond with the new vehicle, and that cars built in future should follow this design. The new type of vehicle is fitted with transverse seating on the lower deck, and is upholstered with leather cushions, similar to those used on 'buses. The lighting is improved, the windows provide better ventilation, and coloured destination boards are fixed to the side. The Committee has also decided on the general use of a new car-cleaning device which will eliminate hand washing, and save £15,000 a year.

Telegraph and Telephone Notes.

France.—Autographed Telegrams.—For some time past an autographic telegraph service has been in operation between Paris, Lyons, Strasburg, Marseilles, Nice and Bordeaux, by means of which telegraph messages are transmitted in the handwriting of the senders. Hitherto such messages have had to be written with a special syrupy ink, but as the result of improvements recently effected by Mr. Belin, they can now be written with ordinary ink, or even type-written.

International Telephony. — Poland-France.—Direct telephone communication has recently been established between Poland and France (Warsaw-Paris).

Stockholm-Warsaw.—A new telephone line between Stockholm and Warsaw (by way of Berlin) was opened on April 1st. The length of the new line is about 990 miles.—*Reuter* (Stockholm).

Italy.—Vatican Wireless Station.—After several audiences given by the Pope to Senator Marconi, plans for the erection of a receiving and transmitting wireless station at the Vatican City in Rome have been agreed upon. According to the *Daily Telegraph*, the station will be equal in power to the Italian Government station near the Basilica of St. Paul's.

The Telephone Service.—Development.—Sir Alexander Roger, presiding at the annual general meeting of the Telephone Development Association in London on March 25th, said, *inter alia*, that capital investment in telephone extensions was scheduled at the rate of £10,000,000 a year for the next two years, but in the view of the Association that was not sufficient, especially at a time when the relief of unemployment, preferably by self-supporting remunerative schemes of development, was perhaps the most vital need of the country. The service was living from hand to mouth, apparently starved for capital and compelled to work under what the present assistant Postmaster-General had called the "shackles put upon it by the Treasury." London was tending to become the telephone centre of this side of the world, if not the switching centre of the entire globe, but that situation carried with it responsibilities as well as privileges. When international communication did not play the important part it did to-day, it mattered primarily to ourselves that we were tenth in the list of telephone-using countries, but to-day when we were a link in a chain of practically world-wide communication were we going to remain one of the weaker links in that chain? We were no longer an isolated community, and our comparative weakness in telephone density stood out in more grim contrast than before in the light of the efforts being made elsewhere.

Police Service.—Telephone kiosks in Blackpool are being put to a new use by the police. Instead of spending the £1,054 estimated as the cost of installing a system of police boxes, the chief constable, says the *Daily Mail*, has ordered policemen on duty to keep in constant touch with their head office through the ordinary telephone kiosks. By the new scheme 500 disks like copper coins are issued among the policemen, so that they can use the 36 boxes in the town for half-hourly calls. The Post Office is to be paid for the calls each time the 500 disks are exhausted.

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Radio Notes.

Austria.—Future Development.—Herr Oskar Czeija, general manager of the Austrian Broadcasting Company, recently drew the attention of members of the Vienna Scientific Club to the ambitious goal which the constructors of the Zoffen station had set themselves—the transmission of a programme which could be received at any point on the earth's surface, says *The Times*. The Dutch station at Huizen was nightly entertaining Dutchmen in the Dutch Indies. The broadcasting experimental department at the Academy of Music in Berlin was groping after an art peculiar to "broadcasting" in which exponents would be specially trained. On the technical side effort was everywhere concentrated on the construction of a receiving set with automatic, highly selective powers, which on the mere pressure of a button would instantly adjust itself to any desired wavelength.

Belgium.—Radio Liege.—The tests of the station at Liége, formerly known as "Radio-Wallonie-Liége" (EB4RW), have been resumed after a short interval for adjustment, on a wavelength of 280 metres.

Common Wave-length.—Liverpool Station.—The Liverpool station has been included among those stations transmitting on the national common wavelength of 288.5 metres (1,040 kilohertz), which is ultimately to be adopted by practically all British relay stations; the change took place on March 28th. The Liverpool station used to transmit on a frequency of 1,020 kilohertz (294.1 metres).

India.—Losses.—The report of the Indian Broadcasting Co. for the past year shows a loss of two lakhs 15,000 rupees (£16,125), the total loss sustained by the company to date being three lakhs 82,000 rupees (£28,650). The directors consider that the loss would have been much less but for two important disabilities from which the company suffers. In spite of the prosecutions undertaken by the Government of persons found possessing receiving sets without licences, there is still much piracy which deprives the company of legitimate revenue. The company is also unable to collect all the amounts due as a 10 per cent. tax on wireless imports, and, according to *The Times*, it is negotiating with the Government over means to cover up loopholes through which such losses occur.

United States.—Labour Station.—Station WCFL in Chicago has been added to the National Broadcasting Company's system, says *World Radio*. It is the only important broadcasting station in America that is controlled by labour organisations, being owned and operated by the Chicago Federation of Labour and supported by the American Federation of Labour, and subscriptions from the thousands of members of organised labour. It has a power of 15 kW, and operates at a frequency of 970 kh (309.1 metres). It recently received a permit from the Federal Radio Commission for a 50-kW transmitter.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 15th. Victorian Railways. One geared 3-phase electric winding engine. (A.X. 7650.)*

Batley.—April 15th. Electricity Department. L.p. cable. (March 29th.)

Bridport.—April 15th. Electricity Department. H. and l.p. underground and overhead cables. (March 29th.)

Dumfries.—April 17th. Electricity Department. One water cooling tower. (March 29th.)

Dundee.—April 10th. Electricity Department. D.c. and a.c. house service meters. 30,000 pairs arc lamp carbons. (March 29th.)

April 24th. Transport Department. Stores, including armature and field coils, castings, &c., for a year. Specifications, &c., from general manager.

Edinburgh.—April 15th. East Lothian Education Authority. Electrical and heating installations for the new school at Tranent. Schedules, &c., from R. & A. K. Smith, surveyors, 4, Forres Street, Edinburgh.

Edlington.—April 17th. West Riding Education Committee. Installation of electric lighting at new schools and caretaker's house. Education Officer, County Hall, Wakefield.

Egypt.—Cairo.—May 15th. Ministry of Public Works. 120-kW d.c. Diesel engine generating set and a small electrically-driven cooling water pump. Forms of tender from the Chief Inspecting Engineer, 41, Tothill Street, S.W.

Irish Free State.—Dublin.—April 29th. Electricity Supply Board. Supply and laying of 40,000-V cables in the County and City of Dublin. (See this issue.)

London.—Central Electricity Board.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (March 15th.)

Paddington.—April 8th. Great Western Railway. Stores, including electrical wires and cables, telegraph ironwork, and iron and steel wires. (March 22nd.)

Islington.—May 6th. Cleansing Committee. Two new lead batteries for Edison Electric vehicles. (See this issue.)

Lourenço Marques.—April 22nd. Port and Railways Board. Electric hanging and ordinary lamps. (B.X. 5188.)*

Manchester.—Electricity Committee. April 8th. Two 33,000-V metal-clad switch units. (March 22nd.)

Middlesbrough.—April 10th. Electricity Department. 12 months' supply of cables and meters. (March 29th.)

New Zealand.—Wellington.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Prestwich.—April 13th. Urban District Council. Electric lamps required during the year 1929-1930. Form of tender from Mr. A. Piercy, surveyor to the Urban District Council, Council Offices.

South Africa.—Umtali.—April 18th. Municipal Council. 1,000-kW turbo-alternator, spray cooling plant, switchgear, transformers, crane, &c. (B.X. 5142-5.)*

Johannesburg.—April 25th. South African Railways and Harbours. Three electrically-driven wheel lathes. (A.X. 7621.)*

May 16th. Electric signalling apparatus. (B.X. 5165.)*

Port Elizabeth.—April 25th. Municipal Council. 22,000-V switchgear, h.p. and l.p. switchboards, 200-kVA transformer, earth resistance, and various lamps. (B.X. 4194-5.)*

Cape Town.—May 1st. Electricity Department. 30-ft. steel tubular poles, cross arms, insulators, &c. (A.X. 7697.)*

Bloemfontein.—May 18th. Electric Supply Department. Turbine and generator, condensing plant and auxiliaries; switchgear and cables; cooling spray pond equipment or alternatively cooling tower complete. (B.X. 5192.)*

Southampton.—April 30th. Electricity Department. Steel-framed building, steelwork for firing floor, platform carrying induced draught fans, overhead bunkers, &c.; two water-tube boilers with superheaters, economisers, air heaters, mountings, chain-grate stokers, water walls, induced and forced draught fans, sootblowers, steel flues and chimneys, grit arrestors and collectors, &c.; steam, feed-water and other piping, covering, &c.; water softener. (March 29th.)

Stoke-on-Trent.—April 12th. Electricity Department. One 22/24-h.p. heavy oil engine for Stallington Hall. (March 29th.)

Uruguay.—Montevideo.—May 6th. State Electricity Works. Electric cables and accessories. (B.X. 5178.)*

Wolverhampton.—May 10th. West Midlands Joint Electricity Authority. One 50,000-kW turbo-alternator with step-up transformers, &c., condensing plant, boiler feed pumps, evaporators, circulating water pumps, &c., main and auxiliary 33,000-V switchgear with circuit breaker. (March 29th.)

Westhoughton.—April 9th. U.D.C. Electric metallic filament lamps required during year ending March 31st, 1930. Form of tender from Mr. G. Hayes, surveyor to Council, Town Hall.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Brighton.—Tramways Committee. Accepted:—
Brake blocks (£132).—Mather & Smith, Ltd.
Trolley wire (£229).—British Insulated Cables, Ltd.
Steel tires (£330).—Steel, Peech & Tozer, Ltd.
Lamps (£100).—Tungstalite, Ltd.

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Bexhill.—Electricity Committee. Recommended:—
Meters.—(£865), Chamberlain & Hookham (£202), British Sangamo Co., Ltd.; (£496), Edison Swan Electric Co., Ltd.; (£87), Reason Manufacturing Co., Ltd.; (£97), Ferranti, Ltd.

Bolton.—Tramways Committee. Accepted:—
400 tons of steel tram rails.—Dorman, Long & Co.

Douglas (I. of M.).—Correction.—We regret that the award of a contract for the wiring of 100 houses for the Electricity Committee was erroneously attributed to Siemens Bros. and Co., Ltd. Messrs. Siemens, of course, do not carry out this class of work, although they supply house-wiring materials.

Dunblane (Perthshire).—Electrical installation at the New Parish Council Chambers.—W. & T. Marshall (Stirling).

Eastbourne.—Electricity Committee. Accepted:—
Switchgear (£3,504).—General Electric Co., Ltd.
Four single cubicles (£172).—Ferguson, Pailin, Ltd.

Glossop.—Electricity Committee. Accepted:—
Wiring the Hadfield Library for electric lighting.—Urban Electric Supply Co., Ltd.

Lancaster.—Electricity Committee. Accepted:—
Battery booster and switchgear for the Caton Road station (£6,336).—Alton Battery Co., Ltd.

London. — Battersea.—Electricity Committee. Recommended:—
Cables for 12 months.—Callender's Cable & Construction Co., Ltd.
Meters for 12 months.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.
Bitumen for 12 months.—Dussek Bitumen Co., Ltd.
750-kW motor convertor and automatic switchgear for Lavender Hill sub-station (£5,720).—General Electric Co., Ltd.

Southwark.—Electricity Committee. Accepted:—
Two automatic switches, 3,000 A and 2,000 A (£135).—General Electric Co., Ltd.
Battery plates.—Alton Battery Co., Ltd.

Stepney.—Electricity Supply Committee. Recommended:—
Cables for the period of two years ending March 31st, 1931.

W. T. Henley's Telegraph Works Co., Ltd. (Recommended)	£18,192
Hackbridge Cable Co., Ltd.	18,293
Macintosh Cable Co., Ltd.	18,433
W. T. Glover & Co., Ltd.	18,750
Siemens Bros. & Co., Ltd.	18,803
Pirelli-General Cable Works, Ltd.	18,830
British Insulated Cables, Ltd.	18,845
Standard Telephones & Cables, Ltd.	18,932
Callender's Cable & Construction Co., Ltd. ...	18,978

Admiralty.
Operating keys and key combinations, accumulators and cells, terminal and bearing blocks.—Edison Swan Electric Co., Ltd.

Tynemouth.—Electricity Committee. Accepted:—
Cables for 12 months.—Macintosh Cable Co., Ltd.

Wimbledon.—Electricity Committee. Accepted:—
Eight 200-kVA transformers (£840).—Foster Engineering Co., Ltd.
Nine 200-kVA ditto (£945), two 200-kVA ditto (£240), one 100-kVA ditto (£86).—Hackbridge Electric Construction Co., Ltd.
Five 1,000-kVA ditto (£1,755).—Johnson & Phillips, Ltd.
Feed pump (£626).—J. P. Hall & Sons, Peterborough (recommended).

Forthcoming Events.

Institute of Wireless Technology.—Monday, April 8th. Engineers' Club, Coventry Street, W. 7 p.m. "Wireless Receiver Design from Pre-broadcasting Days to the Present Time." Mr. M. A. Hutchins.

Television Society.—Tuesday, April 9th. Engineers' Club, W. 8 p.m. "Some Notes on Exploring." Mr. J. C. Ronnie.

Electrical Power Engineers' Association.—Tuesday, April 9th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Electricity Supply in the Greater London Area." Mr. F. W. Purse.

(Manchester Local Group).—Thursday, April 11th. Geographical Hall. Manchester. 7.45 p.m. "Electrical Engineering Economics." Mr. D. J. Bolton.

Institute of Marine Engineers.—Tuesday, April 9th. The Institute, The Minories, E.1. 6.30 p.m. "The Relative Merits of Pulverised Fuel and Mechanical Stoking and their Application for Marine Purposes." Mr. W. E. Woodeson and Mr. J. S. Gander.

Institution of Civil Engineers.—Tuesday, April 9th. Institution, Great George Street, S.W.1. 6 p.m. "The New Piccadilly Circus Station." Mr. H. Hall.

Electroplaters' and Depositors' Technical Society.—Wednesday, April 10th. Northampton Polytechnic Institute, Clerkenwell, E.C. 8.15 p.m. "Effects of Organic Addition Agents in the Electro-deposition of Copper." Mr. B. Clark.

Royal Society of Arts.—Wednesday, April 10th. John Street, Adelphi, W.C. 8 p.m. "Some Modern Aspects of Electrical Communication.' Mr. G. H. Nash.
Friday, April 12th. 4.30 p.m. "Recent Electrical Developments in India." Mr. A. T. Cooper.

Institute of Fuel.—Wednesday, April 10th. 6 p.m. "Some Notes on Waste Heat Recovery." Major W. Gregson.

Institution of Electrical Engineers.—Thursday, April 11th. Institution, Victoria Embankment, W.C. 6 p.m. "The Testing of Porcelain Insulators." Mr. B. L. Goodlet.

(Meter and Instrument Section).—Friday, April 5th. Institution, London, W.C. 7 p.m. "Some Technical Considerations Concerning Power Factor in Relation to Tariffs." Mr. E. W. Hill.

(Wireless Section).—Wednesday, April 10th. Institution, London, W.C. 6 p.m. "Short Waves." Mr. T. L. Eckersley.

(North-Eastern Centre).—Monday, April 8th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Annual general meeting. "The Testing of Porcelain Insulators." Mr. B. L. Goodlet.

(North-Midland Centre).—Tuesday, April 9th. Hotel Metropole, Leeds. 7 p.m. Annual general meeting.

(North-Western Centre).—Tuesday, April 9th. Engineers' Club, Manchester. 7 p.m. Annual general meeting. "Direct Generation of Alternating Current at High Voltages." Sir Chas. A. Parsons and Mr. J. Rosen. "Recent Developments in Turbo-Generators." Mr. J. A. Kuyser.

(Scottish Centre).—Tuesday, April 9th. Royal Technical College, Glasgow. 7.30 p.m. Annual general meeting. "An Introduction to Researches on Circuit Breaking." Messrs. E. B. Wedmore, W. B. Whitney and C. E. R. Bruce. (E.R.A. Report.)

(Western Centre).—Monday, April 8th. Guildhall, Plymouth. 6 p.m. "Water Heating." Mr. H. C. Sanders.

(North-Eastern Students' Section).—Friday, April 5th. Dial House, Newcastle-on-Tyne. 7 p.m. Annual general meeting. "Modern Artificial Illumination." Mr. E. S. Evans.

Salford Technical and Engineering Association.—Saturday, April 13th. Royal Technical College. 7 p.m. "Electric Storage Battery Traction." Mr. J. A. Hunt.

Association of Mining Electrical Engineers (Western Sub-Branch).—Saturday, April 13th. Swansea. Annual dinner.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Woven wire type anti-vibrators for outside fittings.
Glass-faced refrigerators specially designed for butchers' shop windows.
Rotating poles for use outside barbers'-shops (driven by small motor in base).

Notes.

Post Office Electric Vans.

Plans are being prepared by the Post Office for an expansion of officially-owned motor transport for the conveyance and delivery of mails, and electric traction is engaging the attention of the department.

In connection with these plans, the *Daily Telegraph* states that the Secretary's staff has just been supplemented by the appointment to the postal traffic branch of two motor transport experts: Mr. F. N. Gosling, assistant surveyor, Class 1, and Mr. A. E. Squirrell, head postmaster of Coventry. Experiments with electrically-propelled motor-vans are being

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made; a few such vehicles are already in use in London and Leeds. The present annual expenditure on contract motor services is estimated to be about £562,000, for which sum about 2,300 vehicles are provided. The present cost of the officially-owned motor services is approximately £650,000 per annum, but this expenditure covers other services additional to those formerly worked by contract. The Post Office fleet of motor-vans and motor-cycles now numbers about 2,320 of various types.

Local Societies.

Dr. G. W. O. Howe, James Watt Professor of Electrical Engineering, Glasgow University, delivered the fourth and concluding Keith Lecture in Edinburgh on March 25th, under the auspices of the Royal Scottish Society of Arts. The subject was "Recording and Reproduction of Speech and Music." Professor Howe dealt, in the first place, with the revolution which had been introduced into the art of the gramophone by the application of electrical methods to recording and reproduction, and in the second place, with the talking film, which, he said, must be regarded as a serious rival to the gramophone.

Members of the Paisley Association of Electrical Engineers were to have visited the Clyde Valley Electrical Power Co.'s hydro-electric station at Bonnington, Falls of Clyde, on March 30th. The Association is making awards in connection with apprentice papers as follows:—Mr. Arch. Brown and Mr. R. McLachlan (tie for first two prizes) for papers on "Rewinding an Armature" and "Faults and Breakdowns in Motors and Generators"; Mr. Evan McCallum (third prize) for "Rewinding Small Machines"; Mr. Norman C. Maclarty (additional prize) for "Store Keeping."

Fatality.

The death of a woman who received a fatal electric shock on March 11th while cleaning a house at 143, Sinclair Drive, Glasgow, was the subject of an inquiry on March 28th. It was stated that the woman had been standing on a zinc-covered sink in a scullery, and an electric lamp swinging from the ceiling was knocking against her. Later she was heard moaning, and when the occupant of the house went forward the woman was standing with her arms round the lamp cord. The electricity supply was cut off, and the woman removed to the Infirmary, where she was found to be dead. It was stated that when the supply had been changed over from d.c. to a.c. there had been some trouble with the lamp, and an electrician stated that it looked as if the fitting had been put in by an amateur. A formal verdict was returned.

L.C.C. Tramway Developments.

The Highways Committee of the L.C.C. has prepared a report on the provision of new tramcars to replace cars at present in use which are either unfit for passenger service or not suitable for reconditioning, in which it states that it has considered estimates of additional revenue and saving in maintenance costs and operating expenses resulting from the provision of 287 new cars of modern type in substitution for 292 cars not suitable for reconditioning, and is of opinion that the substitution will result in an improvement in the financial position of the tramway undertaking. The committee states that it also has had in mind the question of the general development of passenger traffic and possible commitments in respect of the proposed extension from Grove Park Station to Well Hall Road, Eltham, and it considers that a small margin of cars should be provided, additional to the number (287) required in substitution for cars of the older type. It has therefore approved in principle the purchase of 300 new tramcars (including 50 of a special type for use on hilly routes), and proposes as a first step the purchase of 150 new cars. Particulars of the total cost of providing new rolling stock have been communicated to the Finance Committee and, if approved, will be submitted to the Council in due course. In the meantime, the committee recommends the expenditure of £1,000 to cover the cost of inviting tenders, printing specifications, &c., and preliminary expenses. (This expenditure was approved at a meeting of the Council on March 26th.)

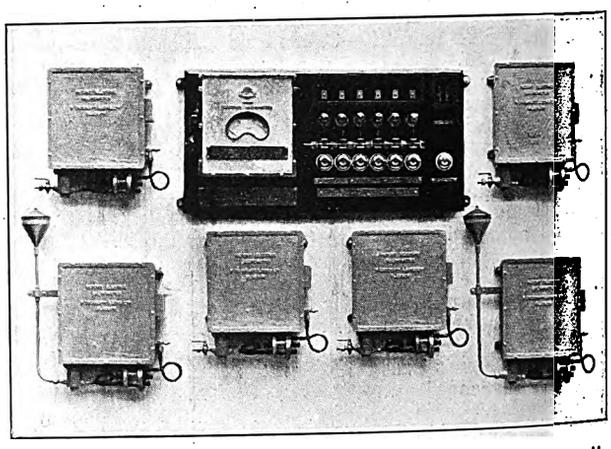
The committee has also prepared a report on the reconstruction and extension of tramway sub-stations, which includes the substitution of plant of increased capacity for the existing plant at the Limehouse, Tooting and New Cross sub-stations. In each case it is proposed that three 1,000-kW rotary convertors with the necessary l.p. switchgear should be installed in place of three of the present 500-kW motor-generators, which would be removed to outlying stations. The e.h.p. switchgear, which is now obsolete and of inadequate capacity, should also be removed. The estimated cost of the proposals is £65,000, and although the expenditure would be spread over three years, the actual work would be carried out within two years, the expenditure during 1929-30 being estimated at £25,000. The committee recommends the appropriation of £1,000 in respect of preliminary expenses.

The Control of Electric Power in British Columbia.

The Vancouver correspondent of the *Financial Times* states that the British Columbian Government launched an attempt to regulate public utility companies on March 20th, when legislation was adopted for placing complete control of the sale of electrical power in the hands of the Provincial Water Board. The Liberal Opposition conducted a vigorous drive to put greater powers in the Bill, and reopened the subject of the much-discussed increase in the capital assets of the British Columbia Electric Railway Co. from $25,000,000 to $80,000,000 last year. Members of the Opposition contended that the new Bill legalised the transaction. The Government replied that the Water Board would have complete power to consider transactions of this character.

Electric Salinometer Equipment.

The accompanying illustration shows a 6-way multi-point salinometer outfit supplied by Messrs. W. Crockatt and Sons, Ltd., for the R.M.S. *Statendam* to the order of Messrs. Harland & Wolff, Ltd. The feature of this installation is that there is only one indicating instrument on the control board, which is calibrated to read from 0 to 70 milligrammes of salt per litre. The temperature compensation is for from 80 deg. to 130 deg. F. There are mounted on the control board, in addition to the instrument, one master switch, d.p. fuses, and six selector switches. Above the selector switches are a warning lamp and relay for each circuit. The normal arrangement of the switches is such that the electric circuits are completed through the warning lamps and relays. In the event of excessive salt being present, a warning lamp commences to glow, and should the quantity increase, the relay operates and rings a warning bell. Should the engineers desire to read the amount of salt present in any of the circuits, the switch corresponding to that circuit is put into the correct position and the reading is given directly on the



Salinometer Equipment on R.M.S. "Statendam."

instrument. While the one point is indicated on the instrument, the others are still in circuit through the warning lamps. The selector switches are all interlocked so that it is impossible to switch more than one circuit on to the instrument at any one time. In this outfit two of the compensator boxes fitted with funnels take the main feed-pump discharge, and the other four compensator boxes are provided with inlet cocks to which are connected the pipes from the two main condenser-pump discharges, the distiller-pump discharge, and the auxiliary condenser, respectively. The apparatus works on 220 V d.c.

Mid-East England Electricity Scheme.

The Central Electricity Board announced on March 27th that it had adopted the Mid-East England Electricity Scheme, 1929, on March 19th, 1929, and in accordance with the provisions of Section 4 of the Electricity (Supply) Act, 1926, it had published the scheme (see Elec. Rev., January 25th, 1929, p. 169) as adopted. Copies can be obtained, price 1s. 6d. each, from H.M. Stationery Office.

Large Swedish Electric Furnace.

The Uddeholm Company is planning the erection at its works at Hagfors of an electric furnace of the Flodin-Gustafsson type, of 4,000 tons capacity, for the production of ingot steel direct from iron ore.

Radio Loud-Speakers.

Mr. R. P. G. Denman, in a paper on "Loud Speakers and their Development," which he read at a meeting of the Royal Society of Arts recently, reviewed the improvements made during the last six years. While it would be unwise to prophesy, he is reported by *The Times* to have said that it would appear that science had reached a stage at which, given the necessary funds, means could be provided to deal with almost any problem that was not fundamentally insoluble. It might be that the absence of a true binaural effect constituted one such limitation, but the imperfections of present-day materials with regard to strength, stiffness, permeability, and so forth, were probably more important. With the financial resources of the gramophone and motion-picture industries to foot the bill, it was probable that the most striking developments of the future would be made in large auditorium instruments, and that the small domestic loud-speaker would either remain in its present form, or else gradually give place to small-scale examples of those types. When one considered the size and cost of a pianoforte in relation to its average domestic useful-

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ness, £50 or so would not seem much to pay in the future for an instrument which, he thought, would be more capable than the present instruments of sustaining the many rôles that were demanded.

A Turbine-Electric Ship.

A passenger liner on which electricity will provide power for propulsion, for the operation of practically all the auxiliary equipment, for cooking, refrigeration, and other conveniences for passengers and crew, is under construction for the Grace Steamship Company. The vessel will be used between New York City and western South American ports, will have an estimated capacity of approximately 600 passengers and 6,000 tons of freight, and a maximum speed of 19 knots. Expected to be in operation by the middle of 1930, she is being constructed by the New York Shipbuilding Co., at Camden, N.J., U.S.A., and the electrical machinery is being built by the General Electric Co. of America. The general dimensions of the vessel are: 499 ft. overall length, 64 ft. beam, 25 ft. draught, and 14,300 tons displacement. The liner will be of the twin-screw type; each propeller will be driven by a synchronous induction motor rated at 6,300 propeller shaft h.p. Power for the motors will be generated by two 4,800-kilowatt, 3-phase, 3,000-volt, a.c. generators, each driven by a 3,000-r.p.m. steam turbine, fed by six Babcock & Wilcox, oil-fired, water-tube boilers. Three levers will control the reversing and speed of each motor; the propulsion motors will be used as strict induction machines when reversing, and under all running conditions they will be strictly synchronous machines. The engine room will be equipped with electrically-operated auxiliaries and will also contain the main switchboard for all the electrical circuits; in addition, there will be a number of smaller local-lighting panels in various parts of the ship. The auxiliaries will involve an aggregate of approximately 950 h.p. in electric motors, and power for them will be supplied by four 350-kilowatt, 240-volt, turbo-generators, the turbines being driven by steam obtained from the same boilers as will feed the main propulsion turbines. The auxiliary turbines will also furnish power for lighting the ship on a 3-wire 115/230-volt system.

An Aviation Lighthouse.

A lighthouse has recently been constructed at the Kbely airport, near Prague, Czecho-Slovakia, to assist commercial aircraft to locate the landing place. The seven-storey structure is of reinforced concrete, and has been erected on a rock foundation about 13 ft. below the surface. It reaches a height of 141 ft., an electric lamp with revolving reflector, having an intensity of 2,750,000 candle-power and a vision radius of 30 miles, being mounted at the top. A feature of the tower is a large ferro-concrete tank to provide an abundance of water in case of fire at the aero station. The pumping machinery and a small emergency generating plant are located in the basement of the tower.

A Large Transformer.

An 83,333 kilovolt-ampere auto-transformer has been built at the Pittsfield works of the American General Electric Co. for use in the Charles R. Huntley station of the Buffalo General Electric Co. It is 3-phase, water-cooled, 25 cycles, star-connected, 24,500/12,000 V. and it required parts that could have been used for building a 60-cycle, two-winding, transformer rated at about 100,000 kilovolt-amperes at the same voltage. The transformer occupies a floor space of 23 by 14 ft. and stands 14 ft. over the top of the cover. It weighs 165 tons when filled with 13,300 gallons of oil; the core alone weighs 58 tons. The conservator tank, which holds more than 1,000 gallons of oil, is 192 in. long and 40 in. in diameter. A mile and a half of copper cooling coil is arranged in four layers and 20 sections, with 20 inlets and 20 outlets; when operating at full load the transformer requires 190 gallons of cooling water per minute. The high-voltage, or series, winding consists of two separate circuits, each of which is connected to a separate section of the station bus bars, which arrangement limits the current that can flow during a short-circuit on the system. Each circuit is designed to carry not only half the total load (or 41,667 kilovolt-amperes), but also, under unbalanced conditions, a maximum of 55,000 kilovolt-amperes with the load on the other circuit not exceeding 28,333 kilovolt-amperes. Instead of the standard three-legged core, use was made of a five-legged core, so as to keep the height down to a minimum for shipment and to facilitate end-sheeting during assembly.

International H.P. Conference.

The programme of the fifth annual Conference on High-voltage Transmission, which is to be held in Paris, France, from June 6th to 15th next, shows that the work of the Conference will be divided into three groups: (1) power generation and transformation, (2) transmission lines, and (3) operating problems. Fifteen papers will be submitted, among them being one by Herr Norberg Schulz (Norway) on "International Standardisation of Electricity Generation, Transformation, and Distribution Statistics," one by Herr Bellaar-Spruyt (Holland) on "Acceptance Tests for Cables," one by Mr. Perrochet (Switzerland) on "The Construction and Testing of Oil Switches," one by Mr. Weiss (France) on "Oils for Transformers and Switches," and one by Signor Roncaldier (Italy) on "The Parallel Working of Power Stations." Electrical engineers desiring to take part in the Conference should notify the general secretary, Mr. Tribot Laspiere, 25, Boulevard Malesherbes, Paris, by May 1st next. The Conference fee is 250 francs.

Residents in Great Britain who wish to take part in the Conference are requested to communicate with Mr. P. F. Rowell, secretary of the Institution of Electrical Engineers, in order that British engineers may be brought together regarding various matters relating to the Conference activities.

Impregnated Cable Paper.

In a recent issue of the *Journal* of the Institution of Electrical Engineers of Japan, Mr. S. Mochizuki outlines the results of a series of tests of the dielectric rigidity of impregnated paper of various degrees of humidity. They show that for a relatively low degree of humidity, the variation of this factor has a marked effect on the dielectric rigidity in perforation tests with d.c., but only a slight effect with a.c. With high degrees of humidity, the effect on the rigidity is the same for both classes of current.

A 60,000-kW Exhaust Turbo-Generator.

Some interesting particulars are given in *Power* of the new 60,000-kW turbine-generator recently installed in the Lakeside plant of the Milwaukee Electric Railway & Light Co. It is among the largest single-cylinder complete-expansion turbines so far constructed, and is the first of its size and type made by the Westinghouse Electric & Manufacturing Co. The machine is to operate from the exhaust of the two existing 1,300-lb. per sq. in. turbo-generators, and the three sets will carry the base load of the station. The principal features of the new set are the use of an impeller-type oil governor in the place of the mechanical flyball type, the use of a new type of fastening for the last three rows of reaction blading, the single-anchor method of supporting the cylinder, and the provisions for insuring easy starting. The general design follows the modern tendency in that it is particularly free from accessory devices. The generator is a three-phase 60-cycle machine having an output pressure of 13,800 V. As is customary, the exciter is mounted at the end of the shaft and below the machine is a generator air cooler of the closed type. A 55,000-sq. ft. single-pass condenser with motor-driven auxiliaries serves the turbine. The initial gauge pressure at the turbine throttle is 290 lb., the steam temperature 700 deg. F., and the speed of the unit 1,800 r.p.m. The turbine rotor is composed of two forgings, the one forming the high-pressure end being of carbon steel, and that forming the exhaust end of 3½ per cent. nickel steel, because of the high blade load. The exhaust and spindle forging has been designed so that the last three rows of blades are carried in integral disks. Instead of consisting in each case of a single groove turned in the periphery of the disk, the blade grooves in these disks consist of a series of curved grooves or slots across the disk in an axial direction. Into these grooves, which are formed in the contour of a buttress thread, the blades are inserted from the side, and the choice of centres of curvature of the blade-root surfaces is such that each blade inserted locks the one ahead of it against withdrawal. The exhaust end of the turbine cylinder is carried by a supporting flange that rests on heavy sole plates grouted to the foundation and machined in place. The thrust end rests on pads on the thrust-end pedestal, which is bolted to the foundation and carries the thrust bearing housing. The latter is connected to the cylinder by comparatively flexible struts, and keys, restrained between guides on the thrust housing and pedestal, prevent lateral displacement of the thrust-end pedestal. To avoid spindle distortion, to which all turbines are subject during the cooling process after shutting down, two means are provided for rotating the spindle. In addition, compressed-air connections to the cylinder are provided, so that the vapours within the cylinder structure may be circulated, and in this way uniformity of temperature of the medium surrounding the spindle is maintained. The rotating devices comprise a turning gear capable of keeping the spindle rotating at about 25 r.p.m., and a hydraulic jacking gear that may be used to move the rotor half a turn at stated intervals. The rotating gear may be engaged before the spindle comes to rest. By the judicious use of this combination of facilities it will be seen that good starting characteristics are assured at all times.

World's Fastest Large Boat.

Following the announcement last November that the United States airplane carrier *Lexington*, which is electrically-propelled, had developed a test-run speed of 34.82 knots, a report came from San Pedro, California, U.S.A., that the *Saratoga*, a sister ship, had exceeded that record, for she achieved a rate of 34.99 knots, or approximately 40.5 miles per hour. In order to develop that speed for a vessel of such great weight (33,000 tons) the electric motors had to develop 215,581 h.p. at the propeller shafts. Mr. W. C. Watson, an engineer of the American General Electric Co., who was on board the *Lexington* during the trials when she established her record, said that at her greatest speed the fore part of the vessel was lifted, while the stern settled low in the water.

Conference on Fire Protection.

Following the recent conference arranged by the Association of Liquid Chemical Fire Extinguisher Manufacturers, and in response to requests received by the Association, a further conference will be held on April 9th at the Institution of Mechanical Engineers, London, S.W.1, at 7 p.m. The chair will be taken by Mr. A. E. Wiseman, chairman of the Council

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of the Association, and the conference will deal with the need of some simple form of organisation and staff training for private fire protection.

"Clean" Coal.

Sir Richard A. Pease, at the annual luncheon of the Doncaster Coal Exchange, urged that the coal industry should welcome recent developments in the scientific use of coal. The great developments in the industry in the past year were the introduction of the Central Collieries Commercial Association scheme for the regulation of output, development of the low-temperature carbonisation process, and the use of pulverised coal. It seemed to be established beyond dispute that the best value was no longer to be obtained from the burning of coal of the larger sizes. The effects of smoke and blackness, let alone the monetary cost of the soot which descended on cities, were justifications for putting a high value on small coal, which was suitable for low-temperature carbonisation.

Recent editorial references and correspondence in *The Times* relative to atmospheric pollution, particularly by electricity generating stations, elicited an interesting letter from Dr. R. Lessing, pointing out that a further problem created by the operation of large boiler plant of the mechanical-stoker or powdered-fuel type, in or near towns, is the emission from the chimney stacks of mineral dust, as distinct from smoke and sulphur gases, in quantities many times larger than the other impurities, threatening to replace the vanishing smoke problem by a growing dust nuisance. This can and should be avoided, for it is possible to clean boiler slack commercially, so as to reduce its ash content from 15 or 20 per cent. to 2 per cent. or less. Indeed, recent investigations have shown that the dust emission from power stations happens to consist of that ash portion which can be most readily removed from the raw coal. The reduction of the ash content of coal to such low figures has also a profound influence on the sulphur question. Pyrites, the mineral impurity richest in sulphur, can be readily separated, and the sulphur content of the available coal substance may thus be reduced by as much as 50 per cent. Moreover, what little ash is left in truly clean coal happens to be of a kind which retains the residual sulphur, so that only a comparatively small portion escapes with the waste gases. Abatement of pollution of the air with dust and sulphur (smoke-free combustion being taken for granted) by the use of clean coal or coke does not involve a sacrifice of working efficiency. On the contrary, Dr. Lessing foresees that considerable advantages, both technical and economic, will accrue from the elimination of coal ash. He is convinced that all progressive collieries are willing to produce "clean coal" if the consumer will learn to recognise its value.

Television.

According to *The Times*, the secretary of the General Post Office has informed the Baird Television Development Co., Ltd., that the Postmaster-General has considered the results of the recent television demonstration, in conjunction with the British Broadcasting Corporation and his technical advisers, and that he has reached the following conclusions, which accord generally with the opinions of those who witnessed the demonstration (see Electrical Review, March 15th, 1929, p. 494.) The demonstration showed that the Baird system was capable on that occasion of producing with sufficient clearness to be recognised the features and movements of persons posed for the purpose at the transmitting point. It is not at present practicable to reproduce simultaneously more than perhaps two or three individuals, or to exhibit any scene, or performance, which cannot be staged within a space of a few feet in very close proximity to the transmitting apparatus. In the Postmaster-General's opinion the system represents a noteworthy scientific achievement, but he does not consider that at the present stage of development television could be included in the broadcasting programmes within the broadcasting hours. He bases this view, not so much upon the quality of the reproduction which further experiments may be expected to improve, as upon the present limited scope of the objects which can be reproduced. The Postmaster-General is, however, anxious that facilities should be afforded, so far as is practicable without impairing the broadcasting service, for continued and progressive experiments with the Baird apparatus, and he would assent to a station of the British Broadcasting Corporation being utilised for this purpose outside broadcasting hours. He understands that the Corporation would agree in principle to this course, provided satisfactory terms were negotiated between the Corporation and the Baird Co.

It would probably be essential that any experimental demonstrations of television should be accompanied by the broadcasting of speech, and in consequence two wave-lengths and two transmitters would be required. It would not be possible to provide a second transmitter in a suitable locality which would avoid interference with important wireless services in Central London until the completion of the new station of the British Broadcasting Corporation at Brookmans Park, which is expected to be ready in July. In the meantime, it is suggested that the company should open negotiations with the Corporation as to the financial and other arrangements which might be necessary, and it would probably be advantageous to it to enter upon discussions of the technical aspects with the Corporation's chief engineer. In order to find room for a television service in broadcasting hours it would probably be necessary to utilise for the reproduction of vision wave-lengths outside the bands now being used for speech broadcasting: those bands are already highly congested, and it is important, therefore, that the company should press on with experiments on a much lower band, which would be notified to it in due course. The Postmaster-General emphasises that in granting facilities for experimental demonstrations in which the public can, if it so desires, take part, neither he nor the British Broadcasting Corporation accepts any responsibility for the quality of the transmission, or for the results obtained. The object of the demonstrations is to afford the Baird Co. a wider opportunity than it at present possesses for developing the possibilities of its system and for extending the scope and improving the quality of reproduction. While the company will not be precluded from selling apparatus to anyone who desires to purchase it, the purchaser must understand that he buys at his own risk at a time when the system has not reached a sufficiently advanced stage to warrant its occupying a place in the broadcasting programmes.

The Times also reports that the German postal and radio broadcasting authorities are paying much attention to "television," and have arranged for the Baird process to be tested in Berlin.

An Improved Electric Sign.

An invention of Mr. Louis Alfred Ramsden relates to improvements in electric signs of the type formed of a number of separate panels which can be illuminated to indicate any letter of the alphabet or any numeral from 1 to 9. The object of the scheme is to so arrange and construct the control that each panel can be illuminated at will by the operator. One terminal of each of the lamps is connected to the neutral of the source of supply, the other terminals being brought to a control in groups, corresponding to the various letters and numerals. A second panel carrying an equivalent number of spring-controlled contacts is arranged in proximity to the control panel, and to this second panel current is supplied. Each contact is operated by a magnet in an auxiliary circuit controlled from a further panel having one terminal to control each group of lamps. The magnet coils are energised by a plate mounted in proximity to the terminal plate and contacting therewith, the required terminals making circuit with the plate through a perforation in a strip or roll of non-conducting material. The terminals in the terminal block are connected in groups, one group for each letter or numeral, to a combination multiple contact plate of non-conducting material which is fitted with a number of combination contact pieces, one for each panel. A second multiple-contact plate containing a similar number of spring-controlled contact pieces arranged opposite the first plate and all the contacts responsible for the control of each panel set of lamps are metallically fixed to a separate bus bar. The two control plates are so fixed that the contact pieces on each are directly opposite each other, the plates being held in position by suitable metal pieces, but do not touch each other until required to be placed in circuit. One end of each bus bar is constructed so as to form contact with a travelling current-carrying contact maker, which is connected to the source of supply. The required terminals are placed in circuit by magnetically operated coils arranged in an auxiliary control circuit similar to the main circuit, except that only one simple terminal is required for each letter or numeral, instead of the combination contact piece of the main circuit. A perforated sheet of non-conducting material is arranged to pass or be placed between the terminal carrying plate and a contact plate of the auxiliary circuit, so that when these are pressed close together the spring-controlled contact makers of the second plate make metallic contact through the perforations in the non-conductive sheet material with the energised contact plate, thus energising the coils which operate their respective contact makers in the main circuit to illuminate the corresponding letters or numerals on the sign frame.

A specially-constructed perforator punching machine may be employed to perforate the non-conductive sheet material at suitable points according to the letter or numeral desired.

Appointments Vacant.

Electrician-fitter for the Surrey County Sanatorium. Meter reader and collector for the Scunthorpe and Frodingham U.D.C. Electricity Department. Superintendent of posts and telegraphs workshops (£443) for the Sudan Government. Electrical engineer for the Shoeburyness U.D.C. electricity undertaking. Assistant underground engineer for the Egyptian State Railways Telegraph and Telephone Administration (£553). Wireless engineer (£600) for the Government of Nigeria Posts and Telegraphs Department. Electrical engineer and manager (£850) for the Corporation of Torquay electricity undertaking. (See our advertisement pages to-day.)

Institution Note.

Institution of Electrical Engineers.

North Midland Centre.—Nominations for vacancies arising on September 30th, 1929, have been made by the Committee as follows:—*Chairman*: Mr. T. Roles (Bradford); *vice-chairman*: Mr. R. M. Longman (Leeds); *hon. secretary*: Mr. H. Cecil Fraser (Leeds); *committee* (five vacancies): Messrs. J. D. Green (Leeds); F. N. Rendell-Baker (Halifax); W. R. T. Skinner (Ferrybridge); R. G. Ward (Sheffield); and Prof. E. L. E. Wheatcroft (Leeds).

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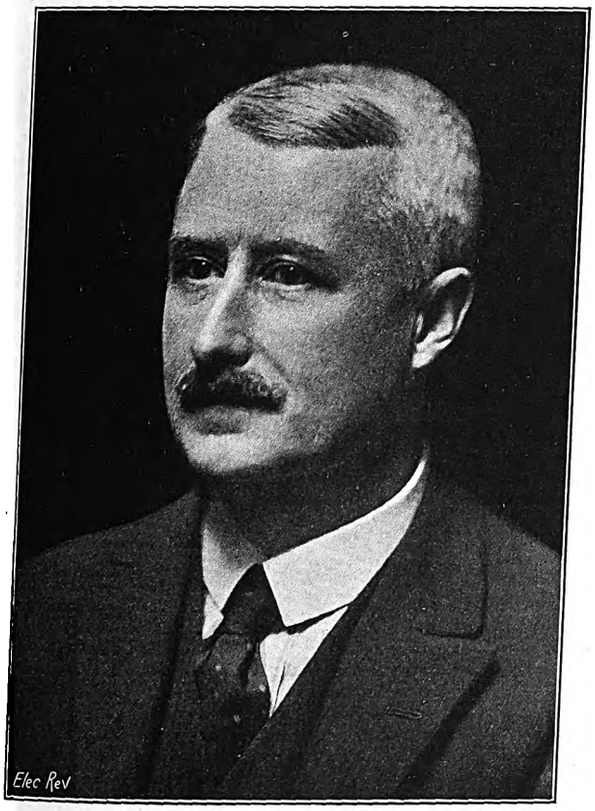
Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We give accompanying these notes a photograph of Mr. V. Watlington, M.B.E., A.C.G.I., M.I.E.E., managing director of the English Electric Co., Ltd., who has recently been elected chairman of the Council of the British Electrical and Allied Manufacturers' Association, as announced in this column last week. Mr. Watlington, to whose career reference was made in our issue of August 21st, 1925, has been the chairman, since its inception, of the Revising Committee of the B.E.A.M.A., which has standardised general contract conditions for the electrical industry.



Gainsborough Studio] *[London.*

Mr. V. Watlington,
The new Chairman of the B.E.A.M.A. Council.

Mr. R. A. Fearnley, tramway manager, Keighley, has been presented with a wireless set from the chief officials of the Corporation, on his appointment as tramway manager at Southend-on-Sea.

Mr. G. C. Tegetmeier, chairman of the South Wales Transport Co., Ltd., paid a visit of inspection to the recently-electrified Swansea and Mumbles Railway last week. The staffs and employés of the companies concerned made him a number of presentations.

Mr. F. S. Hayburn, deputy managing director of the Marconi International Marine Communication Co., Ltd., has been elected to the Brentford and Chiswick Urban District Council.

According to the *Daily Telegraph*, Mr. A. Beith, chief electrician at Buckingham Palace, Windsor Castle, &c., has retired after forty-three years' service under the Office of Works.

Herr Martin Rehmer, of the Berlin municipal electricity supply undertaking, has been awarded the degree of Honorary Doctor Engineer of the Technical High School of Brunswick in recognition of his work in connection with super-power stations.

Middlesbrough Corporation General Purposes Committee has rejected the applications of the gas and electrical engineers and the chief sanitary inspector for increased salaries on the ground that salaries of £500 and over are not to be considered for increase.

Mr. G. A. Vowles, superintendent of the Stoke-on-Trent Corporation's central power house at Hanley, has been appointed technical assistant at the Hull Corporation electricity works at a salary of £624 per annum.

Mr. William Thom, who recently retired from the position of general manager of the Potteries Electric Traction Co., after occupying that position for over 21 years, and who has been elected a director of the company, has been presented by the staff and employés with a "Compactum" wardrobe.

Obituary.—Herr H. P. N. Halbertsme.—The death recently occurred, at Utrecht, Holland, at the age of 76 years, of Herr H. P. N. Halbertsme, the engineer and director of the Utrecht municipal electricity, gas and water undertaking.

Mr. C. Speak.—The death is announced of Mr. Cyril Speak, who had for some years been on the staff of the Corporation Electricity Department at Nelson, Lancs.

Mr. A. E. Wallis.—The death took place on March 21st, at the age of 51 years, of Mr. A. E. Wallis, who was for 21 years foreman electrician at the works of J. S. White & Co., of Cowes, Isle of Wight. Latterly he had been in business at Cowes on his own account.

Lord Montagu of Beaulieu.—The death occurred at the end of last week, at the age of 63 years, of Lord Montagu of Beaulieu. Lord Montagu, who had undergone an operation following pneumonia, was a leading pioneer in motoring, and was connected with various companies, including Edison Accumulators, Ltd., of which he was chairman.

The death is announced of Mr. J. J. Cook, the manager of the Darlington Corporation electricity showrooms, which were recently opened in Skinnergate. Mr. Cook, who died from pneumonia, was only 29 years of age, and leaves a widow and two young children. He went to Darlington from Birmingham in September last year to take over the work of preparing the showrooms, of which he had been in charge since they were opened in February. Mr. Cook was gassed in the war, and had suffered severely ever since.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

J. Lewtas, Ltd.—Private company. Registered March 19th. Capital, £10 in £1 shares. Objects: To carry on the business of manufacturers, merchants and factors of lamps, and gas incandescent and electric lighting and hardware goods, &c. The directors are:—J. Lewtas, Bryn Croft, Grange Road, Bowdon; Mrs. Katherine, Lewtas, Park Lodge, Park Road, Timperley. Registered office: 22, Little Peter Street, Manchester.

Painter Brothers, Ltd.—Private company. Registered March 21st. Capital, £30,000 in £1 shares. Objects: To adopt an agreement with L. E. Painter and R. A. Painter, and to carry on the business of constructional, electrical and general engineers formerly carried on by them as "Painter Brothers" at Hereford. The first directors are:—L. E. Painter, 2, Stoneleigh, St. James Road, Hereford, engineer; R. A. Painter, Fairhaven, Three Elms Road, Hereford, engineer (both permanent). Solicitors: Durrant, Cooper & Hambling, 70-71, Gracechurch Street, E.C.

Syrophone Radio Co., Ltd.—Private company. Registered March 22nd. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers and assemblers of and dealers in radio apparatus, gramophones, records, &c. The directors are:—W. Norris, 6, Rosetti Gardens, Chelsea, S.W.3; L.

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Norris, 15, Porlock Island, Teddington; S. Reeve-Harriman, Crossways, St. Leonards Road, Thames Ditton. Registered office: 8, Red Lion Square, W.C.2.

A. E. Morrison & Sons, Ltd.—Private company. Registered March 23rd. Capital, £10,000 in £1 shares. Objects: To carry on the business of electricians, electrical, mechanical, motor, sanitary, radio and general engineers, &c. The directors are:—A. E. Goddard, Syracuse, London Road, Leicester, boot manufacturer (chairman); A. E. Morrison, 39, Sparkenhoe Street, Leicester, engineer (managing director and deputy chairman); C. Wormleighton, 37, Knighton Church Road, Leicester, engineer's clerk; A. C. Morrison, Ravenscar, Rufford Street, Leicester, engineer. Registered office: Gartree Street, Leicester.

Mechanical and Electrical Engineering Co. (Birmingham), Ltd.—Private company. Registered March 26th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in electrical and mechanical equipment, wireless, electrical, magnetic, telegraphic, telephonic and other appliances, &c. The directors are:—H. J. Webb, 62, Bradford Street, Walsall, engineer; B. Webb, "Redroofs," Walsall Road, Four Oaks, engineer. Registered office: 18-20, Stafford Street, Birmingham.

Maestro Radio Gramophone Co., Ltd.—Private company. Registered March 26th. Capital, £2,000 in £1 shares. Objects: To acquire the business carried on by L. A. E. Parkes at 50a, Birch Lane, Longsight, Manchester, including the right to use the trade mark "Maestro," and to carry on at Manchester and elsewhere the business of wireless, telephone, and telegraph engineers, and manufacturers, electricians, manufacturers of and dealers in wireless sets, phonographs, gramophones, &c. The first directors are:—G. Fryer, Sandhills, Bramhall, builder; F. Mitchell, Tioga, Broadway, Stockport, manufacturer; E. Barlow, Prudential Buildings, Stockport, solicitor. Registered office: 50a, Birch Lane, Longsight, Manchester.

Iola (Radio-Gram), Ltd.—Private company. Registered March 25th. Capital, £400 in £1 shares. Objects: To acquire provisional patents and rights relating to radio and gramophones belonging to D. C. Brega, and to carry on the business of manufacturers, factors and distributors of wireless receivers and instruments, gramophones, &c. The subscribers are:—A. Bacal, 94, Teignmouth Road, N.W.2, merchant; E. H. Lever, 7, Minson Road, South Hackney, E.9, gramophone manufacturer. Registered office: 60, Chiswell Street, E.C.2.

Servall Electric Co., Ltd.—Private company. Registered in Edinburgh on March 25th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical, mechanical and general engineers and contractors, &c. The directors are:—J. George, 31, Hamilton Drive, Cambuslang, Lanarkshire, commercial traveller; J. S. Walker, 42, Hamilton Road, Cambuslang, electrical engineer; R. H. London, 7, Whitefield Avenue, Cambuslang, schoolmaster; A. Ramsay Lawson, Elmbank, Glenboig, colliery manager; J. Kay, 137, Main Street, Cambuslang, solicitor. Secretary: J. Kay. Registered office: 46, Hamilton Road, Cambuslang.

Lattin Electrical Products, Ltd.—Private company. Registered March 25th. Capital, £3,500 in 10,000 ordinary shares of £5 each and 1,000 7 per cent. cumulative preference shares of £1 each. Objects: To carry on business as manufacturers and distributors of electrical heating and cooking apparatus, electrical engineers, &c. The first directors are:—T. J. Lattimer, 36, Alexandra Road, East Croydon, electrical engineer; P. W. V. Fright, 3, Godwin Cottages, Cliftonville, Margate, mechanical engineer. Registered office: Alexandra Works, Limes Road, Croydon.

Official Returns of Electrical Companies.

Baxter & Caunter, Ltd.—Debenture charged on property at 219, Tottenham Court Road, and 8, Alfred Place, W.C., and the company's undertaking and property, present and future, including uncalled capital, and as collateral securities thereto two land registration charges on properties at 219, Tottenham Court Road, and 8, Alfred Place, all dated March 6th, 1929, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., respectively.

Allite, Ltd.—Particulars filed of £2,000 debentures authorised March 14th, 1929, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Simmonds & Stokes, Ltd.—Issues on March 15th, 1929, £200 of second series of second debentures, and £1,100 of third series of second debentures, parts of a series already registered.

Voltron Co., Ltd.—Debenture dated March 14th, 1929, to secure £2,500 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Mrs. B. Ricketts, 14, Queen Anne Street, W.1.

Wardle Engineering Co., Ltd.—Capital, £25,000 in 10,000 preference and 15,000 ordinary shares of £1 each. Return dated November 2nd, 1928. 5,765 preference and 7,306 ordinary shares taken up. £12,871 paid. £200 considered as paid. Mortgages and charges, £4,000. Return of allotments, made up to February 13th, 1929, shows a further 123 ordinary shares allotted, payable in cash, and fully called up.

Matthews & Yates, Ltd.—Capital, £22,050 in £50 shares. Return dated December 31st, 1928. All shares taken up. £6,000 paid. £16,050 considered as paid. Mortgages and charges, £20,000.

Liskeard Gas & Electricity, Co., Ltd.—Capital, £14,000 in 6,000 preference and 8,000 ordinary shares of £1 each. Return dated November 22nd, 1928. 6,000 preference and 7,832 ordinary shares taken up. £6,787 paid on 6,000 preference and 787 ordinary shares. £7,045 considered as paid on 7,045 ordinary shares. Mortgages and charges, £8,000.

Royce, Ltd.—Debenture dated March 14th, 1929, to secure £5,000 and further advances charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. H. Royce, Elmstead, West Whittering, near Chichester.

Bann Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1929. 8,002 shares taken up. £8,002 paid. Mortgages and charges, nil.

Davies, Kent & Stewart, Ltd.—Capital, £3,500 in 2,500 preference and 1,000 ordinary shares of £1 each. Return dated December 28th, 1928. 1,974 preference and 1,000 ordinary shares taken up. £2,974 considered as paid. Mortgages and charges, £1,050.

Hewittic Electric Co., Ltd.—Capital, £50,000 in £1 shares. Return dated November 6th, 1928. 40,000 shares taken up. £40,000 paid. Mortgages and charges, £30,000.

City Notes.

British Insulated Cables, Ltd.

This company's report was dealt with in our issue of March 22nd (p. 532). Mr. D. Sinclair (chairman) presided at the annual meeting, and in his speech reviewed the accounts which, he said, were very satisfactory. The company had ample cash resources not only for carrying on its business, but also to enable it to participate in any beneficial investment. The reserves amounting to £1,535,000 (excluding over £250,000 carried forward) were considered to be in excess of requirements, and it was therefore proposed to capitalise £833,333 and distribute it as set out in the report. Although the new capital would mean the finding of a large sum for dividends, with continued hard work and confidence justified by their past history, they hoped to be able to carry the weight. The concerns in which the company was interested had continued to do well. The Midland Electric Corporation for Power Distribution, Ltd., had increased its actual distribution upon its capital, doubled by a bonus issue last year, by 1 per cent. The Electric Supply Co. of Victoria, Ltd., was in a much more favourable position. That company had entered into a satisfactory agreement with the Government of Victoria by which the latter would acquire the undertaking in three years' time. The "closer working" agreement with other cable-making companies had continued to work smoothly and satisfactorily. Valuable results had been achieved by combination in research leading to improvements in quality and in manufacturing processes. Further advantages were expected from this direction. The staff pension fund was now on a sound basis, and it was only necessary for the company to make its regular contributory payments. They had decided, however, to set aside £50,000, the interest on which would be employed in giving compassionate allowances to workpeople and their dependents.

During the past year the company had fully maintained its position in the electrical world. Among the orders recently received was one from the Central Electricity Board for cables to be laid in the London area. The bulk of these would be for a working pressure of 66,000 V; the company had supplied cables for this voltage in the North-East Coast area, and they had been working successfully for the past three years. The value of the Central Board's order was well over £500,000. The company also had in hand important contracts for railway electrification in India, overhead lines in this country for the Central Board, and in the Federated Malay States for the Perak River Hydro-Electric Power Co. The lines being installed in this country were of steel-cored aluminium, and the company had also secured large orders for the sections being carried out by other contractors. An arrangement had been entered into with an American firm to manufacture and cell "Copperweld" wire, consisting of steel cores coated with copper. This wire had a high tensile strength coupled with comparatively high conductivity, and was particularly suitable for overhead line work, which was an expanding business. Mr. Sinclair concluded with a reference to the changes in the personnel of the board which were mentioned in the report.

Following the adoption of the report and accounts, an extraordinary meeting was held, at which a resolution was passed altering the articles of association to give the directors wider power with regard to the capitalisation of reserves.

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Automatic Telephone Manufacturing Co., Ltd.

The annual meeting took place on March 26th. Sir Alexander Roger (chairman) in presenting the report and accounts (ELEC. REV., March 22nd, p. 534), referred to the recent death of Mr. John Lee, a director, and after reviewing the accounts said that he wished to emphasise that the extra dividend of 2½ per cent. should be considered in the light of a bonus and not as a change in the dividend rate. The debenture issue had been cancelled, and as the reserve fund now stood at £130,000 the guarantee of the British Insulated Cables, Ltd., to the 1911 issue of preference shares automatically lapsed. The Broadgreen factory had been improved and extended to meet the increasing demands for "Xcel" domestic appliances, and the plant at the Strowger works had also been added to. In addition to further contracts for equipping London exchanges with Strowger apparatus, the company was now engaged in manufacturing the equipment for the main automatic exchange at Blackfriars, Manchester, and during the year they had equipped further exchanges at Wilpshire, St. Marychurch, Armley and Ainsdale. Extension equipment had been installed in twelve provincial areas. Development and research continued to be an important part of their work and many economies in production had been effected. He desired to put on record their indebtedness to their parent company, the Automatic Electric Co., of Chicago, for assistance in the form of new patents, experience, research and vigorous exploitation of the Strowger system. In spite of keen competition they continued to experience a good demand, through their overseas arrangements with the International Automatic Telephone Co., for automatic equipment for service abroad. In the period under review they had shipped apparatus for extending eleven exchanges in the Buenos Aires network, orders for the equipment of three exchanges had come from Australia, and an equipment for Mansoura marked the introduction of the Strowger system into Egypt. They had installed a number of small Strowger equipments for intercommunication in factories, offices, &c. There was no business which called for a larger view in order to safeguard one's interests than the telephone industry. So far as Great Britain was concerned they might reaonably expect to secure their share of Post Office orders. With respect to overseas business, foreign competition was keener than ever before, and considerable capital investment became necessary for the purpose of establishing proprietary interests. In this connection the company was fortunate in its relationship with the International Automatic Telephone Co. The factory order book contained a good programme for the current year although they always had a margin for urgent business.

The sales of "Xcel" appliances were up by 80 per cent. in comparison with the figures for last year and it had been found necessary to extend the production facilities. Among other orders was one for the supply of electric cooking equipment for the new airship "R101." The chairman concluded with references to the Telephone Development Association and the A.T.M. Pension Trust.

International Automatic Telephone Co., Ltd.

The annual meeting was held on March 27th, Sir Alexander Roger presiding. In presenting the report (ELEC. REV., March 22nd, p. 534), the chairman said that the directors considered the additional 2½ per cent. dividend as a bonus, not as a change in the dividend rate. The company was engaged principally in selling in overseas markets—through its agents—Strowger automatic telephone equipment, manufactured by the Automatic Telephone Manufacturing Co. A substantial amount of revenue was disbursed annually in the development and consolidation of overseas markets, and in addition the patent rights of the Strowger system were being maintained by the company and its associated companies in all important markets of the world. By agreements there was a mutual exchange of patent licences in the common interests of the associated companies and of the system. The company's investments had risen from £758,449 to £897,732. These investments were made for a double purpose. They not only considered them from an investment or security point of view, but they always had in mind the purpose of furthering the sales exploitation activities of the company, and in consequence the manufacturing efforts of the Automatic Telephone Manufacturing Co.

General Electric Co., Ltd.

An extraordinary meeting was held at Magnet House on March 28th, for the purpose of confirming the resolutions passed at the meeting on March 13th. Sir Hugo Hirst, Bt. (chairman) presided, and briefly outlined the events of the past two or three weeks in connection with the company's proposals to create 1,600,000 "British ordinary shares" and issue them at 42s. each to the British public only (*vide* ELECTRICAL REVIEW, March 22nd, p. 531.)

He said that American holders of the company's shares had objected to these proposals and therefore the issue was held up pending the consideration of alternative methods of dealing with the new shares. Two representatives of the American shareholders' committee were on their way to this country and the British, Foreign & Colonial Corporation, Ltd., which had acquired the 1,500,000 of the shares for issue to the public had communicated with them to the following effect:—The shareholders having approved the board's proposals the contract became a binding one and the Corporation was entitled to the delivery of the shares, or, in the alternative, to damages. It was suggested, however, that the terms of the issue might be varied as follows:—That arrangements be made for the company to issue 140,853 shares in the proportion of one to sixteen to existing shareholders at a price to be agreed upon but not being more than forty shillings. The issued ordinary share capital would then be £2,394,498. The company would then offer two British shares in respect of every three shares then held by shareholders irrespective of nationality or residence, which would absorb 1,596,332 British shares. This new issue would be made in the usual way, accompanied by renunciation letters which would be marketable on the London Stock Exchange, and three Stock Exchange accounts terminating, say, at the end of May next would be allowed for shareholders desiring, or by reason of nationality required, to dispose of their rights to do so. The issue of British shares would be at forty-two shillings. Any rights not sold by, say, at the end of May, the Corporation would be prepared to purchase at a price to be agreed. By this method all but 9,170 shares out of the total authorised issue of 4,000,000 shares would be absorbed, and these shares should be left available for issue to the company's staff at the discretion of the management.

Sir Hugo said he believed that this offer met all the fundamental demands of their critics and the resolutions were unanimously confirmed.

Upon their arrival on March 30th, the American delegates (Messrs. Chadbourne and Swope) made a statement in which they pointed out that the proposals deprived American shareholders of voting rights; took from them valuable property rights; diluted their interest in the company; deprived the shares of a free market; and disturbed the financial relations between Great Britain and the United States. They expressed their hope that the G.E.C. board would trace the cause of the speculation in the company's shares, and concluded with an appeal for justice.

On Tuesday last Messrs. Chadbourne and Swope discussed the position with Sir Hugo Hirst and Mr. M. J. Railing, but no conclusion was arrived at; the discussions were to be resumed on Wednesday.

British Aluminium Co., Ltd.

Col. S. H. Pollen, C.M.G., who recently succeeded Mr. A. W. Tait as chairman, presided at the annual meeting on March 27th, and after reviewing the accounts said that although aluminium prices had fallen there had been an increase in the trading profits, due to more stable industrial conditions and the efforts of their operating and technical staff. The many uses of aluminium continued to develop; the past year had seen considerable progress in the electrical field. Steel-cored aluminium cables had been adopted for the national "grid"; for the first two sections about 3,500 miles of conductor was required, and the company had received the order for the metal for those conductors. Other uses of aluminium in the electrical industry had not shown so marked an increase, but they were convinced that, when engineers fully appreciated the advantages to be gained and the economies that could be made by substituting aluminium for copper, especially at to-day's high price of the latter, their metal would be more widely utilised for busbars, windings, fittings of all descriptions and various other applications. After dealing with other directions in which aluminium was widely used, the chairman referred to the company's Lochaber hydro-electric scheme. He said that the civil engineering works had not been completed within the contract period, but the boring of the 15-mile main tunnel was practically finished and nearly half of it had been concrete lined. Good progress had been made with the foundations and the erection of the buildings of the power house and factory, and with the preparation of the necessary plant and machinery. They had every hope that the factory would be in operation in the course of the current year. Against the low prices they had the maintenance of the demand for their products, which encouraged them to anticipate a satisfactory volume of sales during the year.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The annual meeting was held on March 26th, Mr. R. P. Sloan (chairman) presiding. In moving the adoption of the report, the chairman said that last year a commencement was made on the renewal of plant on a somewhat larger scale than had been undertaken for some years past. This work was the complete replacement of two of the older turbo-generators at Dunston power station by modern plant of a considerably greater capacity. The estimated cost of this replacement was £45,500, of which about £9,000 only was paid in 1928, and was included in the £60,426 expenditure. The major portion of the expenditure would have to be provided for during the current year, and in spite of the rapid increase in the domestic supply business during the last four or five years, the great bulk of the business was that of supplying power to industries. It had been decided to issue two new tariffs, one applicable to shops, which would operate as from the commencement of this year, and the other, applicable to domestic supplies, which would come into operation at the end of the current quarter. It had also been decided to withdraw all meter rentals, except in a few special cases. The introduction of these tariffs would represent a concession of £45,000 to consumers. The development of the domestic business was being continued, principally concentrating on filling up networks already laid. With

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regard to the North-East Coast Exhibition which was to be opened in May, space had been secured to demonstrate the domestic uses of electricity. The report and accounts were adopted.

Mersey Power Co., Ltd.

Presiding at the annual meeting on March 26th, Mr. G. H. Cox (chairman) said that although the company was registered in 1911 that was its first public meeting as none of the capital had been made available to the general public until last autumn. During the past year the capital had been raised by £700,000 to £1,050,000, of which £1,046,475 had been issued. All the mortgages and loans, with the exception of £200,000 lent under the Trade Facilities Act, had been paid off on favourable terms. In addition to the issue of £400,000 of 6 per cent. cumulative preference shares in October last, 150,000 shares of this class and £146,475 in ordinary shares had been allotted to the Salt Union for the cancellation of its second debenture. The chairman then reviewed the accounts (*vide*, Electrical Review, March 22nd, p. 533), and said that the prospects of the company were good. Several extensions were in hand which would be completed during the year and would result in increased sales of energy. It was also expected that the Central Electricity Board would make progress with its North-West England scheme in which the company's Percival Lane station was to be a selected station.

At a meeting of the Salt Union, Ltd., on the same day, Mr. Cox, who is also chairman of this company, said that an offer had been made by American interests to purchase the Mersey Power Co., but they had decided not to accept it at the price put forward.

Midland Electric Corporation for Power Distribution, Ltd.

The annual meeting was held on March 26th. Mr. D. Sinclair (chairman), who presided, said that a Special Order had been obtained to extend the company's area of supply to the parishes of Swindon, Seisdon, Trysull, Bobbington, and Claverley. The new areas were at present almost entirely rural, and the increased load would not be large. The company's area was now entirely surrounded by the areas of other undertakers, so that further extensions were unlikely. On the other hand, the company had contracted to sell a small portion of the undertaking in the urban districts of Heath Town, portions of Upper and Lower Penn, together with Tettenhall. Wolverhampton extended the borough boundaries, and had the right to purchase in 1940, a substantial portion of the area sold by virtue of such extension. The company had been approached as to an immediate sale, and a price had been agreed. Various local authorities had the right to purchase the company's distribution system in their particular areas in 1940 or any subsequent tenth year, and negotiations were now in progress with the respective Councils to obtain an indication of their views on this matter so as to be able to plan the development of the area accordingly. The report and accounts were adopted.

New Issue.

British Automatic Refrigerators, Ltd.—The formation of this company was recorded in the "New Companies" section of our last issue. Last week the company made an issue of 240,000 10 per cent. participating preferred ordinary shares of 10s. each and 720,000 deferred ordinary shares of 2s. each at par. The prospectus stated that the company was to acquire the businesses of Thomas Hall & Son, Ltd., and the British Automatic Refrigerator Co., Ltd. The avowed policy of the company is "to exploit and develop the urgent demand in Great Britain (following the enforcement of the Board of Trade regulations in respect of the non-adulteration of foods) for a domestic electrical refrigerator at a reasonable price." It was also stated that "many electric supply companies have already expressed their interest in the machine and are expected to adopt it as a standardised model." The output is to be about 1,000 domestic and 200 commercial refrigerators per month. Of the proceeds of the issue, £30,000 is payable as the cash portion of the purchase price, £25,000 is to be expended upon the extension of works at Rotherham, and £51,000 will be available for working capital. The remainder of the purchase consideration takes the form of 425,000 deferred ordinary shares.

Tyneside Electrical Development Co., Ltd.

The profit for the year ended January 31st last amounted to £7,422 (against £4,508) and a balance of £1,116 brought forward is added, making £8,537. A dividend at the rate of 6 per cent. per annum has been declared on the preferred ordinary shares from the dates on which they were called and paid up (interim for half-year already paid), and one at the rate of 7 per cent. per annum on the amounts paid up on the deferred ordinary shares. The general reserve receives £1,000 and £1,244 is carried forward.

The directors propose that the company's name shall be altered to "The Tyneside Investment Trust, Ltd."; that each of the 75,000 £1 preferred ordinary shares already issued shall be sub-divided into 55,000 5 per cent. cumulative preference shares of £1 each and 20,000 ordinary shares of £1 each; that each of the £1 preferred ordinary shares shall be sub-divided as to eleven-fifteenths into cumulative preference shares and as to four-fifteenths into ordinary shares; that the 50,000 deferred ordinary shares already issued be sub-divided into 20,000 5 per cent. cumulative preference shares and 30,000 ordinary shares; and that each deferred ordinary share shall be sub-divided as to six-fifteenths into cumulative preference shares and as to nine-fifteenths into ordinary shares.

Llanelly and District Electric Supply Co., Ltd.

Mr. A. H. Beatty, O.B.E., presided at the annual meeting on March 26th and pointed out that, although severe trade depression continued and the company was hampered by the installation of the new plant, there was a substantial improvement in the trading results. The new plant was put into service in November, and had since operated satisfactorily. The sales of energy rose from 18,300,200 to 21,843,400 kWh. The traction business was again affected by motor-'bus competition, but showed some improvement. The Llanelly Electricity Special Order, 1928, had received Parliamentary sanction and had materially increased the company's area of supply in the anthracite coalfields district. There were signs of an improvement in trade, and inquiries for new business were being received at a satisfactory rate. The time for the resumption of ordinary dividends had not yet arrived, but they could hold out hopes of a dividend at an early date, after the proper allocation had been made to reserve.

County of London Electric Supply Co., Ltd.

The balance on revenue account for the past year is £1,207,130, as compared with £1,014,027 in 1927. Adding £55,685 interest charged to capital (Barking supply) and £204,988 brought forward, there is an available amount of £1,467,803. Of this £28,975 is placed to contingency fund, £35,000 to taxation reserve, £257,469 to depreciation, &c., reserve, leaving £870,938. After the payment of a final ordinary dividend of 7 per cent. (making 10 per cent. for the year), £364,210 is carried forward, subject to the operation of the London Electricity (No. 1) Act and to prospective reductions in rates of charge. The sales of energy rose from 248,311,589 kWh to 323,462,637 kWh.

At the annual meeting on April 16th a resolution is to be submitted providing for the creation of 2,000,000 6 per cent. preference shares and 3,000,000 ordinary shares of £1 each, raising the capital to £12,000,000.

Pinchin, Johnson & Co., Ltd.

Presiding at the annual meeting last week, the chairman (Mr. E. Robson) said that the past year had shown extremely satisfactory results, and the company was in a very strong financial position. They expected still further progress during 1929. After the ordinary business, the chairman said that the directors were fully justified in recommending the capitalisation of £344,989 of the reserves and issuing this in the form of ordinary shares to the present shareholders. At a subsequent extraordinary meeting a resolution providing for the subdivision of each of the ordinary shares into two shares of 10s. each was carried. The chairman explained that this was being done to give the shares a freer market and wider distribution.

A. Reyrolle & Co., Ltd.

After providing for redemption of leases and depreciation and including interest received, the net profit for the year ended December 31st, 1928, was £90,615, as compared with £89,306 in 1927. To this is added a net amount of £64,430 brought forward, making £155,045. From this the preference dividend is paid, £25,000 is again to be transferred to reserve, and a dividend of 12½ per cent. (as in 1927) is recommended on the ordinary shares, leaving £78,892 to be carried forward. The capital expenditure during the year was £23,276, practically all of which was for plant and machinery. In April last year 100,000 ordinary shares were allotted to shareholders at 25s. each; part of the proceeds will be expended on extensions to plant and buildings now in progress. A staff pension fund has now been inaugurated. The meeting was to be held yesterday (Thursday).

Madras Telephone Co., Ltd.

The net revenue for the year ended December 31st, 1928, amounted to Rs. 1,46,332 after providing for taxation, depreciation and writing-down of stock. The directors recommend a dividend of 8 per cent., free of tax, for the year; Rs. 14,000 is placed to the dividend equalisation reserve, and Rs. 10,048 is carried forward, against Rs. 14,159 brought in. There were net gains of 124 exchange lines, 91 extension lines, and six private lines during the year, making the total figures for the year end 1,625, 962, and 84 respectively. In order to finance extension schemes, the issued capital is to be increased to Rs. 20,00,000 by an issue of 29,439 ordinary shares of Rs. 10 each. Sir James F. Simpson, the chairman, has resigned upon his impending retirement from India, and Mr. W. O. Wright has been elected to the position. Mr. R. C. M. Strouts has been appointed to the board.

Clyde Valley Electrical Power Co.

The company proposes to issue the balance of its authorised capital (£900,000) in the form of £1 ordinary shares. These will be offered to ordinary shareholders in the proportion of three new shares for each four held.

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Cambridge Electric Supply Co., Ltd.

The balance of the net revenue account for 1928, after providing for interest and income tax and adding £4,807 brought forward is £35,537, as compared with £28,993 (including £4,904 brought forward) in 1927. A sum of £10,000 is again transferred to reserve, £3,000 is written off capital expenses, £1,500 is placed to the staff benevolent fund, and after paying a final dividend of 4 per cent. (making 7 per cent. for the year, as in 1927), £5,839 is carried forward. A further call of 5s. per share was made during the year on the 50,000 partly paid up ordinary shares. Mr. P. D. Tuckett has resigned from the board and Sir James Devonshire, K.B.E., has been appointed chairman. During the year £71,036 was spent on capital account, and the report says that further very large sums of money will be required within the next few years.

British Engine, Boiler and Electrical Insurance Co., Ltd.

The report for 1928 records the death of Mr. W. Fletcher, one of the original directors. An interim dividend of 14s. per share was paid in June last, and it is proposed to pay a further 15s. per share, to transfer £20,000 to the pension fund and £10,000 to reserve. Last year the company celebrated its jubilee, and during the period £2 per share was called up and a corresponding sum was transferred from the contingency fund by way of bonus dividend.

Vickers, Ltd.

Sir Herbert A. Lawrence (chairman) presided at the annual meeting on March 25th, and in the course of his address said that the policy of the board was to build up substantial reserves and concentrate on armaments, shipbuilding and steel. He concluded by saying :—

"We are sowing the seeds of a new industrial era, and although we may not reap the harvest immediately, I believe the time is not far distant when the changes in our production methods, and the advantages of co-operation, will again give a satisfactory yield to those associated with British industry."

Associated Gas and Electric System.

The gross income for 1928 is reported to be $42,163,550, against $35,296,741 in 1927, and the net earnings amount to $19,170,637, against $17,032,086. After providing for interest, preferred dividends, depreciation, &c., the balance available for dividends and surplus is $6,498,592 (against $6,258,653).

Official Notice re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary :—

Bell's Radio & Electrical Co., Ltd.
Christian Bergh Electric Co., Ltd.
Continental Automatic Telephone & Electric Co., Ltd.
Torque Electrical & Engineering Co., Ltd.

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved :—

Automobile Electrical Repairers, Ltd.
Bucks. Electric Wire & Engineering Co., Ltd.
Domestic & General Electrical Co., Ltd.
Perfecta Electric, Ltd.

Stocks and Shares.

Tuesday Evening.

Stock Exchange markets have passed through a time of considerable storm and stress owing to a semi-panic which broke out in New York a few days before Easter, and had the effect of bringing about severe falls in most of the speculative stocks and shares. For some time past, the gamble has been assuming larger and ever larger proportions, on the snowball principle. Every effort made by the Banks to curtail the wild bullishness proved unsuccessful, and it was not until call money reached 20 per cent. that the bull party began to get afraid and started to unload. Weakness developed into flatness, and flatness into demoralisation. Falls of 10 to 20 points occurred. Margins ran off, and the money of the weaker bulls was swept away by the violence of the fall. No support was rendered to the market by the bigger people until the storm of selling had blown itself out, after which the list promptly rallied, the recovery being almost as dramatic as the previous fall had been. Easter Monday brought a second money-flurry in New York. Borrowers paid 15 per cent.: share prices again gave way. But the excitement found only pale reflection on this side, and Stock Exchange business, after the holidays, became a limp and dull affair.

The Ill Wind.

The general view in London is that the slump in American prices is the best thing that could have happened, in that it served to eliminate a ricketty bull position, and to lower prices to levels less difficult to justify than the quotations that had previously ruled. The drop was, however, very indiscriminate; Brazilian Tractions, 84 at one time this year, lost about 27 points before a recovery occurred to 62. International Nickels have been one of the liveliest of the gambling counters. British investment markets are the better for the flatness in New York, on the impression that the less desirable element of the bull party has been forced to clear out, and that people who at present hold the stock are likely to find no particular difficulty in financing it. The fear of a rise in the Bank Rates of London and New York has retreated, accordingly, to a safe distance, and gilt-edged securities are all better.

Cable and Wireless.

In either this week or next, it is fully expected that the details of the proposed Communications Company will be published by the Government or by the Cable Companies. The Assistant Postmaster-General announced in the House of Commons last week that the negotiations between the Government and the interests concerned were well advanced. The terms and conditions of service of the staff to be transferred were subjects of discussion at the time that Viscount Wolmer spoke. Eastern Telegraph ordinary, after being 270, reacted to 267½; the prices of the three other members of the group are almost unchanged. Marconis have been a better market at 4 3/16. The shares look expensive, on paper, matched against the stock and shares of the Eastern Cable group, but Marconi shareholders may get the offer of the Merger Company's "B" shares, and this is regarded as likely to prove of substantial benefit to the Marconi proprietors. The adjourned Marconi meeting is due to be held at the end of this month. Hopes are entertained that the directors will declare another dividend in the accounts which are expected to be made public within the course of the next two or three weeks. The company's preference shares keep about 4¾. Great is the speculation as to what terms will be offered to the holders of Marconi £1 shares.

International Telephone and Telegraph.

One of the largest deals that has taken place in the Telegraph and Telephone world for some time past is the reported purchase by the International Telephone & Telegraph Co., for something like a hundred million dollars, of the Radio of America Communications, Inc. It is said that the deal was negotiated in Paris between the companies concerned and a group of international bankers. Should the fusion materialise, the International Telephone and Telegraph Corporation will come, it is claimed, into a position with which it may compete with the British cable and wireless amalgamation that is on the point of being consummated. There seems to be some doubt as to whether the arrangement is a merger in the complete sense of the word, or no more than an agreement of interests between the two companies. Having regard to the keen interest which Americans have taken for some time past in the business of communication, both at home and abroad, there seems to be nothing improbable in the report which has been received in regard to these two undertakings. The announcement was followed by a substantial rise in the price of International Telephone and Telegraph stock, which rose to 275 before reacting to 267. The latter company is, in its turn, threatened with competition by another corporation having similar objects, which is being formed under Kreuger & Toll auspices. Kreuger & Toll are manufacturers of matches, but the energies of the company radiate in a number of other directions, and it is conceivable enough that Kreuger & Toll may desire to obtain a footing in the communications business in order to obtain concessions from foreign governments in return for loans which the company may be able to make to the governments concerned. There is something arrestingly bold, however, in this conception of a company such as Kreuger & Toll entering the lists against competitors already firmly entrenched in their own field.

Electric Gramophones.

The Gramophone H.M.V. Company proposes to increase its capital by the creation of 20,000 additional ordinary shares of £1 each, in order to satisfy a portion of the purchase consideration payable to Marconi's Wireless Telegraph Co. for the acquisition of certain assets. The H.M.V. Company, it may be repeated, is controlled by the Victor Talking Machine, which, in its turn, has been bought by the Radio Corporation of America. What seems to be developing is a gigantic American-European scheme for operating radio, gramophone and entertainment systems under one management. Already it is suggested that the days of the mechanical gramophones, as such, are numbered, and that in the future the majority of gramophones will be worked by electricity and in conjunction with the radio industry, the whole business being under a unified control. At present, this direction appears to be likely to draw its inspiration from the United States.

New Issues.

The County of London Electric Supply Company proposes to create five million additional shares of £1 each, of which two million will be 6 per cent. preference, and three million will be ordinary shares, all ranking *pari passu* with the existing shares. The additional capital is required to finance the necessary developments at the Barking Power House, and for other purposes. The meeting to authorise the new capital will be

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held next Tuesday week, April 16th. The price of the ordinary shares strengthened to 53s. 6d. on the hope of the new issues being made to the company's proprietors, and on favourable terms. Another considerable new issue is that of 30 million dollars 15-year convertible 6 per cent. debentures at par in the International Hydro-Electric system. The offer was made last week in New York by a syndicate of well-known financiers, a part of the issue having been held over for sale in Holland. The International Hydro-Electric was recently formed in order to acquire control of the New England Power Association and the Canadian Hydro-Electric Corporation.

De-Rating Anomaly.

At two companies' meetings held last week, reference was made to what wears the appearance of being an inequitable product of the Rating and Valuation (Apportionment) Act, 1928. It was declared by the chairmen of the Newcastle-on-Tyne Electric Supply Co. and the Midland Electric Corporation that a privately-operated generating station can obtain the rate relief of 75 per cent., but that public supply stations do not. The latter are, indeed, likely to be called upon to pay more rates, under the latest reassessment. It is asked in the Stock Exchange whether this intention lay in the Government's mind at the time the Act was passed. The success of the Central Electricity Board depends so greatly upon the matter of costs as to render it vital for the public undertakers to be able to get in on the same ground floor as privately-operated stations. To give the latter an initial—and an important advantage—in the matter of rates would seem to be a reversal of sound policy.

Electricity Supply Companies.

Clyde Valley shares are the firmest in this week's price-lists, the shares having gained 2s. 3d. at 43s. 3d. Urban ordinary are 1/16 down, at the same price. Metropolitan Electric ordinary shed a similar fraction, at 2 1/16, and Bournemouths are equally reduced at 64s. 6d. The group as a whole is quiet. London Power 5 per cent. debenture new scrip hardened to 1 premium. A substantial amount, twenty to thirty thousand pounds, is available of Bankside Investment Trust 5 per cent. first mortgage debenture. This can be bought at 99 or rather less, giving £5 1s. per cent. on the money. Interest and sinking-fund being guaranteed by the City of London Electric Lighting Company up to 1971, the security is gilt-edged. A first and partial interest distribution is due on July 1st, after which the full half-yearly payments will be made on January and July 1st.

Railways and the Holidays.

The gorgeous weather ushered in by Good Friday led to a little demand for stock in the Home Railway market. Prices of the steam companies' issues went materially better. Traffics have started to show a recovery, and the hopeful party contends that the railways have now taken the measure of road competition. Undergrounds improved, though more slowly, with the rest. Modest advances have occurred in Metropolitan Consolidated at 60½ and in both classes of Underground Electric Railways of London at 24s. and 114 for shares and income bonds respectively. No price movements have taken place in the stocks and shares of the London Tramways group.

Dollar Stocks.

The abrupt drop in New York's financial temperature led to a fairly general sagging of quotations in the "dollar" stocks. Mexican utilities are heavy, Mexican Light & Power common shares losing 4½, Mexico Tramways 5 per cent. bonds 2, at 75½ and 69½ respectively. Pennsylvania Water & Power went back to 85½, Power Corporation of Canada to 103, Shawinigan Water to 77½. Montreal Light & Power remained steady at 105.

General Electrics.

After being down to 54s. 6d., General Electrics recovered to £3, thus showing no net change on the week. In view of the personal interchange of opinions between the British and American spokesmen, it may be well not to comment upon plans already published.

Miscellaneous Matters.

Associated Electrics have been an active market, the price rising sharply to 38s. 3d. on demand attributed to American sources. Atlas Light & Power are dull at 27s.; the company has declared an interim dividend of 2 per cent. actual, the same as that of a year ago. Baird Televisions are better at 10s.: Chadburn's Ship's Telegraph preference rose to the same level. India Rubber 5 per cent. debentures have gained several points at 88½. British Insulated Cables lost ⅛ at 4 9/16. Ever-Ready shares drooped to 22s. 6d. Bogota Telephones, at 28s. 6d., are hardly affected by the announcement that no interim dividend will be paid, as compared with 5 per cent. last April. Venezuela Telephone ordinary changed hands at 26s. 9d. a week ago, and the preference at 27s. 9d. International Automatic Telephones, of both classes, remain at 40s. Amongst lower-priced shares, Sphinx Electrics have been active, and higher, at 1s. 7½d., it being said that the company has secured several good contracts. The rubber share market is in a condition of suspended animation, awaiting the next movement in the price of the raw material.

Share List of Electrical Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price April 2 1929.	Rise or fall	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14†	15	64/6	$-\frac{1}{16}$	... ...
Brompton Ordinary	1	$8\frac{3}{8}$	$8\frac{1}{2}$	27/-	—	5 8 8
Charing Cross Ordinary	1	$8\frac{1}{7}$	$8\frac{1}{7}$	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	$4\frac{1}{2}$	$4\frac{1}{2}$	17/6	—	5 2 10
Chelsea	1	$8\frac{7}{8}$	$8\frac{7}{8}$	27/-	—	5 8 8
City of London	1	10	10	32/-xd	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	23/-xd	—	5 4 4
Clyde Valley	1	8	8	43/3	+2/3	3 14 1
County of London	1	$7\frac{1}{2}$	$7\frac{1}{2}$	53/6	+6d.	3 14 8
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	55/-	—	4 0 0
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	$7\frac{1}{2}$	$7\frac{1}{2}$	30/-	—	5 0 0
London Electric	1	$8\frac{1}{2}$	$8\frac{1}{2}$	27/-xd	—	5 3 8
Metropolitan	1	8	9	$2\frac{1}{16}$	$-\frac{1}{16}$	4 7 4
do. 4½% Pref.	1	$4\frac{1}{2}$	$4\frac{1}{2}$	17/6	—	5 2 10
Midland Counties	1	6	$6\frac{1}{2}$	28/-	—	4 12 10
Mid. Elec. Power	1	—	15	36/3	—	4 2 9
Newcastle on-Tyne Ordinary ...	1	5	6	$1\frac{1}{4}$	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	$10\frac{3}{4}$	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/-xd	—	5 3 3
South London	1	$8\frac{1}{2}$	$8\frac{1}{2}$	27/6	—	5 2 8
Urban Ordinary	1	7	7	43/3	$-\frac{1}{16}$	... ...
Westminster Ordinary	1	$8\frac{1}{2}$	$8\frac{1}{2}$	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	$7\frac{1}{2}$	$7\frac{1}{2}$	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

†4% of which was tax free.

Home Rails.						
Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	3	3	$60\frac{1}{2}$	$+\frac{1}{2}$	5 15 8
do. District	,,	$3\frac{1}{2}$	4	$76\frac{1}{2}$	$+\frac{1}{2}$	6 10 9
Underground Electric	£1	$1\frac{1}{2}$	5	24/-xd	+6d.	5 16 8
do. do. Income ...	Bonds	6	6	114	+1	5 5 3
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	$1\frac{1}{2}$	$1\frac{1}{2}$	24	—	6 8 9
Automatic Telephone	1	10	10	$2\frac{3}{16}$	—	5 14 2
Eastern Extension	10	10	10	$26\frac{3}{4}$	$-\frac{1}{4}$	*3 14 8
Eastern Tel. Ord.	Stock	10	10	$267\frac{1}{2}$	$-2\frac{1}{2}$	*3 14 8
Globe Tel. and T. Ord.	10	10	10	$26\frac{1}{2}$	—	*3 15 3
do. do. Pref.	10	6	6	$11\frac{1}{2}$	—	5 9 0
Great Northern Tel.	10	20	20	32	$-\frac{1}{2}$	... ...
Indo-European	25	10	10	$55\frac{1}{2}$	—	*4 10 0
Marconi	10/-	5	*10	$4\frac{3}{16}$	$+\frac{1}{16}$	... ...
Marconi-Marine	1	$8\frac{3}{4}$	$12\frac{1}{2}$	$3\frac{1}{8}$	$-\frac{1}{8}$	4 16 0
Oriental Telephone Ord.	1	12	12	3	—	... ...
Western Telegraph	10	10	10	$26\frac{3}{4}$xd	—	3 14 8

*Interim.

Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	$5\frac{1}{2}$	$5\frac{1}{2}$	$8\frac{11}{16}$	—	7 9 3
do. do. 2nd Pref. ...	5	6	6	$8\frac{15}{16}$	—	7 12 4
do. do. 5% Deb. ...	Stock	5	5	$72\frac{1}{2}$	—	6 18 0
British Electric Traction Def. Ord.	,,	—	—	850	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	6	7	62	+1	3 4 6
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	$95\frac{1}{2}$	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	$69\frac{1}{2}$	-2	7 4 0
Mexican Light Common	100	Nil	Nil	$75\frac{1}{2}$	$-4\frac{1}{2}$	... ...
do. 7% Pref.	100	Nil	7	$74\frac{1}{2}$	-2	9 3 0
do. 1st Bonds	—	5	5	$77\frac{1}{2}$	$-1\frac{1}{2}$	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...
Manufacturing Companies.						
Assoc. Elec. Ord.	1	—	—	38/3	+5/3	... ...
Babcox & Wilcox	1	13	15	$3\frac{1}{16}$	—	*4 7 3
British Aluminium Ord.	1	10	10	47/6	—	*4 4 2
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	$4\frac{3}{16}$	$-\frac{1}{8}$	3 5 9
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	$4\frac{3}{8}$	—	8 9 0
do. 6½% Pref.	1	$6\frac{1}{2}$	$6\frac{1}{2}$	$1\frac{1}{4}$	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	$7\frac{1}{2}$	$7\frac{1}{2}$	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	$86\frac{1}{2}$	—	5 15 7
Electric Construction	1	$7\frac{1}{2}$	$7\frac{1}{2}$	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4xr	—	5 0 0
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	3	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	$6\frac{1}{2}$	$6\frac{1}{2}$	24/6	—	5 6 1
do. Ord.	1	$7\frac{1}{2}$	10	3	—	3 6 8
Henley...	1	25	25	6	—	4 1 8
do. 4½% Pref.	5	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	$12\frac{1}{2}$	10	$1\frac{15}{16}$	—	5 8 1
Siemens Ord.	1	$7\frac{1}{2}$	$7\frac{1}{2}$	$1\frac{3}{8}$	—	5 9 1
Telegraph Construction	12	10	10	$25\frac{1}{2}$	—	*4 14 3

* Dividends paid free of Income Tax.

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United States Electrical Exports.

Figures for 1927 and 1928 Compared.

BELOW are shown the values of electrical machinery and apparatus exported from the United States during the 12 months ended December last. Comparative figures for the year 1927 are added, and notes of increases or decreases are also given, except in a few instances (marked by asterisks) where the classification has been recently subdivided :—

	1927. Thous. $	1928. Thous. $	Inc. or dec. Thous. $
Electrical machinery and apparatus (total)	84,806	88,959	+4,153
Generators—			
Direct current—			
Under 500 kW	871	1,231	+ 360
500 kW and over	650	624	– 26
Alternating current—			
Under 2,000 kVA	170	227	+ 57
2,000 kVA and over	1,089	394	– 695
Steam turbine generator sets ...	1,822	856	– 966
Accessories and parts for generators	1,137	1,094	– 43
Self-contained lighting outfits	1,339	1,116	– 223
Batteries—			
Flashlight batteries	2,250	2,940	+ 690
Other primary batteries ...	2,430	2,750	+ 320
Storage batteries	3,673	3,400	– 273
Transforming or converting apparatus—			
Power transformers	1,556	*	—
Power transformers, 500 kVA and over	*	1,200	—
Distribution transformers, less than 500 kVA	*	830	—
Instrument transformers ...	*	90	—
Battery chargers, under 15 amps.	*	289	—
Other transformers	1,051	893	– 158
Rectifiers, double-current, and motor generators, dynamotors, synchronous, and other convertors	1,729	1,130	– 599
Transmission and distribution apparatus—			
Switchboard panels, except telephone	1,628	1,620	– 8
Switches and circuit breakers over 10 A	1,987	1,760	– 227
Fuses and fuse blocks	370	440	+ 70
Watt-hour and other measuring meters	419	990	+ 571
Volt, watt and ampere meters and other recording, indicating and testing apparatus	2,138	*	—
Indicating instruments ...	*	450	—
Recording instruments	*	220	—
Lightning arrestors, choke coils, reactors and other protective devices	726	780	+ 54
Motor starters and controllers—			
Motors, ½ h.p. and under ...	*	2,120	—
Motors over ½ and under 1 h.p.	*	840	—
Stationary motors—			
1 to 200 h.p.	3,067	2,870	– 197
Over 200 h.p.	403	390	– 13
Railway motors	916	600	– 316
Electric locomotives—			
Railway	690	1,060	+ 370
Mining and industrial ...	631	470	– 161
Station and warehouse electric motor trucks	200	180	– 20
Starting and controlling equipment—			
For industrial motors ...	1,152	1,520	+ 368
For electric railway and vehicle motors	247	240	– 7
Portable electric tools	965	1,300	+ 335
Accessories and parts for motors	2,410	2,542	+ 132
Radio apparatus—			
Transmitting sets and parts ...	401	770	+ 369
Receiving sets	2,961	4,550	+1,589
Tubes	1,004	1,020	+ 16
Receiving set components ...	2,306	3,050	+ 744
Receiving set accessories ...	2,510	2,670	+ 160
Electrical appliances—			
Electric fans	1,005	940	– 65
Electric lamps—			
Metal filament	1,537	1,460	– 77
Other electric lamps	440	600	+ 160
Flashlights	2,474	2,530	+ 56
Searchlights and projectors	874	640	– 234
Motor-driven household devices	2,312	*	—
Vacuum cleaners	*	1,310	—
Other cleaners	*	860	—
Flat irons	*	360	—
Domestic heating and cooking devices	1,558	*	—
Cooking ranges	*	300	—
Other ranges	*	930	—
Industrial electric furnaces and ovens	532	454	– 78
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, &c.	1,660	1,780	+ 120
Telephone apparatus—			
Telephone instruments	356	435	+ 79
Telephone switchboards	727	400	– 327
Other telephone equipment ...	2,721	2,490	– 231
Railway signals, switches, and attachments	770	710	– 60
Bells, buzzers, annunciators and alarms	319	360	+ 41
Telegraph apparatus	1,037	860	– 177
Other electrical apparatus—			
Spark plugs	*	1,420	—
Other starting, lighting, and ignition apparatus	*	1,080	—
Insulating material	1,360	1,350	– 10
Metal conduit, outlet, and switch boxes	1,038	1,330	+ 292
Sockets, receptacles and lighting switches	1,803	1,930	+ 127
Electric interior lighting fixtures	*	2,090	—
Electric street lighting fixtures	*	570	—
Other wiring supplies and line material	1,358	1,070	– 288
Other electrical apparatus ...	7,490	8,300	+ 810

The following, not included in the total of electrical apparatus, were also exported :—

Insulated iron or steel wire and cable	191	220	+ 29
Insulated copper wire and cable	5,172	4,820	– 352

In commenting on the electrical trade for the past year *Commerce Reports* says that the Western Hemisphere takes more than 50 per cent. of the total electrical exports of the United States, its share for the past year amounting to $64,114,000. Nearly half of this ($30,150,505) was credited to Canada. Argentina was the next most important outlet, exports to that country totalling $7,506,650. More than half of the shipments were composed of batteries, radio apparatus of all classes, bare and insulated copper wire and refrigerators. Brazil offered a good market for electric railway locomotives, bare and insulated copper wire, refrigerators, transformers, batteries and meters. The United Kingdom ($6,994,582) was the leading European market. The chief purchases were portable electric tools, accessories and parts for motors, vacuum cleaners, radio components and accessories, insulating material, insulated copper wire and cable and furnace electrodes. Australia took goods valued at $6,693,889, including large quantities of batteries, vacuum cleaners, radio apparatus and refrigerators which accounted for half of the total. The shares of other British Empire countries were as follows :—British India, $2.614,597; South Africa, $1,982,477; and New Zealand, $1,554,056.

The electrical imports of the United States amounted to only $2,789,994, which was $243,611 less than in 1927. The largest item was lamps the total value of the various classes being $1,234,672. Most of the lamps came from Japan, although Germany supplied considerable quantities.

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The B.E.A.M.A. Report.

The Association's Activities during 1928.

In the course of its annual report for the past year, the Council of the British Electrical and Allied Manufacturers' Association says that its general view and policy being that all difficulties and exigencies of trade and industry should be the subject of discussion and re-discussion by the parties interested until agreement or compromise is reached, resulted, during a year abounding in difficulties, in a demand for such a large number of meetings as seriously to tax the capacity of the permanent staff.

It was expected, at the beginning of 1928, that new records would be achieved in industrial production, but, after March, there were indications of a widespread trade depression in this country. This depression affected the supply industry in the leading industrial areas, and restricted, to some extent, the demand for electrical products. It caused a slowing down of extensions in generating stations, and it was only in the last two months of the year that a revival took place. On the whole, therefore, electrical production during 1928 was only slightly in advance of that of 1927. The development of the national power scheme and the determination of regional power zones, brought a number of important orders to the transformer and switchgear sections of the industry, while large contracts were placed for cables and overhead transmission material. In addition to this, extensions carried out in the chemical, artificial silk and paper industries, brought large orders to the industrial motor section, and preserved it from the worst effects of the trade depression.

Electrical Export Trade.

A slight decline in exports was recorded during the year, but, in the purely engineering sections, including steam turbines and condensers, progress was made, the real decline taking place in wires and cables and in telegraph and telephone apparatus. Examination of comparative statistics for other large exporting countries showed that, to some extent, Britain had lost ground in international competition, but the orders secured towards the end of the year will probably restore the state of balance existing in 1927. With the possible exception of India, a much smaller volume of orders was actually placed by the Dominions. This might be attributed to the unsatisfactory economic and trading conditions in those territories, which will probably pass away this year. In neutral markets, such as Europe and South America, the British position was improved, and there are indications that, during 1929, the extension of the curve of progress will be upwards.

The Association's solicitor directs attention to the increasing tendency of the courts to countenance agreements between manufacturers which contain obligations and/or restrictions formerly held to be bad as in restraint of trade and against public policy. Such agreements, if properly drawn and observed, may now be enforceable at law if they can be shown to be necessary to the industry and not unreasonable. The Trade Disputes and Trade Unions Act made unlawful the placing of an employé under any disability by reason of his being or not being a member of a trade union, but did not bar making it a condition of a contract that employés must be paid trade union wages. The few remaining local authorities still opposed to the B.E.A.M.A. clauses usually, therefore, word their clauses in that sense; and efforts are now being made to engage the attention of the chief association concerned in the question whether the House of Commons clauses, *plus* the provisions for outworkers as issued by the B.E.A.M.A., should not be entirely acceptable to all parties. Negotiations are proceeding with certain of the railway companies aiming at the settlement of standard sets of conditions.

During the year amendments were made to the I.E.E. Model Conditions and the Association's "Conditions A."

The Standardisation Committee has been largely occupied during the year on questions arising out of the Conference of the International Electrotechnical Commission at Bellagio, such as, for example, methods of measuring the losses included in declarations of efficiency; tolerances; dielectric tests; high-frequency and impulse tests, &c. The subjects dealt with included bushing type insulators, oil-immersed switches and circuit breakers, transformer tests, terminal marking, the standardisation of motor roller and ball bearings, &c.

Transport and Customs Duties.

The Traffic Committee has experienced a period of relaxation whilst studying the effects of the *régime* put into operation on January 1st, 1928. Few meetings of the Committee have been held, but individual members, as a result of consultations with representatives of the railway companies, have been able to secure important concessions in classification, particularly in regard to h.p. switchgear and electric heating and cooking apparatus. Special arrangements have been made for the conveyance of the large transformers required for the national power stations now in course of construction.

The conditions of trading during 1928 did not allow of the Education Committee proposing the enlarged scheme of scholarships referred to in preceding reports. The number of overseas students in members' works at the close of 1928 was 208, an increase of 50 over the number at the close of 1927. The countries sending the largest numbers were: India, Africa, Australia, New Zealand, Egypt, China, South America, British Guiana and West Indies, Tasmania, Japan and Canada.

Dominion and foreign Customs again occupied the chief part of the Export Committee's attention during the year. Little progress was made towards clearing the apparent deadlock involved in Australia's inability to give Great Britain the preference she intended to give, but is unable to give owing to her method of assessment, the Committee continuing to point out that until *ad valorem* duties are replaced by specific duties, progress cannot be made.

Although the South African tariff on certain items in which the Association is interested has been increased from 3 per cent. to 5 per cent., goods of British origin receive a rebate of the whole of the duty, so that the South African preference has been increased. The recent South African-German Commercial Treaty has caused the Committee some anxiety, as possibly militating against the interests of British manufacturers, certain of its terms being somewhat obscure. The Committee is watching an Indian proposal to restrict coastal trade to vessels Indian-owned to the extent of 75 per cent., a policy capable of considerable extension against British interests.

The Costing and Accounting Committee has followed closely the Government proposals and orders in connection with the rating of plant and machinery and the derating of industrial equipment under the Rating and Valuation Acts.

Co-operation with Other Bodies.

The Economic and Statistical Department has widened its sources of information, and has co-operated with similar bodies operating in America, Germany and other countries. Greater uniformity of classification has thus been obtained. The Department has been continuously engaged in creating an atmosphere more favourable to the support of British electrical production, especially in the daily Press, and has prepared a number of special publications bearing on disputed issues. It has also worked in conjunction with certain important customers of the electrical industry, with a view to advancing power schemes and thus accelerating the demand for generating plant. A passage of the report dealing with exhibitions was reprinted in our last issue.

After extended reference to the Electrical Research Association, the British Electrical Development Association and the World Power Conference, the report states that a new section covering electrical refrigerators was formed and got to work during the year. The members of the Accessories Section who had relinquished their membership of B.E.A.M.A. on the formation of an Accessories Association, rejoined upon the dissolution of the latter, and several new members were added to the Section.

Domestic Appliances in New Zealand.

The Canadian Trade Commissioner at Auckland, New Zealand (Mr. Paul Sykes) has recently given some advice to Dominion exporters of electrical household appliances. He considers that his countrymen are not obtaining all the business that they might in New Zealand, and that in some instances they are giving insufficient attention to the requirements of the market. He points out that transmission systems are still being extended to outlying districts, generating stations are being enlarged, and power is being distributed more cheaply than before. In these circumstances the appreciation of the economy and efficiency of electrical household articles, which was formerly limited to a comparatively few lines, such as stoves and heaters, is expanding to include a varied range of other articles.

While Canadian stoves have a high reputation, other electrical devices are less well known, and the Trade Commissioner says that the trade is suffering from omissions on the part of manufacturers to effect improvements in type, introduce new lines, and offer prices and quality comparable with those of overseas and local competitors. He draws attention to the preferential treatment accorded to British products, not only by the import tariff, but also by the public generally. Certain of the Trade Commissioner's notes on individual commodities will be of interest to British exporters:—

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Cookers.

The New Zealand market for electric cooking stoves is characteristically Canadian, and these products are regarded as establishing a standard in quality and design. An all-important feature of the market is the endorsement of Electric Power Boards, and this support, given to several Canadian makes, is of the greatest value. Some lines introduced to the local trade several years ago have failed to secure a high reputation for quality, their defects being chiefly those in finish and in the durability of elements. Hot-plates and "rangettes" have been among the new lines offered by exporters, and have met with a favourable reception, although the market for such auxiliary appliances is a small one and power distributing organisations consistently encourage the installation of heavier apparatus. Price is a vital factor in the trade in this smaller cooking equipment.

Irons.

There is keen competition in the local market for electric irons, the business being divided between English, Canadian, Australian, German, and United States makers. One widely-advertised type now imported from Canada is considered to enjoy the most successful distribution and, with other lines of the same origin, gives this market also a distinctly Canadian character. English irons are generally well regarded from a quality standpoint, while German makes have been sold extensively through price considerations.

Washing Machines.

There has been a good demand for electric washing machines during recent years. Several Canadian products have been sold successfully, but American machines have been in greatest demand. One of the latter, designed on the centrifugal principle, has been very popular, although the market is now equally sympathetic to oscillating types. Several recent inquiries have been for machines equipped with water-heating apparatus, and practically all dealers prefer a machine without a wringer attached. Electrically-driven machines are practically the only type in demand.

Vacuum Cleaners.

Canadian-made vacuum cleaners are at present enjoying a rapidly increasing sale in New Zealand. The market has for some years been closely cultivated by Canadian, English, Swedish and American producers, but is still capable of further development. One Swedish line has had an unusually extensive sale, but is now losing ground, notably to several Canadian makes.

Heaters.

There is a surprisingly heavy sale of electric heaters in New Zealand—a result of the lack of central heating in practically all dwellings and other buildings. This market has yielded few returns to Canadian manufacturers, and might well be given greater consideration. The standard in such heaters has been raised to a point where sales may be anticipated only when attractive appearance is combined with assured quality and efficiency in operation. Round types with copper reflectors still meet with some demand, but for house use the grate type is the most popular, and such heaters are now being offered in a variety of attractive designs. The bar type of element is at present meeting with general approval. Prices of heaters are comparatively high, averaging some £3, but occasionally running to £6 or more.

Miscellaneous.

There is a fair market for electric toasters, and several Canadian products are being offered by local dealers. The few varieties in type result in prices exercising an important effect on the possibilities of any particular makes. Grills are also in fair demand. Successful sales depend on substantial and novel designs such as the combination of several possible uses in the one article.

Electric heating pads are gradually displacing hot-water bottles, and a growing market is anticipated by the trade. In view of the unusually large local demand for articles of this nature, the market for such heating apparatus holds out interesting prospects. There is only a small market for fans.

The Leipzig Spring Fair.

Some Comments on, and Figures Relative to, its Organisation and the Exhibits Displayed.

By Our Own Correspondents.

THE annual Spring Fairs which are held at Leipzig, in Germany, date back to 1160. In 1895 the City of Leipzig opened the Municipal Trading Warehouse constructed to meet the requirements of the Fair, and it became a model, in principle, for a series of "Fair Palaces" erected at many convenient places in the centre of the city. The number of these buildings is now 43, and they represent a capital outlay of 80,000,000 marks, either by individuals, or small companies created for the purpose. The demand for suitable buildings was finally met by the establishment, with the approval of the Saxony Board of Trade, of the Public Utility Corporation of the Leipzig Fair Management, which charged itself with the task, not merely of bringing before the world the importance of the Fair, but of being also responsible for the entire administration of the two fairs now held each year, the Spring Fair commencing on the Sunday previous to the first Monday in March and the Autumn Fair commencing on the last Sunday in August. The duration of the Fairs is seven days, the Technical and Building Fairs, now only held in the spring, lasting for ten days.

The results of the organisation are worthy of study, and it may be well to commence with the exhibits in 1929, which are officially divided as in Table I.

Of the total, 8,860 exhibitors were German, and the rest (which included 60 English exhibitors) came from all parts of the world, Japan and India being particularly well represented. The area covered by the exhibits was over 2,000,000 sq. ft. in the town and 1,300,000 sq. ft. in the technical fair grounds buildings.

The important place machinery is taking in industry was exemplified by the spreading this spring of the superabundant machine tools to an additional hall, and the greater area available enabled the number of exhibitors in this branch to be increased from 812 to 960. The electrical industry also spread beyond the confines of the building specially erected for it, many electrical exhibits being found in one or other of two halls in which miscellaneous mechanical and hygienic articles were shown. The visitors reached a total of over 300,000, of which number about 30,000 came from outside Germany, and included many from North America, and some even from Australia. Some 10 per cent. of the foreign visitors came from England and a similar proportion from Holland, 3 per cent. from Switzerland, while the rest were from 30 different countries. The German visitors came from all parts, and, according to the 1928 statistics, over 34 per cent. from distances in excess of 100 miles. Such an influx of visitors taxed the sleeping accommodation of the city to the utmost, although, in addition to the hotel accommodation and that provided by friends, 17,000 beds were available in carefully selected homes. It is rumoured that the city proposes to build a hotel to contain 1,000 beds for visitors to the Fair if some equitable understanding can be arrived at with the ordinary hotel proprietors regarding its use at other seasons.

TABLE I.

Classification.	No. of exhibitors.
Illumination devices	234
Chemicals and pharmaceutical preparations	194
Precious metals, watches, clocks, jewellery	210
Glass, porcelain and ceramics	742
Household articles and metal ware	855
Photography, optics and delicate mechanisms	123
Arts and artcrafts	400
Novelties and fancy goods	651
Leather goods and travelling cases	289
Furniture and wicker goods	363
Musical instruments	203
Foods and delicacies	105
Books, stationery and the graphic arts	716
Office appliances	354
Shoes and boots	84
Toys	817
Sporting goods	128
Textiles	947
Packing and advertisement goods	293
Prime movers	129
Production and machine tools	683
Hoists and conveyors	300
Building and gas appliances	271
Electrotechnical appliances	511
Iron and steel products	294
Miscellaneous	210
Total	10,106

The tangible results of such enterprise are difficult to ascertain, but serious endeavour has been made during the last two years to obtain reliable information, and the Berlin Trade

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Research Institution was informed by the German exhibitors that the Spring Fair of 1928 brought definite direct orders to them of over one milliard of marks, and they anticipated further benefit from orders placed subsequently, but as a result of the Fair, of an equal value, while they also felt sure of receiving repeat orders. The buyers have been more difficult to obtain information from, but the London office of the Fair was able to secure replies from 10 per cent. of the English visitors, who reported purchases amounting to over half a million sterling. That the results are satisfactory may be assumed from the fact that, although the automobile makers did not show and the wireless trade has established an annual exhibition in Berlin and so was but poorly represented, the total number of exhibitors increased, and 95 per cent. of them were actual manufacturers, while the balance were recognised wholesalers of exceptional position. The buyer may also say that the Fair is worthy of his attention, as the exhibits were all well shown, as many machines as possible being in actual (and sometimes in rather expensive) operation, while the catalogues and pamphlets available were well written and illustrated, making him feel that the exhibitors had done their share in supporting the organisation. The welcome, provided one carried the official badge, commenced at the German frontier and was continued up to the moment of leaving the country, for every requirement, whether for accommodation, general information, interpretation, money changing, addresses, national meeting places, postal facilities, refreshment, &c., seemed under the invisible, but highly efficient, supervision of some competent official.

The electrical section of this year's Fair comprised heavy and light machinery, as well as household appliances, office and traffic equipment, and materials used in the industry.

The tendency in recent motor construction on the Continent is a preference for the low-power motor specially equipped to drive one machine individually. "Rationalisation" in industry has almost invariably meant that the designers of modern industrial plant have favoured the individually-driven machine, as against group driving, and the motor industry has taken due cognisance of the tendency. Another feature is that Continental engineers are now again turning to motors which permit of adjustable speed regulation by degrees. The A.E.G. exhibited a new group of direct-current motors with outputs from three to 15 h.p.; furthermore, a new series of repulsion motors with outputs from one-half to 5½ h.p. at 400 revolutions per minute were claimed to be particularly suitable for driving centrifuges, laundry machinery, &c.

The novelty on Messrs. Siemens-Schuckert's stands was motors of from 0.5 to 10 h.p., which are fitted with the so-called "Waelzgetrieben," and are space saving.

As regards switching systems, the feature of the exhibits was large interrupting capacity; a recently perfected controller (Druckluft Antrieb) is employed which makes operation extraordinarily easy; remote control is also possible through telephone wires. The "Ceka" reversible gliding switch (Gleitsprung Schalter) is easier to handle than the rotary switch used hitherto. Rectifiers must be mentioned, the capacity of which has been increased all round.

Amongst insulation material, "Tenazit" is a new pressed material free of rubber. Apart from the picture-telegraphy apparatus which is already in use in Great Britain and Japan, Messrs. Siemens & Halske exhibited a new electro-chemical transmitter of black and white pictures; it is based on the fact that certain substances are coloured when an electric current passes through them and the pictures are obtained on a paper which is soaked in these substances. Amongst house telephones, new "conference plant" was shown; it enables several participants in a conference to hold their discussions while remaining in their several offices, with the aid of a loud-speaker and microphone in each room.

The Institute of Metals.

An account of the meetings and social functions held in London in celebration of the coming-of-age of the Institute.

(*Concluded from page* 585.)

Amongst the papers read at the March meeting were two on electric furnaces.

Mr. D. F. Campbell, M.A., consulting engineer, described the last two years' improvements and modifications in melting practice, discussed the relative performance of small and large induction furnaces, and the reasons for selecting the size of unit according to the work to be done. A short description of improvements in practice with high-frequency furnaces and details of new methods of lining those furnaces were included; a general survey of heat-treatment furnaces followed, with a detailed description of the construction and performance of a number of specific furnaces, including a continuous furnace for annealing brass strip. The largest brass works, where electricity is utilised more than elsewhere, was described, with explanation of the uses to which electricity had been applied, diagrams showing the energy consumed, and the effect of the special precautions used to improve power and load factor.

In the discussion Mr. A. Glynne Lobley, referring to the author's statement that the measurement of the consumption of energy to maintain the required heat with doors closed, or the rate of temperature drop after the current was cut off, was a simple and effective indication of thermal efficiency, said that the determination of the consumption was by no means simple. The rate of cooling depended not only on the insulation, but on the heat capacity of the inside of the furnace also, so that a furnace which was heavily constructed inside would cool at a lower rate than one less heavily constructed. Therefore, the cooling-curve method should not be adopted normally, and if it were, it should be considered with great care. The problem of determining the heat loss of a furnace was a difficult one. It was often imagined that if one stopped using the furnace for some time and then turned on the energy required to maintain the temperature, one could arrive at the heat loss. The problem was not so simple as that, however, because a considerable time elapsed before the materials reached equilibrium and before the temperature gradient became constant from the inside to the outside of the furnace. As an example of the difficulty of measuring heat loss, he mentioned an attempt to determine it in respect of a furnace operating normally at about 900 deg. At the end of a day's work the furnace was left with the current switched on for a couple of hours, and the consumption measured during the second hour. The loss indicated was just under 7 units. That figure was thought to be unduly low for such a furnace, which had a usuable inside length of 7 ft. and a width of 3 ft. 6 in. On investigating what had happened during the day, it was found that for a short time the furnace had been used at a temperature of about 950 deg., which was a little higher than the normal, and it was thought that surplus heat in the lining was probably responsible for reducing the heat-loss figure. Another determination was made, therefore, in a similar way, and a figure of 14 units was obtained. The furnace was then left empty for 12 hours, with the energy on, and at the end of that time a determination was made. It was left for another two hours, when a further determination was made, and the results of the two determinations were the same, being 8.3 units. He suggested that a useful figure to specify would be the consumption in units per ton of output of material. Whether or not an electric furnace should be installed usually depended ultimately upon cost. The direct fuel cost in respect of an electric furnace was not always less than the fuel cost in respect of other types of furnace, but it was sometimes, and in a very great number of cases the electric furnace certainly had an advantage in overall cost. In a case in which it was proposed to install an electric furnace for heating steel plates for straightening and bending, the operation could be carried out more cheaply with a coke furnace, from the point of view of fuel cost, but the electric furnace had several economic advantages. One was the fact that it could be placed just where the process was being carried out, and it happened to be a position in which it was impossible to place a solid-fuel furnace. Again, being automatically controlled, it required no attention; the working temperature could be attained before the shift started, and the product was cleaner. The electric furnace was, therefore, installed and the direct labour cost in connection with the handling of the plates was reduced by an amount equivalent to the whole of the electricity bill. With regard to carburising furnaces, he gave figures relating to the operation of modern electric and recuperative gas furnaces for a whole week, the furnaces being worked night and day from Sunday night until Saturday mid-day, so that the cost of heating up was included. The electric furnace had a usuable hearth of 6 ft. 3 in. by 3 ft. 9 in., and the gas furnace, although it measured a little more, was not able to take quite so big a charge as the electric one. They were both loaded to the same extent, the carburising periods ranging from 8 to 12 hours. The average consumption of the electric furnace was 20 units per hour, which worked out, at the price of electricity ruling in the district, at 12.3d.; the cost of working the gas furnace worked out at 18d. per hour. With cheap gas at 2s. per thousand cu. ft. The cost of running the gas furnace, when it was first tested, was 2s. 6d. per hour.

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but by altering dampers and generally tuning up the furnace the figure was reduced to 1s. 6d. per hour. A new type of furnace in this country was the rotary annular hearth furnace for the heat treatment of gears. The design was entirely British and did not follow American lines. Accurate consumption figures were not yet available, but preliminary observations had shown that the consumption was about 250 kWh per ton, and it was doing what was expected of it. Very great improvement in the product was effected, due to even and uniform heating, which had eliminated distortion.

Dr. H. W. Brownsdon said that from the electrical point of view electric furnaces were fairly efficient, but they were still up against problems with regard to refractories from the economic point of view. The Wyatt and the Northrup types of furnace depended for their economic running upon the life of their refactory linings. There was no doubt that in both these types melting could be carried out more cheaply than in furnaces using gas, or other types of fuel, provided the linings had a certain minimum life; the linings must have very special properties. He had used a Wyatt furnace lined with "Sillimanite"; as a refractory it was excellent, but after melting quite a big tonnage of brass the furnace had failed because the "Sillimanite" lining had allowed zinc to diffuse through it (99.5 per cent. pure zinc had diffused through a 1½-in. or 2-in. thickness of refractory) and short-circuited the electrical equipment on the other side. This pointed to the fact that refractories must sinter or fuse superficially to prevent the diffusion of zinc vapour through them. A big advance effected quite recently in the Northrup furnace was the adoption of a sintered lining; in that case, however, there was compromise, because the lining fused to a kind of glass, the coefficient of expansion and contraction of which was rather high, he imagined, so that it was somewhat liable to damage; also, it was of considerable thickness, so that it prevented close coupling and the electrical efficiency of the furnace was probably somewhat reduced in consequence. There was far too much agitation in the Ajax-Northrup furnace. It might be useful in certain refining operations, but for the simple melting of metals it would be generally advantageous to have a more quiescent melt, especially in certain cases when the metals were reactive with air. A weak point of electric furnaces was that the temperature gradients were big. In the Wyatt furnace the heat was generated in a very small area, and in the other type there was a tendency to heat concentrations; there was no doubt that there were hot spots where probably reactions could take place between graphite and silica. Was it not possible to arrange for the heat to be more evenly and uniformly absorbed by the metal, rather than to effect the solution of cold metal in what one might consider to be a superheated metal? It would be advisable to couple the annealing furnace with the pickling and cleaning furnaces; one winding mechanism would then take the metal through the muffle, remove the oxide film, and leave a uniformly annealed and clean product.

Dr. R. S. Hutton (Director, British Non-Ferrous Metals Research Association), who had visited the works of the Hirsch, Kupfer u. Messingwerke A.G., near Eberswalde, Germany, said that Mr. Campbell's statement with regard to those works was exceedingly conservative. His own impression was that the replacement of fuel by electric heating had been carried a good deal further than was indicated by Mr. Campbell. Indeed, he had been so surprised by the development there that he had asked the young director who had accompanied him during his inspection how the elderly directors had been persuaded to scrap the old plant and install the new. The reply was that there were no elderly directors, and that the oldest one was only 45 years old; in other words, the directors had been scrapped first and the plant afterwards. An outstanding point was the improvement which had taken place in the lining of furnaces.

Mr. W. R. Barclay, who was particularly interested in furnaces capable of dealing with high melting-point alloys, said he retained his great admiration for the arc furnace for that purpose. He had also had experience of the high-frequency furnace and could bear testimony to some of its advantages, but felt that they had still a long way to go before they would fathom all the factors bearing upon its success. One of the difficulties was connected with refractory linings, and although important advances had been made recently, they were still by no means out of the wood. By careful building one could make a hearth for the arc furnace, say, with magnesite bricks lined with a high-grade magnesite powder, thoroughly well rammed and properly treated in its early stages, and he had still at work furnace linings which had been used for 12 months in arc furnaces dealing with pure nickel and high-nickel alloys. In view of the difficulties with refractories, the high-frequency melting proposition hardly compared with that of melting in arc furnaces. He urged the need for a much more detailed study of the subtle differences in the action of the products of high-frequency arc furnaces. There was also difficulty in getting absolutely clean metal from the high-frequency furnace. With reference to extreme agitation, it was obvious that with an acid lining there would be produced a considerable amount of slag. As a rule, one could get rather cleaner metal from the arc furnace than from the high-frequency furnace. The problem of deciding upon the economic unit for melting had still to be settled, and he was glad to note that the range had extended so enormously during the last year or two. Whereas two or three years ago buyers were asked to accept high-frequency furnaces of only 10 or 20 lb. capacity, Mr. Campbell was now offering furnaces of 1 ton capacity, which represented one of the greatest advances in connection with the high-frequency furnace.

Mr. T. H. Turner referred to two industrial electric heat-treatment furnaces used abroad. One was of the inverted-box type, which was raised and lowered on to the work, and required flexible connections or connections which must be broken. The other was somewhat of that kind, perched in the air. under black-body conditions, and enabling one to overcome dangers of convection currents causing variations. It was used on a large industrial scale in America, and when used for sheets or plates of relatively small dimensions or irregular sizes the metal was charged on to a bogie and run under the furnace, and raised on the bogie into the furnace. So far as the treatment of the material was concerned, it was obvious that little or no oxidation should occur. Neither of those types of furnace was used in this country so far as he was aware.

Mr. W. B. Clarke, referring to melting of high-melting-point alloys, said that the lives of the crucibles were invariably very short; the usual linings did not appear to prolong the life of the crucibles, and painting them inside and out with the very best fireclay procurable seemed to have little effect. However, the lives of crucibles and furnace linings were increased to a wonderful extent by painting them with a water emulsion of "osmos clay," a very pure form of clay. Ability to control the temperature was a great advantage of the electric furnace; he was using the tubular form at temperatures ranging from just over 100 to 1,500 or 1,600 deg., and could control the temperature very well over that range by using a voltmeter. A variation of 1 or 2 volts in an electric furnace would not make anything like as much difference as would a difference of 1 or 2 tenths in the pressure of the gas supplied to a gas furnace.

Mr. S. L. Archbutt said the new method of lining the container of the Ajax-Northrup high-frequency induction furnace was stated in the paper to consist of placing a metallic liner inside the furnace and pouring a carefully-prepared lining material between the liner and the furnace inductor coil; he could not see what prevented the refractory material running into the inductor coil. It had been stated by the author that the cost of the electric furnace, generally speaking, was high, but his figures with regard to two heat-treatment furnaces in the Midlands showed that the cost of their operation compared favourably with that of gas furnaces.

Mr. Campbell said he had meant that the cost of installation was high, not the cost of operation.

Mr. F. Adcock, discussing nomenclature, suggested that the term "high frequency" was often mis-applied. At the beginning of electric furnace development, frequencies were high, but it was quite customary to-day to adopt frequencies of 500 cycles, and furnaces had run at 50 cycles, which could not be called high frequency. He suggested that the term "ironless," or "coreless," should be applied to induction furnaces.

Dr. W. Rosenhain, president, said that agitation in electric furnaces was very important. In steel making the agitation had an immense effect in producing a very rapid attainment of equilibrium between slag and metal. There was the countervailing disadvantage, however, that any particles of slag, lining, or any other non-metallic substance, when once entrained in the metal had not the opportunity of rising to the surface, as they would in quescent crucible melting. The only cure that he could think of (short of frequency adjustment, which had electrical disadvantages) would be to switch off the current for a sufficently long period to allow the metal to come to rest and to allow, at any rate the larger impurities, to rise to the surface. Unfortunately, however, the rate of cooling when the current was off was extremely rapid, in view of the thin wax lining. The coreless induction furnace offered the possibility of controlling the gaseous atmosphere to which the metal was exposed during the whole process of melting and casting, and he habitually melted alloys of high melting point in vacuo; the arc type did not permit of that, and the advantage of the induction type in that respect was likely to prove an important factor. It might be thought that melting in a controlled atmosphere was a laboratory rather than an industrial process, but the work of Dr. Rohn in Germany showed that it was an industrial process, and it was likely to be used more extensively in industry in the future.

Mr. Campbell replied to the discussion. Agitation of the metal in the Ajax-Northrup furnace was thoroughly understood; in certain operations considerable agitation was necessary. The movement of the metal could be varied by varying the periodicity and the dimensions of the furnace, and so on. He had had a good deal of experience of "Sillimanite" refractory, and it seemed that there might be some chance of making "Sillimanite" linings impervious to zinc fume, which was metallic and caused short-circuiting. If one compared arc and high-frequency furnace results, one should be careful to compare acid with acid and basic with basic, or allow fully for the great difference in the characteristics of the two; arc furnaces were working with acid linings and high-frequecny furnaces with basic linings. Inasmuch as the body of the high-frequency furnace was so simple, it was useful to keep spare bodies in stock and replace the old ones when necessary. It was the practice in many works to allow the metal to rest in the high-frequency furnace. It might pay when continuous annealing was being carried on to have the pickling machine in a straight line with the annealing furnace and use the same gear for the two operations. It must be remembered, how-

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ever, that the pickling machine could work three times as fast, and deal with three times as much material, as could the annealing furnace. The inverted-box type of resistance furnace was used in France for annealing copper and aluminium wire, and was quite generally known to be rather expensive to install, as compared with others, but it was efficient. He asked if Dr. Rohn (of Germany, who attended the meeting) would contribute to the Institute's *Proceedings* a description of the inverted type of furnace with a water seal which he used for annealing, and some particulars of his experience of various types of linings in high-frequency furnaces. In this country they were deficient of the type of furnace which was water sealed for annealing in special gases.

The limiting factor at present in the case of induction furnaces was the difficulty of obtaining silica ware in sufficiently large sizes for very large melts.

Developments in Turbo-generators.

Limitations met with in recent years in the design and production of increasingly larger machines.

By J. A. KUYSER, M.I.E.E.

(*Abstract of a Paper read before the* Institution of Electrical Engineers.)

THE main problem which has been before designers of turbo-generators in recent years is that of devising a satisfactory method of ventilating very long machines. When outputs and speeds increased it became necessary to provide more area for the ventilating air, and this was obtained by arranging a large number of ventilating holes in the stator core. Many systems of axial ventilation and combined radial and axial systems have been devised, and in a scheme adopted by the author in 1918 a comparatively large number of radial ducts is used, providing a large radial surface in addition to the axial surface. Each axial duct is allowed to discharge in a definite radial duct at a definite position along the stator core. It is possible to distribute the air by this means in a definite way, and a counter-flow action may be obtained. Good results have been obtained with this system on medium-sized generators, the temperature of the core being very uniform.

Experience of a large number of axially-ventilated machines shows that there is a limitation to the amount of axial ventilation which can be economically employed. The introduction of axial holes causes increase in iron losses. This increase, however, is considerably greater than can be accounted for theoretically, or from measurements on small experimental cores. It became evident that the amount of axial ventilation used on large machines, which in some cases amounted to from 12 to 15 per cent. of the core volume, was such as to defeat the object for which it was provided, *i.e.*, the increase in air quantity and surface was almost neutralised by the increase in iron loss. For very large outputs at 3,000 r.p.m., the radial-axial system became in its turn inadequate, owing to the limited amount of axial area which was advisable. Further difficulties arose through the inability of providing self-contained fans of reasonable efficiency. To deal with these new conditions the multiple-inlet radial-axial system was developed. This system is a combination of the radial-axial system and a system which had been in use by the author's firm since 1911. Air is obtained from a separate motor-driven blower and admitted into one or more compartments of the stator casing, from which it travels through the radial air ducts. Part of this air traverses the whole core radially and passes between the stator conductors into the air-gap. From there it leaves through the radial ducts in the adjacent core sections. The other part passes through the axial ducts and returns *via* the radial ducts in the adjacent core sections. The multiple-inlet radial-axial system appears to be a final solution of the ventilation problem for very large sets. It is obvious that with this system there are no more difficulties in providing the requisite ventilation for a long machine than there are for a short machine.

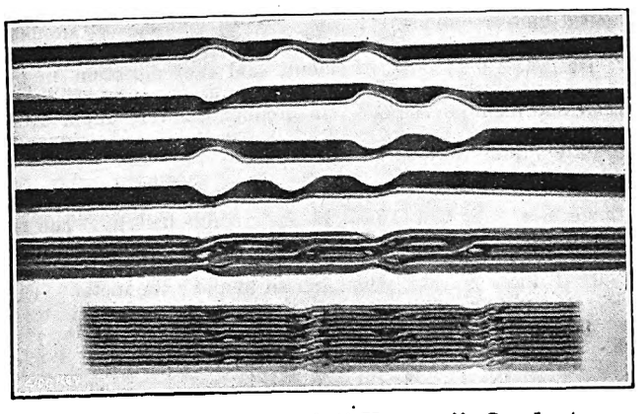

Fig. 1.—Construction of "Kuyser" Conductor.

The generally adopted method of eliminating eddy currents is by subdividing the conductors and changing the relative position of the parallel circuits during their progress through the winding. In turbo-alternators, and generally where a large number of ampere-turns is concentrated in one slot, subdivision into two groups is no longer sufficient, and the conductor has to be subdivided into a large number of straps which are placed across the width of the slot. A number of methods of twisting and transposing, suitable for these conditions, have been proposed. Some years ago designs had to be prepared for some very large turbo-alternators to be built by the author's firm, and it became desirable to develop a transposed slot conductor. Experiments were made with two types of conductor proposed by the author. In one only a single layer of straps is required, and transpositions are arranged from the bottom to the top of the conductor. The number of transpositions is equal to the number of straps per conductor. At the point of transposition the straps are reduced in width to allow the transposed strap to pass other straps without increasing the size of the assembled conductor. This "Punga" conductor was developed later on the Continent, and has been adopted there by several firms. Amongst others it appears to be used on the large alternators at Gennevilliers. So far this conductor has not been used commercially by the author's firm, but it has been abandoned in favour of the conductor shown in fig. 1, which has several advantages over the first type. The principle used in this conductor (Kuyser) is that the transposition is obtained by a system of individual twists between adjacent straps. At the point of twisting the two straps are reduced to somewhat less than one-half of their original width and bent upward, or downward, to change position with the adjacent strap. Several combinations of this twist are possible. It is evident that in order to obtain complete transpositions a larger number of individual twists is required than for the case of twisting. For transposition the number of individual twists is given by the formula $(s-1)^2+\frac{1}{2}s$ for an even number of strands, and $(s-1)^2+\frac{1}{2}(s-1)$ for an odd number of strands. For twisting, the required number is $\frac{1}{2}s(s-1)$, where s=number of strands.

It has been known for many years that a strong magnetic field is produced by the stator end-connections, and that this field causes heating of the stator core clamping plates and other solid parts at the end of the stator. An investigation was made on a 4,000-kW, 3-phase, 2-pole alternator under different load conditions, *i.e.*, the machine was operated at short-circuit and at full load ($\cos\phi=0$, lagging), the main field being over-excited. The strength of the leakage field was measured by means of a search coil, vacuo-junction and unipivot galvanometer, the apparatus having previously been calibrated with the coil in a standard solenoid. A specially small search coil of $\frac{7}{8}$-in. diameter was mounted in a stirrup support at the end of a brass tube 2 ft. long, the coil being arranged to rotate through an angle of 90 deg. At the other end of the tube a rotatable, graduated dial knob was mounted. The dial and the search coil were positively connected by small pulleys and a fine-wire belt, so that the position of the coil in one plane of rotation could be read off the dial. The orientation of the coil in the plane at right angles to its axis was performed by turning the brass tube in its graduated slide block, the block being clamped in any desired position to the stator end-winding support bolts. In addition to the two rotational movements of the coil it could also be moved in line with the brass tube by sliding the latter in its housing. It was thus possible to place the search coil in the small spaces between the stator end-winding coils, and in the gap between the coils and the rotor coil-retaining ring, and to move it in various directions until the galvanometer gave the maximum

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reading. In this way both the strength and the direction of the field were obtained. The wave-form of the e.m.f. induced in the search coil was measured by oscillograph, and by integration the flux wave shown in fig. 2 was obtained. Examination of the results shows that the intensity of the magnetic field varies little for different positions of the periphery of the stator. For lagging load ($\cos \phi = 0$) conditions the field intensity is approximately 65 per cent. of that on short-circuit. In order to find an explanation of the cause of the end field we may assume the generator to be operating on leading-load conditions without rotor excitation. The machine can, under these conditions, be considered as an induction motor on no load, the stator ampere-turns being totally expended as magnetising ampere-turns for the air-gap. The stator ampere-turns, air-gap induction and length of air-gap are therefore in the usual relation to one another, and the air-gap induction can be determined from the length of the air-gap and the stator ampere-turns per pole. The rotor coil-retaining rings are assumed to be made of magnetic material, and they can be considered as an extension of the rotor. The magnetic field a short distance away from the core ends can then be considered to be an extension of the air-gap field, and the flux density at each point can be calculated in the same way from the stator ampere-turns per pole and the length of the line of force at the point in question, measured between the stator end-plate and the coil-retaining ring. This relation holds good for a region of about 10 to 12 in. from the ends of the core, where the density is a maximum. At points further distant from the core only part of the stator winding is interlinked with the end field, and the latter diminishes gradually to zero at the outer end of the coil-retaining ring. The flux lines collected by the magnetic ring are carried by the ring and the rotor end-plate in a peripheral direction to the adjacent pole, and the magnetic section of the rings will determine the magnitude of the flux. A result similar to that obtained from a reduction in section of the retaining rings will be obtained by applying excitation to the rotor. The coil-retaining ring will in this case become magnetically saturated in a direction opposing that of the stator ampere-turns, and even a small rotor excitation can be expected to reduce the end field appreciably. This is what actually occurs under short-circuit and lagging load. It will be evident that it will be advantageous to reduce the coil-retaining rings to as small a section as possible, or to use non-magnetic rings.

A phenomenon which has been observed by most makers and mentioned in recent papers on the subject is the swelling of the mica insulation of the stator conductors. The swelling is observed at each ventilation duct, particularly in the centre of the machine or at whatever place the temperature is a maximum. The cause of the swelling is at the present time not clearly understood. One explanation is that under the action of temperature on the bonding material used in the mica insulation a high vapour pressure is formed which has a tendency to force the mica into the ventilation ducts, which are the only unsupported portions. A novel method of preventing swelling is indicated in fig. 3.* The conductor is surrounded at each ventilation duct by a metal shield which forms a continuation of the slot. The metal shield serves at the same time as a spacer to maintain the distance between the two sides of the ventilation duct. By this means a continuous smooth surface, free from interruptions due to ventilation ducts, is presented to the insulation, and swelling is prevented.

Difficulties due to cracking of the mica insulation at the end of the stator core caused by expansion have been pre-

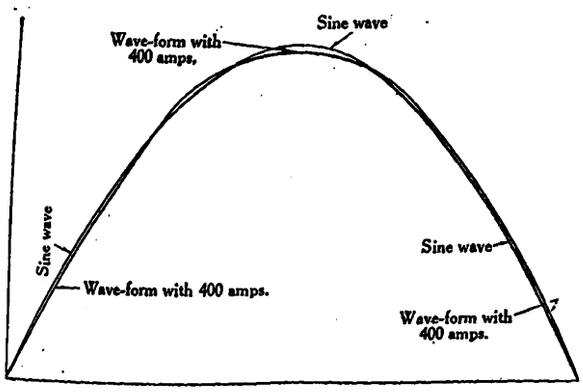

Fig. 2.—Stator Leakage Flux Wave.

viously reported, but the author has not experienced actual failures from this cause in service. However, investigation on a large generator of 110-in. core length, which had been in operation for several years, revealed signs of a peculiar crinkling of the mica insulation of the slot. The insulation had the appearance of having experienced a permanent increase in length, or of having moved from the two ends towards the centre of the machine, an axial compression resulting in the centre which caused the crinkling. An interesting fact was that the amount of crinkling was considerably more than could be accounted for by the difference in expansion of copper and insulation, and must have been the cumulative result of a repeated action. A possible explanation is that a "grip" exists between copper and insulation at low temperatures, but that slipping takes place at higher temperatures.

Important advances have been made by the steelmakers in the production of high-class rotor forgings, and progress in this respect has contributed to the improvement in performance and the increase in output of modern high-speed units. The material generally used before the modern large 3,000-r.p.m. sets were designed was a carbon-steel having a small nickel content.

For more severe duties, *i.e.*, larger peripheral speeds or increased specific outputs, a steel has more recently been de-

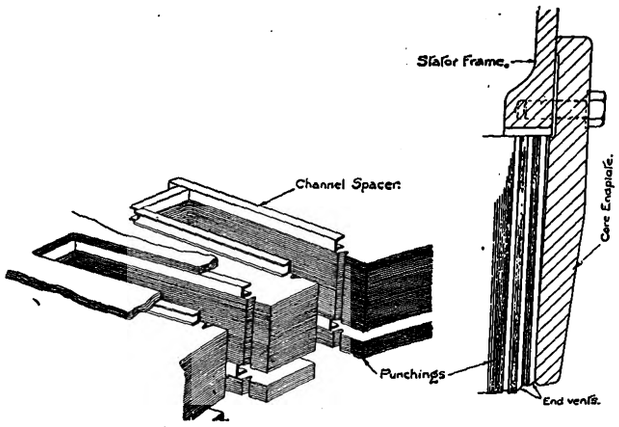

Fig. 3.—Smooth Core for Preventing Mica Swelling.

veloped which contains about 2 per cent. nickel and a very small percentage of chromium, and is used in the annealed condition. A large number of highly satisfactory forgings up to 25 tons at 3,000 r.p.m. have been made of this material. Builders of generators on the Continent have for some time been using oil-hardened chromium-nickel steel forgings having a nickel content of 3 to 4 per cent. and a chromium content of 0.7 to 1 per cent. These forgings are heated and quenched to obtain a yield point of 32 to 34 tons per sq. in. and an ultimate strength of 45 to 48 tons per sq. in. The advantage of a material having such high physical properties was recognised several years ago by the author and his associates, but the general opinion was that oil-hardening was too drastic a process for a large solid mass of metal, and was likely to cause dangerous strains. Recently, however, in view of the extensive use of this material abroad, it was decided to reconsider the matter, and a 25-ton 3,000-r.p.m. rotor was obtained from one of the leading steelmakers on the Continent and put in the factory. When this rotor went through the machining operations it behaved peculiarly. When the winding slots were planed a deformation took place, the teeth bending sideways at every radial ventilation hole. The slot showed a variation in width of approximately 0.1 in. Evidently a high longitudinal compressive stress had been produced by the hardening process, resulting in a sideways collapse of each tooth as a strut in compression, as the planing tool approached the bottom of the slot.

A clause often appears in specifications for turbo plant to the effect that the safety factor should not be less than a definite figure, say, five. It should be emphasised that the observance of a definite safety factor is not in itself a sufficient guarantee of the soundness of the mechanical design. Equally or more important is a knowledge of the materials used, in particular as regards their limitations with regard to homogeneity, hidden flaws and indeterminable strains. Also, the methods of calculating stresses used by different designers may vary, and figures for calculated stresses may not be comparable. Furthermore, different safety factors are required in different parts of the rotor if conventional methods of stress calculation are used.

The following is a list of safety factors recommended for present-day conditions:—

Tooth stress, 1/4.25× (ultimate tensile strength); 1/2.5× (yield point).

Centre of core (local stress), 1/3.5× (ultimate tensile strength) for ductile material; ½× (yield point).

Chromium-nickel coil-retaining rings, ¼× (ultimate tensile strength); 1/3.5× (yield point).

Local bending in shafts and journals, 1/12× (ultimate tensile strength).

Non-magnetic coil-retaining rings, 1/3.6× (ultimate tensile strength); 1/2.8× (yield point).

It is felt that these figures include sufficient margin to cover what is sometimes called "factor of ignorance," *i.e.*, a factor covering minor undetected defects and unknown variations between actual and calculated stresses. The above recommendations are given on the assumption that an overspeed test of 25 per cent. is carried out. In the absence of such a test higher safety factors are advisable.

* Patent No. 265,740—1925.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Standardised Induction Motors.

A new range of protected squirrel-cage induction motors (known as type K), in sizes from 1 to 25 h.p., 400/440 V, three-phase, 50 cycles, is manufactured by the British Thomson-Houston Co., Ltd., Rugby. By production in quantity on highly-standardised lines economies are effected which result, it is claimed, in machines of improved design at prices lower than would otherwise be possible. Type K motors comply, it is claimed, in all respects with B.S.S. 168, and have high efficiency and power factor, give maximum starting and overload torque, and take low starting current. Ball and roller bearings are fitted. The rotor has aluminium bars and end rings cast in one piece by a special process, and is practically indestructible under service conditions. The core is ground on the periphery to ensure true running. The stator windings are specially dried and impregnated under vacuum.

New Oil-immersed Starters.

A range of "OS" oil-immersed starters for the control of squirrel-cage motors up to 650 V recently marketed by the English Electric Co., Ltd., Queen's House, Kingsway, W.C.2, are of the ironclad, totally-enclosed, weatherproof type. These starters embody 2-throw switches with central "off" positions. Drum- or contactor-type switching can be employed, according to the size of the apparatus, and in each case the switch proper is self-contained as a complete unit. Low-voltage and overload releases are fitted to the starters and can operate in any position of the handle. The equipment is made in four forms for:—direct-on starting of 2- and 3-phase motors on 3-wire circuits; star-delta starting; series-parallel starting of 2-phase motors on 3- or 4-wire circuits; direct-on starting of 2-phase motors on 4-wire circuits. A universal cable box

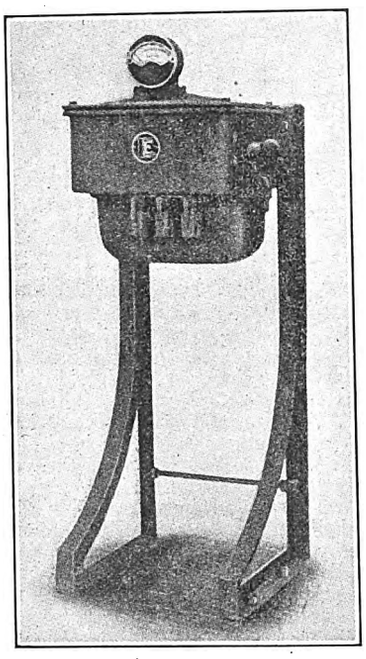

Fig. 1.—"O.S." Starter on Floor Stand.

for armoured cable is provided. The starters are provided for wall mounting or on a floor stand as shown in fig. 1.

A New Jumper Connector.

Although designed more particularly for overhead lines, a mechanical jumper connector recently introduced by Messrs. W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1, is intended for use either indoors or outdoors wherever two free ends of conductors—copper rod, busbars, or the jumper loops of overhead lines at angle and junction poles—have to be jointed. The outstanding claims for the device are cheapness, efficiency and lightness in weight. The connector consists of three parts—a seamless, parallel-sided copper sleeve contains two gun-metal wedges grooved to accommodate the conductors. The wedges fit tightly inside the sleeve, and during transit or handling will not, it is claimed, come out of position. Wires of different diameter can be accommodated together in the same connector. Fig. 2 shows how the connector is used. The free ends of the conductor are inserted into the sleeve over the small ends of the grooved wedges, which are then driven into position. During this operation there is no necessity to take the wedges out of the sleeve. It is recommended that a coat of bitumastic paint should be applied when the joint is made. There are no iron or steel parts to corrode, and no bolts or screws of any kind. In a recent test on a connector for a 0.10-sq. in. conductor the increase in resistance of the conductor, directly due to the

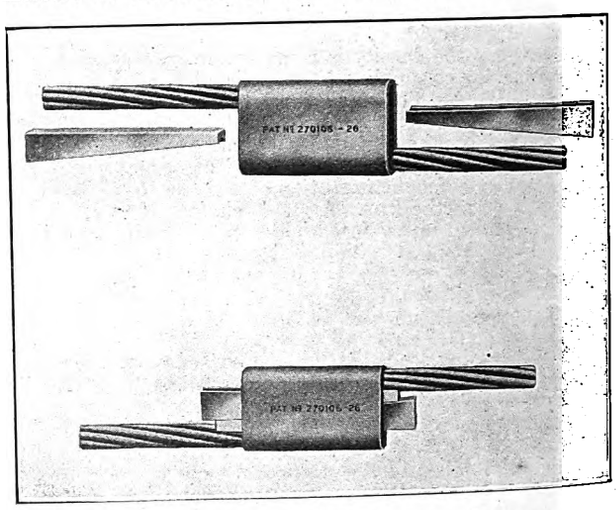

Fig. 2.—Application of Jumper Connector.

joint, was less than 6 microhms. After further being subjected to a tensile test, the pull-out load of which was 670 lb., the connector was in no way damaged and could have been immediately put into service. At present, four sizes are in stock, suitable for conductors up to half-an-inch in diameter, but larger sizes can be supplied if the demand arises.

Selected Radio-telephone Apparatus.

Recent Developments and Improvements.

Constructors' Kit.

One of the latest additions to the range of home-construction kits now available is that marketed by Ferranti, Ltd. The circuit consists of one screened-grid h.f. valve, a detector, and one l.f. power stage, the output being delivered through a multi-ratio transformer. A feature that is unusual in screened-grid sets is the h.f. coupling through a transformer, having astatic windings to avoid any tendency to self-oscillation; they improve selectivity also and reaction is obtained in a simple manner. The "anode feed" principle is incorporated in the set, which, besides preventing back coupling between the various stages, acts as a safeguard to the valves, preventing them from being burnt out accidentally; for example, should there be a "short" inside the screened-grid valve. The receiver is simple to build; there is no soldering to be done, and the general appearance of the instrument is good.

Fultograph Equipment.

The Fultograph picture receiver may now be assembled by any enthusiast with very little trouble, as the various components are available in the form of a complete kit, or as separate parts, exactly to the specification of the assembly of the standard instrument. The kit is complete, with the exception of the valve, paper, and solution, and all instructions regarding assembly and operation, &c., together with wiring diagrams and methods of adjustment are included. The kit actually consists of 26 parts, all of which may be purchased

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separately if required, and there are several optional parts, which are not necessary to the functioning of the instrument.

Wireless Pictures (1928), Ltd., have improved their system, and a new type of transmitter has been installed at 5XX. The first transmitter employed a copper foil cylinder with a sensitised glue image, but the new one consists solely of photo-electric equipment. The image in this case is placed on a cylinder and scanned by a powerful beam of light which has a to and fro movement in a continuous series of parallel movements about 1/96 inch apart. The beam passes over the whole of the image in turn; after passing through it, the beam is made to strike against a photo-electric cell, causing current variations which are amplified in the usual manner and radiated. In comparison with the old method, the received pictures are more sharply defined, and have a much better gradation of light and shade.

T.C.C. Condensers.

The Telegraph Condenser Co., Ltd., is now marketing electrolytic condensers which have been evolved to furnish large

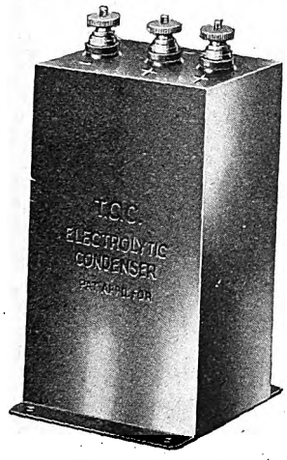

Fig. 1.—Electrolytic Condenser.

capacity at a low price. Their main uses are for smoothing the ripple from a.c. when used for heating valve filaments, and for the same purpose when connected across moving-coil loud-speakers; in the latter case oscillograph records indicate the absence of destructive surges, and the condensers are, therefore, suitable for that duty. Their specification is as follows: minimum capacity, 4,000 μF, double type (fig. 1) and 2,000 μF, single type, measured at 50 cycles; the minimum working peak pressure is 12 V d.c., at which the maximum leakage is 10 milliamperes per section; the dimensions of the double type are 5 by 3 by 2 inches. The condensers are of the dry polarised kind, are contained in the usual metal cases, and fitted with insulated terminals. They will operate satisfactorily in tropical as well as in temperate climates.

G.E.C. Products.

As a useful adjunct to the General Electric Co.'s anode batteries, grid-bias batteries are available in 6, 9, and 15-volt sizes, having the unusual feature of terminals in place of the more conventional plug sockets; they are tapped every 1.5 volts.

Users of the "Osram" LS 5A valve who appreciate its reliability and large power output should note a slight change which has been made to its characteristics: originally the maximum anode voltage considered safe at which to operate it was 350 volts, but in order to bring it into line with its companion LS5 and LS5B valves, the actual rating was fixed at 400 volts. Now, with 350 volts on the anode, it is possible with a valve fitted with the LS5A filament to keep the amplification factor (representing permissible grid swing) and impedance low, and actually for some time past the actual amplification factor has been of the order of an average of 2, instead of 2.5 as rated. The tendency to operate at the full 400 volts sometimes resulted in the valve being under-biased in use, and in an excessive wattage dissipation at the anode and loss of emission due to overheating. It was therefore decided to increase the amplification factor slightly to its rated figure of 2.5. The advantages of the modified valve are that it will deliver the same large output in milliamperes required by a valve of this class, with less input in grid voltage to do so; smaller grid bias is required, which enables the valve to work on a more useful part of its curve, reducing the chance of anode-bend rectification resulting from any attempt to restrict the wattage dissipation to the rated figures of 13.5. The main object of a power valve is to provide a large power output (represented by large anode-current fluctuation); it does not necessarily require a large grid swing to do this; in fact, the inception of the pentode stressed the fact that the *smaller* the grid swing required to produce a given power output the more efficient is the valve.

Three-phase 132-kV Transformers.

Brief notes concerning large-capacity high-voltage transformers manufactured by the English Electric Co., Ltd., for the Central Electricity Board's Central Scotland Scheme.

Apart from the primary object of developing the electricity supply industry of this country, the activities of the Central Electricity Board are conferring very great benefits upon British electrical manufacturers by giving them the opportunity to develop electrical apparatus for very high voltages and very great outputs, comparable with the products of foreign manufacturers in point of magnitude. Such developments will undoubtedly lead to the setting up of a whole series of records for products of British manufacture: an example of this kind is shown in the accompanying illustration, which represents, not only the first 132,000-volt, 3-phase transformer to be completed for the national schemes, but also the largest of the type and voltage which has, at the moment, it is claimed, been produced in this country.

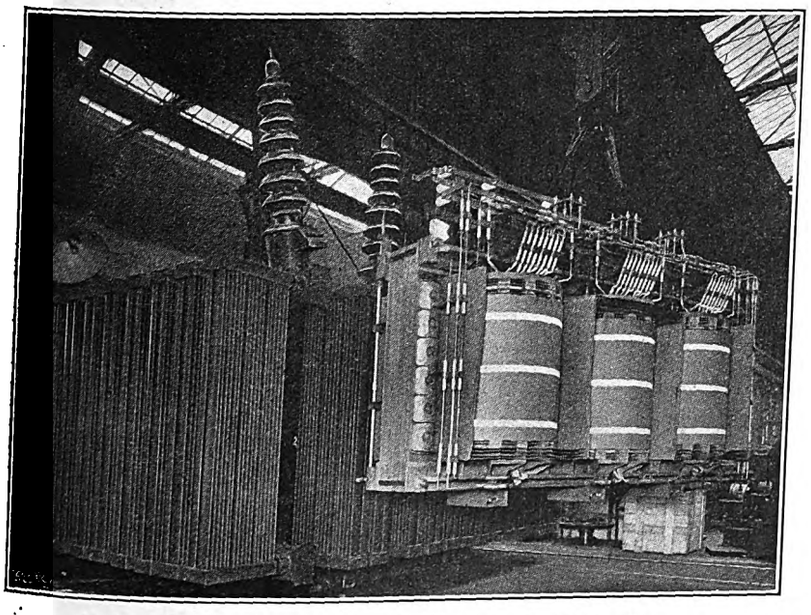

Fig. 1.—A Large 3-phase, 132,000-volt Transformer for the Central Scotland Electricity Scheme.

The English Electric Co., Ltd., has in hand four 15,000-kVA units like the one illustrated, four 10,000-kVA units of a similar type, and four 5,000-kVA units for 33,000 volts. The following description applies particularly to the 132-kV transformers: the high-voltage windings are star-connected with the neutral solidly grounded, and advantage has been taken of this fact to use graded insulation, with considerable resultant economy. The l.v. windings are connected in delta, and to provide a neutral a separate earthing reactor will be installed and used also to give a 440-volt supply for operating auxiliary apparatus. Each transformer is equipped with on-load tap-changing gear to give plus and minus 10 per cent. variation in steps of 1.43 per cent. This gear is mounted directly on the side of the transformer tank, and is motor-operated with remote control.

The "English Electric" scheme of effecting tap-changing under load utilises an auxiliary auto-transformer, with a middle point, to enable the equivalent of twice as many tappings to be obtained as there are actual tappings on the main transformer. The regulating winding is located towards the neutral end of the h.v. winding, which,

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of course, is solidly grounded, but between this winding and the neutral is the reinforced portion of the h.v. winding, which must necessarily be permanently in circuit.

The 15,000-kVA transformers are arranged to operate with a mixed system of cooling developed by the company; up to 75 per cent. of full load they will work with natural cooling, the necessary radiating surface being provided by detachable radiators. To dissipate the increased losses at greater loads, the cooling effect of the radiators is increased by means of a blast of air directed to the radiator tubes from a motor-driven fan equipment forming part of the layout; this auxiliary cooling equipment is brought into operation automatically by means of a relay controlled by the temperature of the transformer winding. In the case of the 10,000-kVA transformers, natural cooling has been adopted for all outputs.

To facilitate the transport of the transformers in their tanks, covered with oil, a valve is fitted to the inlet and outlet connection on the tank for each radiator. This permits the radiators to be detached for transport, or removed at any time should they become damaged.

The transformers themselves are of the five-limb core type, with the windings on the three central limbs, which arrangement leads to a considerable reduction in the overall height of the core, and has the further advantage that the exciting currents in the three phases are much more evenly balanced than is the case with the usual three-core design. The windings themselves are arranged in a double concentric manner, the l.v. winding being placed between the two parts of the h.v. winding, the neutral end of which is adjacent to the core.

The total weight of each unit is approximately 59¼ tons when installed ready for service. It may be added that the particular transformers described above are for installation in connection with the Central Scotland scheme.

Architectural Lighting.

Notes on the modern systems of lighting embodying the "built-in" feature.

By WALDO MAITLAND.

(*Abstract of a Paper read before the* Illuminating Engineering Society.)

To-day, with the modern gasfilled lamp, one is able to place lighting units at any desired position, and to take advantage of this fact in designing the lighting as part of the fabric, imparting important character to the room and influencing its form to a certain degree. Isolated examples of built-in lighting, such as cornice lighting or illumination from skylights, have been designed during the last 10 to 15 years, but it was not until comparatively recently that this movement received general stimulus, subsequent to the Paris Exhibition in 1925, from which the basis of architectural lighting, as we know it at the present day, took form. It is necessary in architectural lighting to have a good basic light, that is an "all over" light of sufficient intensity, after which all other lighting effects may be built up. In some instances the lighting effects are obtained by reflection from opaque surfaces, *i.e.*, indirect lighting, while in other instances the light is obtained through translucent material, providing either semi-indirect or direct illumination. In the former, the effect is achieved by reflection from white or coloured surfaces, while in the latter the quality and colour of the translucent material is important. The indirect method, however, inevitably suffers from the lack of vitality associated with this form of lighting, and, in general, requires supplementary lighting methods to give complete satisfaction.

An interesting effect has been obtained in some instances by lighting the caps of columns, and this method may be applied to provide general lighting in the interior when the columns are sufficiently close together. To be at all successful from an architectural point of view, the columns themselves have to be very carefully designed. The lighting decorations need not be important from an illumination point of view, but may nevertheless be a valuable element in the architectural design; in such cases, however, adequate illumination must be provided from auxiliary sources.

In the first-class dining saloon on the "Ile de France," direct lighting is provided from the ceiling by 164 symmetrically arranged portholes, each housing a 300-W lamp and covered with thick yellow-tinted glass. The strong lines of the room are not in any way detracted from by the lighting system, but are, if anything, emphasised by the repetition of the lighting units, which are well placed in the ceiling and walls. The electrical loading is 5½ W per sq. ft., and the lighting effect is that of brilliant sunlight.

If logical methods of application are evolved there is no reason why the lighting of building exteriors should not become a natural thing in the future. While the main consideration, from a commercial point of view, is obviously that of giving a shop front added power of attraction, there is no reason why the architect cannot obtain both commercial attractiveness and architectural soundness by careful arrangement of lighted surfaces on the façade.

The Galeries Lafayette, Paris, represents a well-known example of marquise lighting, and is interesting from its magnitude and commercial value. The marquise, which is 500 feet long, consists of a strong metallic frame to carry the glass, in the structural design of which great care was taken to permit easy access to the lamps. The construction of such a large marquise presented a difficult problem. Most of the glass in the marquise is ribbed on one face, and designs are made by cutting these ribs in certain parts. Some portions of the glass are left clear, while others are rendered diffusing by sand-blasting or acid-etching, all of which gives variety and relief to the material. The marquise itself requires 800 lamps of 500 W each, while the outer edge, which defines its shape, uses 1,500 lamps of 500 W each. There are in all 2,600 lamps, totalling 625 kW, and when it is borne in mind that the lighting circuits are arranged to give blending of colour it will be readily appreciated that the marquise appears at night time as a colossal jewel. The new marquise of Messrs. Selfridges is perhaps one of the best examples in this country of decorative exterior lighting of this kind.

Simultaneously with the development of modern architectural lighting practice, there has evolved a range of lighting fittings to accord with modern conceptions. One might almost term these fittings as the necessary detail to architectural lighting. The design of the fittings is free and generally simple in character, the form of the fitting predominating. A further characteristic is the fact that there is a predominance of glass, and the tendency to employ a number of small lamps in the place of a few lamps of higher wattage, and frequently the fittings present quite an extensive luminous surface of low intrinsic brilliancy. While the best results are only obtained when these fittings are used to supplement the main architectural lighting, there are many instances where modern interiors are exclusively lighted by such means.

With a view to giving architects and engineers facilities to study these new methods of lighting, the Lighting Service Bureau has inaugurated an architectural department (Electrical Review, March 22nd, 1929, p. 517). This department has already collected much important data on the lighting of public and domestic buildings, and has constructed a new lighting studio where some of the many aspects of architectural lighting are portrayed. In its conception the studio does not represent any particular interior, but is intended to show the effect of light in relation to space and the importance of combining the lighting as an intimate element in the architecture, and to this end various systems of lighting have been incorporated. The room itself is roughly 450 feet square, and is generally finished in pale green, the detail work being picked out in other colours.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Co-ordination of London Passenger Traffic.

Further evidence was heard last week by the Select Committee of the House of Commons which is considering the Bills for the joint control of London's passenger transport services, which are being promoted by the London County Council and the Underground Group.

Sir John M. Gatti was further cross-examined on March 25th. In reply to Mr. R. Harper, K.C., who appeared for the Middlesex County Council, he said that the L.C.C. earnestly desired that all the tramways in the area should be included in the agreement, although special difficulties would have to be met in the case of the Middlesex tramways. Answering the chairman (Sir Henry Cautley), the witness said that it was estimated that in 1929-30 there would be a surplus of £40,000 on the operation of the L.C.C. Tramways; that was due to some extent to economies in expenditure and partly to the restriction of motor-'buses under the 1924 London Traffic Act. If the Bill went through the L.C.C. would insist on the retention of workmen's fares and the benefits resulting from the special facilities would be continued. Although the finances of the L.C.C. Tramways had been satisfactorily stabilised, the situation had to be looked at from the general point of view and not merely from that of the tramways.

On March 26th, in answer to Mr. Stafford Cripps, K.C. (for certain Metropolitan borough councils), Sir John said that if there was sufficient money the Underground companies would get a full return on the whole of their capital. The ranking capital of the L.C.C. Tramways would probably be the difference between the outstanding debt and the net debt—about £4,000,000. The net debt would be a prior charge. Witness agreed that if the tramways became obsolete they would have to be replaced by something else. Sir Lynden Macassey, K.C., interposed to say that the Bill expressly provided that the tramways as such could not be extinguished. Mr. Cripps

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suggested that under the Bill the L.C.C. could guarantee capital for the construction of new tubes, but the chairman considered that no Court would put that construction on it. He suggested, however, that a clause might be inserted guarding against the possibility of the rates being used for this or a similar purpose.

Sir Lynden Macassey, reverting to a previous proposal, said that the promoters were prepared to agree that the formula for fixing the amount of ranking capital and the reasonable return should be subject to the approval of the Minister of Transport.

On March 27th Mr. R. Harker, K.C., said that at the instance of the Society of Motor Manufacturers and Traders, the promoters had agreed to insert a clause preventing them from manufacturing road vehicles, except for their own purposes.

Answering objections of the promoters to proposals of the Minister of Transport, Mr. R. H. Hill, of the Ministry of Transport, said that the duty which the Bills imposed upon the Minister involved matters of considerable public importance. He thought it desirable, therefore, that public authorities should have an opportunity of expressing their views with regard to the return on ranking capital (which involved the question of fares) at a public inquiry.

Re-examined by Mr. Charteris, K.C., Sir John Gatti said that the Bills gave the public for the first time the opportunity of making representations with regard to fares, and they also for the first time provided a limitation on dividends. After hearing further evidence the Committee adjourned until April 16th.

The London County Council (Money) Bill.

This Bill, which authorises the L.C.C. to raise further capital for the extension of tramways, came before the House of Commons for second reading on March 26th.

Mr. Benn and Mr. Gillett pointed out that the Bill was in a measure dependent upon the London Traffic Bill now before Parliament. Mr. Benn asked if the Government intended to take steps to carry that Bill over the Dissolution, or whether it could be regarded as dead.

Mr. Gillett asked if there was any idea what return would be received on the capital which the Council proposed to raise in view of the operation of the agreement with the Underground group.

Sir G. Hume said that unless the House passed this Bill the L.C.C. would be unable to carry out very necessary extensions. The Bill was read a second time.

Special Electricity Orders.

Special Orders have been approved in respect of part of the parish of Piddinghoe, in the rural district of Newhaven, East Sussex; parts of the rural districts of Billericay and Romford, Essex; and the amendment of the Brentwood and District Electricity Special Order, 1923; the rural district of Langport and parts of the rural districts of Bath, Shepton Mallet, and Wells, Somerset; parts of the urban district of Tonbridge, and of the rural districts of Malling and Tonbridge, Kent; and the rural district of Glaslyn, Carnarvon, and the rural district of Dendraeth, Merioneth.

Another Overhead Line Protest.

On March 27th Sir Charles Trevelyan asked the Minister of Transport whether his attention had been drawn to an application which had been made for compulsory powers to place an overhead electric cable across some land on the top of the Downs at Whipsnade, near Dunstable, which had been given to the National Trust as a place from which extensive views could be obtained; and would he give careful consideration to the proposal, and any possible alternative routes, before authorising a line across the property which must materially affect the purpose for which the land was given.

Col. Ashley said he had received an application from the Luton Corporation under Section 22 of the Electricity (Supply) Act, 1919, for wayleaves in respect of an overhead line to which the County Council and the local authorities concerned had given their consent. He had ordered an inquiry to be held on April 8th, at which the objections of the National Trust and other owners of property, to wayleaves across their land would be considered.

Scottish Water Power Bills.

The House of Lords Select Committee reports that the preamble of the West Highland Water Power Bill has not been proved. The Committee is to consider the Grampian Electricity Bill after the Easter recess.

Private Bills.

The Bills promoted by the following companies have been read a third time and passed by the House of Lords:—Yorktown (Camberley) and District Gas and Electricity Co.; South Lancashire Tramway Co. (Trolley Vehicles, &c.); and the Derbyshire and Nottinghamshire Electric Power Co.

The Leamington and Warwick Traction Bill has been read a third time in the House of Commons.

The Easter Recess.

Parliament rose for the Easter Recess on Wednesday, March 27th, and will reassemble on Monday, April 15th, when the Budget will be introduced.

Reviews.

Electrical Transmission and Distribution. Vols. I and II. Edited by R. O. Kapp, B.Sc. Pp. 476; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. each volume.

These are the first two volumes of a comprehensive treatise on electrical transmission and distribution, now in preparation by a number of well-known specialists under the editorship of Mr. R. O. Kapp. Vol. I opens with an introduction by the editor, in which the importance of the general subject matter of the whole work is explained. The remainder of this volume deals with the construction and maintenance of overhead lines. The first section is contributed by Mr. J. L. Eve, A.M.I.E.E., and deals in detail with the principles underlying the design of overhead lines, and with the properties of the materials used in their construction. Modern practice in this field is fully described, and much useful numerical data is given in tabular and graphical form. The second section by the same author deals with the erection of overhead lines, and is of an essentially practical character. This section will be of considerable use to distribution engineers whose experience has so far been confined to underground cable systems, but who have now to concern themselves with the installation and upkeep of overhead systems. The third chapter, dealing with maintenance, is by Mr. H. S. Selves, the outside superintendent of the North Metropolitan Electric Power Supply Co.; like the one preceding it, is thoroughly practical, and deals not only with the details of repair work, but also with routine inspection by patrols, with routine and emergency switching, and with the important subject of painting. This section is particularly useful as, unlike the others, it contains much that is not found in the existing books on overhead line construction. The last section of this volume is from the pen of Mr. Borlase Matthews, and is entitled "Distribution in Rural Areas." Whilst being interesting reading, it is sketchy in character, and seems hardly on a level, in respect of permanent utility, with the rest of the volume.

Volume II is concerned with the subject of the manufacture, installation, and maintenance of power cables. Cable manufacture is admirably dealt with in the first section by Mr. A. P. Pyne, and the various processes are clearly described, and illustrated in a way which will render this section of particular use to the junior engineer, to whom an acquaintance with manufacturing processes will be very helpful. Cable laying methods are dealt with in the next section by Dr. Norman A. Allen. This section is of a very practical and useful character, and explains clearly the principles underlying the best practice in the laying of underground cables, and describes the details of this work. The portion of the section dealing with jointing accessories is very meagre, and might with advantage have been considerably expanded. The third section of this volume, also by Dr. Allen, deals with the testing and maintenance of underground cables, and, in addition to much useful information on the subject of testing and fault localisation, has an interesting chapter on the corrosion of the sheaths of lead-covered cables. The author outlines the methods which may be adopted for the mitigation of corrosion troubles, and he describes the tests which show the extent to which this trouble may be anticipated. Fig. 8 on p. 421 will be very misleading to those who have had no experience of testing work of this kind, as it implies that the potential differences between the sheath of the cable and earth in areas in which electric tramways are operating are of a steady character. These potentials are, of course, usually so fluctuating that it would be very difficult to plot a curve of the kind referred to.

The concluding section of this volume, by "Mains Engineer," deals with the subjects of records, costing, and routine tests which are carried out in a mains department. This section contains a good deal of useful and suggestive matter, but it is a little regrettable that so small a space is devoted to the matter of maps and sketches for recording the position of buried cables and joints.

These two volumes are deserving of considerable praise. The fact that they are not altogether homogeneous in character is only to be expected when a work is prepared by the collaboration of a number of contributors, however skilful may be the editing. The subjects whose treatment is really perfunctory are however really few in number, and the matter is generally practical and comprehensive. Both these volumes can be recommended, and, together with Vols. III and IV, reviewed in our last issue, are a very valuable treatise on transmission and distribution.

Electricity Applied to Mining. By H. Cotton, M.B.E., M.Sc., A.M.I.E.E. Pp. xi+625; figs. 359. London: Sir Isaac Pitman & Sons, Ltd. Price 35s. net.

There is perhaps no branch of engineering which has problems so varied and distinct as that of electricity applied to mining. Every mode of generation, transmission and utilisation is employed following, as far as the surface equipment is concerned, the best general practice, but, especially below ground, controlled by the Coal Mines Act, 1911, with the rules and regulations made to comply with it.

Within the last twenty-five years mining electrical engineering has advanced nearly to the status of a separate profession,

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the approach to which may be by apprenticeship and training at an electrical engineering works followed by experience of mining conditions, or by apprenticeship in a colliery undertaking. For the purpose of training students there are excellent text books dealing with first principles, one of them by the author, but for the detailed information required in the consideration of any new scheme there has not been hitherto a specific work of reference. This lack Mr. Cotton's book will go a long way to supply. It deals on broad lines with the general question of power supply, with the generation of electrical energy in power stations including analyses of costs. Power station control and transmission and distribution in general as distinct from special mining applications are very fully considered. These together occupy the first third of the book; the remainder deals with the electric drive of fans and air compressors, pumps, haulage, winding, coal cutting and conveyors, underground lighting, and finally flame-proof apparatus. The information given is full and accurate within the scope of the book, but in the present state of the subject a separate volume might well be written on specific mining problems alone from the point of view of a concern taking power from a public supply scheme.

The matter is presented clearly and systematically, as, for example, in the chapter on electric winders, but the subject is too wide for everything to be included. Electric signalling is not mentioned. A chapter on the rules for the installation of electricity in mines, with reasons for them, would be welcomed. A fuller account of coal-cutting machinery might have been given, and that on trailing cables extended. Examples of electricians' logs and notes on the range and nature of the systematic tests on which the management of a great colliery undertaking relies for prevention of breakdown might also have been given. Fuller references to books or journals containing special articles cognate to the various chapters, and in particular a more extended index would have been an improvement.

The point of view taken by the author is rather that of the installation of machinery or apparatus, than its operation or maintenance. The chapters on ventilating fans, pumps, haulage and winding are very good indeed, and occupy more than half the book. The advertisement on the cover states: "It will form an indispensable work of reference for every mining electrical engineer, and will also be extremely valuable to those responsible for the efficient operation of mining plant." With this we entirely concur. When the second edition is called for it might well be in two volumes. A mass of valuable material for a work of reference on electricity in mining, is to be found in the pages of the "Mining Electrical Engineer," itself a mine of information not yet worked, much of it original; we commend this to the author's attention.

Handbook of Procedure and Evidence in Arbitrations. By W. T. Creswell. Pp. xvii+167. London: Institute of Arbitrators. Price 6s. net.

To write a legal text-book for the layman is always a task of some difficulty for a practised lawyer, and doubtless Mr. Cresswell in this useful and concise little book has not been free from the difficulty of expressing in terms to be appreciated by the non-legal reader the provisions of an important but complex branch of the law. Perhaps a longer introduction, giving some outline of the purpose and method of the Arbitration Act, of the causes which led up to its introduction, and making a clearer distinction between a suit in the Courts and a submission to arbitration, might have rendered this book of even greater help to the layman.

Fortunately, however, there is no great fear that because of this the book will fail in its purpose; for it will undoubtedly be read mainly by those who are already in some measure acquainted with the practice of arbitrations. And for such persons it will be of great assistance. The lay arbitrator—the technical expert who is called upon to adjudicate upon a technical matter in the legal form of a reference to arbitration—will find the chapters on evidence and procedure at the hearing of invaluable assistance. Mr. Cresswell treats of these important subjects in a manner which is unusually exhaustive in a work of this size, and, indeed, it might be suggested with confidence that no other work of the same size on this subject of arbitrations provides so much information which will prove of the greatest assistance to the arbitrator in the course of the hearing.

Such information is of course most necessary to the lay-arbitrator. Points of law, details of the mode of presenting the award, and the rules as to the alteration and enforcement of a submission are points which each arbitrator can look up at his leisure between or before the sittings of the tribunal. But the rules of evidence must be applied forthwith as and when the moment for their use arises, and it can confidently be stated that the arbitrator who reads this work will be prevented from making serious blunders, and will be guided on the right lines.

The book is packed with matter. Everything is there which the ordinary arbitrator may require. Besides this the work contains information on numerous matters which will prove of use to intending parties to arbitration, particularly the chapter on costs—always an important feature in litigation of any kind.

The work does not claim to be an exhaustive treatise on the subject, but it is to be recommended as a handbook for ready reference and as a useful aid in the preliminary stages of looking up a complicated and abstruse point. As every practising lawyer knows, it is often from the small and elementary works that one obtains the vision of the broad principles, their adaption in detail being obtained from the heavier works afterwards. It is not suggested that Mr. Cresswell's work is elementary, but it is submitted that its brevity will assist the layman and the lawyer to grasp an outline of the law, where a larger work would only confuse.

The Council of the Institute of Arbitrators has done well in causing such a necessary work to be compiled, and there is no doubt that the work will succeed in its purpose. It is a book which should be on the shelves of every technical expert who may find himself called upon to act as arbitrator, and intending litigants will find the work not without interest.

Legal.

Cooper Roller Bearings Co., Ltd., v. Power Plant Co., Ltd.

Mr. Justice Talbot, in the King's Bench Division on March 27th, concluded the hearing of a very protracted case, which had lasted nearly a month, concerning the merits of certain friction clutches which were used in connection with electrically-driven machinery. The plaintiffs sued the defendants for £833 in respect of the price of goods sold and delivered and for work done. The question in dispute was whether certain friction clutches supplied by the plaintiffs for use in connection with the machinery at rolling and other mills were in accordance with contract or not. Plaintiffs supplied and installed the clutches at the order of the defendants, and they said they afterwards maintained the plant at the request of the defendants. It was for this work which they claimed.

The defendants contended that the clutches were unsuitable for the purpose for which they were required and that plaintiffs had committed breaches of contract and warranty. They alleged that they had been put to considerable expense in consequence of the plaintiffs' breaches and they counterclaimed £1,500.

The main allegation of the defendants was that though they gave the plaintiffs all the information for which they asked so as to enable them to design and supply suitable clutches, the clutches actually supplied were too small, and as a result a good deal of trouble was caused when the mills at which they were installed were being started up. The clutches overheated, the plates cracked and broke, and in many cases it was found very difficult to start up at all.

The reply of the plaintiffs was that, while admitting there had been a good deal of trouble at some works, it was entirely due to the lack of adequate electric power supply. The result was that when attempts were made to start up, especially on Monday mornings, the clutches could not get the mills away without slipping for an abnormal length of time. This long period of slipping generated the heat which caused the plates to fail.

A considerable body of evidence was called on either side. Plaintiffs' witnesses concluded that there was a lack of power and defendants' witnesses were equally confident that the power supply was ample.

At the conclusion of the evidence Mr. Justice Talbot reserved judgment.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Words of Wisdom.

I submit the following extracts from Dr. S. Z. de Ferranti's address at a recent gathering for the special benefit of those of your contributors who frequently tell us what electricity will not do, who wax eloquent about the dangers of peak loads, and remind us of the useless efforts made to compete with gas for domestic purposes.

To those persons I would say, after twenty-five years' experience with a supply authority, that on the advent of the metallic-filament lamp, gas ceased to be a competitor for lighting; for over twenty years it has never been a competitor for power, and if it were not for the fact that gas service was already in a large majority of dwellings it would not compete with electricity for domestic purposes.

Now for the spoken wisdom of a great man:—

"There are three classes of service"—

(a) "Those in which there is no competition."

(b) "Those in which a definite supremacy has been obtained."

(c) "Those in which competition has to be met and fought."

"Whenever a service can be performed electrically, it is better done in that way than by any other means."

"People have been too apt to compare the number of heat units in a B.O.T. unit of electricity with the number of heat units in a given quantity of coal, or other fuel."

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"The attractive feature of electricity is that it makes ideas and ideals possible."

"Electric heating and heating by any other means are not comparable."

"Combustion is a most difficult problem."

As a little comfort to the maximum-demand and peak-load "fans," I submit the following:—

"I am old and have had many troubles, most of which have never happened."

Recedam.

March 27th, 1929.

Morganite Radiators.

We were much interested to read the note entitled "Small Chapel Heating Installation" which appeared on page 481 of your issue of March 15th, as illustrating a method of employing electric heating in cases where no space is available for the usual floor-fixture radiators. The system described resembles in principle the common method of air heating by means of hot-water pipes laid in covered trenches, but in this case the heating effect is rather more localised.

It may interest your readers to know that halls presenting the same difficulties for floor-fixture heaters can be satisfactorily heated by radiators working on the principle of the "Morganite" radiator system. For this purpose radiators, consisting essentially of an electrically-heated earthenware plate 25 in. by 13 in., or smaller, are mounted at an angle on the walls, pillars, or ceilings, of side aisles and from such elevated positions they throw out a gentle radiant heat over a wide area.

The advantages of radiant heat over air heating are manifold, and are now well recognised by heating engineers. Apart from the more pleasant nature of the warmth, which is akin to sun heating, the sensible heating effect is more quickly felt than when warm air is used as the indirect medium for the transfer of heat from its source to the occupants of a building. This effects economy in energy consumption and enables a comfortable warmth to be obtained in a shorter space of time.

The Morgan Crucible Co., Ltd.

Chas. W. Spiers, *Director.*

London, March 26th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

22,764. "Quenching of sparks in spark-gaps of electrical switches and the like." S. Ruppel. August 30th, 1927. (307,311.)

23,291. "Telegraph systems." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks (deceased)) (Western Union Telegraph Co.). September 5th, 1927. (307,405.)

23,437. "Electromagnetic couplings." O. Fulton. September 6th, 1927. (Patent of addition not granted.) (307,365.)

26,679. "Electronic-discharge devices." Manhattan Electrical Supply Co., (Inc.). October 8th, 1926. (278,751.)

26,795. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd., and T. H. Kinman. October 10th, 1927. (307,519.)

29,294. "Automatic or semi automatic telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin and L. Polinkowsky). November 2nd, 1927. (307,368.)

29,295. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin, L. Polinkowsky, G. E. Stevens, C. de Vriendt, and G. Liebkind). November 2nd, 1927. (307,369.)

29,633. "Electric motors for rotating cans or boxes for spinning or otherwise treating artificial silk or other fibres." F. Newton. November 5th, 1927. (Cognate application 17,128, 1928.) (307,523.)

29,663. "Telephone receiving and transmitting apparatus." T. G. Allen. November 5th, 1927. (307,317.)

31,845. "Transmission of signals in printing telegraphy employing for transmission voice-frequency or high-frequency alternating currents." G. T. Evans. November 26th, 1927. (307,318.)

32,520. "Repeaters for telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. December 2nd, 1927. (307,370.)

32,592. "Loud-speakers." Ideal Werke Akt. Ges für Drahtlose Telephonie. July 6th, 1927. (293,414.)

32,746. "Control of electric motors." General Electric Co., Ltd., and M. Kahn. December 5th, 1927. (307,322.)

32,769. "Electric protective systems." A. Reyrolle & Co., Ltd., and E. W. M. Scott. December 5th, 1927. (307,323.)

32,812. "X-ray tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). December 5th, 1927. (307,377.)

32,841. "Circuit arrangement for automatic telephone exchanges." F. Merk. December 4th, 1926. (281,725.)

32,857. "Thermionic devices." Graham Amplion, Ltd., and P. Freedman. December 5th, 1927. (307,325.)

32,858. "Thermionic devices." Graham Amplion, Ltd., and P. Freedman. December 5th, 1927. (307,326.)

32,859. "Thermionic devices." Graham Amplion, Ltd., and P. Freedman. December 5th, 1927. (307,378.)

32,860. "Thermionic devices." Graham Amplion, Ltd., and P. Freedman. December 5th, 1927. (307,327.)

32,918. "Electrical remote-control systems." A. Reyrolle & Co., Ltd., B. H. Leeson, and O. C. F. King. December 6th, 1927. (307,379.)

32,927. "Selective indicating mechanism." A. Reyrolle & Co., Ltd., B. H. Leeson, and O. C. F. King. December 6th, 1927. (307,381.)

32,931. "Selective indicating mechanism." A. Reyrolle & Co., Ltd., B. H. Leeson, and O. C. F. King. December 6th, 1927. (307,383.)

32,933. "Electrical remote-control systems." A. Reyrolle & Co., Ltd., B. H. Leeson, and O. C. F. King. December 6th, 1927. (307,384.)

32,934. "Electric switches suitable for use in controlling the transmission of signalling or operating currents in an electrical remote-control system." A. Reyrolle & Co., Ltd., and O. C. F. King. December 6th, 1927. (307,385.)

32,946. "Electrical remote-control systems or the like." General Electric Co., Ltd., and H. C. Hannam-Clark. December 6th, 1927. (307,443.)

32,968. "Auxiliary lighting of railway and like vehicles." J. Stone and Co., Ltd., and A. H. Darker. December 6th, 1927. (307,386.)

33,016. "Electric luminous tubes." Naamlooze Vennootschap International Octrooibureau. December 10th, 1926. (282,064.)

33,053. "Mounting of switch fuses and similar units or accessories in boxes, cases, or containers." J. A. Crabtree and F. Painter. December 7th, 1927. (307,411.)

33,063. "Devices for the production of ultra-violet radiation." Naamlooze Vennootschap International Octrooibureau. February 11th, 1927. (285,068.)

33,164. "Aerial systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). December 7th, 1927. (307,446.)

33,282. "Conical diaphragms for sound-reproducing and like devices." W. E. Clifton. December 8th, 1927. (Cognate application 1,253/28.) (307,450.)

33,285. "Electrolytic cells." W. E. Kershaw and J. L. Woodbridge. December 8th, 1927. (307,452.)

33,366. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. S. Vick, and G. D. Turton. December 9th, 1927. (307,537.)

33,368. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. December 9th, 1927. (307,538.)

33,382. "Means for controlling the intensity of a beam of light in accordance with electrical variations for use, for example, in recording sounds." A. Whitaker, C. O. Browne, and Gramophone Co., Ltd. December 9th, 1927. (307,539.)

33,472. "Manufacture of lead antimony alloys for use in sheathing electric cables and the like." Standard Telephones and Cables, Ltd. (Matériel Téléphonique). December 10th, 1927. (307,543.)

33,473. "Thermionic amplifiers." W. S. Smith and N. W. McLachlan. December 10th, 1927. (307,544.)

33,474. "Means for controlling the intensity of a beam of light in accordance with electrical oscillations, for use, for example, in recording sound." A. Whitaker, M. B. Manifold, and Gramophone Co., Ltd. December 10th, 1927. (307,545.)

33,892. "Electric trolley heads." A. Avtsine. December 14th, 1927. (307,552.)

33,960. "Time switch for incandescent electric lights." E. Pye and S. J. Heale. December 15th, 1927. (307,554.)

34,060. "Thermionic valve holders." Ashley Wireless Telephone Co. (1925), Ltd., and W. A. Brooke. December 16th, 1927. (307,555.)

34,070. "Electric switches and other electrical devices." J. A. Crabtree. December 16th, 1927. (307,556.)

34,355. "Telephone system." A. G. Hasler Vorm. Teleraphenwerks tätte Von G. Hasler. July 26th, 1927. (294,562.)

34,363. "Thermionic valves." A. H. Midgley. December 19th, 1927. (307,558.)

34,781. "Socket contacts and the mounting of the same for use with switchgear or other electrical apparatus." British Thomson-Houston Co., Ltd., and H. C. Heath. December 22nd, 1927. (307,562.)

1928.

104. "Process for preventing explosive gas mixtures from being formed in the casings of electrical apparatus enclosed in an insulating medium." M. Buchholz. January 2nd, 1928. (307,570.)

196. "Insulating material." Elektra-Lack-Werke Ges. System Dr. Kronstein. July 2nd, 1927. (293,293.)

480. "Ignition devices for internal-combustion engines." British Thomson-Houston Co., Ltd., and L. M. T. Bell. January 6th, 1928. (307,572.)

1,977. "Electric switches." A. C. Wynne. January 21st, 1928. (307,584.)

2,015. "Production of coherent deposits of organic substances from aqueous dispersions thereof by electrodeposition." Anode Rubber Co., Ltd. (S. E. Sheppard and C. L. Beal). January 21st, 1928. (307,585.)

2,907. "Systems of electric distribution." British Thomson-Houston Co., Ltd. February 1st, 1927. (284,624.)

3,825. "Speed-control systems for alternating-current induction motors." British Thomson-Houston Co., Ltd. February 17th, 1927. (285,455.)

4,245. "Direction indicators or the like for motor vehicles." British Thomson-Houston Co., Ltd., and F. E. Smith. February 10th, 1928. (307,599.)

5,588. "Electric switchgear." General Electric Co., Ltd., and P. H. Coales. February 22nd 1928. (307,611.)

6,035. "Electric cables." C. J. Beaver and W. T. Glover & Co., Ltd. February 27th, 1928. (307,617.)

6,082. "Method and means for pasting battery plates." F. B. Dehn (Vesta Battery Corporation). February 27th, 1928. (307,618.)

7,546. "Formers for electrical heating elements." Walker, Hunter and Co., Ltd., and J. Walker. March 12th, 1928. (307,629.)

8,102. "Circuit arrangement for telephone installations with selector working." Siemens & Halske Akt. Ges. September 17th, 1927. (297,312.)

8,479. "Elevators." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks (deceased) (Shur-loc Elevator Safety Corporation). March 20th, 1928. (307,637.)

9,052. "Protective panels for the motors of electric cranes and the like." W. Rea and E. Holme & Co., Ltd. March 26th, 1928. (307,640.)

9,256. "Driving system for electric induction meters." Landis & Gyr Soc. Anon. April 25th, 1927. (Addition to 249,074.) (289,374.)

10,398. "Lead-through insulators." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). April 5th, 1928. (307,647.)

10,941. "Method of and apparatus for electric resistance welding." A. F. Burgess (J. H. Gravell). April 13th, 1928. (307,648.)

11,401. "Electrical conductors." J. McCallum. April 18th, 1928. (307,651.)

11,631. "Electric contacts, particularly for electrically-actuated clock-work." Etablissements E. Jaeger. May 31st, 1927. (291,373.)

12,641. "Cutters for electric fuses." British Thomson-Houston Co., Ltd. May 2nd, 1927. (289,809.)

13,423. "Electrodynamic braking apparatus for use in electric vehicles." G. Somajni. May 7th, 1927. (290,176.)

14,758. "Electric braking systems." International General Electric Co., Inc. May 19th, 1927. (290,678.)

14,905. "Contact pins for electric plugs." G. Maag-Eckenfelder. June 27th, 1927. (292,945.)

15,931. "Circuit arrangements suitable for biassing electrostatic loud-speakers." E. Reisz. November 10th, 1927. (300,252.)

17,019. "Electric motor control systems." W. E. Date. June 29th, 1927. (292,996.)

17,406. "Electric welding." F. Dworzak. October 12th, 1927. (298,598.)

17,725. "Circuit connection for direct-current electric machines with two shunt windings." Siemens-Schuckertwerke Akt. Ges. June 21st, 1927. (292,537.)

17,755. "Method and construction of non-glare headlights." J. Roche. June 19th, 1928. (307,671.)

18,049. "Ionic valve with two anodes and two grids." Soc. des Etablissements Industriels de E. et de A. Grammont. August 10th, 1927. (Addition to 288,965.) (295,351.)

18,161. "Fastenings for cables, and casings." General Electric Co., Ltd., and H. W. Cron. June 22nd, 1928. (307,673.)

20,637. "Soldering of conductors to small electric batteries." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks (deceased)), Batterien- und Elemente-Fabrik System Zeller Akt. Ges. July 16th, 1928. (307,684.)

21,268. "Circuit arrangement for automatic telephone exchanges." F. Merk. December 5th, 1927. (Divided application on 281,725.) (Addition to 281,725.) (307,389.)

33,381. "Electrical insulating materials." W. S. Smith, H. J. Garnett, and H. C. Channon. September 2nd, 1927. (Divided application on 307,087.) (307,390.)

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Housing scheme (264), Ruthrieston; city engineer. New city square for Corporation; A. B. Gardner, architect to the Town Council.

ADWICK-LE-STREET (Yorks.).—School (£9,000), for the Roman Catholic managers; Rev. Father Donkers.

AMERSHAM.—Grammar school extensions, for Bucks. E.C.; C. G. Watkins, secretary, Aylesbury (returnable deposit of £2 2s.).

BEXHILL.—40 houses, Burnt House Farm; borough engineer. Development Southlands Park Estate for H. W. T. Fogden; Callow & Callow, architects. 150 houses, Gunters Lane; Bexhill Provident Building Association, Ltd.

BIRMINGHAM.—Cinema, Birchfield Road and Thornbury Road, Perry Barr; J. Colton, estate agent, New Street. Cinema, College Road, Perry Common; for E. Garfield. Housing scheme (£5,000); Warren Farm Estate; for Corporation. Dance hall, Walford Road, Sparkbrook; for Wm. K. Anderson. Extension of wholesale fruit and vegetable market; markets superintendent. Fire station, near Soho Road, Handsworth (£23,000); city engineer.

BOGNOR.—Hotel, Marine Park Estate (£150,000), for a syndicate; particulars from H. P. Brazier, vendor of the site.

BOLTON.—Development housing estates at Heathfield, Crumpsall and Castle Hill; borough engineer. Alterations, Palladium Cinema, Higher Bridge Street; Associated British Cinemas, Ltd. 62 houses, Snow Hill Estate; borough engineer.

BRIGHTON.—Rebuilding 94-101, London Road; Brighton Equitable Co-operative Society, Ltd. Development, Withdean Hall Estate; Messrs. Abbeys. Infants' school, Hertford Road (£13,786); Education Committee. Extensions, Pavilion Museum; borough engineer.

BRISTOL.—Houses on Fishponds Estate; Bissicks & Fletcher (60), A. W. Norris (42). Houses on Horfield Estate; E. Walters & Son (118), J. Pugsley & Son (74), E. A. W. Poole & Son (42), G. F. Bryant & Son (38), and E. Howell (30).

BURNHAM (Essex).—Premises, Marine Parade Estate, for Cranfield & Carter, sail makers, and the Crouch Engineering Co.

CARSHALTON.—Houses (48), Sunnymede Avenue, for A. E. Wilkinson, Ltd.

CHATHAM.—School, Palmerston Road (250 places), for the Borough E.C.; E. B. Lee, clerk.

CHELMSFORD.—48 houses, Boarded Barns Estate; G. J. Hawkes & Son.

COVENTRY.—Proposed St. Barnabas Church; rural dean. Proposed St. Mary Magdalene Church; rural dean. Extensions, Stoke School (£15,840); Education Committee.

CROYDON.—Alterations and additions, 11-31, North End; J. T. Evans & Sons.

DEVIZES.—Electric light installation, 42 houses, for the R.D.C.; clerk.

DUMFRIES.—Nine blocks of houses, for the T.C.; John Barker, burgh surveyor.

DUNDEE.—Alterations and additions at Dundee West Station, for L.M.S. Railway Co.; the engineer, Buchanan Street, Glasgow.

EDINBURGH.—Conversion of mansion house into child welfare centre for Corporation (£90,000); city architect. Hospital, Farmilehead (£75,000), for the Hospital for Crippled Children; secretary. Extension of workshops, Gas Department (£8,000); gas engineer.

FALKIRK.—Alterations and additions for Messrs. F. Woolworth & Co., Ltd., Victory House, Kingsway, London; the manager.

FARNWORTH.—Housing scheme (72) (deposit £2); F. Ashton, surveyor, Town Hall.

GALASHIELS.—Cottage Hospital extensions (operating theatre and X-ray room) (£4,000); Rev. W. S. Matheson, chairman of managers.

GUILDFORD.—Cinema, Worpleston Road; Crow, Bates and Weekes. Arcade, High Street and North Street; W. J. King, architect, 5, Great James Street, London, W.C.

HERNE BAY.—Alterations, Council offices; Hammond & Co. (Canterbury), Ltd. Development, Cherry Gardens Estate; U.D.C. surveyor.

HERTFORD.—Branch stores, Bengeo, for Enfield Highway Co-operative Society; secretary.

HUGGLESCOTE.—Re-erection of motor works, for Samuel Green.

IRISH FREE STATE (Limerick).—Church at St. Mary's; Ashlin & Coleman, architects, 7, Dawson Street, Dublin.

KINGSTON-ON-THAMES.—Extensions, Victoria Hospital (£13,000); John W. Spink, architect.

LEICESTER.—Education buildings (£52,000); G. Nott. Waterworks (£40,000); Henry Herbert & Sons for buildings, and Bell Bros. for plant.

LONDON (Bethnal Green, E.).—Tenements, Pedley Street (£15,500); borough engineer.

(Hackney, E.).—Tenements, Shore Estate (£18,300); L.C.C. architect.

(Catford, S.E.).—Development, Bellingham Farm Estate: J. Everington, for Forster Estate Development Co.

(Greenwich, S.E.).—Houses (79), Charlton Park Estate, for the T.C.; Corolite Construction, Ltd., builders, Henrietta Street, Covent Garden.

(Lewisham, S.E.).—36 shops, Bromley, and 11 in Downham Way; A. Frampton. Factory, Gladiator Street; Rice and Son, Ltd.

(Southwark, S.E.).—Town Hall; Special Committee, Borough Council.

(Walworth, S.E.).—Tenements for 900, Hard Street; Hartnoll trustees.

(Wimbledon, S.W.).—Workshop and store, Wellington Road; Burton Holt (Chelsea), Ltd.

MANCHESTER.—Year's school programme (£570,000); Education Committee. Library, Wilbraham Road; city architect.

MARLOW.—Handicraft and cookery centre, for Bucks E.C.; C. G. Watkins, secretary, Aylesbury (returnable deposit of £2 2s.).

MIDDLEWICH.—Housing scheme (56), for the U.D.C.; F. W. Stocks, surveyor (returnable deposit of £2 2s.).

MILMOOR.—Alterations and additions to the Working Men's Club premises, Dale Street (deposit (£2 2s.); J. Hayhurst, architect, 32, Richmond Terrace, Blackburn.

MORECAMBE.—Estate scheme, Torrisholme; Edmondson Bros., Ltd.

NEWBURY.—Pumping station, Cold Ash; water engineer.

NORTHWICH.—Housing scheme (24), Church Walk, for the U.D.C.; John Brooke, engineer (returnable deposit of £2 2s.).

PERTH.—Corporation housing scheme (£32,000); burgh surveyor.

PLYMOUTH.—Housing programme (1,300) at estates; borough engineer.

PRESTON.—Schools (400 places), Ducie Avenue, for the managers of St. Joseph's Schools. School, Ribbleton Avenue, for the Borough E.C.; director of education.

RIPPONDEN (Halifax).—Re-erection of Chapelfield Mill, for the Ryburn Mill Co., Ltd. (£50,000).

ROMFORD.—Extensions, London Road Schools, for Essex E.C.; J. Stuart, county architect, Chelmsford (returnable deposit of £1 1s.).

ROMSEY (Hants.).—Cinema, Prince's Road; particulars from Scammell & Smith, estate agents, Portswood Road, Southampton.

ST. COLUMB (Cornwall).—Housing scheme (26), for the R.D.C.; surveyor.

SALFORD.—Housing scheme (76), Pendleton, for the T.C.; borough surveyor.

SEAHAM HARBOUR.—Extensions, Council offices; U.D.C. surveyor. 124 houses, Carr House Estate; U.D.C. surveyor.

SEVENOAKS.—Additional housing scheme (68), for the R.D.C.; surveyor.

STIFFORD (Essex).—Houses (44), Nutberry Estate, for F. C. Stark.

STIRLING.—Housing scheme (16), with electrical work, for the T.C.; A. H. Goudie, borough engineer (returnable deposit of £1).

TIPTON.—Houses (168), for the U.D.C. by direct labour; surveyor.

TYNEMOUTH.—Extensions, Masonic Hall, Norfolk Street, for St. George's Lodge; W. Stockdale, architect.

WEDNESFIELD.—Housing scheme (98), near Amos Lane (deposit £2 2s.); A. H. Lawrence, architect, Council Offices.

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The

Electrical Review

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Export Trading.

POLITICIANS are busily engaged describing their suddenly discovered magical means for rapidly reducing unemployment. We have discussed the subject seriously and conscientiously on so many occasions that we prefer to refrain at the moment from a controversy which has been brought down to a vote-catching level. We still attach greater importance to the improvement of British trade, by sound and legitimate means than to these other "forced growth" proposals, as the means for providing work for our great army of unemployed.

Yet we have to confess that in the discussion of trade expansion measures we are getting rather tired of the use that is being made of "that blessed word" "Salesmanship." Everybody seems to know all about it excepting the manufacturers themselves who are engaged on the job! That they are saying nothing seems significant! As we have remarked again and again it is all old, so very very old, for our manufacturers and traders to be told that they don't know their business. We told them so ourselves many years ago, knowing so much better then than we do now! We quoted visitors from overseas markets, consuls, commercial attachés and trade commissioners, regarding our failure to meet the needs of potential customers in foreign markets; declared that we were beaten by the German who found his way into the buyer's household, married the favourite daughter, and so established a lasting trade connection with a big concern in South America; told them that the foreign-made little article with a pretty red label was also beating us hollow because of our British-made habit of offering a plain-looking good quality thing without the little bit of paint that made the natives dance with delight in that very desirable market in Central Africa, or China, or somewhere else overseas. As to the need of our youths all learning foreign languages and obtaining other qualifications for overseas travelling, our set of ELECTRICAL REVIEW volumes as they face us as we write, make the shelves creak through their eagerness to alight flinging open their pages to point out here and there—in scores of places: "So long ago, we told you so!" There were, as we knew, some of an earlier generation who profited by the advice then given. But of what service is it to

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remember such things and to remind our readers of them to-day! Possibly very little, yet the times have changed, the markets have changed, new and stronger foreign competitors have entered the field, and above all, new generations have arisen who need to be taught practically the same old lessons. That, at any rate, is how it strikes us as we read or listen to the advice of those in leading positions to-day. Frankly, what new things have they to tell us so that the world may be overrun by high-class electrical men who have the judgment to recognise good business and the alertness and authority to seize the opportunity? We suppose it is little short of natural that it should strike many of us as strange that British traders alone are still at the bottom of the class in selling efficiency; may it not be partly due to that stupid habit of self-depreciation?

When criticisms are levelled haphazard it may be forgotten, or not even known, that in, say, the electrical world, splendid foreign trade enterprise and organisation mark the operations of certain big concerns, and they don't want to be told much about salesmanship overseas, for they've got the men, they've got the goods, and got the money too—this last allusion being to their ability to finance big operations. Such concerns with specialised properly qualified salesmen may well take exception to the tendered advice that principals ought to go abroad, because they can already afford to pay good men and arm them with authority for action. Some of the companies that are now regarded as small, by comparison, but a few years ago would have been counted big, could a glorious tale unfold of trading enterprise abroad if they did not fear to blush or to give away their secrets; they have either gone, in the person of their head, if they have had a good second to leave, or perhaps a partner or a director has made the tour—but every business must decide for itself whether "the head" or other important man can do better abroad than at home. After all, there are important duties requiring that the head or heads shall be at home, especially in these days. The body of manufacturers who have either gone or have sent delegates to Russia recently have found no difficulty in settling that question. Possibly some manufacturers have not attended to foreign trade affairs quite so energetically as they would have done if they had relied less upon a belief that they could gain benefit from the concerted action of central organised associations. We have heard of manufacturers who expect no good to come from such sources at present, and are convinced from experience of the greater benefit that has come from the exercise of personal initiative or individual enterprise; but there is ample room for concerted co-operative action of smaller concerns suitably grouped and thus able to bear the cost.

The changes that are taking place among electrical men on the "road" at home are releasing experienced salesmen who might do good service overseas if other firms cared to give them the chance.

The head of a well-known engineering company recently advanced a proposal for the Government to provide half-a-million sterling to advertise British goods overseas. It is hardly surprising that the suggestion has fallen flat. Suppose that the Government had favoured the idea and wanted to control the spending of the money! Is it better qualified than the private trader to decide the most appropriate place and form for his advertisement, or to choose the most suitable business-getting trade papers, circulating to the right men overseas? We emphatically say "No!" A more appropriate thing for the Government to do would be to make generous allocations for increasing the efficiency and usefulness of the Department of Overseas Trade, not instead of private effort, but supplementary thereto. It might well be reorganised with the addition of a definite electrical and engineering staff of experts who can visit the various overseas markets for the preparation of expressly electrical and expressly engineering reports which the industry at home can use in connection with its expansion efforts. We have no wish to detract from the importance of the service rendered by some officials, but we certainly believe that if the Department were to send a few real live and energetic electrical and engineering men about the world, either supplementing, or co-operating with, the work of Trade Commissioners, more genuine and business-getting help would be rendered than is obtained from the peripatetic wanderings of officials at home telling us things that we have been told a thousand times before.

Labour Conditions in France.

But for the topsy turvydom which appears to exist in everything that concerns ourselves and our neighbours on the other side of the Channel there would be cause for some amazement at the difference which exists in the relative conditions of labour only a few hundred miles away. While in England it is impossible to find enough employment for our workmen, the difficulty in France is for industry to find sufficient labour for its requirements, for it is safe to say that in France there are at least two employers ready to accept the work of every good workman available, whether winder, adjuster, mechanic, or skilled in any other technical trade. Without the foreigner it is certain that many French industries would suffer severely. In the iron mines of the Sarre and Ruhr districts, for example, the foreign workers amount to eighty per cent. of the total. In the north and east the Belgians, Poles and Italians are practically indispensable in all the metal-working industries, while in the west it is the Spaniard who is invaluable. The Frenchman is industrious, but France is a large country, and the call of agriculture is imperative in a land where small farmers are so numerous. Outside the larger cities the Frenchman is a peasant, and in some districts skilled welders and solderers, for instance, are unobtainable. The consequence is that the number of French workers is totally inadequate to meet the demands of industry when trade is moderately brisk, and it is recognised officially that in years to come this question will grow in importance and will surpass all others connected with the economic future of the country. Two years ago, when French trade and finance were passing through crises which threatened the economic existence of the nation, fears were entertained in practically all quarters that the foreigner would oust the Frenchman from his employment, and steps were taken by the Government at the instigation of some of the socialist members to reduce the number of foreigners in France by creating difficulties in the maintenance of their *cartes d'identité* and by letting foreigners understand that their absence was preferred to their presence. The consequence was that although a large number of foreigners entered France during 1928 the number who left the country was still greater. It is now recognised that this was a grave error, and efforts are being made to induce the foreigner to return, and, if possible, to bring his family with him so as to increase ultimately the French population, for although the children of a foreigner born in France have the right to choose their nationality, his grandchildren, also born in France, are compulsorily French. In one labour bureau in Paris the number of demands from employers during last January amounted to 6,500, whereas the number of introductions which could be made amounted to only 1,660, and this at a period of the year when the building trade and agriculture are slack. It is feared that it will not be easy to attract the quality and quantity of labour desired, men skilled in electrical and metallurgical operations, for although employers are improving their conditions of pay and remuneration by housing accommodation, facilities for the purchase of necessaries, medical attendance, and so on, the average wage of a good workman is only five to seven francs an hour—high rates for France—which is equivalent in England to only 10d. to 1s. 2d. This is not sufficient for a foreigner who is unaccustomed to French market prices and customs, and perhaps to the

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language also. However, attempts are being made to encourage the immigration of workers, and as a beginning the public are asked to recognise the foreign workman as a necessity, and not as a competitor of national labour.

Architectural Lighting.

METHODS of lighting variously described as "architectural," or "modernistic," have excited much interest recently, and the paper on this subject read by Mr. W. Maitland at a recent meeting of the Illuminating Engineering Society, and abstracted in our last issue, was opportune, following his work of assisting to re-arrange and add to the display of systems and appliances for correct illumination which are exhibited at the London Lighting Service Bureau with the aid of the Electric Lamp Manufacturers' Association.

The chief feature of this method of lighting is that it forms an essential part of the architectural decoration. Ordinary chandeliers, and the like, are replaced by lighted panels, lintels, cornices, &c. Sources of light are completely concealed from view, either by means of translucent glass, or by opaque materials (as in cove and cornice lighting). An obvious good feature of this mode of lighting is the elimination of glare. A possible limitation is that in many cases the consumption of electricity is inevitably high, though admittedly the commercial advantage of obtaining striking lighting effects often more than compensates for the extra expenditure involved. This fact is illustrated by numerous Continental installations in restaurants, shops, &c., some of which are lighted on a very generous scale. It is too early as yet to forecast the future of this style of lighting, though it seems to us that the basic idea—that in this electrical age the provision of artificial light should be taken into consideration in the design of buildings—is sound. How far these ideas can be developed into the highest form of creative art remains to be seen. The creations of architects in the past were intended to be viewed exclusively by daylight. Will this conception continue, or may we expect that in the future appearance by artificial light will be considered equally important? The discussion on the subject has revealed a general feeling that inspiration in this new field of lighting should come mainly from the architectural side. We hope that everything possible will be done to interest architects in this conception of lighting, for their guidance is essential to its full development.

International Finance.

THE efforts at world-wide expansion which are being made by powerful financial interests in the United States in the direction of the acquisition of the control of electricity supply and other undertakings in different countries are now attracting general attention. Apart from Europe and the Far East, the American corporations concerned are viewing with increasing favour the prospects of development in South America. Besides the great undertakings which were formerly originally established by the Germans with headquarters at Buenos Aires, and which under the treaty of Versailles were disposed of and are now vested in a Spanish company (the "Chade"), the Swiss Motor Columbus Company, of Baden, Switzerland, has large and growing interests in South America. The directors have just announced that they have rejected enticing offers for the purchase of their interests, but in order to provide guarantees against the contingency of any such group obtaining a majority control over the company, the directors have now decided to create a special type of "C" share of low denomination. It is proposed to increase the share capital from 75,000,000 fr. to 93,500,000 fr. by the issue of 10,000,000 fr. in the form of "A" and "B" shares and 8,500,000 fr. in the shape of "C" registered shares. The directors consider it their duty to see that not more than one-third of the whole share capital passes into the hands of foreigners, and for this purpose they are authorised in certain circumstances to make uniform reductions in foreign subscriptions in the necessary measure. The new "A" and "B" shares will be acquired by a banking syndicate, which will also take over the "C" shares with the obligation to offer 75,000 of these to the existing shareholders, and the balance, including those not subscribed by old shareholders, will be handed over to a "blockading syndicate." The arrangement is said to resemble the action taken by the Swiss Aluminium Industry Company, of Neuhausen, which created a special class of share as a protection against too many shares getting into foreign ownership. The practice now being followed in Switzerland seems materially to differ from that adopted in Germany a few years ago, where shares with multiple voting rights were issued so as to achieve the same object.

A Seasonable Campaign.

HAVING made an effort to mitigate the terrors of spring cleaning, the British Electrical Development Association is now proceeding to help members of the public to help themselves by installing electric radiators and water-heating apparatus.

No better month than April could be found for this purpose, as has already been proved by the current month. Although April days are generally warm enough to enable fires to be dispensed with (there are, of course, many exceptions to this rule), the mornings and evenings are often very chilly. It is too much trouble to light fires on that account, and that is where the electric radiator proves its worth.

As the weather gets warmer, the fire in the kitchen range makes the place unbearable, but the hot-water supply is dependent upon it. The only satisfactory substitute for the domestic boiler is an electric water heater, and there should be a good market for it where the electricity supply authority offers an economic rate for the purpose—and we are glad to say that a great many supply undertakings have realised the potentialities and have instituted special water-heating charges.

Aluminium and Copper Prices.

THE recent advance in the price of copper has naturally interested producers of aluminium. Last year the price of the latter metal was reduced by agreement among the producers in Europe, by about 10 per cent. so as to stimulate the use of aluminium for still further purposes. Now, with the great rise in copper before them, the idea is growing in interested European aluminium circles that advantage of the situation should be taken by increasing prices. Until recently the price of aluminium was dearer than that of copper, but the relation has now been reversed and aluminium was lately about 17s. per cwt. lower than copper, this leaving out of consideration the advantages of the latter from the standpoint of greater conductivity, elasticity and from other points of view. The producers of aluminium, however, now seem to believe that the advantages of aluminium so greatly surpass those of copper that an increase in prices can be made without any fear of this having an unfavourable effect on the sale of aluminium. In connection with this matter, it is reported that a preliminary meeting of the committee of the European Aluminium Syndicate met in Paris on March 25th to consider the question and that meeting was to be followed by a new conference of the members of the syndicate on April 19th. It is stated that the amount of the increase will not by a long way represent the present difference between the prices of the two metals, as it cannot be known what course copper prices will take in the future, and it is not desired to destroy the incentive to an increased consumption of aluminium. In the meantime, by propaganda and by other means, every effort is being made in Germany to promote the consumption of aluminium.

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A Control-gear Manufactory.

A Visit to the Works of the Igranic Electric Co., Ltd., at Bedford.

IGRANIC ELECTRIC CO., LTD., has resulted from a friendship formed between two young fellow-students at college, Mr. H. H. Cutler, the founder of the Cutler-Hammer Manufacturing Co., of America, and Mr. George A. Mower, who has been the chairman and managing director of Igranic Electric Co., Ltd., from its formation. These gentlemen, more than thirty years ago, introduced simultaneously to the American and British markets, it is claimed, the first completely standardised range of electric motor controlling apparatus. At first, the British business constituted the electrical department of the Sturtevant Engineering Co., Ltd., of which Mr. Mower was, and still is, the chairman. In 1905, the Adams Manufacturing Co., Ltd., was formed to further develop the business in these specialities. A factory was built at Bedford, in which the manufacture was continued under the trade mark "Igranic." In 1913, the Igranic Electric Co., Ltd., was formed; it took over the Bedford factory, which it greatly enlarged. Since 1913, the business has increased enormously, and the range of manufactures has been considerably extended. The range now includes magnetic aids to industry, such as lifting magnets, magnetic separators, magnetic clutches and brakes, as well as newspaper dispatch conveyors and magazine reels. The manufacture of radio apparatus has also been added to the activities of the company.

Fig. 1.—General View of Machine Room at Bedford.

The ground occupied by the works at Bedford is 6½ acres, the actual building space covered being 3½ acres. The number of hands employed is approximately 750. Fig. 1 is a view in the main machine room. The whole of the works and offices is illuminated electrically, and the total power used for electrically driving the works machinery is approximately 340 h.p. Three-phase squirrel-cage induction motors are mostly used. An electricity supply is taken from the Bedford Corporation electricity works at 6,600 V, and is transformed down to 400 V for power and 230 V for lighting The equipment in the works sub-station includes a 200-kVA, 6,600/400-V, three-phase oil-cooled transformer, and a 75-kVA, 6,600 V to 220 V three-phase oil-cooled transformer.

The motor power, at 400 V, three-phase, is taken through a main circuit breaker and a wattmeter, and then to six triple-pole switches and fuses from which six-wire armoured paper cables carry it to the distribution boards in the works, from which subsidiary cables are taken to the various motors and points of consumption. The lighting cables are taken through twelve s.p. switches and fuses, and as far as possible the whole works lighting is broken into three main groups, one on each phase.

A 50-h.p. motor-generator set is installed in the works "power station," and consists of a 400-V, 50-cycle, 50-h.p. three-phase squirrel-cage induction motor of the "Parkinson" type, coupled to a 35-kW, 220-V d.c. generator (Lancashire Dynamo & Motor Co., Ltd.) and one 35-kW, 220-V d.c. "Crompton" generator. The set is controlled by a standard "Igranic" push-button remote controller. The d.c. switchboard for this set consists of the necessary d.p. switches and regulator, while a change-over switch is provided to allow the generator or rectifier to be connected to the bus-bars. A mercury rectifier sub-station is installed, and the equipment, complete with bulbs and potential transformer, choke coils, and so on, was supplied by the Hewittic Electric Co., Ltd.; the automatic control panels for voltage regulation and current control were built in the Igranic Co.'s shops. Fig. 2 shows the "power station."

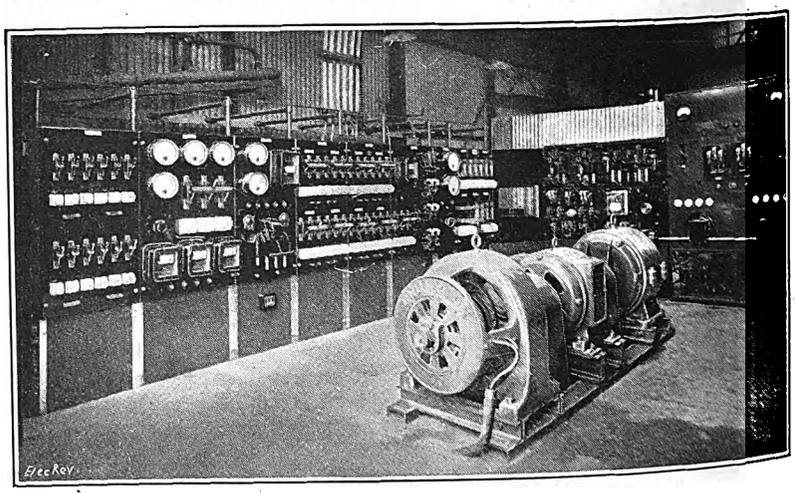

Fig. 2.—Works "Power Station."

During a recent visit to the Igranic works, several very

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interesting equipments well worthy of note were seen passing through various stages of manufacture. One of these items was a newspaper dispatch conveyor of the type recently installed in some of the largest newspaper press rooms in this country. These conveyors are designed to take the newspapers direct from the folder of the press, to carry them in a continuous stream to the tables in the publishing room, and there deliver them at the rate at which they are being produced by the press, right side up, with the count indicated by "kick" copies. As the conveyor is normally driven from the press itself, the speed of delivery is at all times equal to the rate of production by the press. An auxiliary motor drive is provided merely for the purpose of clearing the copies remaining in the conveyor at the moment at which the press stops. Fig. 3 shows three newspaper press controlling equipments constructed for the London *Daily Express*. The power units are of the usual worm-geared pony-motor type, rated at 110 h.p. continuous output. The panels give full push-button control of the printing presses and reel stands, and are arranged so that any two power units can be paralleled as may be required.

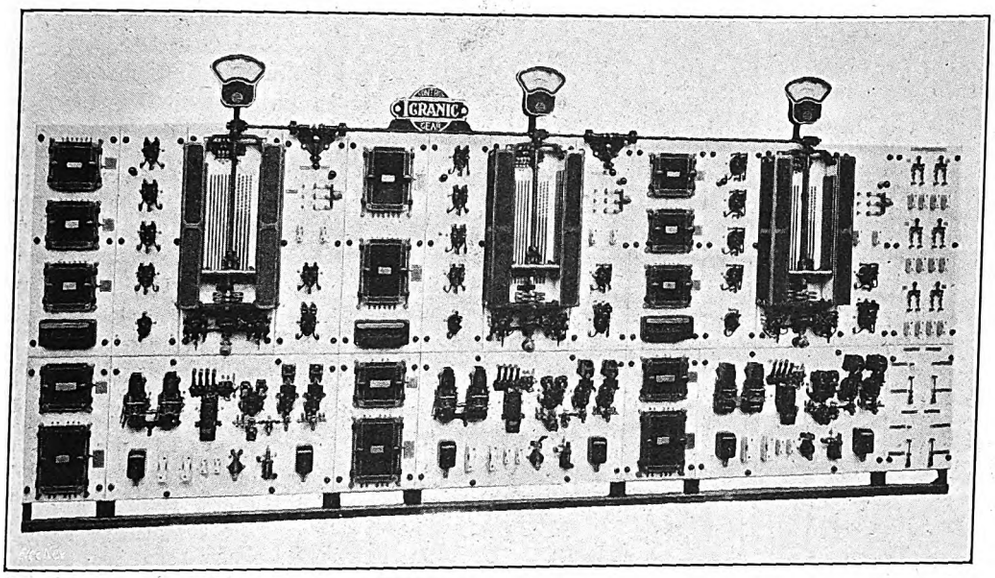

Fig. 3.—Control Equipment for Three Printing-press Drives.

Another particularly interesting item which was seen was an automatic control panel for a 150-h.p. d.c. motor driving a skip hoist for blast-furnace charging. The hoist is designed to automatically accelerate the motor and slow down and stop at the end of the travel. After a predetermined interval to allow for the load to be tipped, the hoist automatically returns, slows down and stops, ready for recharging. It is interesting to note that similar equipment is being supplied for the control of the revolving-furnace top, in such a manner as to distribute the charge evenly round the furnace, with automatic dumping and electrically-operated try-rods for indicating the height of the charge in the furnace itself. The equipment is for an important British steel works, and is the third furnace in this steel works to be equipped with "Igranic" gear.

Fig. 7 shows the control panels on ebony sindanyo bases for the double-leaf bascule bridge for the Port of London Authority at Tilbury Docks. Each leaf is operated by two 35-h.p. d.c. motors, and the panel equipment provides for full contactor control of both leaves of the bridge from a single master controller. It operates a full system of signal lights in the cabin, informing the operator of the position of both leaves of the bridge by night and day. In operating the bridge, the acceleration of the motors is automatically timed, and automatic slow-down and stopping is arranged by means of limit switches. Special care requires to be taken in closing the bridge to secure the correct interleaving of the two bascules. For this purpose, automatic gear is provided which lowers one leaf to the correct interlocking position before the arrival of the second leaf, which afterwards arrives at a dead crawling speed, and then drives both leaves together to the fully-closed position.

A control panel for two 62-h.p. d.c. motors installed for operating the grab hoist of a coaling crane at Rotterdam is shown in fig. 8. Unit clappers for reversing and acceleration are mounted on slate panels on a tubular framework, and full provision is made by a system of relays to enable grab manipulation to be carried out by hoisting on the grab-opening and grab-closing lines, respectively, and also for load sharing between the two motors when hoisting the full grab. The equipment shown in fig. 4 provides for the full hoist control of a grab unloading crane, but in this instance the motors are a.c. slip-ring ones. As in the previous instance, full control is provided of two 165/200-h.p. motors for grab manipulation and also for load sharing by the two motors during hoisting.

Some interesting control equipments seen were for ten level luffing dock cranes now under erection by Messrs. Stothert & Pitt at the Avonmouth Docks of the Port of Bristol Authority. Eight of the cranes are of the 4-motor type, and all the motors are a.c. squirrel-cage induction machines wound with two-speed stators. Tests made on site suggest that the operation of these cranes will be very successful.

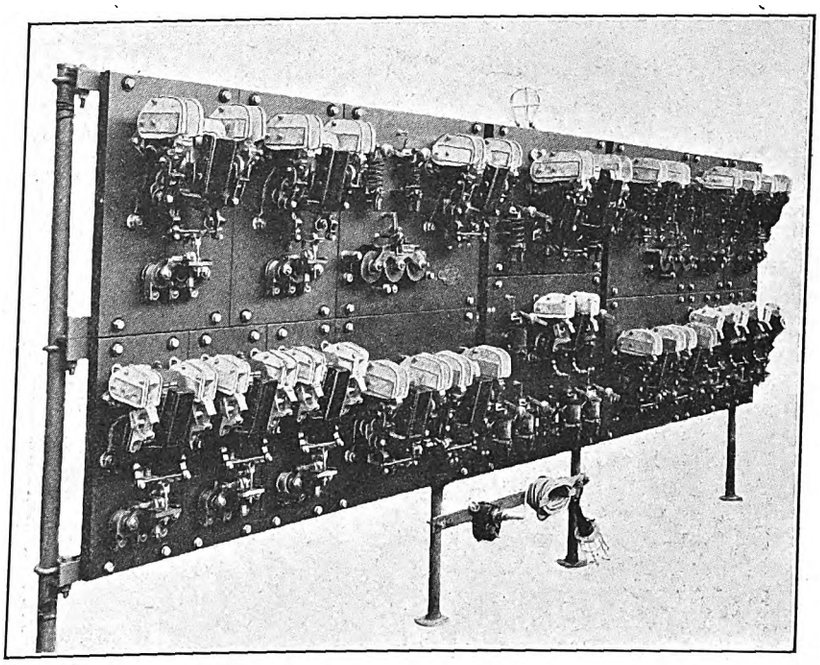

Fig. 4.—Controller for Crane Equipment, with A.C. Slip-ring Motors.

Fig. 6 shows a control panel made by the Igranic Co. to the order of the British-American Laundry Machinery Co., Ltd. The feature of this is the drum-

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switch control of the contactors. The board has provision for a laundry unit, at the top. For future units

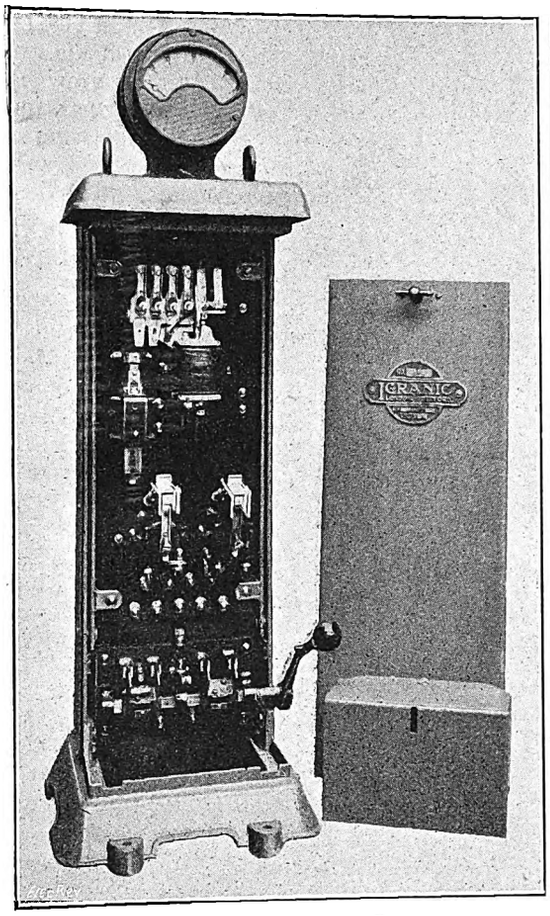

Fig. 5.—" A " Automatic Pillar Panel; Front Lifted Out.

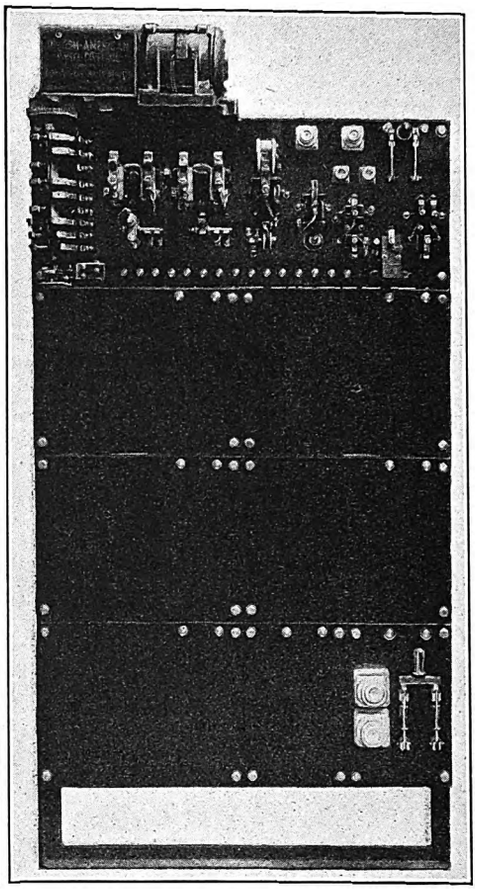

Fig. 6.—Panel with Provision for Drum-switch Extension.

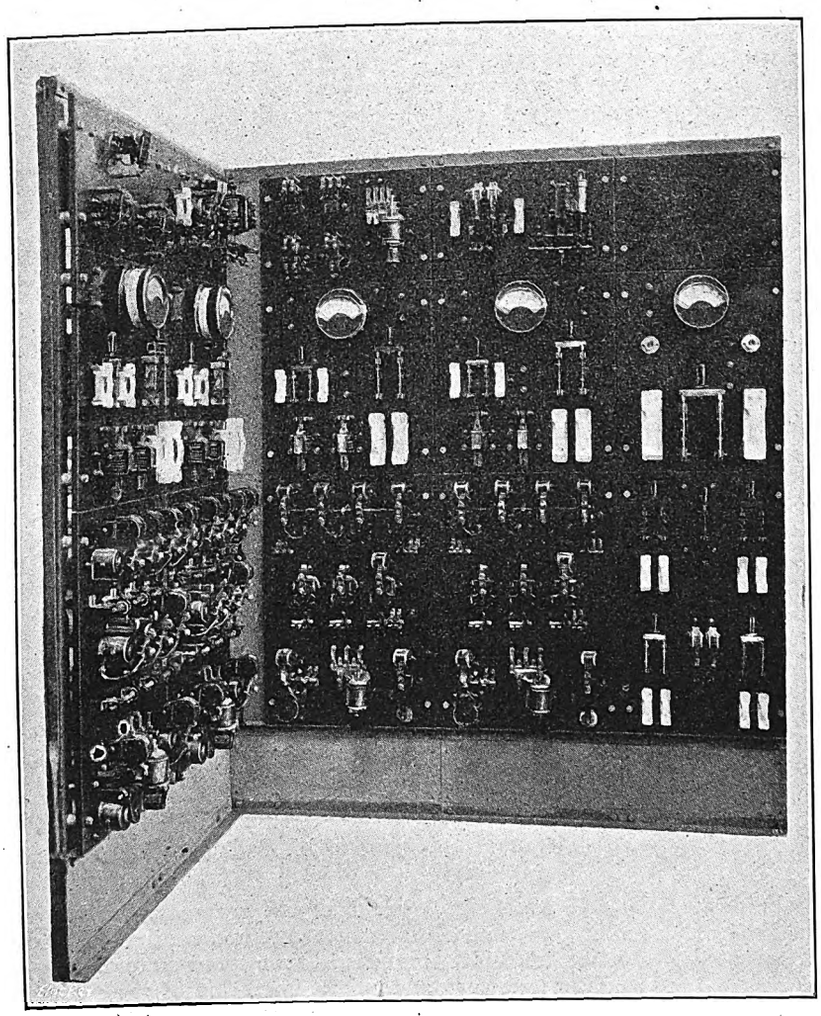

Fig. 7.—Control Panels for Tilbury Docks Bridge.

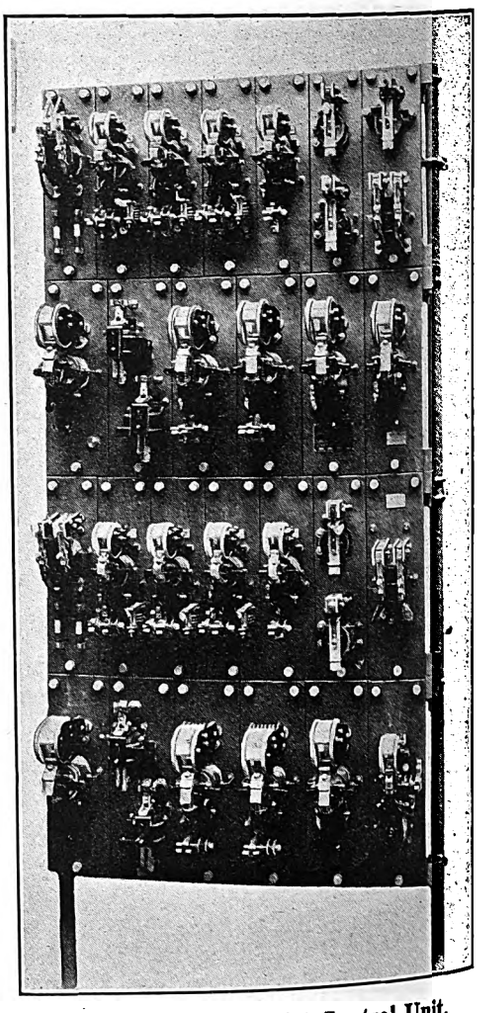

Fig. 8.—Coaling Hoist Control Unit.

additional equipment may be mounted on the lower panels and the drum switch extended downward without disconnecting or interfering in any way with the existing apparatus. Some interesting examples were seen of a line of automatic starting pillar panels recently developed by the Igranic Co. These are made in three sizes, A, B and D, for all voltages up to 550 V. The "A" and "B" panels each comprise a self-acting motor-starting rheostat of the multiple-finger type, and a double-pole magnetically-operated circuit breaker. The "D" type panel employs a multiple-finger self-acting starter, two single-pole mechanicallly-operated switches, one of which is used for the opening and closing of one pole, while the other is employed for short-circuiting the multiple-finger starter after all the armature resistance has been cut down. Overload protection is provided for by a time-limit device, and a "start and stop" button is fitted in the panel housing. A pediment ammeter may be added to either type of panel, and also an interlocked double-pole isolating switch accommodated in a separate compart-

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ment. The housing is a strongly-made iron and steel pillar, which entirely encloses the switchgear and effectually protects it from mechanical injury as well as from the weather. Efficient ventilation is provided. The feature which distinguishes the housing is the easy and perfect access which is afforded to the whole of the contents of the pillar without the necessity of dismantling. The panel is not built in the housing, but is placed therein as a unit, complete with all its switchgear, resistances and interconnections. It is built on a strong iron frame and in no way depends upon the housing for support. The pillar is split vertically down the sides, so that the front can be entirely detached from the back. The front can be quite easily let down or lifted right off, as shown in fig. 5. Access to the back of the panel is gained by simply freeing two latches at the top and pulling the panel forward, in which position it is held by two slotted steel straps, one at each side. If necessary, these two straps can be easily unshipped, the leads at the bottom of the panel disconnected, and the whole panel, with its resistances, can be lifted entirely out of the housing.

When an isolating switch is furnished this can be opened and closed by means of an external operating handle. The front portion of the main housing is so interlocked with the isolating switch in the lower chamber that whilst the upper portion of the panel remains open the isolating switch cannot be closed. When the isolating switch is open, both the motor circuit and the control circuit are disconnected on both poles, so that during examination every part of the panel is "dead."

The self-acting motor starter is solenoid operated, the solenoid plunger being controlled by a dash-pot, so that the time for cutting out the starting resistance can be varied by adjustment of a small screw on the side of the dash-pot. A number of contact fingers for cutting out the sections of starting resistance are actuated by a revolving shaft which is operated by the solenoid plunger. The whole of the starting equipment is mounted on an ebony sindanyo base, which, it is claimed, is superior to slate and is suitable for use in all climates. The armature resistance, which is liberally rated, is supported at the rear of the sindanyo base. The usual features of "Igranic" ordinary starters, such as porcelain insulation, bare connection wires, solderless mechanical joints, and so on, are embodied in the new apparatus. The equipment may be adapted to many special purposes, including pump control and pressure regulation.

Mention should be made of the "Igranic" transverse current microphone, a recent development of the company, which is designed to respond uniformly to sound waves of all frequencies and with complete freedom from background noises. The feature of this device is that the path of the current is at right angles to the plane of the diaphragm, so that sound waves impinge on the diaphragm at right angles to the direction of current flow. It is possible to employ in the microphone a diaphragm which is a non-conductor and which, therefore, can be made practically non-resonant, so that it responds evenly to notes of all audible frequencies. Interspersed between the two electrodes are several compartments, each containing carbon granules of a size different from those in the other compartments. Each group of granules responds to one band of frequencies more than another, and in this way the grading of the carbon granules into groups of various sizes ensures that all frequencies are dealt with uniformly. The combination of this principle with the use of a non-resonant diaphragm enables, it is claimed, particularly excellent results to be obtained.

Changing Over to A.C.

Notes on the methods of dealing with consumers' apparatus and service equipment adopted by a large electricity supply undertaking during the alteration of the distribution network from the d.c. to a.c. system.

By R. H. RAWLL, A.M.I.E.E., A.M.I.Mech.E.

(*Concluded from page* 606.)

Battery Eliminators.—Every supply engineer engaged on changing a d.c. network over to a.c. to-day will confirm that, had it not been for the popularity of wireless in the home, little or no apparatus would have required alteration or changing. During the last twelve months, anode battery eliminators, especially those working off d.c. mains, have grown enormously in popularity. It is not, perhaps, generally realised that a d.c. eliminator working the average 3-valve set takes only about .015 ampere, and, since this does not work the meter (electrolytic types excepted), this service is, therefore, given free by the supply undertaking. Now, there are good, bad, and indifferent d.c. eliminators in use to-day, not only in their performance, but also in their intrinsic value. At one time new a.c. eliminators were given in exchange for consumers' existing d.c. ones, but this was quickly stopped for two reasons. In the first place, the man with a poor eliminator, costing a few shillings, was treated to a good, reliable a.c. one, just in the same way as the man who had paid a good price for his, which, of course, was manifestly unfair. Secondly, a.c. eliminators are expensive, being at least double the price of the d.c. type. So it was decided to install an a.c. rectifier and leave the consumer's existing eliminator in his possession. This means that if a consumer had a poor eliminator on d.c., he still retains it when the supply is changed to a.c., and likewise with the man who had purchased an efficient and comparatively expensive one.

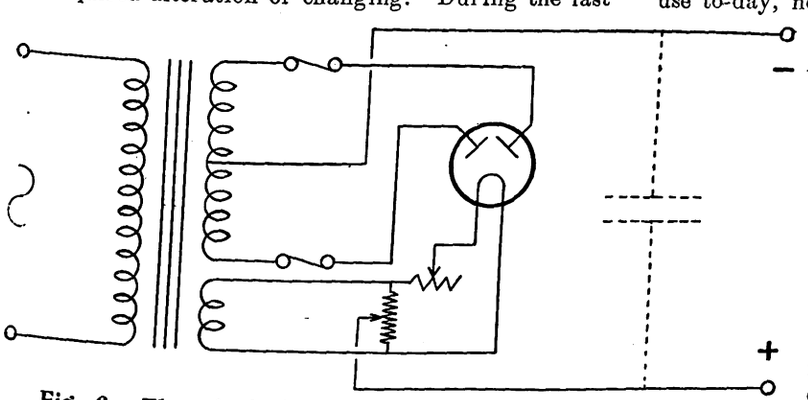

Fig. 2.—Thermionic Rectifier for Anode Battery Eliminator.

Such rectifiers can be of two types, either thermionic or metallic. With regard to the first type, a trans-

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former being essential in its construction, this automatically isolates the whole of the consumer's wireless apparatus from the supply mains, and thus conforms with the I.E.E. Wiring Regulations. On the other hand, if a metal rectifier is employed, in most cases it is not necessary for a transformer to be used from a purely operating point of view, but it is most desirable, in that the vast majority of wireless sets working off d.c. mains have many exposed parts which are alive, besides the lurking danger consequent on a breakdown of the insulation of head-phones or loud-speaker circuits, which is always present without the provision of some form of isolation, such as a double-wound transformer between the 'phones, or speaker, and the output terminals of the set.

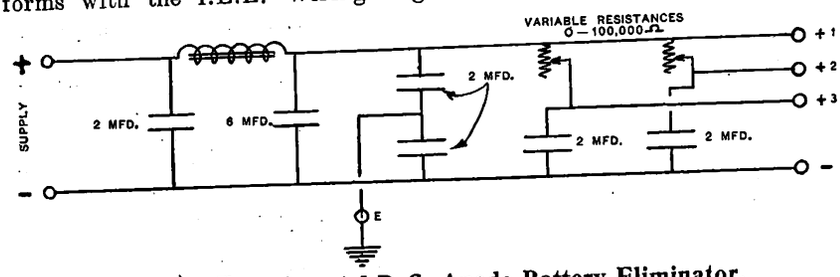

Fig. 3.—Experimental D.C. Anode Battery Eliminator.

A typical valve rectifier for use with a d.c. eliminator is shown in fig. 2. The a.c. supply is 230 volts, 50 cycles. This is intended to be utilised with eliminators working on 220 volts d.c. The load characteristics of this is shown in fig. 4, and those of a metal rectifier in fig. 5. These rectifiers are simply connected between the source of supply (usually a plug-socket or lamp-holder) and the eliminator.

On some occasions when a rectifier is installed, a rather prominent mains-hum is emitted from the loud-speaker. The consumer, of course, always states that this was not present before the change in the supply was effected! And since the supply cannot, obviously, be changed back again to d.c. in order to prove this, the supply undertaking has to give the benefit of the doubt in this matter to the consumer. This can usually be overcome by connecting a capacity, totalling a few microfarads, across the output terminals of the rectifier.

These rectifiers should be enclosed in stout metallic casing, bonded to the transformer core and equipped with an earthing terminal which is connected by means of a cable not less than 7/.029 to a convenient earth—not the wireless earth which is liable to be removed or interfered with—in order to prevent danger of shock should a breakdown in the insulation occur. The covers of such rectifiers should be securely fastened down, and fitted with a label warning the consumer to disconnect the rectifier from the supply before attempting to remove the cover. This is very important, because in the case of valve rectifiers employing full-wave rectification, the mid-tapped secondary coil of the transformer has a pressure of the order of 500 volts a.c. across the terminals at its extremities.

Sometimes when a rectifier has been installed the consumer is not at all satisfied with the results obtained, compared with the alleged perfect radio reception when the supply was d.c. And when it is mildly pointed out that the fault may possibly be in his own eliminator, this is usually hotly denied on his part, and the supply undertaking's rectifier is indicated as being the undoubted cause of the trouble. At this juncture it is often worth while to see if some slight adjustment of the receiving set, such as the correct grid bias to the various valves, will put matters right. If not, the consumer's d.c. eliminator is removed, and a test d.c. eliminator (see fig. 3) inserted in its place. The voltages on the anodes of the various valves are adjusted to their correct value and usually everything is then O.K. By this means it can be demonstrated to the consumer which is the apparatus at fault—his own or that supplied by the undertaking. Incidentally, this testing eliminator is also a most useful piece of apparatus in connection with the ordinary routine work of the supply undertaking on those parts of the network which remain on d.c., in that it can be utilised in investigat-

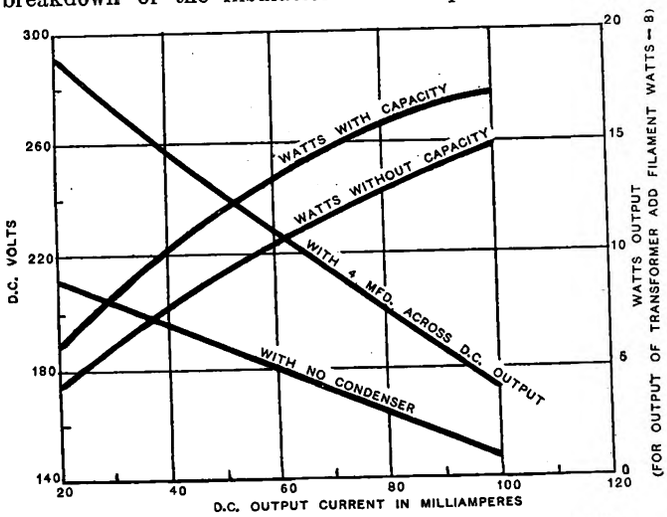

Fig. 4.—Load Characteristics of Thermionic Rectifier.

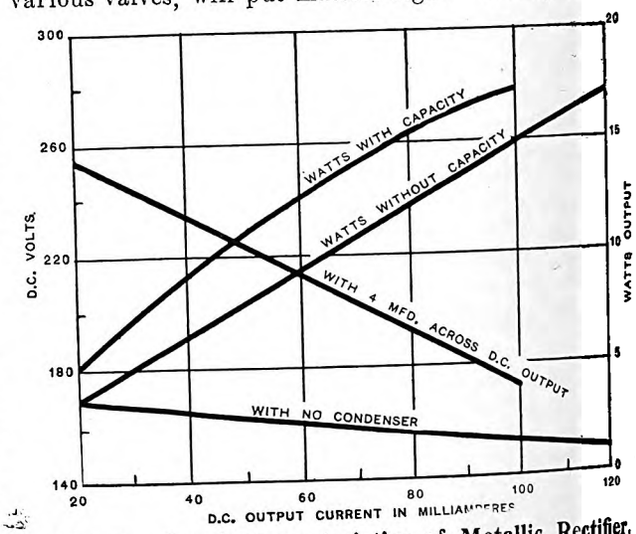

Fig. 5.—Load Characteristics of Metallic Rectifier.

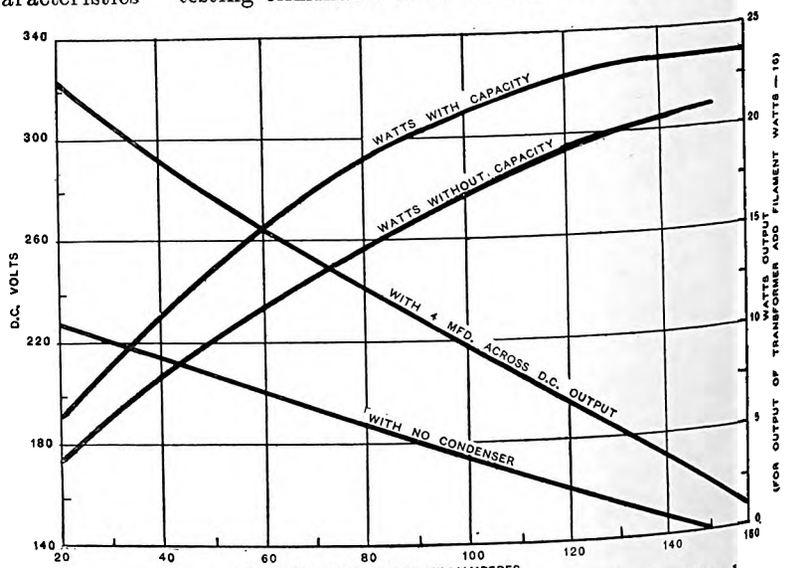

Fig. 6.—Load Characteristics of Rectifier for Combined L.T. and H.T. Eliminators.

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ing complaints of interference with wireless reception, which is the latest burden laid on the shoulders of the supply engineer.

Occasionally, one comes across a consumer who utilises the full d.c. outer pressure, of the order of 440 volts, for the anode voltages of his power valves. For this purpose a valve rectifier should not be considered, because round about 1,000 volts a.c. across the secondary terminals of the transformer would be necessary, and such a dangerous pressure is most unwise in a private house. Metal rectifiers also are somewhat costly for such a voltage. The cheapest and safest method is to obtain a 440-volt anode accumulator, with the necessary charging apparatus, already referred to. This takes up a good deal of room, but it is by far the best proposition in the circumstances.

Some wireless receiving sets operated from d.c. mains possess combined l.t. and h.t. battery eliminators. If these are of a reputable make, it is often the wisest and cheapest plan to install an a.c. model of the same make in exchange. In the case of home-made combined l.t. and h.t. eliminators, a large rectifier, with an output as shown in fig. 6, will often be satisfactory.

Moving-Coil Loud-speakers.—The recent introduction of these requires special consideration. Their magnet systems may be energised from accumulators or fed directly from the d.c. supply mains. Since these energising coils are often wound by amateurs themselves, little is known of the actual current consumption, so it is usually necessary to insert a milli-ammeter before the change-over takes place, in order to ascertain it. Most of the currents are of the order of 120 mA. If the load characteristic curves of the various rectifiers to hand are consulted, simple interpolation will indicate the correct one for the job. Often a consumer runs both a moving-coil loud-speaker and the plate voltages of his valves from the supply mains. In such a case, one rectifier will often suffice for the two purposes. Where an energising coil has been wound by an amateur in such a way that, having a fairly low resistance, it requires a relatively high rectifier current, it will often pay the supply undertaking to have the coil rewound to the correct values to work with a suitable rectifier. If a metal rectifier is used to supply the current to the energising coil of a loud-speaker only, and not to the receiving set as well, it is not necessary to employ a transformer to isolate it from the supply mains.

Another point to be appreciated is that with regard to the measuring of the currents and voltages already referred to above, a special volt-ammeter is required. The voltmeter must have a resistance of at least 1,000 ohms per volt, otherwise serious errors will creep in, by reason of the voltmeter taking more current than the apparatus, the pressure across whose terminals is being measured. A suitable combined voltmeter and milliammeter for this purpose is the following:—

Milliampere ranges	0—12.5
	0—50
	0—500
Volt ranges	0—12.5
	0—125
	0—500

Ultra-Violet-Ray Lamps.—These lamps have become very popular, both in the home and with the doctor, of late. On changing over to a.c., the ordinary carbon-arc type is usually not affected. The mercury-arc type, however, is, of course, put completely out of action. The burner must be changed to a special a.c. type with two positive and one negative electrodes, and a transformer and one or two accessories connected between it and the supply. This alteration should, of course, be executed by the makers of the d.c. lamp. A motor-generator can, alternatively, be employed, but this is usually vetoed on the score of noise, space occupied, expense and possible interference with wireless reception. Many people do not consider the a.c. mercury-vapour lamp satisfactory, and at least one maker of ultra-violet-ray lamps of the mercury-arc type has decided to manufacture only the d.c. burner, and if this has to be installed on an a.c. supply, a mercury-arc rectifier must be connected between it and the supply mains. Such a rectifier is mounted in a neat metal case on castors, and is an excellent and economical method of solving the difficulty of converting existing d.c. ultra-violet-ray lamps of the mercury-arc type to a.c. supply. Incidentally, these mercury-arc rectifiers, having a continuous d.c. output of about 3 amperes, and capable of withstanding a starting current of 12 amperes, can often be used for other purposes in changing-over to a.c., apart from that referred to here.

There are, obviously, many other pieces of apparatus which have to be exchanged or altered to work on a.c., but those referred to above have been selected as the most common in use.

In conclusion, the author is indebted to Mr. R. A. Chattock, M.I.E.E., city electrical engineer, Birmingham, for permission to publish much of the information contained in this article.

Dew Point Measurement of Flue Gas.

A Method of Detecting Leakage from the Boiler Elements while the Unit is under Working Conditions.

By VERNON WALKER, A.M.I.E.E.

THE capacity and pressure of the modern water-tube boiler have increased very rapidly during the last few years. Units capable of evaporating from 250,000 to 300,000 lb. per hour are becoming general in large stations, and pressures have increased in some cases to as high a figure as 1,300 lb. per sq. in. Water walls and screens are being extensively applied, and these render a very high combustion temperature imperative, subjecting the furnace tubes to very heavy duty. Under these conditions, it is a great advantage to be able to detect any leakage from the boiler elements while the unit is under actual working conditions, and the following notes show how this can be done by the aid of a fairly simple method. To obtain the amount of moisture contained in the flue gases escaping from the boiler or economiser, it is first necessary to ascertain the "dew point" of the gases. This enables one to deduct from pychrometric charts the amount of moisture contained in each pound of gas. It has been found that the characteristics of flue gas follow so closely those of air, that data at present available for air conditions can be used without introducing any serious error. The apparatus shown in fig. 1 for obtaining dew point has been employed on pulverised-fuel units of large capacity, for obtaining the wet- and dry-bulb temperatures. It will be seen that the gases are drawn by the aid of an aspirator, first through a dust filter made of felt or wool, which is wrapped round a fine-gauze-wire

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core placed in the first earthenware jar. After passing through this filter, the gases enter the second jar in which is placed a ½-in. copper "U" tube containing in one leg the dry-bulb thermometer, and in the other the wet-bulb thermometer. A slot is cut in one of the legs of the wet-bulb tube to allow the wicking which is wrapped round the wet thermometer bulb to drop in the water at the base of the jar. This keeps the wet-bulb wick moistened, and the temperature of evaporation is therefore given by the thermometer in the usual way.

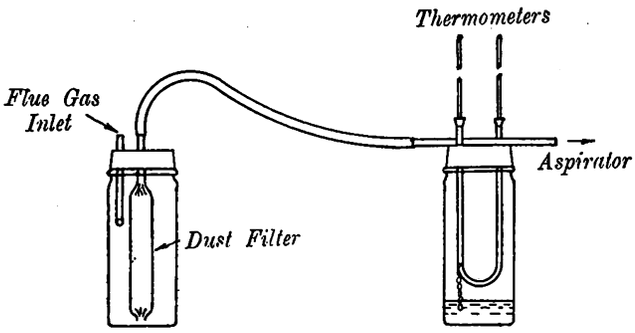

Fig. 1.—Flue-Gas Dew Point Apparatus.

The gas passes first past the dry-bulb thermometer and then past the wet-bulb one with the aid of an aspirator which should draw the gases through the tube at about 10 ft. per second. The filter and thermometer jar are placed in a box lightly packed with cotton wool or waste, in order to prevent the cooling of the gases below dew point, in which case the filter and thermometers become covered with moisture and the readings will not be reliable. The jars should be as small as possible on this account, and it is advisable to pack the box so that the tops of thermometers are just showing. The rubber stoppers should also be a tight fit in order to prevent leakage of air into the jars; these are preferably made to fit the tops of the jars. The connection to the flues should also be as short as possible if iron or copper pipe is used, and this can be wrapped with asbestos string. It is of first importance that the apparatus should not be placed in a cold or draughty place, and the gas should be drawn through the apparatus for a sufficient length of time to allow the temperature to become stabilised and the readings of the thermometers to become steady. The readings of the wet- and dry-bulb thermometers having been noted, the pounds of moisture per pound of flue gas can be obtained from the humidity charts. The next procedure is to calculate from the ultimate analysis of the coal the pounds of combustible per pound of coal, and having multiplied this figure by the coal used in unit time and by the moisture content as found by the "dew point," the result will be the actual pounds of moisture contained in the flue gases in a given time. The pounds of moisture in the flue gas from the combustion air, moisture contained in the coal, and from the combustion of the hydrogen content, are then determined for a given time. If this figure is now taken from the actual amount of moisture as determined by the "testing set," the result will be the leakage in unit time thus:—

$$\text{Boiler leak} = \frac{\text{lb. of moisture observed per unit time} - \text{lb. of moisture accounted for per unit time}}{\text{lb. of steam evaporated per unit time}} \times 100$$

It is interesting to test the apparatus by turning on one of the soot blowers, or operating a steam lance, and it will be seen that the wet-bulb thermometer instantly rises and falls almost instantaneously with the turning of the steam on or off. To facilitate the above calculations, it is handy to draw up a curve showing the amount of moisture that is contained in the flue gas per pound of coal from the combustion air, moisture from the coal and the hydrogen content, for a given CO_2 content of the gases and moisture content of the coal. The following table gives an example of the total moisture in the flue gases and the lb. of combustible from a coal having an ultimate analysis as shown. In general, the main influence is the quantity of hydrogen in the fuel, actual variations in the atmospheric conditions and moisture in the coal having a very small influence on the total moisture contained. In the example shown, the air is taken as fully saturated at 60 deg. F. and therefore contains .011 lb. of water vapour per lb.

Ultimate analysis of coal.

Lb. per lb. of coal:

Carbon .712; oxygen .0649; sulphur .024; hydrogen .0466; nitrogen .0131; ash .0824; dry air required for combustion 9.65 lb.

Maximum CO_2 18.25 per cent.

CO_2 per cent. ...	15.2	13.0	11.3	10	8.96
Excess air per lb. coal	1.93	3.86	5.79	7.72	9.650
Moisture in excess air ...	.023	.042	.063	.084	.106
Moisture in air for combustion	.129	.148	.169	.190	.212
Moisture in coal and from combustion of hydrogen	.476	.476	.476	.476	.476
Total moisture in flue gas	.605	.624	.645	.666	.688
Lb. combustible per lb. coal	12.0	13.93	15.86	17.79	19.72
Excess air per cent. ...	20	40	60	80	100

In a very interesting article in the Review* some time ago, Mr. Waite showed how "dew point" could be calculated from the volume of the flue gas and the water vapour, and it was pointed out that the "dew point" temperature is reached when the temperature of the flue-gas mixture causes the volume of gas present to coincide with the volume of the water vapour. It is therefore possible to calculate the "dew point" by making a series of curves showing the gas volume and water-vapour volume for a given CO_2, the intersection of the curves giving the desired "dew point" temperature. This calculated dew point will be found to coincide very favourably with no leakage dew point as determined by the above apparatus. Fig. 2 shows a home-made apparatus as described above, the copper piping being wrapped with asbestos string to prevent condensation. Several faulty economiser-tube ends are also shown, corrosion having occurred externally and internally.

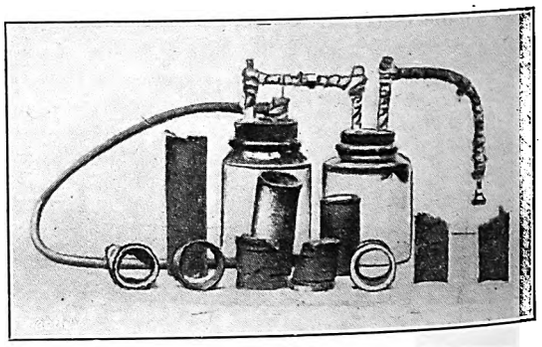

Fig. 2.—"Home-Made" Model, and Faulty Tubes.

The following figures taken on a 50,000-lb. stoker-fired unit fitted with soot blowers may be of interest.

Coal used per hr.	Dew Point apparatus of Wet	Dry	Moisture grains per lb.	Lb. per lb. air.	CO_2% at exit.	Calculated moisture lb. per hr.	Actual moisture lb. per hr.	Leakage steam lb. per hr.	Remarks.
5,500	100	117	270	.033	10	3,930	3,900	—	Boiler steaming. No steam on soot blower elements.
5,500	106	118	350	.050	10	3,930	4,800	870	Steam on soot blower system. Valve found leaking.
5,500	115	120	490	.070	10	3,930	6,800	2,870	Soot blower in 1st pass in operation (20 nozzles).
5,500	122	125	620	.088	10	3,930	8,600	4,670	Soot blower in 2nd pass in operation (28 nozzles).

* June 13th and 20th, 1924, pp. 954 and 994.

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The Copper Situation.

A summary of the causes of the recent movement and a consideration of the prospects for the future.

By A. V. WILLSMORE.

THE feature of the base metals market during recent months has been the rapid rise in the price of copper. In September, 1928, the quotation for electrolytic bars stood at a little over £69 per ton. By the end of 1928 the price had risen to £75, and at present the figure is in the neighbourhood of £110 with an upward tendency. The electrical industry, as the principal consumer of copper, is naturally interested in how far this movement is likely to continue. A summary of the underlying features of the present situation may therefore be of interest.

Between 1914 and 1918 production of copper was forced up to unprecedented levels to meet war needs. After the boom years following the Armistice, however, demand fell off. This falling off in demand was accompanied by the liquidation of large Government-held stocks and the disposal of large quantities of scrap metal so that prices declined to a low level. These heavy stocks were gradually absorbed and consumption has steadily improved to such an extent that there is now a pressure on output resulting in a rise in prices. This rising tendency has been helped by the activity of the Copper Exporters' Association, an American monopolistic body acting on behalf of producing interests.

In considering the situation it is necessary to take two distinct views. Production of copper cannot be increased at short notice and a different situation exists between the immediate future and the not so near future. We will take first the probable situation over the next few months.

Recent Movements.

The recent rapid rise in the price of copper originated in October last year, when the news of an earthquake in Chile led to increased buying orders. The output was again threatened shortly afterwards by civil disturbances in Mexico and again there was an increase in demand. Up to February 23rd, however, the price had only risen to about £80.

At that time it was appreciated that world consumption of copper had increased by leaps and bounds and was growing rapidly, and in the following week the price advanced almost daily as a result of a rush to buy the metal, until a figure of £90 was reached. The demand then slackened for a while, but when the February statistics were issued they showed that as a result of increased deliveries stocks had dropped to a level representing barely ten days' requirements. This immediately led to a fresh burst of buying which has culminated in the present situation.

Present Situation.

Persistent buying has continued in the face of declining stocks; American consumption has been fully maintained if not increased; production has not yet responded to the spur of increased prices. That, in brief, is the present situation, and the outlook for the immediate future is that prices will be maintained on a high level.

Production cannot be increased at short notice, and in view of the state of affairs in Chile and Mexico, if demand is maintained at the present level a further increase in prices must be expected. There is, however, a growing feeling that American consumers are overbuying, and, although there is no reliable information concerning stocks privately held, it is believed that the purchases already made are sufficient to cover orders in hand until the middle of the year. If, therefore, consumers would be content to cover only against actual fresh orders, the situation would probably right itself by June or July.

The condition over the next few months will probably continue to be abnormal, but even when this has been straightened out it is practically certain that copper will stand at a level higher than that prevailing before the recent movement.

On the supply side, American consumption shows signs of increasing and the general demand for copper is likely to grow. Extensive electrical development schemes will mean increased consumption of the red metal (unless the high price leads to a postponement of certain projects), the motor industry in America continues to develop, and there seeems little sign of a business depression leading to reduced consumption.

Substitution.

There is, however, an important factor to be considered in taking the long view. A rise in price of a commodity always leads to a search for substitutes. For instance, the rapid rise in tin prices some time ago led to the increased use of aluminium and it is probable that this and other metals will in certain cases replace copper. Such a tendency is very much to the disadvantage of the producers of the displaced metal, for the substitute very often continues to be used long after the price discrepancy has ceased to exist. In the case of copper itself, the rapid rise in 1920 led to substitution which has taken years to overcome. Moreover, inflated prices tend to encourage users to replace worn articles as soon as possible when a cheaper metal can be substituted, and to sell the scrap metal at the high prices prevailing.

On the supply side the Copper Exporters' Association probably appreciates the danger of the present situation and it is improbable that it will make any attempt artificially to limit the supply of copper so as to maintain an uneconomical level. At the same time, however, it would seem that even with normal conditions in Chile and Mexico, production resources will be taxed to their limits to keep pace with the growing demand.

World Output.

The following figures prepared by the American Bureau of Metal Statistics are of interest in this connection as showing world output of copper (in short tons) in 1927 and 1928.

	1928	1927.
United States	1,060,094	968,657
Chile and Peru	363,201	297,093
Europe	135,700	135,100
Belgian Congo	124,172	97,103
Japan	72,796	69,872
Canada	63,040	35,613
Mexico	50,556	43,964
Australia	10,912	10,944
Elsewhere (est.)	36,000	36,000
	1,916,500	1,694,300

It will be seen that Canada has shown a big increase in production and this country is considered to have a great future as a copper producer. Ten years hence, production in Canada will probably reach a figure of 230,000 metric tons per annum according to a Canadian mining official, and from a more optimistic quarter it is foretold that this figure will be reached within five years.

Even more bright is the future of Northern Rhodesia. Very important deposits of ore have recently been dis-

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covered there, and it is estimated that within ten years the four principal Rhodesian companies will be producing copper at the rate of 360,000 long tons, or 400,000 short tons per annum.

In view of these and similar developments the ultimate price is expected to average £75 per ton. It will, however, take two or three years before production in these areas reaches a level high enough to affect market prices. In the meantime, prices will be maintained on a higher level unless :—

(*a*) There is an increase in the substitution of other metals for copper.

(*b*) There is a decline in demand as a result of business depression or some similar cause.

The reader will, of course, make his own decision on these two points.

Sensitive Speed Regulator.

Some descriptive notes on a centrifugal electrical governor which will, it is claimed, afford extreme constancy of electric motor speeds.

THERE are numerous purposes, chiefly in telegraphic and radio work, for which an extreme constancy of speed of electrical machines, of the order of 1/10 per cent., or even 1/100 per cent., is required. This constancy has to be maintained in spite of temperature and load variations, and with supply voltage variations of, say, ± 10 per cent. The result must be produced with a minimum of attention, and with simple, robust and inexpensive additions to the existing machinery.

A special centrifugal governor* which meets the requirements was described by Dr. Walter Dornig originally in 1925, and has since been improved. One of these governors is shown in fig. 1, and a simplified diagram of connections for it in fig. 2. It consists of three strong steel springs bent to a large radius as shown, and provided with insulated contacts at the free ends. When the desired speed is reached these moving contacts press against the fixed contacts and so short-circuit a resistance, or, in some other way, influence the speed of the driving motor.

Movable weights are provided underneath the springs to allow for any necessary adjustment, though this adjustment

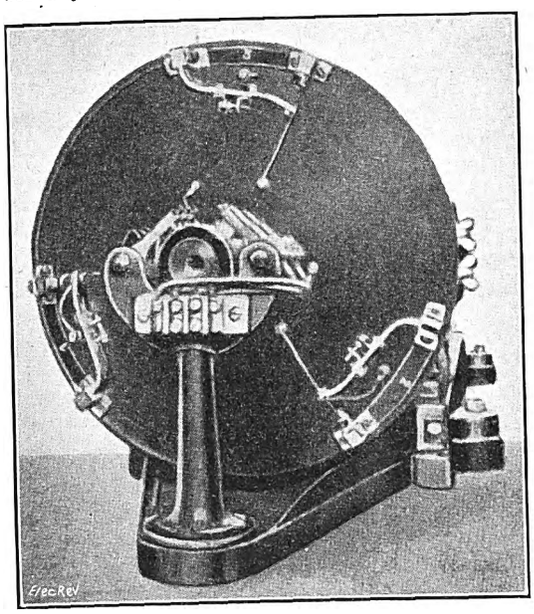

Fig. 1.—Centrifugal Electrical Governor.

can also be obtained by moving the fixed contacts in or out. Bent springs of the form shown give a fine elastic action without the risk of excessive metallic fatigue, which is liable to cause breakage of straight springs at the point of support.

Referring to fig. 2, 1 shows the speed-correcting resistance, *e.g.*, a resistance in the shunt circuit of a d.c. motor; 2 and 2¹ are two slip rings connected to the moving and fixed contacts 4 and 5, on which the brushes 3 and 3¹ rub and make connection to the resistance. The distance between the contacts 4 and 5 is, naturally, very small, and should the motor speed tend to increase, the contacts at once become short-circuited and cut out the resistance in the shunt circuit, and so tend to lower the speed. Actually an extremely fine to and fro motion between the contacts is occurring all the time. It is obvious that the slightest sparking or roughening of the contacts would entirely spoil the regularity of action, and it is in this connection that the third ring 6 is employed. This ring consists of a number of insulated segments like a commutator, the alternate segments being connected to the two rings 3 and 3¹, respectively. The brush 7 rubbing on this commutator is wider than the insulation between the segments, so that it rhythmically short-circuits the two slip rings

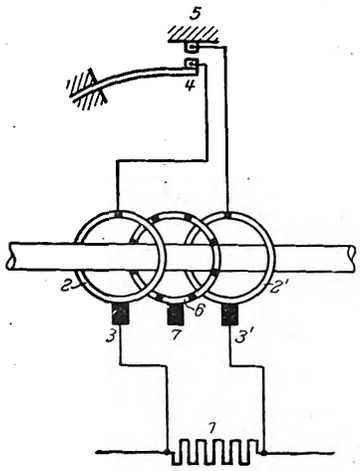

Fig. 2.—Governor Connections.

(and the shunt resistance) at frequent short intervals. Thus, if the speed is 3,000 r.p.m. and there are 16 segments, short-circuiting will occur 800 times per second. Any tendency to sparking at the spring contacts 4 and 5 is, therefore, instantly suppressed by this auxiliary short-circuiting device.

Experience has shown that the arrangement works perfectly satisfactorily for months on end without even any discoloration of the main contacts.

The continuous rhythmical short-circuiting of the resistance by the ring 6 has not the slightest effect on the speed-regulating properties of the apparatus—it merely affects the effective mean value of the motor shunt current.

With a single spring contact on the governor it is found impossible to get really good results with more than 10 per cent. supply voltage variations, as beyond this the resistance required in the shunt becomes comparatively large, and is liable to cause hunting of the motor. For such cases it is preferable to use a number of springs set to make contact at slightly different speeds. In this way the necessary changes in the motor field are so small and are made at such small intervals that no disturbance of the motor occurs. The regularity is further enhanced by the facts that there would be three of the segmental rings 6 in use and that they would be set at 120 deg. to one another, so as to break contact in turn. In practice it is not actually necessary to make up three separate segmental rings—segmental extensions to the slip rings can be interleaved to produce the required result.

With such a governor it has been found quite simple to maintain a speed constancy of 1/10 per cent. with the supply voltage varying from 170 at full load to 250 volts at no load without any sign of sparking or wear at the delicate contacts.

* D.R.P. 457, 499. (*E.T.Z.*)

B.E.S.A. Hydraulic Turbine Tests.

British Standard Specification for Testing of Hydraulic Turbines (No. 353—1929) is the latest addition to the list of B.S. specifications for prime movers, which series includes specifications for steam turbines, reciprocating steam engines, and various types of internal-combustion engines. The latest specification differs from the previous members of the series, however, in the fact that it relates entirely to the testing of the machine, and does not deal with the performance, except in so far as the conduct of the test is concerned. The following points are dealt with in the specification: conditions of head, speed and output for acceptance test; condition of turbine during test; speed variation; power output of turbine; measurement of net or effective head of reaction turbine, Pelton wheel or impulse turbine; errors in measurement; efficiency; and measurement of rate of flow. It is of interest to record that this specification is based on, and is, to all intents and purposes, identical with the International Rules for the Testing of Hydraulic Turbines, published by the International Electrotechnical Commission. Copies of this specification may be obtained from the British Engineering Standards Associaton, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Date of Mr. Sharp's Return.

In our last issue we incorrectly stated that Mr. E. E. Sharp (Venner Time Switches, Ltd.) had returned from his tour of Australia and New Zealand. As a matter of fact, although Mr. Sharp is on his way back, he will not arrive until the first week in May.

We have received from Mr. Sharp a copy of the "Municipal Monthly Review," published by the Christchurch City Council, New Zealand. It is worthy of note that at least half the contents of this bright and well illustrated little journal are devoted to matters electrical, a sure indication of the progressive methods of the municipality.

American Electrical Production.

The official figures collected at the biennial census of manufactures taken in 1928 in the United States show that the establishments engaged primarily in the manufacture of electrical machinery, apparatus, and supplies in 1927 had a total output valued at $1,637,407,035, an increase of 6.3 per cent. as compared with $1,540,002,041 reported for the last preceding census year (1925). Of the total value for 1927, $1,551,816,138 represented electrical machinery, apparatus and supplies, and $85,490,897 miscellaneous products and receipts for contract work and repairing. The value for electrical machinery, &c., was made up as follows:—Batteries, $150,216,485; control apparatus, $33,869,615; electric fans, $10,755,001; generators, motor-generator sets, and automobile starter motors, $115,179,671; household heating and cooking appliances, $72,933,274; industrial apparatus and appliances, not including motor-driven tools and devices, $12,343,673; interior conduits and fittings, $42,105,294; incandescent lamps (bulbs only), $87,933,204; measuring instruments, relays, and instrument transformers, $34,009,999; motors (not including automobile starter-motors), motor parts, and supplies, $122,146,337; radio apparatus and radio tubes, $191,228,647; switchboards, circuit breakers, and switches, $70,801,619; telephone and telegraph apparatus, not including radio, $119,271,904; transformers, induction voltage regulators, and current-limiting reactors, $66,611,334; wiring devices, $32,216,698; and miscellaneous electrical machinery, apparatus, and supplies, $390,193,383.

The statistics for 1927 and 1925 are presented in the following table:—

	1925.	1927.	Percentage increase or decrease.
Number of establishments	1,739	1,777	+ 2.2
Wage-earners (average number)	239,921	246,565	+ 2.8
Wages	$323,834,541	$336,238,750	+ 3.8
Cost of materials, factory supplies, containers for products, fuel, and purchased power, total	$636,692,076	$645,761,699	+ 1.4
Materials, supplies and containers	Not reported separately	$626,617,053	—
Fuel and power ...		$19,144,646	—
Products, total value ...	$1,540,002,041	$1,637,307,035	+ 6.3
Electrical machinery, apparatus and supplies	$1,435,470,008	$1,551,816,138	+ 8.1
Other products, value, and receipts for contract work and repairing	$104,532,033	$85,490,897	−18.2
Value added by manufacture	$903,309,965	$991,545,336	+ 9.8
Horse-power employed	589,398	668,701	+13.5

American G.E.C. to Institute a Five-day Week.

The New York correspondent of *The Times* reports that the General Electric Co. has announced its intention to put all its plants on a five-day week schedule in July and August. Many thousands of workmen will be affected by the new order.

Recent Contracts.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., has recently been very active in India. The company's Indian contract staff has, of course, been busy on the electrification of the G.I.P. Railway, and a considerable order has been received from the Ajmera Electric Supply Co., Ltd., for the supply, laying and jointing of paper-insulated cables and the installation of distribution pillars, joint boxes, &c., and a smaller contract from the same concern for the supply and jointing of h.p. junction and terminal boxes. The company is also engaged in a number of smaller contracts for jute mills. Another interesting contract being carried out by Henley's is that at Jhansi (United Provinces) for the supply and installation of h.p. underground feeder cables, l.p. overhead feeders and distributors, street lighting fittings and equipment for three sub-stations, the system being 2,200/460 V, 3-phase, 50 cycles.

The D.P. BATTERY CO., LTD., has received orders through the English Electric Co., Ltd., for seven batteries in connection with the South-East England Electricity Scheme. The very large battery supplied by the company for the Brisbane (Queensland) automatic telephone exchange was recently put into commission.

The *Financial Times* reports that the Swedish Telegraph Board has given MARCONI'S WIRELESS TELEGRAPH CO., LTD., an order for equipment for a new 60-kW broadcasting station, near Stockholm. The cost of the equipment will be about kr.400,000, and delivery is to be made next November.

The Manchester Corporation has purchased nine "Cyclone" 'bus and car-washing plants (4 gun size) from the EQUIPMENT AND ENGINEERING CO., LTD.

Ambitious N.E.L.A. Convention Programme.

A motion talking picture bringing into the Convention Hall speakers of national and international fame; another motion talking picture giving a lecture entitled "The Romance of Power"; spectacular displays and uses of electrical wonders among the exhibits; a great "Festival of Light" contributed by Atlantic City; the dedication of a new $15,000,000 auditorium; personal addresses by well-known electrical men; and famous operatic stars are among the special features which will mark the fifty-second convention of the National Electric Light Association, in Atlantic City during the first week in June.

Competition of Industrial Designs.

The public exhibition of works sent in for this year's open Competition of Industrial Designs will be held in the Exhibition Pavilion of the Imperial Institute, South Kensington, S.W. Full particulars of the scholarships and prizes offered in connection with the competition can be obtained from the Secretary of the Royal Society of Arts, Adelphi, W.C.2. Applications for forms of entry, labels, and instructions must be sent to the Secretary between May 1st and 11th, and the last day for receiving entries is May 27th. The judging takes place in July, and the accepted designs will be exhibited to the public at the Imperial Institute from August 3rd to September 1st.

Copper Consumption in the United States.

According to the National Electric Light Association the electrical industry of the United States consumes over 100,000 tons of copper per year, which is half of the country's total consumption. The proportions of the latter used by branches of the industry are: Electrical manufacturers, 23 per cent.; light and power lines, 14 per cent.; telephone and telegraph, 11 per cent.; sundry allied lines, 2 per cent. The next largest consumer is the automobile industry, with 13 per cent. of the total. An increase of 10 cents per lb. in the cost of electrolytic copper before fabrication means a rise of something over 12 cents per lb. in the price of finished wire. This represents an added expense in the construction of new facilities of at least $25,000,000 per year. Applied to farm electrification, it means an added cost of $40 to $67 for electrifying each new farm. Applied to the telephone and telegraph industry, the increase in the cost of copper means about $20,000,000 added to the construction budgets of the year; and to the electrical manufacturers it means nearly $50,000,000.

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Book Notices.

"Can We Trade with Russia?" By Edouard Luboff (48 pp.). London: The Anglo-Russian Press. Price 1s.—After making what appears to be an unbiased review of the situation of Russia, with special reference to its foreign trade, the author of this booklet answers his own question in a qualified affirmative. He scouts the idea that the resumption of full trade relations with Russia would solve our unemployment problem, and aims at showing that if export credits are to be granted there are far safer directions in which they can be usefully employed. Dr. Luboff thinks that there is no immediate possibility of Russia becoming a valuable and progressive market for British goods, but he also considers that the present balance of Anglo-Russian trade is too much in Russia's favour and should be righted. In discussing methods of doing business with Russia, the author mentions banking control, deposits on imports, and clearing-house operations. The last of these is considered most practicable.

Circulars of the U.S.A. Bureau of Standards, No. 374; "X-Ray and Radium Protection—Recommendations of International Congress of Radiology" (price 5 cents).

"Science Abstracts (A and B)." Vol. XXXII. March 25th, 1929. Part 3. London: E. & F. N. Spon, Ltd. Price 3s. each.

"*Journal* of the Institution of Engineers in Australia," incorporating transactions, discussions, &c. Vol. I, No. 2; February, 1929. Sydney, N.S.W.: The Institution, 16, College Street.

Bankruptcy Proceedings.

L. J. Smith, electrical, radio and cycle engineer, late of 3, Lower Kings Road, Berkhampstead.—Receiving order made April 2nd on debtor's own petition.

H. A. Hyde, wireless dealer, late of 2, East Street, Bromley, Kent.—Last day for proofs for dividend, April 20th. Trustee and Official Receiver, Mr. T. Gourlay, 29, Russell Square, W.C.1.

E. Temple and Mrs. J. E. Burkett (Westoe Electrical Co.), 105, Canterbury Street, South Shields.—Last day for proofs for dividend, April 22nd. Trustee, Mr. A. J. Gray, 48, Pilgrim Street, Newcastle-on-Tyne.

O. C. Lay (Home Wireless Installation Co.), accumulator specialist, 2c & 2d, High Street, Wandsworth, S.W.—Last day for proofs for dividend, April 20th. Trustee and Official Receiver, Mr. T. Gourlay, 29, Russell Square, W.C.1.

Company Liquidations.

Ashworth & Smith (Electrical Supplies), Ltd.—Winding up voluntarily. Liquidator, Mr. B. H. B. Eldridge, 52, Brown Street, Manchester. Meeting of creditors, April 16th, at the Manchester Chartered Accountants' Society, 60, Spring Gardens, Manchester. Particulars of claims to be sent to the liquidator forthwith.

New Standard Wireless Valve Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. H. Janes, 27, New Hall Street, Macclesfield. Meeting of creditors at the register offices of the company, High Street, Bollington, near Macclesfield, on April 12th. Particulars of claims to the liquidator by May 12th.

Dissolution of Partnership.

W. G. Pye & Co., manufacturers and sellers of wireless, transmitting and receiving sets and apparatus, scientific instruments and apparatus, physical and electrical apparatus and instruments, &c., Granta Works, Cambridge.—Mr. W. G. Pye, T. A. W. Robinson and H. J. Pye have dissolved partnership. Messrs. W. G. and H. J. Pye will attend to debts and continue the business of manufacturers and sellers of scientific instruments and apparatus, physical and electrical apparatus and instruments, &c., under the old style.

Reduction of Capital.

North Wales Power Co., Ltd. and Reduced.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £1,000,000 to £808,058, and will be heard in London on April 15th.

A North-Midland E.D.A. Conference.

A sales conference was held by the North-Midland Area E.D.A. on the evening of April 4th at the Corporation Electricity Offices, Leeds. The speaker was Mr. D. Millner, of the Westminster Electric Supply Corporation, Ltd., who read his paper on "Organising for Better Selling in Electrical Showrooms," which was abstracted in our issue of October 26th last (p 709). Mr. F. N. Rendell Baker, borough electrical engineer, Halifax, supported by Col. W. A. Vignoles, D.S.O., presided. There was a good attendance, and a very lively discussion was provoked.

Foreign Samples Exhibitions.

During last year a series of exhibitions of samples of foreign competitive goods was held by the Department of Overseas Trade in conjunction with the Chamber of Commerce of Birmingham. The Council of the Chamber, in its annual report, states that it is of the opinion that these exhibitions are of great value to manufacturers—a view which is confirmed by the large number of interested firms which have sent competent representatives to inspect the samples, and the number which have borrowed samples for closer examination, and also the foreign catalogues which are available.

B.T.-H. Magnetos in Long-distance Record.

In a recent test at the Montlhéry track, Paris, a motor-cycle was driven night and day for between 23 and 24 days, covering a distance of 25,000 miles. The machine was fitted with a B.T.-H. magneto, which during the run made over 50 million sparks.

The Italian Lamp Market.

During the fiscal year 1922-1923 the production of electric lamps in Italy totalled 5,000,000; in 1927-1928 the production amounted to 13,379,143, an increase of about 170 per cent. Electric lamps are manufactured in Italy by about twenty firms, of which the most important are the Società Edison Clerici, Milan, the Società Industria, Italiana Elettrichi Radio, and the Società di Montel. The home production is, however, insufficient to cover the needs of the market. The imports of electric lamps and the countries from which they came during the past two years were as follows:—

	Number of Lamps Imported. 1927.	1928. Jan.-Sept.
Holland	7,865,386	6,859,821
Germany	5,762,212	4,393,889
Austria	1,748,540	1,111,251
Switzerland	137,022	346,917
Hungary	1,037,600	470,957
Great Britain	—	197,998
Other countries	122,763	127,404
Total	16,673,523	13,508,237

These figures show that there is a very considerable opening for foreign lamps of suitable makes and prices. The best-known foreign brands on the Italian market are "Philips," "Osram," "Pop," "Tungsten," and "Vertex." The screw cap is almost universally used. The import duties are: lamps weighing up to 70 grammes, 480 gold lire per quintal; above that weight, 720 gold lire per quintal. There is also an additional tax of 90 centesimi on each lamp.

Estonian Foreign Electrical Trade.

According to the *Board of Trade Journal*, the imports of "electric machines, apparatus, and implements" into Estonia during January had a value of 173,318 E.kr. (about £9,600). Exports of this class were valued at 40,330 E.kr. (about £2,200).

American Vacuum Cleaner Exports.

From a recent article in *Commerce Reports*, it is learned that Great Britain was the largest customer for American electric vacuum cleaners in 1928; 29,018 machines, valued at $542,744 were supplied. The next in importance, Australia, was a long way behind, having taken 8,251 cleaners, valued at $192,979. Another British Dominion, Canada, took the third largest share, 7,368, valued at $197,828. The total value of exports of this class from the United States was $1,307,957 (60,269 machines). The same article deals with the competition which United States manufacturers have to meet, and it is said that Sweden is the principal competitor; the value of Swedish cleaners taken by the United Kingdom in 1926 was $236,155.

The Trade Delegation to Russia.

Reuter (Moscow) reports that Mr. H. Drummond-Wolff, a member of the British Trade Delegation to Soviet Russia, in the course of a statement issued to the Russian Press on behalf of his fellow delegates, said that before leaving England they secured the sympathy of some of the great British banks, but it was not their object to connect their efforts and interests with large international financial organisations. The enormous potential resources of Russia when brought into proper co-operation with British industrial and financial forces could not but give results of great magnitude. The firms represented in the delegation would not be dealing simultaneously, selling money and goods, as appeared to be the custom in the case of many firms working with Russian commercial organisations abroad. They hoped, on the other hand, by co-operating with Russia to create a wider economic basis for trade. They understood full well that Anglo-Soviet trade could only be conducted on a large and adequate scale if an economic basis was found which would open Russia's gates to the British money market. Their visit already promised to bear fruit. In an interview with the Press, Mr. Ernest Remnant is reported to have said that the Delegation would base its relations with economic organisations in Soviet Russia upon the principle of mutual benefit. The economic organisation of the two countries was a guarantee that the business relations between them could develop extensively. The great advantage enjoyed by the U.S.S.R. was its foreign trade monopoly, which made it possible for it to place a large number of big orders with foreign industries. British industry would be able to adjust itself to the demands of the Soviet market. The receipt of big orders would make it possible for British factories to produce machinery especially required by the U.S.S.R.

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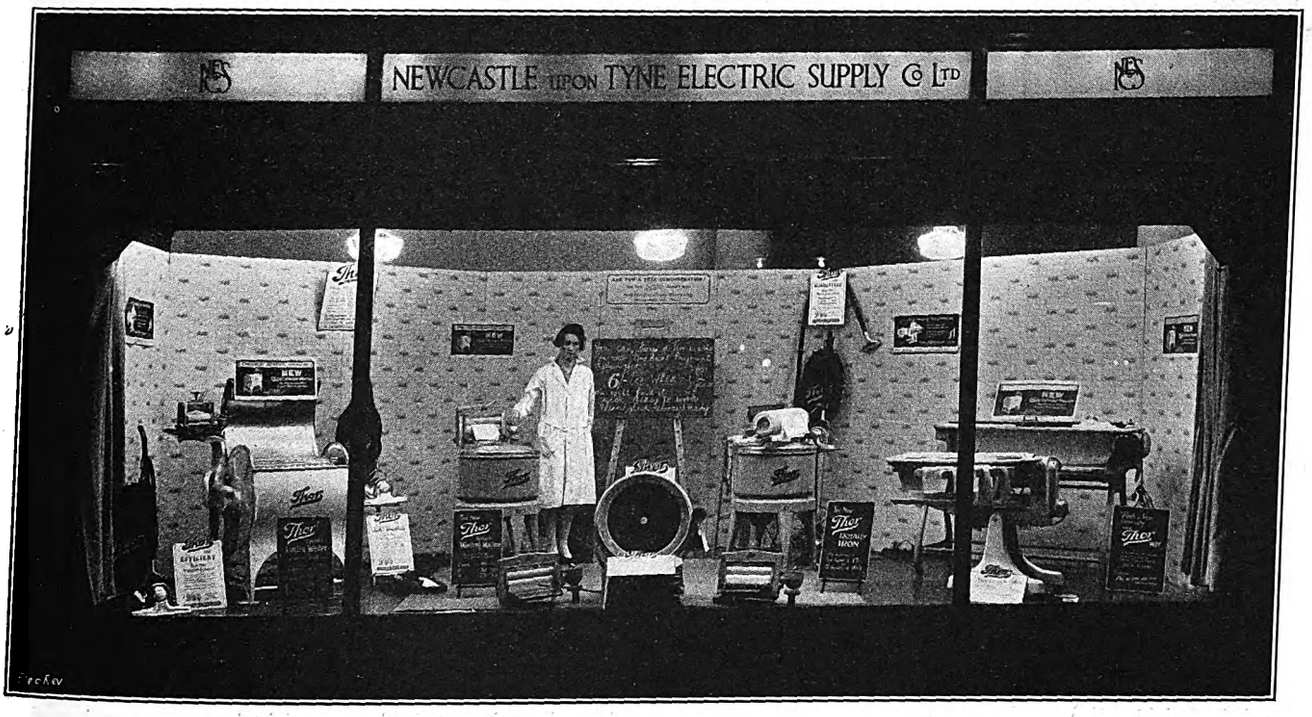
German Electrical Prices Increased.

The price bureau of the Central Union of the Electrotechnical Industry announces an immediate increase of from 5 to 10 per cent. in sale prices. In explanation it is mentioned that since the last revision of prices the costs of materials, especially copper and its alloys, have risen by from 60 to 70 per cent.

"Thor" Domestic Appliances.

The EDISON SWAN ELECTRIC CO., LTD., announces that, as from April 1st, it has taken over the business of the Hurley Machine Co., and is now responsible for the distribution, sale and service of all "Thor" products in Great Britain and Ireland. The business will continue to be operated from Oxford Circus House, 245, Oxford Street, W.1, and the "Thor" selling, service, and clerical staffs have been taken over by the Edison Swan Co. The principal products involved are washing machines, ironers, and vacuum cleaners.

In a recent "Thor" national window display competition the Newcastle-upon-Tyne Electric Supply Co., Ltd., secured the first prize with the window depicted in the accompanying illustration. A cylinder washer was shown in continuous operation. The spindle of the agitator washer seen in the centre of the window was packed with bandage and the agitator was pressed firmly on the spindle, thus allowing the agitator to revolve backwards and forward all day. The machines were controlled by a time switch cutting off at 11 p.m. Washing and ironing demonstrations were given for two hours in the morning and two hours in the afternoon daily. The second and third prizes were awarded to the North Metropolitan E.P.S. Co. for displays at its Palmer's Green and Wembley showrooms.



A "Thor" Demonstration Window arranged by the Newcastle-upon-Tyne Electric Supply Co., Ltd.

New Catalogues and Lists.

MESSRS. NEGRETTI & ZAMBRA, 38, Holborn Viaduct, E.C.1.—A comprehensive catalogue (List E.5) of engineering and industrial instruments (460 pp.). This contains illustrated particulars and prices of barometers, thermometers, pressure gauges and hydrometers, and other instruments of many patterns. The catalogue is divided into 21 main sections, and a thumb index is provided. A number of tables are included, notably a Fahrenheit-Centigrade conversion table. The list exhibits a serious attempt to standardise many instruments as regards size, range, threads, &c.

THE A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, Westminster, S.W.1.—An illustrated folder dealing with "A.E.G." water heaters, massage and h.f. apparatus, &c., and another dealing similarly with all kinds of domestic appliances.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Book 5, Section 2c, illustrating and describing the "Pul-synetic" system of electric turret clocks.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Leaflet No. 402, illustrating a number of examples of "Phililite" diffusing units, with details showing the ease of erection. Also Leaflet No. 203, giving particulars and prices of the company's industrial lighting fittings.

MESSRS. R. W. CRABTREE & SONS, LTD., Water Lane, Leeds.—A pamphlet giving some particulars of "Victory" d.c. motors and dynamos which are claimed to have a very good output/weight ratio.

MESSRS. HEYES & CO., LTD., Wigan.—A pamphlet advertising the company's switchgear in a novel manner.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue No. P.246, containing illustrations and particulars of wood and steel poles, ironwork, insulators, terminal boxes, and other transmission line materials; a list of the company's many manufactures, including particulars of its overseas branches and agents; and a bell wire price list.

Calendar-blotters for March have been received from Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile-End, Glasgow; Messrs. S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1; and Messrs. WARREN BROS. (MIDDLESBROUGH), LTD.

MESSRS. DAVEY, PAXMAN & CO., LTD., Colchester.—Publication No. 952, describing in a very complete manner the "Paxman" oil engine, with illustrations of actual installations in public and private electric power stations. Fully illustrated.

DRAKE & GORHAM WHOLESALE, LTD., 67, Long Acre, W.C.2.—Pamphlet No. 463, containing illustrated particulars and prices of various types of vacuum cleaners—"Busy Bee," "Goblin," "Vac-Tric," "Universal," "Tellus," "Electrolux," and "Croydon," and of "Hobby" and "Dandy" floor polishers.

The HENDON ELECTRIC LAMP CO., LTD., 104, Southampton Row, W.C.1.—A series of priced and illustrated leaflets advertising the company's electric food warmers, plugs and sockets; two-way adaptor, and electric irons.

MESSRS. HENRY WALLWORK & CO. (1920), LTD., Red Bank, Manchester.—Leaflet 69, giving particulars of enclosed double-reduction helical gears.

THE DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, Middlesex.—An illustrated pamphlet describing in some detail the company's pressure- and temperature-operated switches. Also leaflets illustrating and describing "Drayton" thermo-contactors and differential humidity regulators.

OMEGA LAMPWORKS, LTD., Rodney Place, Wimbledon, S.W.19.—A priced leaflet advertising the company's flame lamp.

MESSRS. T. HARDING CHURTON & CO., LTD., Atlas Works, Leeds.—A stock list of single-, two- and three-phase motors of various sizes ranging from 0.5 to 40 h.p.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A pamphlet treating of the subject of power-factor correction, with special reference to the company's synchronous motor control gear.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Leaflet No. 170, containing illustrations and full particulars (including dimensions and weights) of the company's pole-type transformers.

The G.E.C. Sports.

The General Electric Co., Ltd., announces that its tenth annual London sports meeting will be held at Wembley on June 8th.

Representation on West Midlands J.E.A.

The Minister of Labour announces that he is to designate to the Electricity Commissioners the employés' organisations having members in the employment of authorised undertakers in the West Midlands Electricity District in order that the

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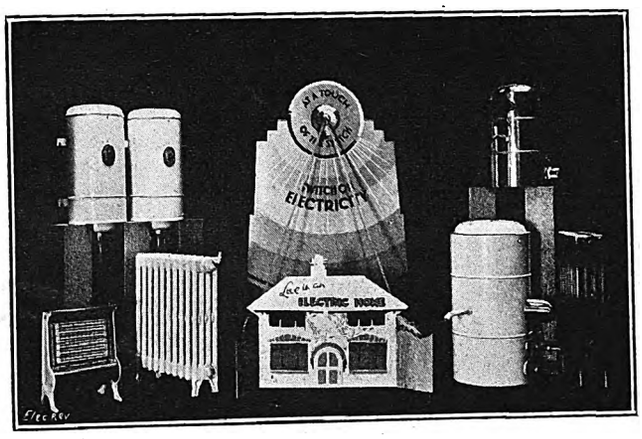
organisations so designated may choose a representative for appointment to the Joint Electricity Authority. Employés' organisations desiring to be considered in this connection are directed to make application to the Minister not later than April 22nd, on a special form obtainable from the Secretary, Ministry of Labour, Montagu House, Whitehall, S.W.1.

E.D.A. Activities.

The Supplementary Programme for April issued to members by the British Electrical Development Association directs attention to the subjects of electric fires and electric water heating, both of which are appropriate to the season. Electric fires are the most convenient form of heating during the cold snaps which are only too frequent in the spring, while during this season the domestic boiler goes out of use and an electric geyser provides a more efficient substitute.



An E.D.A. Water-heating Display.

The aids available to suppliers of electrical energy and apparatus as usual take the form of a series of special national advertisements, "lay-outs" for use in local newspapers, attractive pamphlets, lectures, and two special window displays. These displays deal respectively with electric fires and electric water heating; the latter is illustrated in the accompanying figure.

The Sydney Bribery Charges.

It was announced last week that the State Attorney-General had decided to appeal against the recent decision of the Court allowing the appeal of Messrs. Babcock & Wilcox, Ltd., from a judgment fining them £1,000 and ordering them to repay £10,600 for their alleged complicity in bribery in connection with a Sydney power plant contract.

Trade Announcements.

The address of the Diamond Fibre Co., Ltd., is now 79, Knightrider Street, Queen Victoria Street, E.C.4.

K.N. Electrical Products, Ltd., has moved to new factory premises at 5-7, Singer Street, Tabernacle Street, E.C.2.

The Nox Electric Lamp Co., Ltd., Clarence Road Works, Hunslet, Leeds, states that owing to the demand for its lamps deliveries have been delayed. The works are being extended, and it is hoped that with improvements which have been instituted orders will be more promptly dispatched.

Mr. Cecil Hodges states that he has no connection with any company bearing his name except the Hodges Switchgear Co., Ltd., and Hodges & Dixon, Ltd. The Hodges Switchgear Co. has a large works at Drayton Park, N.5.

London Electricians' Strike Ended.

Meetings were held on April 5th between representatives of the National Federated Electrical Association and the Electrical Trades Union and between the E.T.U. and the Engineering and Allied Employers' Federation in connection with the strike of London electricians. As a result the E.T.U. instructed its members to resume work, and it was decided that a meeting should be held at the end of April, at which the E.T.U. and the Engineering and Allied Employers' Federation would discuss the question of an increase in the wages of men engaged in electrical installation work on lifts. The strike, which lasted a fortnight, was due to an effort by the London District Committee of the E.T.U. to eliminate non-union labour from electrical lift installation work and to enforce the payment of electricians' rates for the work.

For Sale.

Aldershot Borough Council Electricity Department has for disposal one battery, 300 amp., with wooden stand and insulators. Sheffield Corporation Water Works Committee invite offers for surplus power plant, &c. (See our advertisement pages to-day.)

Electrical Propaganda in Norway.

The Norwegian Electrical Plants Federation has recently decided to initiate a large-scale advertising campaign in favour of a more extensive use of electricity in the home. The Federation will function as an information bureau, and supply local municipal authorities and private concerns with information on electricity and its varied uses.

Zagreb Trade Fairs.

Electrical goods are to be exhibited in the Zagreb Trade Fair, Jugo-Slavia, from September 7th to 16th, when a full range of manufactures of all countries will be shown. The Spring Fair, which is being held from April 20th to 28th, is confined to motor cars and cycles, agricultural machinery, and gramophones. It is stated that 300,000 people visit the Zagreb Fairs each year.

Registered Electrical Contractors.

The following applications for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Eyre, R. E., & Sons, South Yardley, Birmingham.
Ashworth, W., Horwich.
Harris, F. W., & Co., Coventry.
Moffett, C. R., South Shields.
Whitton, Fred, & Son, Kirkstall, Leeds.
Rock Electrical Engineering Co., Oldham.
Carrack, J. W., & Son, Kirkstall, Leeds.
Henwood, J. H., & Co., Aldgate, E.1.
Rugby Electrical Engineering Co., Rugby.
Hall's Longitudinal Lighting Co., Ltd., Victoria Street, S.W.1.
Lincoln & Egerton, Great Yarmouth.
Davis, H., & Son, Walsall.
McRobb, A., Aberdeen.
Dove, W. E., & Co., Ltd., Darlington.
Barnes, F. A., & Son, Shoreham.
Durrant, L. H., Harborne, Birmingham.
Bessant, A. J., Ltd., Eastbourne.
Lye, C., Exeter.

The annual meeting of the Register is to be held on Monday next, April 15th.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, April 9th: Copper (electrolytic) bars, £107, £4 dec.; ditto ditto sheets, no change; ditto ditto wire rods, £117, £4 dec.; ditto ditto h.c. wire, 1s. 2½d., 7/16d. dec.

Messrs. James & Shakespeare report, April 9th: No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £26, 35s. dec.

Messrs. Edward Till & Co. report, April 9th: India-rubber, Para fine, 1s. 0¼d., ¼d. dec.

In their letter dated April 6th, Messrs. James Forster & Co. stated that on March 25th the lead market suddenly collapsed, prices falling rapidly until £26 15s. was touched for June. A further fall was seen in the next two days, but on the Thursday before the holiday the tone was a little firmer again. On the resumption of trading after the holidays a firm tone was still in evidence, but on Thursday last week a fresh break occurred, prices falling to £24 10s. for all positions. The American price was marked down in sympathy. Prices have now returned to a level only slightly higher than that ruling before the extraordinary advance started. Little buying has been done during the last fortnight by consumers, but when the market finally settles down and confidence returns, there should be considerable buying. Present arrivals are sufficient for current needs.

Lighting and Power Notes.

Barking.—Supply to Housing Estate.—The Urban District Council Electricity Committee has received a letter from the chief engineer of the L.C.C. asking if the Council would supply electricity to the houses proposed to be erected on the Becontree Estate within the Barking district, if the County Council wired such houses. The Committee has recommended the Council to agree to afford the necessary supply, and asked the engineer to report as to the necessary mains, &c., extensions, including the question of the street lighting of the portion of the estate in question.

Barnstaple.—Special Order.—The Rural District Council has decided to consent to the application of the Ilfracombe Electric Light and Power Co., Ltd., for a Special Order enabling it to supply in Mortehoe, Berrynarbor, and Combe-martin. The proposed maximum charge for electricity is 1s. per kWh.

Beckenham.—Loans.—The Urban District Council has applied for sanction to the following loans: Mains and services, £25,000; sub-stations, £5,000; sub-station switchgear, £2,000; e.h.p. cable, £1,837.

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ELECTRICITY IN BULK.—An agreement has been reached with the West Kent Electric Co., Ltd., for a partial supply of electricity in bulk.

NEW SHOWROOMS.—It is proposed to erect new electricity offices and showrooms.

Birmingham.—HAMS HALL STATION.—The Corporation Electricity Supply Committee, accompanied by the Lord Mayor, recently officially inspected the Hams Hall power station, near Coleshill. It is anticipated that supplies will be available from this source for next winter's load. It is probable that the official opening of the station will take place in October, but no definite arrangements have yet been made.

ELECTRICITY SUPPLY PROGRESS.—At a recent meeting of the Committee it was reported that 1,130 new consumers were coupled up to the mains during the month of February, representing an aggregate of upwards of 12,000 lamps and 4,500 h.p. in power supplies. The cold weather prevailing during the month was reflected in an increase of 22 per cent. in the quantity of electricity sold as compared with February, 1928. A number of contracts for industrial supplies were approved.

Blackburn.—ADMINISTRATION.—The Town Council, on April 4th, approved the following minutes of two special meetings of the Electricity Committee, which had re-affirmed a previous decision: (1) That no person be supplied with electricity free of charge; (2) that no electrical apparatus be "loaned out" for testing purposes; (3) that all apparatus requiring testing be tested either at the electricity works or the showrooms. That the Committee should have particulars of all electrical apparatus and appliances "on loan" as per stock book on March 31st, 1928. Also that a special committee be appointed to inquire into the organisation and management of the Electricity Department and recommend such measures as they think proper to improve the efficiency of the department.

Bradford.—EXTENSION OF TRANSFORMER CHAMBER.—The transformer chamber at the Corporation's chief gasworks at Birkshall is to be enlarged, at an estimated cost of £2,100, owing to extended use of electricity in the gas plant. The chamber, when completed, will be capable of serving the needs of the whole district, as well as the gasworks requirements.

Chester.—OVERHEAD LINES.—Permission has been received by the Corporation to erect overhead lines between Tarporley and Farndon for the transmission of electricity at pressures of 6,600 V and 440 V.

Chichester.—ELECTRICITY IN BULK.—The Town Council has applied for sanction to a loan of £1,657 in connection with a supply of electricity in bulk to Bognor.

Continental.—FRANCE.—Work is about to be commenced on the construction of a new hydro-electric power station on the River Creuse at Roche-au-Moine (Indre). The plant will comprise three turbo-generators, with a total capacity of 15,000 kW.

AUSTRIA.—The Vorarlberg Illwerke Gesellschaft is establishing a new hydro-electric power station at Vermunt in the Montafon Valley. At first four 30,000-kVA vertical-shaft turbo-generators will be installed, but a fifth set of 50,000 kVA is to be added later. The power generated at the station will be stepped up to 100 kV, and will be transmitted at that pressure to a sub-station 20 miles away, where it will be further transformed to 220 kV for transmission to Southern Germany.

Eastbourne.—PARADE ILLUMINATIONS.—The Corporation Electricity Committee is to erect 27 new lamps with "Paisley" fittings and rings for decorative lamps on the sea wall of the Royal Parade and lay cables at a cost of £1,949.

Epsom.—ELECTRICITY IN BULK.—The Urban District Council Electricity Committee has decided that negotiations shall be opened with the London and Home Counties Joint Electricity Authority for a supply of electricity in bulk.

Formby.—LOAN.—It is anticipated by the Urban District Council that in the next three years it will be necessary to incur capital expenditure totalling £6,500 for development, and application is being made for sanction to borrow this sum.

Henley-on-Thames.—STREET LIGHTING.—The Town Council has decided to adopt electricity for street lighting, and to accept the tender of the Thames Valley Electric Supply Co., Ltd., for public lighting on a five-years' contract.

Irish Free State.—ELECTRICITY SUPPLY BOARD.—On March 28th the Electricity Supply Board assumed control of six additional municipal undertakings, including Dublin, Rathmines, and Pembroke. Previously eight such undertakings had been acquired by the Board, and now only four remain under municipal control. It is expected that electricity supplies from the Shannon will be available at the end of September, and in the meantime the Province of Leinster will be supplied with electricity from the Dublin plant.

Lancaster.—EXTENSION OF SUPPLY AREA.—The Lancaster Town Council has agreed to the proposal of the Electricity Committee to apply for a Special Order to extend the area of supply in parts of the Lancaster and Linnerdale Union. Caton and Halton are two villages anxious for better supplies for domestic purposes, and Hest Bank and Slyne are also applying for electricity. Underground cables are recommended for the Hest Bank scheme, and overhead from Hest Bank to Slyne. The estimated cost is £8,895.

Lytham St. Annes.—LOAN SANCTIONED.—Authority has been obtained by the Corporation to borrow £10,986 for the provision of mains, services and plant, in connection with the extension of the electricity supply to Freckleton, Warton and Brying-with-Kelleaneath.

Maidenhead.—NEW SUB-STATION.—The Town Council has applied for sanction to a loan of £3,800 for the provision of a sub-station in Bridge Road.

Northampton.—SUPPLY TO WATER WORKS.—At a recent meeting of the Corporation Water Committee a report from the water engineer was considered on the question of the electrification of the pumping plant at the Billing Road pumping station, at an estimated cost of £1,750. The approximate saving on the present system is estimated at £300 per annum. The Committee recommended that, subject to satisfactory arrangements being made with the Northampton Electric Light & Power Co., Ltd., as to power supply, the water engineer be authorised to purchase the necessary plant.

Northern Ireland.—ANTRIM.—The Antrim Electricity Supply Company, which intends to develop a hydro-electric power scheme on the Lower Bann, expects to be in a position to supply electricity in a large part of County Antrim and a portion of County Derry by October of this year. A survey is now being made over the route of the first section of the overhead transmission line, which will be 35 miles in length, and will extend from a point near Monkstown to Cullybackey, north of Ballymena. As soon as this line has been erected branch lines will be provided, so that the company will be able to supply electricity to all its main power users. Steps will be taken to ensure that the line and the poles will not mar the scenery of the countryside. At a later stage the transmission line will be extended as far north as Coleraine. The company's hydro-electric plant will be situated at Caronroe.

BELFAST.—At a recent meeting of the City Council it was decided to apply for sanction to a loan of £77,035 for distribution and engineering schemes.

Oundle.—ELECTRICITY SUPPLY.—The Urban District Council has referred the question of a supply of electricity for the town to the Highways Committee for consideration.

Penge.—ELECTRICITY CHARGES.—The Urban District Council has adopted a recommendation by the Works Committee that as the time has arrived when the increase of 33⅓ per cent. in the charges for electricity made in 1920 by the South Metropolitan Electric Light & Power Co. is no longer justifiable, the company be informed that the Council is no longer prepared to pay the increase.

Pontardulais.—SUB-STATION FIRE.—The *South Wales Daily Post* reports that serious damage was done by an outbreak of fire which occurred on March 29th at the distributing station of the Gorseinon Electric Light Co., Ltd. The station and machinery were completely destroyed.

Preston.—ELECTRICITY SUPPLY.—At a recent meeting of the Corporation the chairman of the Electricity Committee said that the Penwortham and Ashton districts required an additional transformer and alterations to mains, the cost of which would be £4,100.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BETHESDA.—Lighting: From 9d. to 7d. per kWh.

WIMBLEDON.—Power: The sliding scale abolished, and the flat rate reduced from 1¼d. to 1d. per kWh. Kinemas: Minimum annual consumption of 15,000 kWh, from 3¼d. to 3⅛d. per kWh; minimum annual consumption of 10,000 kWh, from 3½d. to 3¼d. per kWh.

EASTBOURNE.—Domestic rate under the "all in" tariff: The "unit" charge from ¾d. to ½d. Power, heating and cooking: Flat rate from 1d. to ¾d. per kWh. Lighting: First 2,500 kWh per quarter, 4d. per kWh; next 2,500 kWh, 3¾d.; next 2,500 kWh, 3d.; over 7,500 kWh, 2½d. per kWh.

MAIDSTONE.—Telephone system: From 7s. 4d. to 7s. per annum per 30-watt lamp.

OSWESTRY.—*Oswestry Electric Light and Power Co., Ltd.*—Lighting: From 10d. to 8d. per kWh. Power: From 6d. to 3d. per kWh.

Rainford.—INAUGURATION OF SUPPLY.—An electricity supply for the district was recently inaugurated by Mrs. Wilson Grundy, wife of the chairman of the local Council. The supply is provided by St. Helens Corporation.

Scotland.—ELECTRICAL DEVELOPMENT.—The Scottish Southern Electric Supply Co., Ltd., has during the past year made further large extensions throughout the Border area. A l.p. distribution system has now been laid down in Innerleithen, and a h.p. line has been provided between the power station in Galashiels and Melrose. The construction of this line has enabled the company to close down the small plant at Melrose and to generate all the electricity required by the consumers in Melrose at Galashiels power station. The Galashiels-Melrose line has been extended to Jedburgh, where the company has contracted to supply new works which are being established there. It has also acquired the existing electricity undertaking in Jedburgh. During the year approximately 17 miles of h.p. lines were added. The question of extending the supply to Stow and to Kelso is receiving attention.

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Sheffield.—Mains Extensions.—The Corporation Electricity Committee has authorised mains extensions at a cost of £11,265.

St. Helens.—New Electricity Charges.—The Town Council has decided as from July 1st next to terminate the existing rate of charge for electricity to domestic consumers on the ratable value system. Such consumers will have the option of being charged on either of the following rates: A fixed charge of 5 per cent. per quarter on the ratable value, plus 1d. per kWh; a fixed charge of 5 per cent. per quarter on the ratable value, or £1 per quarter, whichever is the greater, plus ⅝d. per kWh. If desired, consumers may be charged at a flat rate of 4d. per kWh for lighting and a flat rate of 1d. per kWh for heating, cooking, and domestic power, plus 2s. 6d. per annum meter rent.

Tarleton.—Electricity Scheme.—At a meeting of ratepayers convened by the West Lancashire Rural Council on March 27th, it was decided to adopt an electricity scheme for the district, 161 residents having consented to take a supply. It is proposed to take a bulk supply of electricity and the charges are to be 8d. per kWh for lighting, and 2½d. per kWh for power. There will also be street lighting with 100 lamps.

Turkey.—Submarine Cable.—Les Forges et Ateliers de Constructions Electriques de Jeumont (Nord), France, has recently completed a submarine cable across the Bosphorus. The cable is about 1½ miles in length, has three 35 sq. mm. conductors, and is intended for the transmission of power at 15,000 V.

Tramway and Railway Notes.

Continental.—France.—The *Morning Post* reports that the Pyrenean electric railway, which is being constructed by the Midi Railway of France, is nearing completion, and it is expected that the first train will run over the new track on July 1st. Hitherto the only route to Barcelona ran east from Toulouse to the Mediterranean coast, along which it travelled south-west to Barcelona. The new route will continue south from Toulouse to Ax-les-Thermes, and will pass through the heart of the Pyrenees to the Spanish border town of Puigcerda. The new cut through the Pyrenees is only 26 miles in length, and will climb from Ax-les-Thermes at an altitude of 2,300 ft. to Puymorens, at an altitude of 5,200 ft. in just under 20 miles.

The Compagnie Paris, Lyons et Méditerranée, one of the principal trunk-line railroads in France, having need of some particularly powerful locomotives for its line from Culoz to Modane, which is now being converted for electrical operation, called for offers from all the important builders in that part of the country. As a result, the company retained four proposals by which the respective builders were to each provide one locomotive to undergo exhaustive trials during a year, when the company would make its choice. Among the four constructors the Société Oerlikon submitted details of a locomotive of 2,400 h.p., with a speed of 130 km. (81 m.p.h.). After two years' service this locomotive was adopted, but the company then requested the builders to prepare a more powerful machine, and the first four are now being built at Ornans, each of 5,400 h.p.; they are of the 4-12-4 type; the driving wheels are in two units of six wheels, all 1.6 m. in diameter, and each pair is driven by two twin motors of 930 h.p. at 1,500 volts d.c., which is supplied by means of an overhead wire, or by a third rail, as circumstances may require. The overall length is 23.8 m., and the gross weight is 158 tons.

Germany.—*The Times* reports that the tramway services of Wiesbaden operated by a private company, have been discontinued on account of the city's refusal to renew the concession. Wiesbaden is now the only one of the larger German cities without a tramway service. Omnibuses have taken the place of the tramcars, and the first day of the experiment proved successful.

Haslingden.—Proposed Abandonment of Tramway.—The abandonment of the tramway in favour of extended omnibus services was suggested at a meeting of the Town Council on April 4th. It was stated that tramway statistics showed an unsatisfactory position. After crediting the surplus from semi-express omnibus service Accrington to Rawtenstall and Bacup, and income from investments, there was a net loss of £225. The estimated loss on tramways for next year, assuming they continued so long with the present competition of semi-express 'bus services, would be £2,330. After crediting an estimated surplus of £821 accruing from running semi-express 'bus services, the deficiency would be reduced to £1,509. The Tramways Committee was unanimously of opinion that the only remedy was to scrap the trams and substitute motor-'buses. It intended to meet Accrington and Rawtenstall representatives early to discuss the position, and it hoped to reach a mutual agreement for the substitution of 'buses.

London.—Tube Lighting System.—The existing lighting installation with 7,000 lamps on the Central London Railway is to be replaced. The cost of the new installation will be nearly £40,000, and sixty-five miles of cable and wire will be used. Hitherto the lighting supply has been by d.c. at 600 V. With the low-voltage a.c. installation, which is to take its place, a better lighting service at lower annual cost will be obtained, maintenance costs will be lower, and the number of lamp failures and renewals will be materially reduced. The new system will also bring the lighting into line with the systems already in use on the other Tube railways, with the usual advantages resulting from standardisation. A further effect of the change will be to provide a supply on the Central London Railway suitable for working certain automatic ticket-issuing machines, small illuminated signs, and automatic "train describers" on the platforms. The work will be started at once and finished next year.

Oxford Circus Station.—The new comb pattern escalator, installed at Oxford Circus station in place of an old-type machine, was put into service on April 5th. This is one of the three escalators connecting the Bakerloo line with the booking hall. It is faster than the old machine by 10 ft. per minute. Four out of the five escalators at this station are now of the comb pattern.

Lytham St. Annes.—Loss on Tramways.—The Corporation Tramways Committee reports a total loss on the tramway undertaking during the past nine years of over £30,000. During the past year the loss was £3,739.

Telegraph and Telephone Notes.

Australia.—Carrier-wave Telephony.—At meetings of electrical engineers held simultaneously in Sydney and Melbourne, communication was maintained by means of the carrier-wave telephone system. Speakers in Melbourne and Sydney were heard with equal clearness at both meetings.

Belgium.—Threatened Wireless Operators' Strike.—Wireless operators, to the number of 160, are claiming an increase of pay, and are threatening to come out on strike should it be refused them. If the strike eventuates, all Belgian vessels of over 1,500 tons will be affected.—*Reuter* (Antwerp).

Canada.—Radio Beacon.—Canada's first automatic wireless beacon was inaugurated on April 6th on Seal Island, off Nova Scotia. It is the first of a chain of seventeen beacons stretching from the Gulf of St. Lawrence to the Great Lakes.

Telephone Development.—There were 1,259,987 telephones in use throughout Canada in 1927, or 13.2 for every hundred persons living in the country. On the *per capita* basis, Canada is second among the nations of the world in the use of the telephone, the United States being the first with 15.3 per hundred of population, New Zealand third with 9.5, and Denmark fourth with 9.2.—*Reuter's* (Ottawa).

France.—Rural Telephones.—The Post and Telegraph authorities propose to considerably extend the number of automatic telephone exchanges in country villages throughout France during the course of the present year.

India.—Beam Radio-telegraphy.—Our Indian correspondent reports that the first complete year's operation of the beam telegraph service introduced by the Indian Radio Telegraph Co. has resulted in a gross profit of Rs. 10,18,000. After making provision for depreciation and reserve, total dividends of 10 per cent. on ordinary shares and 4 per cent. on deferred shares have been declared. From the date the service was inaugurated, the company handled a much greater volume of traffic than was anticipated. The staff was therefore augmented and put into a much better position for dealing with the requirements of the service in all its branches. A significant feature of the increased traffic is the large proportion of "full rate" messages, almost all of which are sent in code. This particular feature is the best evidence that the accuracy and speed of the service are meeting the requirements of the public. There has also been a marked increase during the year in the cheaper classes of traffic, and in this direction the company looks for great expansion of the existing Anglo-Indian circuit. During the past year, in co-operation with the Government of India and the British Post Office, the company extended the facilities for "daily letter telegrams" and "week-end letter telegrams" to many countries.

The company's service still suffers from the handicap of the absence of its own land lines between Bombay, Calcutta, and the other large commercial centres in India. Negotiations are in progress with the Government of India, and if certain proposals which have been made are adopted, this state of affairs may soon be remedied.

The extension of the present wireless service to other countries is engaging the attention of the company's board, and the Government of India has assured the company of its support and has promised sympathetic consideration of any developments of this nature. It is also known that the establishment

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of a system of wireless telephony between India and Great Britain, utilising the beam for that purpose, would meet with the approval of the Government of India.

The trading branch of the company's activities has not, however, been satisfactory, but there is hope that the sale of apparatus for other than broadcasting purposes will increase as the value of wireless point-to-point telegraphy or telephony, wireless beacons, public-address systems, &c., becomes more generally recognised. Several schemes for the establishment of wireless communication have been submitted during the year, some of which it is hoped will materialise in the near future.

International Telephony.—Hungary-Rumania.—A new telephone service between Hungary and Rumania was opened on April 2nd; the facility was welcomed, and the new line was extremely busy. By a conversation with the director of the Norwegian Postal Service, Baron Szalay, of Budapest, inaugurated a telephone service with Norway.

Telegraphy.—Code Rules.—The *Financial News* learns that it has been decided by the several representative bodies concerned to give a trial to the telegraph-code regulations which were formulated at the recent Brussels Conference. It will be recalled that a number of objections were at one time raised to the regulations, but the hope is now entertained that the new conditions will give satisfaction, and that no revision may be found necessary in the interval which must elapse before the next Imperial Telegraph Conference, scheduled to be held in Madrid in 1932. The new regulations come into force on October 1st next.

Radio Notes.

Germany.—New Headquarters.—The Funk-Stunde, Berlin, has sold the *Voxhaus* in the Potsdamer Strasse, where the company has had its studios and offices since its foundation in 1923, and has acquired land on which it is intended to construct a new *Funkhaus* for the Berlin stations. It is hoped to begin work on the new building this summer, and to complete it by the end of 1930. The Funk-Stunde has acquired the land, says *World-Radio*, jointly with the Reichs-Rundfunk-Gesellschaft. The new headquarters will contain the offices and studios of the Funk-Stunde and Deutsche Welle, G.m.b.H. (the company controlling the Deutschlandsender at Königswusterhausen), and the offices of the Reichs-Rundfunk-Gesellschaft and Reichs Broadcasting Commissioner. There will be several large studios, and room has also been provided in the plan for a broadcasting museum. The site is quite near the Radio Exhibition Halls at Witzleben.

India.—Broadcasting.—Our correspondent in India informs us that the trading branch of the Indian Radio Telegraph Co.'s activities was not satisfactory during its first complete year's operations. The sale of broadcast receivers and component parts was disappointing, due largely to the slow progress which broadcast telephony has made in India hitherto. Until the Indian public recognises the benefits to be derived from such a service, it will not be possible to increase the sale of this particular class of apparatus very materially.

International Wireless Conference.—"Brussels Plan."—The International Wireless Conference opened at Prague on April 4th. Delegates of 27 European and three non-European telegraph administrations attended, of eight telegraph companies, the International Union of Wireless Telegraphy and the International Committee of Aeronautics. A discussion took place on the Wireless Telephony Committee on the Czecho-Slovak proposals recommending the so-called "Brussels plan" as the basis for the distribution of "radiophonic waves" and co-operation between the World Telegraph Union of Berne and the Wireless Telephone Union of Geneva.—*Reuter* (Prague).

The first conference of the International Consultative Technical Committee of Wireless Communications will take place at The Hague at the end of September, and will probably last ten days.—*Reuter* (The Hague).

New B.B.C. Premises.—Manchester.—The B.B.C. announces that the address of the north regional studios and offices are Broadcasting House, Piccadilly, Manchester. The old accommodation at Orme Buildings has been vacated, and the first programme from the new premises was broadcast on April 8th. The new premises are situated on the north side of Piccadilly, overlooking the municipal gardens. There are three studios: the largest, 54 ft. long by 35 ft. wide, two storeys in height, and containing a gallery for an audience of about 80 people, will be used for big orchestral and operatic performances; the second studio will be used for dramatic performances and other activities, and is 33 ft. long by 16 ft. wide. In addition, there is a small talks studio. A sound effects studio is attached to the dramatic studio, as is also an echo room. The control room is equipped with the latest engineering devices.

Sweden.—New Station.—The Swedish Telegraph Board has given the Marconi Company, of London, an order for equipment for a new 60-kW broadcasting station near Stockholm. The cost of the equipment will be about Kr.400,000, and delivery is to be made next November.—*Reuter's Trade Service* (Stockholm).

United States.—More N.B.C. Stations.—Coincident with an announcement that it is now on a self-supporting basis, the National Broadcasting Company added four southern stations to its coast-to-coast network, which forms the largest group of associated radio stations in the world. The four stations are: WSMB, in New Orleans; WAPI, in Birmingham (Ala.); KTHS, in Hot Springs; and WIOD, in Miami Beach.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 15th. Victorian Railways. One geared 3-phase electric winding engine. (A.X. 7650.)*

May 15th. Melbourne Tramways Board. One 500-kW substation rectifier unit for automatic control, with switchgear. (B.X. 5206.)*

Melbourne Tramways Board. May 15th. Two rotary convertor units of 1,000 kW and one 500 kW for automatic control. (B.X. 5210.)*

Sydney.—May 13th. Public Works Department. One synchronous condenser. (B.X. 5205.)*

May 28th. Posts and Telegraphs Department. Telephone jacks and number plates. (B.X. 5202.)*

Batley.—April 15th. Electricity Department. L.p. cable. (March 29th.)

Bridport.—April 15th. Electricity Department. H. and l.p underground and overhead cables. (March 29th.)

Canterbury.—April 15th. Board of Guardians. Completion of the electric lighting installation at the Guardians' Institution, Nunnery Fields. Specifications from Mr. H. Rose, clerk, 80, Castle Street, Canterbury.

Carlisle.—Electricity Department. L.C. and L.C.A. paper insulated cables for 12 months. (See this issue.)

Dublin.—April 23rd. Dublin Port and Docks Board. Three electric overhead travelling cranes and gantries at new tobacco warehouse, Custom House Docks. Specifications from engineer to the Board, East Wall, Dublin.

Dumfries.—April 17th. Electricity Department. One water cooling tower. (March 29th.)

Dundee.—April 24th. Transport Department. Stores, including armature and field coils, castings, &c., for a year. Specifications, &c., from general manager.

April 27th. Harbour Trustees. Two 3-ton electric travelling jib cranes of portal type. Specifications, &c., from office of the General Manager and Engineer, Harbour Trust.

Edinburgh.—April 15th. East Lothian Education Authority. Electrical and heating installations for the new school at Tranent. Schedules, &c., from R. & A. K. Smith, surveyors, 4, Forres Street, Edinburgh.

April 22nd. Education Authority. Electric lighting and heating installation at the new school at Saughton. Plans, &c., from Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

Edlington.—April 17th. West Riding Education Committee. Installation of electric lighting at new schools and caretaker's house. Education Officer, County Hall, Wakefield.

Egypt.—Cairo.—May 15th. Ministry of Public Works. 120-kW d.c. Diesel-engine generating set and a small electrically-driven cooling water pump. Forms of tender from the Chief Inspecting Engineer, 41, Tothill Street, S.W.

Epping.—May 2nd. Board of Guardians. Installation of electric light at the Institution, Epping. (See this issue.)

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Irish Free State.—Dublin.—April 29th. Electricity Supply Board. Supply and laying of 40,000-V cables in the County and City of Dublin. (April 5th.)

Irvine (Ayrshire).—April 15th. Town Council. Electric lighting installation at housing scheme. Specifications (deposit of £1 1s.) from Town Clerk.

Leeds.—April 17th. Board of Guardians. New steam-driven generating sets, boiler feed pumps, &c., new switchboards and mains, &c., for the Rothwell Institution. Specifications from Mr. E. Griffiths, consulting engineer, The Temple, Dale Street, Liverpool.

London.—Central Electricity Board.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

May 4th. Supply, delivery and erection of 33,000-V and lower-voltage cables in connection with the South-East England Electricity Scheme. (See this issue.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (March 15th.)

Islington.—May 6th. Cleansing Committee. Two new lead batteries for Edison electric vehicles. (April 5th.)

London County Council.—April 22nd. Reconstruction of conduit tramways in Whitechapel High Street. Specification (£5) from the Chief Engineer, Old County Hall, Spring Gardens, S.W.

H.M. Office of Works.—April 22nd. Supply of incandescent electric lamps. (See this issue.)

Lourenço Marques.—April 22nd. Port and Railways Board. Electric hanging and ordinary lamps. (B.X. 5188.)*

Manchester.—April 16th. Tramway Committee. Electric welding equipment for tram rails. General manager, 55, Piccadilly, Manchester.

April 24th. Electricity Committee. Stores for 12 months, including dry batteries, conduit and wiring accessories, fuse boxes, auto-transformers, &c. Particulars from Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall.

Smethwick.—April 17th. Electric lighting installation at Slipper Baths, Mallon Street. Specification (£1 1s.). Form of tender from Mr. R. Fletcher, borough engineer, Council House.

South Africa.—Johannesburg.—May 16th. South African Railways and Harbours. Electric signalling apparatus. (B.X. 5165.)*

Cape Town.—May 1st. Electricity Department. 30-ft. steel tubular poles, cross arms, insulators, &c. (A.X. 7697.)*

Bloemfontein.—May 18th. Electric Supply Department. Turbine and generator, condensing plant and auxiliaries; switchgear and cables; cooling spray pond equipment, or alternatively cooling tower complete. (B.X. 5192.)*

Southampton.—April 30th. Electricity Department. Steel-framed building, steelwork for firing floor, platform carrying induced draught fans, overhead bunkers, &c.; two water-tube boilers with superheaters, economisers, air heaters, mountings, chain-grate stokers, water walls, induced and forced draught fans, sootblowers, steel flues and chimneys, grit arrestors and collectors, &c.; steam, feed-water and other piping, covering, &c.; water softener. (March 29th.)

Stafford.—April 30th. County Education Committee. Installation of electric lighting and power at the New High School for Girls, Wellington Road, Bilston. Installation of electric light at the Girls' High School, Stafford. (See this issue.)

Uruguay. — Montevideo.—May 6th. State Electricity Works. Electric cables and accessories. (B.X. 5178.)*

Walthamstow.—May 3rd. Education Committee. Electrical installation for the Billet Road school. (See this issue.)

Wolverhampton.—May 10th. West Midlands Joint Electricity Authority. One 50,000-kW turbo-alternator with step-up transformers, &c., condensing plant, boiler feed pumps, evaporators, circulating water pumps, &c., main and auxiliary 33,000-V switchgear with circuit breaker. (March 29th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Melbourne.—Commonwealth Department of Works and Railways.

Six motor control switches, three distribution and cut-out boxes, and 2,700 bin magnets for mail handling plant, Sydney (£2,011).—Standard Telephones & Cables (Australia), Ltd.

Victorian Railways.

Copper conductor (£2,422).—British Insulated Cables, Ltd.

State Electricity Commission of Victoria.

22,000-V oil circuit breakers (£4,427).—Siemens (Australia) Pty., Ltd.

22,000-V 3-core cable (£8,222).—British Insulated Cables, Ltd.

Water-tube boilers with auxiliary and accessory equipment (£223,288).—John Thompson (Australia) Pty., Ltd.

Pilot and telephone cable (£1,665).—Johnson & Phillips, Ltd.

Sydney.—New South Wales Railways.

20 sets headlight turbo-generators (£730).—Coates & Co., Pty., Ltd.

30 sets do. (£930).—Lawrence & Hanson Electrical Co., Ltd.

—*Tenders.*

Beckenham.—Electricity Committee. Accepted:—

E.h.p. switchgear (£188).—New Switchgear Construction Co., Ltd.

L.p. switchgear (£103).—British Insulated Cables, Ltd.

Birkenhead.—Electricity Committee. Accepted:—

One 6,600-V truck type cubicle (£99).—British Thomson-Houston Co., Ltd.

Cable (£137).—W. T. Glover & Co., Ltd.

Three 200-kVA indoor type transformers (£372), one 100-kVA do. (£82).—General Electric Co., Ltd.

Cable.—(£267), Hackbridge Cable Co., Ltd.; (£380), British Insulated Cables, Ltd.

Transformer cubicle equipments (£440).—New Switchgear Construction Co., Ltd.

Oil circuit breaker equipments.—(£154) Allen West & Co., Ltd., and (£32) George Ellison, Ltd.

Cambridge.—Board of Guardians. Accepted:—

Installing automatic telephones (£178). — Siemens-Schuckert (Great Britain), Ltd.

Chester.—Board of Guardians. Accepted:—

Electrical accessories for three months.—F. J. Jones & Sons.

Fylde (Lancs.).—Board of Guardians. Accepted:—

Electrical installation at the Poor Law Institution, Kirkham (£2,239).—P. J. Frampton (Blackpool).

Glasgow.—Corporation. Accepted:—

Installing three new ventilating fans in the fan chamber of the City Hall: Supply and erection of new fans (£149).—Matthews & Yates, Ltd.

Necessary wiring.—Haddon & Co., Ltd.

Tramways Committee. Accepted:—

Rails.—Bolckow, Vaughan & Co., Ltd.

Ilford.—Electricity Committee. Recommended:—

Two switch pillars for Gants Hill sub-station (£605).—Metropolitan-Vickers Electrical Co., Ltd.

Transformer and switch kiosks—

General Electric Co., Ltd.	£694
Yorks. Switchgear and Engineering Co., Ltd. ...	668
Ferguson, Pailin, Ltd.	617
Long & Crawford	590
Lucy & Co., Ltd.	563
Foster Engineering Co., Ltd.	531
Crompton Parkinson, Ltd. (Recommended) ...	497

Irish Free State.—Dublin.—Department of Local Government and Public Health.

Six months' supplies of Osram metal-filament, gasfilled and vacuum lamps, also Robertson carbon lamps.—General Electric Co., Ltd.

Electricity and Public Lighting Department. Accepted:—

Change-over time switches (approx. £570).—Roper Bros.

Electric wiring in houses on the Emmet Road (Extension) Housing Area (£4,511).—Hall & Stenson, Ltd.

Twelve months' supply of cables and accessories for the City Electricity Department:—

H.p. and l.p. cables.—Siemens-Schuckert (Ireland), Ltd.; British Insulated Cables, Ltd.; C. J. Vogel; Deutsche Kabelwerke A.G.

Aerial conductors.—British Insulated Cables, Ltd.; Deutsche Kabelwerke A.G.

Section pillars and disconnecting boxes.—British Insulated Cables, Ltd.

Service boxes.—Lucy & Co., Ltd.

Cast iron troughing.—Hammond Lane Foundry Co., Ltd.

Stoneware troughing.—Albion Clay Co., Ltd.

Compound.—Berry, Wiggins & Co., Ltd.

—*Irish Builder and Engineer.*

London.—Metropolitan Asylums Board.

Laying service cables for the supply of electricity to Colindale Hospital (£154).—Hendon Electric Supply Co., Ltd. (Accepted.)

Installation of automatic telephone system at the North-Western Hospital:—

Alpha Manufacturing & Electrical Co., Ltd. (Recommended.)	£995
L. G. Tate & Co., Ltd.	1,074
Telephone & Electrical Maintenance Co.	1,120
W. J. Furse & Co. (London), Ltd.	1,126
Automatic Telephone Manufacturing Co., Ltd.	1,250
T. Clarke & Co., Ltd.	1,300
Read & Partners, Ltd.	1,360
Ericsson Telephones, Ltd.	1,500

The following tenders were received for the installation of X-ray apparatus at the King George V Sanatorium:—

Schall & Son, Ltd.	£486
Solus Electrical Co.	501
Newton & Wright, Ltd.	571
Alternative	594
Do.	609
Do.	632
Watson & Sons (Electro-Medical), Ltd.	635
X-Rays, Ltd.	677

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ADMIRALTY.—
Electric soldering irons.—Electric Heating Co.
Accumulators.—Edison Swan Electric Co., Ltd.
GENERAL POST OFFICE.
Distribution boards.—Edison Swan Electric Co., Ltd.
HAMMERSMITH.—Electricity Committee. Recommended:—
Electrical goods for 12 months.—General Electric Co., Ltd.

Liverpool.—Electric Power and Lighting Committee. Recommended. Supply of materials required during the twelve months ending March 31st, 1930:—
Cables, compounds and tapes for street mains.—Callender's Cable and Construction Co., Ltd.; Penmaenmawr and Trinidad Lake Asphalt Co., Ltd.; Dussek Bitumen Co., Ltd.; British Insulated Cables, Ltd.
Insulated cables.—Mersey Cable Works, Ltd.; William Geipel & Co., Ltd.; Edison Swan Electric Co., Ltd.
Electricity meters.—Ferranti, Ltd.
Incandescent electric lamps.—Tungstalite, Ltd.
Brass and copper castings.—Liverpool Brass and Engineering Co.; R. Roberts & Sons.
A.c. electric motors and starting gear.—Crompton Parkinson, Ltd.; English Electric Co., Ltd.; British Thomson-Houston Co., Ltd.; Airedale Electrical and Manufacturing Co., Ltd.
Stoneware, troughing, tiles and concrete cable covers.—Joseph Place & Sons, Ltd.; Doulton & Co., Ltd.; Joseph Parr, Ltd.; S. E. Bonsall; Isherwood Bros., Ltd.

Maidenhead.—Town Council. Accepted:—
Kiosk for the Punt Hill sub-station (£244).—W. Lucy and Co.

Rotherham.—Electricity Committee. Recommended:—
Transformers.—General Electric Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
Switchgear for sub-stations (£5,933).—A. Reyrolle & Co., Ltd.
Thirty 300-kVA and six 450-kVA three-phase transformers (£6,384).—Metropolitan-Vickers Electrical Co., Ltd.
Six 250-kVA single-phase transformers and four 1,000-kVA Scott-connected sets (£2,868).—British Electric Transformer Co., Ltd.
Recommended:—
Boilers and accessories (£140,206).—Stirling Boiler Co., Ltd.
Turbo-alternator and condensing plant (£94,413).—English Electric Co., Ltd.
Pipework and valves (£25,492).—Brightside Foundry and Engineering Co., Ltd.
E.h.p. switchgear (£55,067).—General Electric Co., Ltd.
Transformers (£5,008).—British Electric Transformer Co., Ltd.
Cooling towers and tanks (£19,194).—Davenport Engineering Co., Ltd.
Coal-handling plant (£23,292).—Mitchell Conveyor Co., Ltd.
Cranes (£5,421).—Isles, Ltd.
Battery shunting locomotive (£1,915).—English Electric Co., Ltd.

Spenborough.—
Electrical work at the new Library.—F. W. Birkett & Sons (Cleckheaton).

York.—Watch Committee. Recommended:—
Installation of automatic traffic signals (£523).—Barber and Colman.

Forthcoming Events.

Institution of Engineers-in-Charge.—Friday, April 12th. Holborn Restaurant. 6.30 p.m. Annual dinner.
Tuesday, April 16th. St. Bride Institute, Bride Lane, E.C. 7.30 p.m. "Some Notes on the Engineering Equipment of Institutions Economically Considered." Mr. W. M. Benny.

Royal Society of Arts.—Friday, April 12th. John Street, Adelphi, W.C. 4.30 p.m. "Recent Electrical Developments in India." Mr. A. T. Cooper.

Association of Mining Electrical Engineers (Western Sub-Branch).—Saturday, April 13th. Swansea. Annual dinner.
(South Wales Branch).—Saturday, April 20th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Three-phase Induction Motors and their Control Systems." Mr. H. T. Gregory.

Salford Technical and Engineering Association.—Saturday, April 13th. Royal Technical College. 7 p.m. "Electric Storage Battery Traction." Mr. J. A. Hunt.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, April 15th. Institution, London, W.C. 7 p.m. "Power Supply and Railway Electrical Signalling." Mr. N. G. Tweedie.
ORDINARY MEETING.—Thursday, April 18th. Institution, London, W.C. 6 p.m. "The Modern Use of Pulverised Fuel in Power Stations." Mr. R. A. Chattock.

Institution of Electrical Engineers—*continued.*
(Irish Centre, Dublin).—Thursday, April 18th. Trinity College, Dublin. 7.45 p.m. "Electric Time Signalling." Mr. J. D. Ferguson.
(Mersey and North Wales (Liverpool) Centre).—Monday, April 15th. University, Liverpool. 7 p.m. Annual general meeting. Short papers by members.
(Sheffield Sub-Centre).—Wednesday, April 17th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Practice and Progress in Combustion of Coal as Applied to Steam Generation." Mr. F. H. Rosencrants.
(Tees-side Sub-Centre).—Wednesday, April 17th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Annual general meeting.
(South Midland Centre).—Monday, April 15th. University, Birmingham. 7 p.m. "Direct Generation of Alternating Current at High Voltages." Sir Chas. A. Parsons, F.R.S., and Mr. J. Rosen.
(North-Western Students' Section).—Tuesday, April 16th. Engineers' Club, Manchester. 7.15 p.m. Annual general meeting. "Errors in Current and Voltage Measurements at Radio Frequencies." Mr. F. Roberts.
(London Students' Section).—Friday, April 19th. Institution, London, W.C. 6.15 p.m. Address by Dr. A. H. Railing.

Electrical Association for Women.—Tuesday, April 16th. Hotel Cecil. One-day conference, luncheon, works visit, and ball.

Association of Supervising Electrical Engineers.—Tuesday, April 16th. Junior Institution of Engineers, 39, Victoria Street, S.W. 6.30 p.m. "Variable Speed A.C. Commutator Motors." Mr. C. V. Hill.

Institution of Civil Engineers.—Wednesday, April 17th. Institution, Great George Street, S.W. 6 p.m. "Problems involved in the Design of Overhead Transmission Lines." Mr. E. T. Painton.

British Institute of Radiology (incorporated with the Röntgen Society).—Thursday, April 18th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

South Wales Transport Co., Ltd.—Thursday, April 18th. Mumbles Pier Pavilion. 1.30 p.m. Luncheon to commemorate the electrification of the Mumbles Railway.

Physical Society.—Friday, April 19th. Imperial College of Science, South Kensington, S.W. 5 p.m. Guthrie lecture. "Properties of the Elements under High Pressures." Prof. P. W. Bridgman.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

SILVERLITE house-lighting plant.

Notes.

X-ray Protection.

We have received Circular No. 374 of the U.S.A. Bureau of Standards dealing with the X-ray and radium protection recommendations promulgated by the International Congress of Radiology at Stockholm last year. These recommendations are substantially the same as those submitted by the British X-ray and Radium Protection Committee, based largely on the experience of the National Physical Laboratory, and it is satisfactory to note their official adoption by the Bureau of Standards. The problems of protection are continually being simplified, and it is intended that the recommendations shall come up for review at the third International Congress of Radiology at Paris in September, 1931. To this end an International Protection Committee was formed at Stockholm, consisting of one representative each from England, France, America, Germany, Sweden, and Italy. Any major questions or suggestions regarding X-ray or radium protection should be referred to this Committee, of which the honorary secretaries are Dr. G. W. C. Kaye (the National Physical Laboratory, Teddington) and Dr. Stanley Melville (9, Chandos Street, London, W.1).

Local Society.

The annual supper and smoking concert of the Paisley Association of Electrical Engineers was held on March 26th. There was a good attendance, presided over by Mr. J. R. Bisland, who was supported by Mr. Barrett (Glasgow) and past presidents W. Blair Smith, W. R. Bruce, R. W. Dodson, James Neil and J. M. Barbour.

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Container for Impregnating and Drying.

The Swiss Federal Railways have lately installed an interesting container for impregnating stators, rotors, and transformers, the dimensions of the vessel being 11 ft. 6 in. in diameter by 13 ft. high. It was constructed by Messrs. Sulzer Bros., and the cylindrical part of the container has a longitudinal joint which was welded; the rounded bottom was constructed in two parts, pressed to shape hydraulically, and afterwards welded together, and then welded to the body of the container. Three sets of coils, with a total heating surface of about 590 sq. ft., are arranged in the interior. At the bottom of the container grate-like supports are provided for carrying the parts to be impregnated. In addition, a special carrier can be fitted on which the rotors to be impregnated are hung and kept turning slowly by means of a motor. The container is fitted with safety valves, and has also an inspection hole and thermometers to allow of the process being observed and controlled. The usual working pressure is 56 lb. per sq. in., but the container is also capable of withstanding a vacuum of 100 per cent.

Appointments Vacant.

Wireman for consumers' installation department, and meter reader and fixer for the Radcliffe Urban District Council Electricity Department. Hiring and sales superintendent (£300) for the Borough of Darlington Electricity Department. Draughtsman (66s. 2d.-82s.) and junior technical officer (£266) for the Royal Aircraft Establishment, South Farnborough. Telephone engineer (£738) for the Egyptian State Railways Telegraphs and Telephone Administration. Mains assistant (£200) for the Worksop Urban District Council Electricity Department. Installation inspector (90s.) for the Borough of Stoke Newington Electricity Department. Power sales engineer (£750 to £1,000) for the Irish Free State Electricity Supply Board. Shift engineer for the Borough of Southport Electricity Department. Switchboard attendant for Eastbourne Electricity Department. Shift engineer (£575) for Malaya, for the Perak River Hydro-Electric Power Co., Ltd. Electric cooking demonstrator (£156) for the City of Lincoln Electricity Department. (See our advertisement pages to-day.)

Ionisation in Paper-insulated Cables.

Messrs. C. L. Dawes, H. H. Reichard, and P. H. Humphries presented a paper on this subject at the recent Convention of the American Institute of Electrical Engineers. It was the second report to be presented to the Institute on the research investigation of ionisation phenomena in paper-insulated, high-voltage cables, which is being conducted at the Harvard Engineering School under the auspices of the Impregnated Paper-Insulated Cable Research Committee. The power dissipated as ionisation loss in cables is much more harmful than the power dissipated in the solid dielectric. The paper presented methods of separating this ionisation loss from the total dielectric loss occurring in high-voltage impregnated paper cables, the methods having been verified experimentally. The paper consisted essentially of seven parts, as follows:—(1) A description of the apparatus and the method of impregnating cable paper whereby test specimens having practically no occluded gases can be produced. It is necessary to prepare and test samples in this manner in order to determine the law of their dielectric properties over a wide range of voltage gradient. It is only by knowing this law that it becomes possible to separate the ionisation loss in a cable from the total dielectric loss. The experiments show that with three typical, but widely different, types of impregnating compounds, the power factor and capacitance are constant up to gradients as high as from 250 to 300 volts per mil; the power loss is proportional to the voltage squared under these conditions. (2) In order to verify the law of ionisation loss in cables, as determined from the analysis of their dielectric-loss curves, it is necessary to know the character of the ionisation-loss curve for thin air films under conditions of "restricted ionisation." Such curves have been determined experimentally and the characteristics of two air films, of different thicknesses, are given. Above the ionisation voltage, the ionisation loss is a linear function of the voltage. (3) By employing the fact that in a cable the power loss in the solid dielectric varies as the square of the voltage, even above the ionisation voltage, it is simple to separate this loss from the total dielectric loss in a cable, the remainder being the ionisation power loss. The ionisation power-loss curve concaves upwards directly above the ionisation voltage. After all the gas films have become ionised, the curve becomes linear. This is confirmed by a synthetic curve determined from appropriate data. The analysis is given for four different cables having widely varying powers of ionisation, as a result of which the power-loss curves of cables may now be expressed by a very simple equation. It is suggested that the constants of the equations be used as a basis for the quality of cables. (4) Cable models, of glass with intervening air spaces, were made, and their dielectric-loss curves determined as with the actual cables. The analysis of the curves gives results identical with those obtained with actual cables, which seems to verify the results obtained with the cables themselves. (5) It is possible to express the power-factor curve by a simple equation, from which its maximum, &c., may be determined; in reality, the power-factor curve consists of three simple curves. (6) The energy current of a cable may be analysed into three simple components, one of which is determined by the loss in the solid dielectric and the other two by the ionisation characteristics of the cable. (7) The character of the capacitance curve, which varies in different cables, is determined by the positions and thicknesses of the gas films. Further experimental data and study are necessary before an accurate interpretation of the curves can be made.

Purified Textile Insulation.

According to Messrs. H. H. Glenn and E. B. Wood, of the Bell Telephone Laboratories, New York, purification of textiles for telephone wire insulation becomes of general interest when it is appreciated that the improvements obtained by washing are not nullified by the supplementary use of impregnating waxes, or varnishes; that is, the improvement in dielectric properties and reduced electrolysis obtained by washing and by impregnating are apparently substantially additive. While studies have not proceeded far enough to cover comprehensively all the better-known impregnating waxes, asphalts, varnishes, &c., they have proceeded to the point where it can be said that this is the case for the beeswax-paraffin waxes and certain asphaltic compounds. Their findings are in line with the generally-known fact that impregnation of textiles with wax compounds does not prevent, though it does retard, the absorption of moisture which, in the presence of soluble salts, causes conducting paths to be established, probably through the embedded textile fibres. Consequently, such materials as fabric-base insulating tapes, varnished linens and cambrics, electro-magnet coil-winding insulation, all being sensitive electrically to moisture, should benefit to a substantial degree by purification of the fibrous components. Therefore, while there is still much to be learned about the behaviour of silk and cotton with respect to their electrical characteristics under various treatments and conditions, the following statements can be made: (1) The removal of water-soluble salts which are present in both silk and cotton not only results in a very decided improvement in their insulating properties, but also reduces the sensitivity to change of the a.c. characteristics with changes in atmospheric moisture conditions. (2) The improvement which can be realised is great enough to permit the substitution of washed cotton for silk where ordinary commercial silk has been found to give satisfactory results. (3) The use of purified textiles in cables carrying continuous d.c. potential will reduce electrolysis and consequently prolong the useful life of such cables about in proportion to the extent to which the purification process is carried.

Salvaging Electric Lamp Caps.

A new machine, called a "rumbler," has been perfected in the United States for salvaging the brass shells from burned-out electric lamps. One company alone is stated to be dealing with 300,000 lamps per year to obtain the brass shells, which are sold as scrap metal. The old method of reclaiming the metal was to break the lamps by hand: they were put into a barrel, rigged like a churn, and a dasher worked up and down. Breaking the lamps in this way was not only slow and costly, but also too much material adhered to the brass caps, lowering their market value. The new motor-driven rumbler is a long, round machine; a revolving steel cylinder inside is perforated with many holes that are not quite large enough for the brass shells to fall through. About a barrelful of the glass bulbs, from 300 to 500 of all sizes, is poured into the cylinder. Loosely placed among them are two long steel bars, which are covered with prongs. As the rumbler revolves at high speed, the prongs quickly knock the glass, filament wires, and cement loose from the brass shells. The *débris* falls through the holes in the cylinder and the brass shells remain inside the cylinder in a clean and bright condition.

Bournemouth Pavilion Lighting.

In the article under the above heading in our issue of April 5th, reference is made to the stage switchboard which, however, is not illustrated in the article. Fig. 5 shows, as indicated, the power and lighting switchboard.

Preventing Blackening of Lamp Bulbs.

The development of a practical method of removing the black deposit which gradually collects on the inner surface of high-power incandescent lamps has been announced by the General Electric Company in the United States. The effects of the discovery will be of immediate service in the fields of aviation and moving-picture production, in which high-power incandescent lamps play rôles of great importance. Bulb-blackening has always been a significant factor in determining the useful life of all incandescent lamps, and, owing to the large filaments in high-intensity gasfilled lamps, the factor has been most important. The rising gas in such a lamp carries along evaporated tungsten, which is deposited on the cooler top and sides of the bulb; this "soot" both absorbs considerable light, and also radiates heat. In time the glass undergoes de-vitrification, and eventually becomes so hot that the bulb is soon ill-shaped and useless. The new deposit-remover is a tablespoonful of coarse tungsten powder, placed inside the lamp before it is sealed. After the lamp has become blackened through use, it need only be taken from the socket, inverted, and the filament deposit "swept" off the inner glass surface. The lamp is thereby restored to its primal efficiency. With the bulb-blackening difficulty practically removed, it is claimed, the lamp filament may be

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heated much nearer to its melting point without endangering the bulb and without shortening the customary 1,000 hours' life for which the lamps are designed. The new method has already been applied to several high-intensity lamps, including 1,500-watt, 32-volt; 3,000-watt, 32-volt; 5,000-watt, 115 volt; and 10,000-watt, 115-volt lamps for aviation service; also to 5,000- and 10,000-watt, 115-volt lamps for moving-picture studios.

Civil Service Commission.

Forthcoming examination for assistant examiners in the Patent Office (20-25).—Regulations and particulars, with forms on which applications must be made, can be obtained up to June 6th from the Secretary, Civil Service Commission, Burlington Gardens, W.1. (See our advertisement pages to-day.)

The Air Route to India.

The wireless organisation for the air mail service to India, which was opened on March 30th, has been completed so that the aircraft will be in touch with aerodrome ground stations throughout the 4,700 air miles of the journey. All the aircraft is equipped with Marconi wireless apparatus, and an intercommunicating chain of ground stations has been arranged. The first section of the route is the London-Basle flight, on which the present wireless organisation for Continental aviation will be employed; it consists of the aerodrome station at Croydon, French stations at Le Bourget, and other intermediate places on the route, and the Marconi station at Basle. The machines are fitted with sets of 150 watts power, type AD6, adapted for communication over distances of from 200 to 300 miles either by telephony or telegraphy. From Basle the night train to Genoa will make the connection with the second section of the air route, from Genoa to Alexandria, for which flying boats fitted with type AD8 sets, also adaptable for telegraphy or telephony, enabling the pilots to keep in touch with Italian and British Air Ministry wireless stations until they arrive at Alexandria. In addition, Imperial Airways, who are conducting the London-Karachi service, have stationed a depôt ship at a point in the Greek archipelago, which has been fitted with a valve transmitter of ½ kW power (type U) and a type RG19 receiver, and will be capable of communicating with Malta, Alexandria (Aboukir), and other stations concerned with the service. At Alexandria a change is made to aeroplanes again to continue the service over the final section of the route, through Basrah and over the Persian Gulf to Karachi. Over part of this section there has already been in operation for some time De Havilland aircraft fitted with AD6 apparatus for communicating with R.A.F. stations and a ½-kW station at Rutbah Wells, which was supplied by the Marconi Company to the Iraq Posts and Telegraphs Department. During the flight from Basrah to Karachi, the machines will be in touch with two Marconi stations in Persia (at Chabar and Bunda Abbas). Persian operators for these stations have been trained at the Marconi Company's works at Chelmsford. The terminal wireless plant at Karachi consists of a 6-kW Marconi transmitter with direction-finder receiving apparatus.

Many features of the apparatus for this service have been specially designed to meet the conditions existing on this new Empire route. The constant-speed windmill generator which provides power for the wireless installation will also supply current for the internal and external lighting of the aircraft. In the unlikely event of a forced landing being necessary the same generator can be used to supply emergency power to the transmitter, either by the use of the battery normally used for lighting, or, if it is required to work for long periods, by means of a special coupling to the small petrol engine used for starting the main engines of the aircraft.

Electricity in Rural Areas.

A scheme designed to demonstrate the practicability of supplying electricity to villages and farming areas is under consideration by the Development Commissioners, the Electricity Commissioners, the Ministry of Transport, and the Ministry of Agriculture. It is understood that the area under consideration is a part of the Bedford Corporation's territory, embracing a number of villages, mixed farms, and numerous country residences. The population of the area at the last census was 17,937, and the number of dwellings was 4,573. According to *The Times*, in order to bring electricity within the means of cottagers it is proposed to adopt the hire and hire-purchase systems of payment for the wiring and other equipment. The scheme, it is estimated, can be made self-supporting in about five years, and to assist the Bedford Corporation it is suggested that the Treasury might be asked to make a loan to cover 75 per cent. of the deficit on working in the first four years, repayment of capital and interest to begin when the scheme becomes self-supporting. The underlying assumption is that the success of such a scheme would stimulate rural electrification on a large scale and tend to attract to the cleaner atmosphere of the country many industries dependent on electrical power, thereby assisting to ease both housing and transport congestion in the towns.

The World's Power Resources.

The World Power Conference proposes to establish standard methods and values for assessing the power resources of the world, with the collaboration of 48 countries, and to survey on this basis the world position. It intends also to prepare in the same way statistics of production of coal, coke, oil, gas, water-power, brown coal, and electricity. It was felt, however, that before the work was undertaken an exact study of existing knowledge and statistical data regarding the world's power resources and production should be made, and the basis defined for international work in the future. Such a survey has now been carried out ("Power Resources of the World, Potential and Developed." World Power Conference, £1 1s. net); it has been compiled by Mr. Hugh Quigley, and will be reviewed in due course.

Fatality.

Nicholas George Perring, aged 52, an electrician's labourer employed by the Torquay Town Council, received a fatal electric shock while at work on the sea front on April 4th. With another man he had been engaged in repairing the public lamps attached to an overhead tramway cable, and upon descending from the repair tower entered a small sub-station in the Rock Walk. There, it is supposed, he came into contact with a live wire, and a few minutes later was found dead by his mate.

Electrical Association for Women.

On March 6th Mr. L. G. A. Sims, M.Sc., gave a lecture to members of the Birmingham Branch of the Electrical Association for Women on "The Economics of Domestic Water Heating." Miss Barrie, head mistress of King Edward's High School for Girls, and one of the vice-presidents of the branch, took the chair. The lecturer emphasised the need of standardisation of plugs and flexibles.

Wired Houses in the United States.

A recent report of the Statistical Department of the National Electric Light Association shows that out of 28,596,000 homes in the United States, 19,057,000, or 66 per cent., are wired for electricity. This is an increase of 1,197,000 over the year 1927. California and New York divide honours for first place, both being credited with more than 100 per cent. of the homes electrified. The record "over 100 per cent" is due to either classification of meters or estimated population. New Hampshire is in second place with 99 per cent. of the homes wired. New Jersey is in the third place with 96 per cent.; District of Columbia, fourth, 94 per cent.; Rhode Island fifth, 92 per cent.; Massachusetts sixth, 90 per cent.; Utah seventh, 89 per cent.; and Connecticut eighth, 88 per cent. Mississippi occupies last place, with only 15 per cent. of the homes wired for electricity.

The Overhead Lines Association.

Attention is drawn to an alteration in the arrangements for the meeting of the O.L.A. on April 24th. On that date Mr. W. Fennell, M.I.E.E., will read a paper entitled "A Review of Ferro-concrete Poles in other Countries," at 5.30 p.m. in the I.E.E. buildings. The change has been necessary to accommodate a modification of the plans of Lieut.-Col. W. A. Vignoles, D.S.O., M.I.E.E., who will deal with "Getting Consumers in Rural Areas" at the May 8th meeting of the Association.

Illuminating Effect Equipment.

An invention of Mr. Louis Alfred Ramsden relates to electrical apparatus for obtaining clear and coloured illumination effects for stage, scenic, advertising and other purposes from a series of clear and coloured lamps. The lamps are constructed with a number of current-carrying sectional filament supports, from each end of which the filament is suspended on one side, the other ends terminating into separate contacts to which connection is made through multiple internal spring contact devices to multiple-contact lampholders, into the terminals of which a multiple-core cable is connected to carry the current from a combination multiple contact and movement controller in such a manner that the current can be passed wholly through the filament of one lamp or set of lamps, or transferred step by step into another lamp or set of lamps, thus gradually dimming current or colour in one lamp or set and proportionately increasing the current or colour in another group, according to the number of sectional filament supports. For stage or other scenic effects each lamp is constructed with a plurality of current-carrying sectional filament supports, say, six or eight for each lamp, and each lamp is mounted in a lampholder having a contact for each filament support, thus there are six or eight contacts for each lamp. Instead of spring-pushed plunger terminals or contacts in the lampholder, a separate multiple internal-spring contact piece may be adjusted so as to form contact between the filament supports of the lamp and the terminals or contacts of the lampholder. In one form of multiple combination contact and movement controller the contacts for each filament are arranged in the form of a circle concentric with which are two rings connected respectively with the positive and negative of the source of current supply. Two arms are arranged to rotate around the circle, and each arm carries contact makers which connect with the filament contacts and also a second contact maker; one of the arms connects with the positive ring and the other with the negative ring. The two arms are arranged at such an angle apart that they will make contact between terminal contacts equal in number to the sectional filaments of one lamp or set of lamps. By suitable gearing the contact maker may be varied in speed and action at points as it

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rotates to give different colour-merging or flashing effects. Other effects may be obtained by interconnecting contacts at different points in the circle.

King's College Centenary Appeal.

In connection with the centenary commemoration this year of the establishment of King's College, University of London (Electrical Review, March 8th, 1928), an appeal is being made for £350,000 to meet requirements for buildings and endowments. The College is now, with the approval of the Senate, acquiring a 200 years' lease of an area of nearly 5,000 sq. ft. above the Aldwych station. Plans have been prepared for the erection on this area of a new building to accommodate several departments, which are now inadequately housed. The attention of our readers is drawn to the special arrangements which are being made to secure endowments for the Chair of Electrical Engineering, which, since the untimely death of Professor J. Hopkinson, F.R.S., in 1898, has been held by Professor Ernest Wilson, and the Chair of Physics, now occupied by Professor E. V. Appleton, F.R.S.

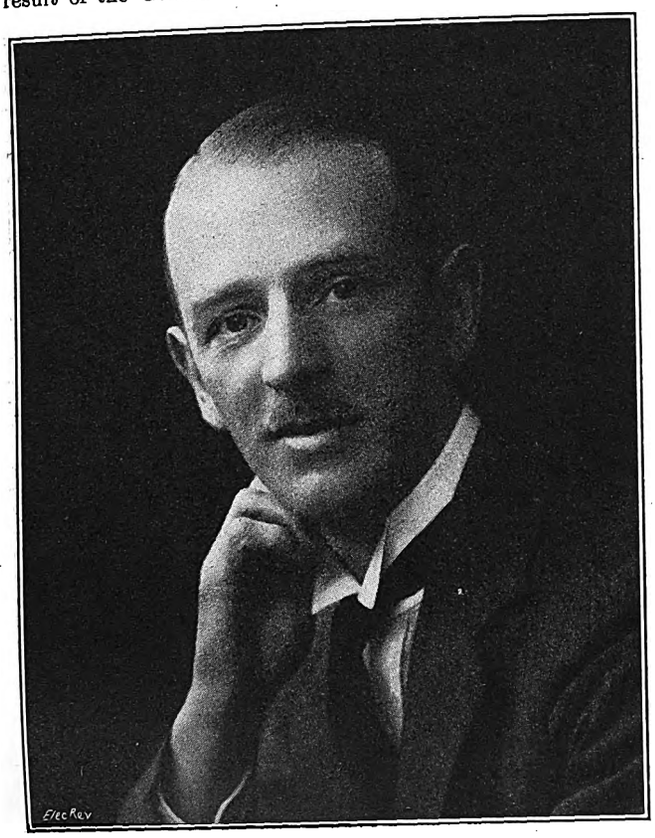
The Engineering Department was founded in 1838, and now forms a separate faculty of the college, comprising departments of electrical, civil and mechanical engineering, each under a professor. During the long history of the college many engineers who later occupied very important positions in the profession received their scientific training within its walls. Through the Engineering Society, a students' organisation which was founded in 1847 and may claim to be one of the oldest of its kind, the close contact maintained between past and present students forms one of the most valued possessions of the college. The Engineering School has always been in the forefront, both in the teaching of the scientific principles of engineering and in the pursuit of original research, yet it has been from the first without endowment. Indeed, unlike most other institutions of the kind, King's College has, throughout the century, been seriously hampered by its pronounced lack of endowment. In contrast with the provincial and older Universities of England, which owe so much to the generous support of benefactors, King's College only receives an annual sum of £4,800 from endowments out of a necessary expenditure of £130,000. This financial embarrassment is emphasised by the ever-increasing number of students.

Since the early period the development of the institution has been continuous. During the 1913-14 session 701 full-time day undergraduate and post-graduate students attended the College, 165 of whom were working for degrees and diplomas in science or in engineering. The further progress made during the post-war years is evidenced by the fact that to-day the number of full-time day students has reached nearly 2,000, of whom about 350 are studying for engineering or science degrees and diplomas. As will be readily understood, this influx of students is putting a severe tax on the available accommodation, and the need of larger premises is becoming more and more imperative every year. We strongly recommend the appeal to the generosity of our readers; donations will be gratefully acknowledged by the Treasurer, King's College, London, W.C.2.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

In the course of a couple of months large numbers of our readers will have come into personal relationship with the newly-appointed Secretary of the Incorporated Municipal Electrical Association. Preparations for the convention which is to take place at Torquay in the first week in June, just as we are all congratulating ourselves or otherwise upon the result of the General Election, are well forward, and between



Mr. J. W. Simpson,
The new Secretary of the I.M.E.A.

now and then the name of Mr. John William Simpson will appear upon many official documents passing through the post, in connection with the proceedings. We therefore take this early opportunity of publishing a photograph of Mr. Simpson and placing upon record particulars of the qualifications and so forth that commended him to the minds of the President and others who had the selection of a Secretary to follow Miss Lanfear, who had for many years carried out so efficiently so much of the Association's secretarial work. Mr. Simpson is 38 years of age, so that if we may be so personal as to say it, he has just reached a period of life which gives one opportunity for greater zest and enterprise than if he were many years older, while it gives him also the opportunity for gaining valuable experience in electrical organisation and knowledge in time to be able to bring them increasingly to bear upon electrical affairs before the curve of his activity begins to decline. He has had considerable administrative and secretarial experience. Twenty-two years' municipal service have brought him intimately into contact with municipal electricity undertakings notably at Tynemouth, Bridlington, and Southwark, where in one official capacity or another he dealt with all matters coming before the Electrical Committees and gained information respecting matters affecting electricity undertakings. He has also had a great deal of experience in dealing with the Electricity Commissioners, the various Government Departments, and Parliamentary Agents. In addition to varied committee work, he has organised a number of conferences appertaining to local government. There are many other parts in Mr. Simpson's career that contribute to impress one with the conviction that the appointment is a wise one, and we wish the new Secretary successful service and the formation of many friendships at this summer's convention.

Mr. S. E. Fedden, M.Inst.C.E., M.I.E.E., M.I.Mech.E., has been appointed district engineer for the Mid-East England Electricity Scheme, 1928, under the Central Electricity Board. He will take up his new duties on May 1st, 1929. Mr. Fedden has been for many years general manager and engineer of the City of Sheffield Electric Supply Department.

Mr. R. Genno, of the electrical maintenance staff at the Michelin Tyre Works, Stoke-on-Trent, who recently sailed in the ss. *Albertic* to Canada, to take up duties with the Hydro-Electric Power Commission of Ontario, was presented with a watch by his colleagues at Stoke.

Mr. W. L. Hambly, late senior heating and cooking representative with the British Electric Transformer Co., has joined the staff of Credenda Conduits Co. as sales engineer for London and South-West England.

At a recent meeting of the Torquay Corporation Electricity Committee, Mr. H. F. G. Woods, borough electrical engineer, submitted his resignation. The Committee, in accepting it, placed on record its appreciation of Mr. Woods's services, and decided to invite applications for a successor at a commencing salary of £850 per annum. We are informed that Mr. Woods is leaving Torquay shortly after the I.M.E.A. Convention to take up the position of general manager to the Exe Valley and East Devon Electricity Supply Companies.

The Dublin City Commissioners, at a special meeting last week, decided, on the occasion of the transfer of the Dublin electricity undertaking to the Electricity Supply Board, to place on record their high appreciation of the skilled knowledge, sound judgment, and business capacity which Mr. Laurence J. Kettle, M.I.E.E., M.I.Mech.E., the engineer

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and manager, had exercised during his 23 years' service. They were satisfied that "his single-minded application to duty, coupled with his acknowledged brilliant qualities, had been a main factor in the development and success of the undertaking." A tribute was also paid to the zeal and ability of the staff.

The marriage took place at Edinburgh on March 30th of Mr. E. R. ROBERTS, of the Transformer Department of Messrs. Bruce Peebles & Co., Ltd., to MARGARET, elder daughter of Mr. R. Thompson, mechanical superintendent of Messrs. Bruce Peebles.

The Direct Spanish Telegraph Co. announces that Admiral H. W. GRANT, C.B., has been elected a member of the board of the company, and that Mr. J. C. DENISON-PENDER has been appointed chairman.

We learn that Sir JAMES DEVONSHIRE, K.B.E., "having reached the retiring age," has resigned the position of chairman and managing director of the North Metropolitan Electric Power Supply Co., but retains his seat on the board of directors. The Rt. Hon. LORD ASHFIELD has been appointed chairman of the company, and Sir James Devonshire deputy-chairman.

Col. Sir JOHN W. PRINGLE, C.B., Chief Inspecting Officer of Railways, retires in May under the age limit. He will be succeeded by Col. A. H. L. MOUNT, C.B.E., who has been an inspecting officer of railways for the past nine years.

The Kingston-on-Thames Town Council has granted an honorarium of £500 to Mr. T. A. KINGHAM, borough electrical engineer, for himself and certain members of his staff in recognition of services rendered in connection with the laying of a cable from the borough boundary to Walton-on-Thames.

The Hebden Bridge Urban Cuncil has decided to stabilise the salary of the electrical engineer at £425 per annum. The previous salary and bonus was about £400.

The Wrexham Town Council has increased the salary of Mr. J. W. WILLIAMS, borough electrical engineer, from £455 to £500 per annum; that of Mr. E. O. JONES, station superintendent, from £5 per week to £300 per annum; and that of Mr. J. ARCHER TIPPETT, consumers' engineer, from £4 10s. to £4 15s. per week.

The marriage was solemnised on April 3rd at Midhurst of Captain G. M. BAKER, Nigerian Administrative Service, eldest son of Mr. and Mrs. C. A. Baker, of Croydon, to Beatrice Marjorie, youngest daughter of Mr. and Mrs. G. Knight, of Midhurst.

Mr. JAMES A. ROBERTSON, consulting engineer to the Salford Corporation, has been elected President of the Manchester Association of Engineers.

The *Manchester Guardian* states that the Gold Medal of the Institution of Mining and Metallurgy has been awarded conjointly to the Hon. W. BAILLIEU and Mr. W. S. ROBINSON "in recognition of their services in the development of the mineral resources of the Empire, with special reference to the zinc and lead industries of Australia."

The Chester Electricity Committee has appointed Mr. E. F. HUMPHREY, of Birmingham, as an additional mains superintendent at a basic salary of £324 per annum.

The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has passed a resolution of appreciation of the services of the chief engineer, Mr. R. BLACKMORE, who, as already announced, is leaving after 25 years' service to take up a position with the Central Electricity Board.

Mr. FRANK THODAY, of the Tunbridge Wells Corporation Electricity Works staff, was married at Eastbourne on March 30th to Miss Evelyn Hollobon. Mr. Thoday's colleagues presented him with an oval mirror.

Mr. and Mrs. MAGNUS VOLK, of early electric railway fame at Brighton, celebrated their golden wedding on April 8th.

Obituary.—MR. T. H. PLOWRIGHT.—The death has taken place, after being knocked down by a runaway horse, of Mr. Thomas Henry Plowright, who had for 27 years been on the staff of the Windsor Electrical Installation Co. He was 58 years of age, and was chief assistant engineer to Mr. A. E. Farrow, until the recent change of management, when he continued to act as station charge engineer at the works.

MR. A. C. MEYJES.—We record regretfully the passing, at the age of 70 years, of an old comrade of the trade and technical Press, Mr. Cornelius Antonie Meyjes, who was with Messrs. Morgan Bros., the proprietors of the *Chemist and Druggist* and the *Ironmonger* in editorial capacities for close upon forty years. He was on the staff of the *Chemist and Druggist* from 1885, until Mr. W. E. Freir (who passed away last year) retired and started a journal of his own in 1898. Mr. Meyjes followed Mr. Freir as editor of the *Ironmonger*, and it was in that capacity that present-day trade journal editors and some members of the electrical trade got to know him best and to recognise in him a man who was fearless and independent with regard to the contents of his journal and possessed of a very sound judgment as to the kind of matter that readers of the *Ironmonger* required. Mr. Meyjes retired in 1924, after the death of his wife.

SIR C. T. MANDER, BT.—We have to record the death, at the age of 77 years, of Sir Charles Tertius Mander, Bt., of Wolverhampton. In business he was a partner in the family business of Mander Brothers, varnish and colour makers. Sir Charles rendered lengthy and prominent public service. His activities on the Council, in connection with tramway affairs, brought him into contact with electrical men. He was Mayor of Wolverhampton for four years.

MR. P. J. POWELL.—The death is announced at the age of 82 years of Mr. Peter James Powell, who was for about 40 years associated with the business of Messrs. E. T. Mackrill and Sons, electrical engineers and contractors, of Aylesbury. He assisted in the foundation of the business.

MR. J. W. LEWSLEY.—The death took place on March 22nd, at London Road, Derby, of Mr. John Wilfred Lewsley, A.M.I.E.E. Mr. Lewsley was 50 years of age, and was connected with the electrical department of the London, Midland and Scottish Railway Co.

Mr. R. H. BENSON.—We regret to record the death of Mr. Robert Henry Benson, the well-known banker, who had for so long a period been closely connected with electricity supply company interests in London. Mr. Benson, who was 79 years of age, was chairman of the London Electric Supply Corporation, Ltd., the St. James' and Pall Mall Electric Light Co., Ltd., and a director of the Anglo-American Telegraph Co., Ltd.

Mr. C. N. WATERS.—We regret to record the death at the early age of 39 years of Mr. C. N. Waters, who joined the staff of the Chloride Electrical Storage Co., Ltd., nine years ago, and was head of the electro-chemical and physical laboratory.

Will.—The late Mr. JOHN MARSHALL GORHAM (of Drake and Gorham, Ltd.), whose death and career were recorded here in January, left £145,638 gross and £134,900 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

J.H.B., Ltd.—Private company. Registered March 28th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus and accessories, phonographs, gramophones, &c. The directors are:—J. H. Benjamin, 19, Lancaster Gate Terrace, Hyde Park, W.2; H. Weber (managing director), 114, Tollington Park, Finsbury Park, N.4. Registered office: 59, Gresham Street, E.C.

Hardyson Radio, Ltd.—Private company. Registered March 28th. Capital, £5,000 in £1 shares. Objects: To acquire any patents relating to the manufacture of wireless sets, combined wireless and gramophone sets, television apparatus, combined television, and sound-producing apparatus, and to carry on the business of designers and manufacturers of and dealers in wireless sets, combined wireless and gramophone sets, &c. The permanent directors are:—J. Dyson, 250, Longwood Road, Huddersfield; C. Hardy, 10, Ravens Crescent, Dewsbury; N. Stott, 6, Hillside Avenue, Fartown, Huddersfield. Solicitors: Cartwright & Fieldhouse, Huddersfield.

Volcanic Sparking Plugs, Ltd.—Private company. Registered March 30th. Capital, £15,000 in £1 shares. Objects: To acquire from E. J. Buckingham and P. C. Knott an exclusive licence to use an invention relating to improvements in or connected with sparking plugs, &c. The directors are:—P. C. Knott (managing director), Lyndhurst, Pooley Green Road, Egham, Surrey; E. J. Buckingham, 3, Hanover Gardens, Camberwell, S.E.; J. E. Jowitt, Ascot Lodge, Walton-on-Thames. Registered office: Chandos House, Buckingham Gate, S.W.1.

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Rural-Volts, Ltd.—Private company. Registered March 27th. Capital, £10,000 in 1s. shares. Objects: To install apparatus for the distribution of energy running across country or in any town, village, residence or place within the United Kingdom, to deal in wireless apparatus, to carry out research connected with the adaptation of electricity to agriculture, horticulture, and any process connected with farming, &c. The subscribers are:—C. H. E. Coles, Deep Dene, Tumblewood, Banstead, engineer; B. S. Hooker, Leyswood, Copthorne Road, Leatherhead, secretary to public company. The first directors are:—C. H. E. Coles and G. J. Gainsford. Secretary: B. S. Hooker. Solicitors: W. H. Smith & Son, Gresham House, Old Broad Street, E.C.

Rotor Signs (England), Ltd.—Private company. Registered March 30th. Capital, £5,000 in 5s. shares. Objects: To adopt an agreement with T. H. Read, and to develop and turn to account the patents referred to therein. The subscribers (each with one share) are:—R. Martin, 41, Bourne Hill, Palmers Green, N.13, accountant; E. Butler, 13, Sprules Road, Brockley, S.E.4, accountant. Registered office: 4, Dove Court, Old Jewry, E.C.

Grange Electrical & Radio Services, Ltd.—Private company. Registered in Edinburgh on April 3rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of contractors, engineers, electricians, builders and constructors of and dealers in motors, &c. The directors are:—J. C. Todd, 55, St. Albans Road, Edinburgh, motor engineer and garage proprietor; G. E. Haig, 11, Newington Road, Edinburgh, electrical engineer; J. D. Cochrane, 29, Falcon Gardens, Edinburgh, insurance inspector. Secretary: J. C. Todd. Registered office: 1, Grange Road, Edinburgh.

Official Returns of Electrical Companies.

C. Barnett, Ltd.—Second debenture dated March 11th, 1929, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital (subject to a prior charge for £1,000). Holder: F. T. Smith, 52, Bedford Square, W.C.1.

Chloride Electrical Storage Co., Ltd.—Satisfaction in full on March 16th, 1929, of debenture dated December 29th, 1928, securing all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Bridgwater and District Electric Supply and Traction Co., Ltd.—Satisfaction in full on March 20th, 1929, of first debentures dated between January 31st, 1905, and August 25th, 1915, securing £13,050.

Satisfaction in full on or before March 20th, 1929, of third debentures, dated April 16th, 1924, securing £1,150.

Western Telegraph Co., Ltd.—Capital, £3,500,000 in £10 shares. Return dated December 20th, 1928. 311,895 shares taken up. £2,339,650 paid. £779,300 considered as paid. Mortgages and charges, £818,675.

Hazeltine Neutrodyne Radio Sets, Ltd.—Capital, £5,000 in £1 shares. Return dated January 2nd, 1929. 4,900 shares taken up. £1 per share called up on 2,550 shares and nil on 2,350 shares. £2,550 calls unpaid. Mortgages and charges, nil.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd.—Capital, £1,250,000 in 750,000 ordinary, 250,000 preference, and 250,000 unissued shares of £1 each. Return dated December 13th, 1928. 750,000 ordinary and 250,000 preference shares taken up. £1,000,000 paid. Mortgages and charges, £400,000.

Venezuela Telephone and Electrical Appliances Co., Ltd.—Capital, £280,000 in 140,000 preference and 140,000 ordinary shares of £1 each. Return dated December 26th, 1928. 136,975 preference and 136,975 ordinary shares taken up. £217,444 paid on 136,975 preference and 80,469 ordinary shares. £56,506 considered as paid on 56,506 ordinary shares. Mortgages and charges, £145,300.

St. Austell and District Electric Lighting and Power Co., Ltd.—Capital, £20,000 in 13,000 preference and 7,000 ordinary shares of £1 each. Return dated October 26th, 1928 (filed February 1st, 1929). 13,000 preference and 6,700 ordinary shares taken up. £19,700 paid. Mortgages and charges, £20,094 8s. 11d.

Whittaker Bros., Ltd.—Capital, £7,000 in 1,000 cumulative preference, 5,000 "A" ordinary, and 1,000 "B" ordinary shares of £1 each. Return dated December 31st, 1928. 3,907 "A" ordinary shares taken up. £3,207 paid. £700 considered as paid. Mortgages and charges, nil.

Stratford Auto and Wireless Co., Ltd.—Debenture dated March 19th, 1929, to secure £315, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Barclay's Bank, Ltd.

Bullers, Ltd.—Capital, £400,000 in 20,000 preference and 20,000 ordinary shares of £10 each. Return dated January 3rd, 1929. 15,000 preference and 15,593 ordinary shares taken up. £150,070 paid on 7 ordinary and 15,000 preference shares. £155,860 considered as paid on 15,586 ordinary shares. Mortgages and charges, £204,250.

Metallic Seamless Tube Co., Ltd.—Capital, £65,333 6s. 8d. in 20,000 preference shares of 13s. 4d. each and 260,000 ordinary shares of 4s. each. Return dated December 24th, 1928. 15,245 preference and 260,000 ordinary shares taken up. £36,163 6s. 8d. paid on 15,245 preference and 130,000 ordinary shares. £26,000 considered as paid on 130,000 ordinary shares. Mortgages and charges, nil.

Rotax (Motor Accessories), Ltd.—Capital, £506,500 in 253,250 preference and 253,250 ordinary shares of £1 each. Return dated July 11th (filed September 20th), 1928. 253,034 preference and 253,250 ordinary shares taken up. £168,867 paid on 75,000 preference and 93,867 ordinary shares. £337,417 considered as paid on the remainder. Mortgages and charges, nil.

New Phonopore Telephone Co., Ltd.—Capital, £10,000 in 9,000 ordinary and 1,000 founders' shares of £1 each. Return dated December 26th, 1928. 7,141 ordinary and 1,000 founders' shares taken up. £6,741 paid. £1,400 considered as paid. Mortgages and charges, £2,666 13s. 4d.

Border Electrical Factoring Co., Ltd.—Mortgage on freehold land and buildings, &c., at Carlisle, dated March 18th, 1929, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Power Construction Co. Ltd.—Three mortgages dated March 18th, 1929, to secure £3,325, £3,325 and £3,800 charged on properties in Farnham Royal, Bucks. Holders: Portman Building Society, 14, Orchard Street, W.

Southern Electric Free Wiring Co., Ltd.—Capital, £5,000 in £1 shares. Return dated October 19th, 1928. 1,510 shares taken up. £1,510 paid. Mortgages and charges, nil.

Imperial United Lamp Co., Ltd.—F. W. Kellaway, Thanet House, 231-2, Strand, W.C.2, ceased to act as receiver and manager on March 22nd, 1929.

Marconi's Wireless Telegraph Co., Ltd.—Capital, £4,000,000 in 499,935 ordinary and 250,000 7 per cent. cumulative participating preference shares of £1 each and 3,250,038 ordinary shares of 10s. each, and 3,250,092 unclassified shares of 10s. each. Return dated December 31st, 1928. 395,114 £1 ordinary, 3,250,038 10s. ordinary, and 250,000 preference shares taken up. £1,797,484 10s. paid on 3,094,969 10s. ordinary and 250,000 preference shares. £472,648 10s. considered as paid on 155,069 10s. ordinary and 395,114 £1 ordinary shares. Mortgages and charges, £400.

Central Radio (Eastbourne), Ltd.—Capital, £500 in £1 shares. Return dated March 19th, 1929. 112 shares taken up. £112 paid. Mortgages and charges, £1,050.

Implitico, Ltd.—Capital, £3,000 in £1 shares. Return dated December 21st, 1928. 3,000 shares taken up. £3,000 paid. Mortgages and charges, nil.

E. Shipton & Co., Ltd.—Capital, £6,000 in 4,000 preference and 2,000 ordinary shares of £1 each. Return dated January 11th, 1929. All shares taken up. £300 paid. £5,700 considered as paid. Mortgages and charges, nil.

George Hill & Co., Ltd.—Capital, £4,000 in £1 shares. Return dated January 12th, 1929. 2,150 shares taken up. £2,150 considered as paid. Mortgages and charges, nil.

C. F. Casella & Co., Ltd.—Capital, £17,000 in 2,000 preference and 15,000 ordinary shares of £1 each. Return dated November 16th, 1928 (filed January 3rd, 1929). 2,000 preference and 12,204 ordinary shares taken up. £3,504 paid. £10,700 considered as paid. Mortgages and charges, £1,500.

City Notes.

Clyde Valley Electrical Power Co.

This company's report was reviewed in our issue of March 22nd (p. 535). The annual meeting was held on April 3rd, when Sir Frederick C. Gardiner, K.B.E. (chairman), who presided, said that although there were certain signs of recovery in the industries of the company's area, they still awaited the general revival which would quickly and favourably affect the operations of the company. In dealing with the accounts, the chairman said that the reduction in fuel costs was due partly to the fuller benefit derived from the increasing production of the Lanarkshire Hydro-Electric Power Co.; that

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factor was also mainly responsible for the larger quantity of purchased energy. The coupling-up of their system to the "grid" necessitated the replacement of obsolete sub-station switchgear at an earlier date than originally anticipated. The increase of about 21 million kWh was due mainly to the expansion of the domestic load; the company now supplied, directly or indirectly, about 40,000 consumers. During the year extensions were made to and supply was commenced in Uplawmoor and Eaglesham, and extensions to Lochwinnoch and Shotts were in hand. Keeping pace with the demand involved continuous capital outlay. At present they were increasing the boiler capacity at Clyde's Mill; that should lower the generating costs. A 20,000-kW turbo-alternator was being added to the Yoker plant; this operated at 50 cycles in anticipation of the change in frequency. The cable system had been reinforced and extended in various directions. The current year had opened favourably; there was a continuous flow of new contracts from domestic consumers, and the output for the first quarter showed an advance of 7 per cent. over that for the corresponding period of last year. The institution of a new method of charging last year had given rise to misconceptions, and to prevent any possible hardship to consumers they had been given the option of remaining on the old system if they desired. Already, however, a large number had adopted the new system, and he thought that in time a large majority would find it to their advantage to do this. They had engaged a special staff for the work of changing the frequency from 25 to 50 cycles, and it was hoped that the extreme western portion of the area would be changed over by the end of this year. It was practically certain that before the next annual meeting the Yoker and Clyde's Mill stations and the two water-power stations of their subsidiary, the Lanarkshire Hydro-Electric Power Co., would be vested in the Central Electricity Board, and the company would then re-purchase all the energy which it required at a price not less favourable than that at which it could itself generate the energy. The company had largely overspent its capital, and it was therefore considered desirable to issue the balance of the authorised capital (£900,000). It was proposed to offer this as ordinary shares at par to the ordinary shareholders in the proportion of three new shares to each four held. The report and accounts were adopted.

Ericsson Telephones, Ltd.

Mr. W. M. Crowe (chairman and managing director) presided at the annual meeting on April 3rd. In presenting the report and accounts (Elec. Rev., March 29th, p. 579), he said that the net profit had risen by about 15 per cent., and the prospects for the current year were very favourable. They had now entered fully into the manufacture of automatic telephone equipment for which there would be a good demand for many years to come. During last year and since the beginning of this year they had received some large orders for automatic equipment as well as for general telephone material and manual exchanges. For the Post Office they had completed and installed an automatic exchange at Bath with two satellite exchanges. They had also completed automatic exchanges at Walsall, Aldridge, and Bloxwich; these would be opened in the near future. The Shepherd's Bush exchange was also well advanced at their works, and installation had commenced. Further exchanges in hand were Crewe and Nantwich and the "Gladstone" (London) exchange. Orders had been secured at home and abroad for large private automatic exchanges. Many improvements in the automatic equipment were being developed, and these should yield benefits before long. Although they were securing business in the Colonies, the prices for certain classes of materials were cut to the finest margin, and in many cases there was no profit. This country had a long way to go before it reached the same telephone standard as other up-to-date countries, but progress was being made. The Treasury had not been over-liberal in the past, but pressure was being brought to bear to secure more funds for this important development. The chairman suggested that the Chancellor of the Exchequer might devote a part of his Budget surplus to this remunerative work to relieve unemployment and benefit industry. With practically no additional capital expenditure on machinery, &c., the company could give employment to double the present number. In reviewing the accounts, the chairman pointed out in the balance-sheet a new item—shares in a new company. That, he said, was an investment in a concern for which they were to manufacture an article of much utility. The report and accounts were adopted.

Llandudno and Colwyn Bay Electric Railway, Ltd.

The accounts for the year ended December 31st last show that after providing for loan interest there is a deficit of £1,153, as compared with a surplus of £332 for 1927. Owing to the attitude of the Colwyn Bay Council, the proposed reconstruction of a section of the track has not been proceeded with. The company has been unable to make reasonable arrangements with the Council and the loss of revenue due to omnibus competition accounts for the unsatisfactory financial results. At the instance of the Colwyn Bay Council, the company was recently fined on account of the condition of track which, the company maintains, is on private land. It is hoped that some satisfactory settlement of the matter will be reached. The directors state that they may have to take steps to secure protection against unwarranted and unnecessary competition. Mr. A. W. R. Lovering, the secretary of the company, has been appointed to the board in the place of Mr. A. W. Tait, and Sir Joseph Nall has been elected chairman.

Windermere and District Electricity Supply Co., Ltd.

The report for the past year states that in December last it was resolved that 20 per cent. of the arrears on the 6 per cent. cumulative preference shares should be cancelled and that the holders should receive in lieu of the remainder one 7½ per cent. non-cumulative preference share for each five 6 per cent. shares held; these non-cumulative preference shares were paid up out of reserve. The Electricity Commissioners gave their consent to the installation of a 300-h.p. Diesel alternator, and the erection of this is nearing completion. The lighting charge was reduced by 1d. per kWh during the year. The revenue account shows a balance of £8,740, and, with the amount brought forward, interest and dividends, the sum available is £11,628. After the usual allocations the directors propose to pay a total of 9 per cent. on the 6 per cent. cumulative preference shares to discharge all arrears, and to pay the full year's dividend on the 7½ per cent. preference shares; this leaves £803 to be carried forward.

Keswick Electric Light Co., Ltd.

After adding £322 brought forward and deducting debenture interest, &c., there is an available balance of £2,626. Of this, £1,926 is absorbed by writing down charges and allocations to reserves. The ordinary dividend is 10 per cent.

South London Electricity Supply Corporation, Ltd.

The revenue account for the year ended December 31st, 1928, shows a balance of £115,385, to which is added £65,683 brought forward, making £181,068. From this debenture and loan interest are paid, £15,000 is put to taxation reserve, and allocations are made to sinking and contingency funds. The preference dividend is paid and a final distribution of 5½ per cent. is to be made on the ordinary shares (making 8½ per cent. for the year), leaving £95,397 to be carried forward, subject to the operation of the London Electricity (No. 1) Act, 1925, and prospective reductions in charges. The sales of energy during the year rose from 17,100,275 to 19,580,122 kWh. The £130,000 5 per cent. mortgage debenture stock has been discharged. Mr. R. B. Renwick has been appointed a director. Meeting: April 16th.

Chelsea Electricity Supply Co., Ltd.

The net profit for the year ended December 31st last, after providing for debenture interest and sinking and contingency funds, is £82,227. The preference and standard ordinary dividends are paid, £5,069 is transferred to special reserve (shareholders' proportion of consumers' benefit for 1926, 1927 and 1928), and £16,220 to employés' pension fund, leaving £24,039 to be carried forward. The connected load increased by 597 kW to 14,048 kW, and the sales of energy rose by 653,692 kWh to 9,465,940 kWh. After yesterday's annual meeting extraordinary meetings were to be held to pass resolutions empowering the directors to capitalise and distribute reserves, and to authorise them to capitalise £8,989 of the special reserve fund and to allot this in the form of £1 ordinary shares "to such persons and in such manner as the directors shall think proper to be held on account of the pension fund formed for the benefit of the employés of the company."

General Electric Co., Ltd.

It was announced last week that the discussions between Sir Hugo Hirst, Bt., and Mr. M. J. Railing for the company, and Messrs. T. L. Chadbourne and H. B. Swope, representing the company's American shareholders, had had to be postponed on account of Mr. Chadbourne's illness.

The following statement was issued by the company on Saturday last:—

"We are not engaged in any negotiations with Associated Electrical Industries, Ltd. We are exploring every avenue to secure friendly agreement with the American shareholders, but there is no plan under consideration which suggests transfer of the control of the G.E.C."

This apparently had reference to rumours which have been current for a long time and were revived in a somewhat sensational form in the financial Press last week.

Lanarkshire Tramways Co.

In their report for 1928 the directors state that intense competition again prevailed during the year, and it is impossible under present conditions to successfully compete with motor-'buses. The company is therefore seeking powers to abandon its tramways in sections; to cancel its wayleaves and other obligations in connection with the tramways; to secure the restriction of motor-'bus competition, &c. The net revenue account shows that an adverse balance of £9,497 was brought forward, and the payment of debenture and loan interest, &c., brought this up to £13,724. Against this is placed a balance of £7,725 from revenue account, leaving a deficit of £5,999 to go to the balance sheet. Although the car-mileage increased from 3,837,864 to 4,057,214, the number of passengers carried fell from 23,351,573 to 19,851,508.

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Electric Furnace Co., Ltd.

On Monday last this company published, for information only, a statement of its constitution and objects. It was formed in August, 1928, to take over the business of a company of the same name (formerly Campbell, Gifford & Co., Ltd.). It has a capital of £200,000, half in preferred ordinary shares and half in ordinary shares, all of £1 denomination. Of these, 80,007 preferred ordinary and 78,036 ordinary shares have been issued. The preferred ordinary shares are entitled to a fixed cumulative preferential dividend of 7 per cent. and to a further 3 per cent. which is also paid on the ordinary shares. The company contracts for installations of electric furnace plant, and either owns or is licensed to use a number of patents covering a wide variety of electro-metallurgical applications. Among the furnaces so installed by the company are the Héroult, the Ajax-Wyatt, and the Ajax-Northrup. The directors are Mr. D. F. Campbell (chairman), Mr. W. S. Gifford, and Lt.-Col. the Hon. O. H. Stanley. The registered office is at 17, Victoria Street, S.W.1.

South Metropolitan Electric Light and Power Co., Ltd.

The balance on the revenue account for the past year was £192,441, and to this is added £118,247 brought forward, making £310,688. The allocations include £10,000 to staff superannuation fund, £20,000 to taxation reserve, debenture interest, sinking funds, &c., and the balance remaining for dividend is £219,576. The final ordinary dividend is 5½ per cent. (making 8½ per cent. for the year), and £152,076 remains to be carried forward, subject to the operation of the London Electricity (No. 1) Act, 1925, and prospective price reductions. The sales of energy rose from 34,285,242 to 39,152,112 kWh. During the year considerable reductions were made in charges. The report records the death of Sir James Hosker, one of the directors. Meeting: April 16th.

Canadian Hydro-Electric Corporation, Ltd.

The first financial report of this company, which controls the Gatineau Power Co., the Gatineau Electric Light Co., and the St. John Power Co., shows gross income for the year ended December, 1928, including other incomes, as $4,367,393. Operating maintenance and all expenses totalled $874,383, leaving a revenue of $3,493,009. The net revenue after all deductions was $776,063, which, added to the previous surplus of $6,066,669 brought forward, made a total surplus of $6,842,732. It is stated that the subsidiaries of the company had a capacity of 622,600 h.p. installed or in process of installation. Extensions to the plant of the Gatineau Power Co., the largest of these subsidiaries, will bring its total capacity up this year to 562,000 h.p.

Salisbury Electric Light and Supply Co., Ltd.

After meeting debenture interest, taxation and depreciation, and adding £92 brought forward, the balance on the past year's working was £9,502. It was proposed to place £600 to reserve; to pay a final dividend of 6 per cent., free of tax, on the old shares (making 10 per cent., tax free, for the year); and to pay a dividend for six months at the rate of 10 per cent. per annum, free of tax, on the new shares, leaving £152 to be carried forward. The supply to Wilton was commenced during the past year, and the extensions in the Salisbury area have been completed. Mr. A. J. Fippard has been appointed to the board.

Woking Electric Supply Co., Ltd.

The balance on working for the past year, plus £1,344 brought forward, is £41,969. After meeting debenture charges and preference dividends, transferring £10,000 to depreciation and renewals fund, £5,000 to reserve, £5,000 to change-over account, and £2,313 to capital expenditure account, it is proposed to pay a dividend of 7½ per cent., free of tax, on the ordinary shares (against 10 per cent., free of tax, for 1927) and to carry forward £1,851. The sales of energy increased from 4,815,108 to 5,431,760 kWh. The directors have capitalised £21,760 of the reserve fund, and this has been allotted to the ordinary shareholders in the form of ordinary shares.

Brompton and Kensington Electricity Supply Co. Ltd.

The report for the year ended December 31st last states that the connections rose from 23,212 to 25,459 kW and the sales of energy from 7,579,261 to 8,645,664 kWh. After providing the statutory amounts for the sinking and contingency funds and adding the balance brought forward, the net revenue is £52,885. The preference dividend is paid, £5,503 is transferred to the special reserve fund (ordinary shareholders' proportion of the consumers' benefit for 1926, 1927 and 1928), and the balance (10.706d. per share) of the standard ordinary dividend is paid, leaving £16,579 to be carried forward. The meeting was to be held yesterday (Thursday).

G. D. Peters & Co., Ltd.

The net profit for the past year was £8,228, and to this is added £7,724 brought forward, making £15,952. After allocating £1,200 to income-tax reserve, it is proposed to carry forward the balance of £14,752.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Benbat Radio Co., Ltd.
Boston Wireless & Electrical Co., Ltd.
Electrical Co., Ltd.
Electrical Displays & Accessories, Ltd.
Excelsior Electrical Co., Ltd.
Lumos Radio Valve Co., Ltd.
New Wireless League, Ltd.
Southampton Wire & Cable Manufacturing Co., Ltd.
"Walco" Electrical Co., Ltd.

Canadian General Electric Co., Ltd.

The annual report for 1928 indicated that the company had enjoyed the most successful operating year in its history. Net profits, after deducting for reserves, taxes, and depreciation were $3,695,665, as compared with $2,103,053 in 1927, an increase of $1,591,612, or 75 per cent. The sum of $599,042 was distributed in dividends, leaving a surplus of $3,195,623. A special appropriation of $2,855,871 was made for deduction in the plant and property values, leaving a surplus of $229,752, which, added to the amount brought forward, made a total surplus of $3,204,625. During the year the company expended $892,641 for additional machinery and equipment, enabling it to enlarge its manufacturing facilities.

Lancashire Electric Light and Power Co., Ltd.

To meet the capital expenditure upon recent general developments, including the Kearsley station which is expected to be in operation later this year, the directors propose to raise the company's capital to £3,171,415 by the creation of 600,000 ordinary shares of £1 each. These will rank for dividend as from April 1st, and will be offered in the first place to present shareholders. The necessary resolution is to be placed before a meeting of shareholders to-day (Friday).

River Plate Electricity Co., Ltd.

The net revenue shown in the 1928 report is £53,400, representing an increase of £1,760. The ordinary dividend is maintained at 11 per cent., £6,794 is placed to reserve, and £7,403 is carried forward. During the year 67,000 shares were created; of these, 63,814 were issued as a bonus to shareholders, and 3,186 were sold at a premium totalling £3,185, which has been added to reserve. The latter now stands at £310,000.

Shanghai Electric Construction Co., Ltd.

The directors recommend a final dividend of 7½ per cent., free of tax, making 12½ per cent. for the year, free of tax, as against 12 per cent., less tax, for 1927. They also propose to raise the capital from £500,000 to £700,000, to capitalise £100,000 of undivided profits, and to issue this in the form of fully-paid £1 shares to present shareholders in the ratio of one new share for each five held.

London Electric Wire Co. & Smiths, Ltd.

The report for the year ended December 31st last records a profit of £110,276, as compared with £75,614 for 1927. To this is added £20,789 brought forward, making £131,065. The allocation to general reserve is increased from £20,000 to £30,000, and a final dividend of 6¼ per cent. (again making 7½ per cent. for the year) is to be paid on the ordinary shares, leaving £22,759 to be carried forward.

American Telephone and Telegraph Corporation.

At the general meeting on April 20th the directors will ask for the shareholders' approval to the issue of new bonds to the extent of $225,000,000. These will be offered to the shareholders on favourable terms, and the proceeds will be employed largely for the financing of new construction work.

Associated Gas and Electric System.

The report for 1928 shows that the gross earnings rose from $35,296,741 to $42,163,550 and the net earnings from $17,032,086 to $19,170,637. After meeting interest, preferred dividends and depreciation, there remains $6,498,592 for dividends and surplus, against $6,258,653.

Hong Kong Tramway Co., Ltd.

The profit for the past year fell from $982,838 to $970,940; $252,849 brought forward is added, making $1,223,789. The dividend for the year is maintained at $1.40 per share by a final distribution of $0.80 per share; $68,000 is written off goodwill; and $245,789 is carried forward.

Commonwealth Power Corporation.

The gross earnings of this company and its subsidiaries rose from $53,172,976 in 1927 to $58,504,122 last year, and the net income from $12,413,628 to $16,296,471. During last year four quarterly dividends totalling $3.25 per share were paid on the common stock.

Atlas Light and Power Co., Ltd.

An interim dividend of 2 per cent. has been declared on the ordinary shares, as last year.

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The Cable-Wireless Merger.

In connection with the amalgamation of the cable and wireless interests two public companies, each with a nominal capital of £100, were registered on April 8th. The first bears the title "Cables and Wireless, Ltd.," and power is taken to increase the capital by ordinary resolution to £53,700,000 in 23,500,000 5½ per cent. cumulative preference shares, 21,200,000 7½ per cent. non-cumulative "A" ordinary shares, and 9,000,000 "B" ordinary shares, all of £1 each. This is the holding company. The second one—"Imperial and International Communications, Ltd.," is to acquire the assets of the companies concerned and the State-owned cable and beam wireless systems. The basis of exchange of holdings in the merged companies for existing stocks and shares is as follows:

Cable companies.—For each £100 of ordinary stock in the Eastern Telegraph Co., Ltd., or each £100 of ordinary shares of £10 each in the Eastern Extension, Australasia and China Telegraph Co., Ltd., or each £100 of ordinary shares of £10 each in the Western Telegraph Co., Ltd.: £165 of 5½ per cent. cumulative preference shares, £108 18s. of 7½ per cent. "A" ordinary shares, and £26 of "B" ordinary shares.

Marconi's Wireless Telegraph Co., Ltd.—For each £100 of 7 per cent. cumulative participating preference shares, or each £100 of ordinary shares of £1 each: £131 10s. of 5½ per cent. cumulative preference shares, £205 8s. of "A" ordinary shares, and £150 5s. of "B" ordinary shares. For each £50 of ordinary shares of 10s. each: £81 10s. of 5½ per cent. cumulative preference shares, £205 8s. of "A" ordinary shares, and £150 5s. of "B" ordinary shares.

Fuller details of the scheme will appear in our next issue.

Alton Battery Co., Ltd.

The directors have declared a final dividend of 5 per cent. on the ordinary shares (making 8 per cent. for the year) and 8 per cent. on the deferred shares in respect of the year ended December 31st, 1928.

Mexican Light and Power Co.

The dividends have been declared in respect of the half-year ending April 30th on the 7 per cent. cumulative preference shares and the 4 per cent. cumulative redeemable second preference shares.

Scottish Southern Electric Supply Co., Ltd.

The capital of the company has been increased, making the total capital issued £120,000 in 6 per cent. cumulative preference shares and £80,000 in ordinary shares.

Dutch Company.

The report of the *Hengelosche Electrische en Mechanische Apparatenfabriek* ("*Heemaf*") states that an improvement in the trade situation took place in 1928. An increasing demand was expected for wire, cables, and electrical machinery and apparatus. Measures were being taken in England of such a nature that in co-operation with an English works good results might be expected in the future, especially in view of the change-over in England from d.c. to a.c. The accounts show a credit balance of 631,000 florins, as against 535,000 fl. in 1927, and the dividend remains at 5 per cent.

German Companies.

The *Saxony Works Light and Power Co.*, Dresden, reports a further favourable development in 1928, the value of the turnover having increased by 20 per cent. The net profits amount to 1,430,000 marks, against 1,150,000 marks, and the dividend on the "B" shares is 10 per cent. (9¾ per cent. in 1927) and 7.5 per cent. (7 per cent.) on the other shares.

The *Voigt and Haeffner Co.*, Frankfort-on-Main, reports that after the measures adopted in 1927 the company was prepared for a greater amount of business, and was able to obtain a materially larger turnover without any noteworthy increase in the number of persons employed. In the autumn of last year a decline set in, and at present the arrival of orders shows a diminution. With the declining activity increased competition has set in, with falling prices. The net profits rose from 730,000 marks in 1927 to 810,000 marks last year, and the dividend is advanced from 8 to 9 per cent.

The *Bergmann Electricity Works Co.*, Berlin, reports net profits of 4,480,000 marks for 1928, as compared with 4,470,000 marks in the preceding year. It is proposed to maintain the dividend at 9 per cent.

The *Mix and Genest Co.*, Berlin, proposes to pay a dividend of 8 per cent. on the old share capital of 9,500,000 marks for 1928, against 9 per cent. in the previous year, and 4 per cent. on the new capital of 6,500,000 marks.

French Companies.

The *Compagnie d'Electricité Industrielle* records a gross surplus of 7,336,000 fr. for 1928, this amount being balanced in the profit and loss account by the financial charges and taxes on securities.

The *Compagnie Générale d'Electricité*, Paris, reports net profits of 20,993,000 fr. for 1928, as compared with 25,327,000 fr. in the preceding eighteen months. It is proposed to pay a dividend of 17 per cent., against 14 per cent.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are shaking off by degrees their allegiance to financial conditions ruling in America. It is true to say that trans-Atlantic gamblers are very much quieter than they were even a month ago. The Federation which rules the banking business of the whole of the United States has issued a brusquely-worded warning on the subject of over-speculation. This served to emphasise the previous impression that the American banks are now in earnest over their declared policy of curtailing credit for stock market purposes. Further liquidation of weak accounts has led to a transfer of stock from one set of hands into another set financially stronger. The latter are under no necessity to pay extravagant rates of interest for money. The scramble for financial accommodation is past. With it has gone the immediate fear of a rise in the Bank of England rate. So investment prices are better.

The Cable Quartette.

The outstanding feature in the stocks and shares quoted overleaf is the manner in which Eastern Cable shares have improved. Eastern Telegraph ordinary rose 12½ points to 280: less than a month ago the stock could have been bought at 255. Eastern Extensions are 30s. up at 28¼. Westerns have risen 27s. 6d. to 28⅛. Globe Telegraph and Trust ordinary, lagging a little behind the rest of the group, are £1 up on balance at 27½. Explanation of these gains is to be found in the report that when the Communications Company scheme is unfolded—as is likely before these pages are—the three cable companies' issues will be found worth about £300 for Eastern ordinary stock, and £30 per share for Eastern Extensions and Westerns. The Globe Telegraph and Trust, as a holding concern, is expected to be left in its present state, instead of having its shares exchanged for new securities. American Telephone and Telegraph at 225 and International Telephone and Telegraph at 265, have gone back several points from the best prices recently touched. In which connection it may be well to correct the statement, made last week, that Kreuger and Toll, which is contemplating entry into the telephone business, is a match-manufacturing concern; it is more in the nature of a trust company holding stocks and shares in various undertakings.

Marconi's.

For months past the statisticians have contended that, on the data available, Marconi ordinary shares should be worth 87s. as a minimum. The imminent advent of an official announcement has led to revival of this prophecy, and the price of Marconi's is 2s. 6d. up, at 86s. 3d. It might be thought that this price permitted small scope for possible further profit if the prediction of 87s. is shown to be approximately correct. Reference was made here last week, however, to the "B" shares in the merger undertaking, of which the Marconi Company should receive 5,850,000 against the 3,150,000 that go to the cable companies. These "B" shares in what is to be known as Cable & Wireless, Ltd., are deemed to represent the equity of the whole business involved in the amalgamation. Unofficial dealings are said to have taken place in them already at 30s. per share, and American demand, according to gossip, is considerable. In the uncertainties that surround these "B" shares lie, partially, the speculative attractions which distinguish Marconis.

The One Pound Shares.

Marconi ordinary shares are of the nominal value of 10s. each, and the price is 86s. 3d. In addition, there are 395,114 ordinary shares of £1 each, which arose out of the conversion rights attached to the debentures. These £1 shares stand at 5⅜. How they will fare in the forthcoming distribution is even yet unknown. The Board's view, made public sometime back, is so guarded as to shed no light upon the opinion of the directors in regard to the legal status of the shares. The optimists contend that one share of £1 must be equal to two shares of 10s. each, and that the price of the first should be exactly twice that of the second. The other side argues that 10s. of the £1 will be treated in the same way as the 10s. Marconi share, but that the other moiety is worth 10s. and no more. If the first assertion be correct, Marconi £1 shares, on the basis of 4 5/16 for the 10s. shares, are worth 8⅝, as compared with the current market price of 5⅜. On the second basis of assumption, the £1 shares are worth 4 5/16, plus 10s.: that is, 4 13/16. The speculator clearly has, in this conflict of view, what the Stock Exchange calls scope for talent. The onlooker will possibly see in it an ample scope for acrimonious discussion and legal expenses.

Electricity Supply.

Announcement by the County of London Electric Supply Company of the intention to issue new capital, in the shape of ordinary and preference shares, caused 1s. decline in County ordinary to 52s. 6d. The new issue, it is safe to guess, will be made at such price as will ensure a bonus to holders of the existing shares. Chelsea Electricity Supply Company is capitalising £8,989 of free reserves, and applying it to full payment of 8,989 unissued ordinary shares. These latter are to be held on account of the pension fund formed for the

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benefit of employés. The Altrincham Electric Supply Company did well last year, its report showing good progress in the total sale of energy, and in net profit. The price of the ordinary stands at 60s., giving a yield of 7 per cent. on the money. The 1s. deferred, now at 17s. 9d., return 8 per cent. The 7 per cent. second preference, of which a 60 per cent. bonus was distributed for 1927 to holders of the ordinary shares, are quoted at 22s. 6d.

Clyde Valley.

Brief mention was made in last week's number (Elec. Rev., p. 622) of the new issue of three ordinary in respect of every four shares held, by the Clyde Valley Electrical Power Company. The price of the shares remains unchanged at 43s. 9d. The Clyde Valley is one of the best in its class. Its earnings of recent years have been materially higher than the amounts distributed in dividends. Sound management has placed the company in a fine financial position, and although the shares, when quoted ex dividend and ex rights, will pay barely 5 per cent. on the money, they can be reasonably expected to increase in value by steady degrees. The yield calculation is worked out on the assumption that the company will maintain, on its increased capital, the 8 per cent. dividend at present being paid.

Tubes and Trams.

Underground Electric Railways income bonds at 112 are a couple of points down, and the shares fell 6d. to 22s. 6d., movements that are difficult to explain in view of the better tendency that has been established during the past few business days amongst Home Railway stocks. There is still some uneasiness felt in regard to the extra cost to which the Underground Electric Railways will be put by reason of the advance in the price of petrol. Probably it is this consideration that holds back the prices of Underground stocks from sharing in the otherwise general recovery. No changes of consequence have occurred amongst the various tramway stocks and shares. Northern General Transports at 1⅜ are quoted ex rights.

New Issues.

One new share at 32s. 6d. is offered in respect of every two old shares held in the Electrical Finance & Securities Co., Ltd. This constitutes a useful bonus, as the old shares stand at 37s. 9d. The company's 7 per cent. preference are 22s. 9d. A free share bonus is offered to proprietors of Shanghai Electric Construction shares, the dividend upon which, for the year recently ended, is raised from 12 per cent., less tax, to 12½ per cent., free of tax. The total capital is to be increased by £200,000, to £700,000. There is not a very free market in the shares, but on the dividend and bonus announcement, the price strengthened to 59s. 6d. Atlas Light and Power shares are quiet at 26s. 9d. The company states that it gave an option, the time expiring this, Monday, evening, at $100 over its holding of 100,000 South American Power preference shares. The option formed part of the arrangement under which the Atlas Light and Power sold its Argentine electrical and tramway holdings to the American and Foreign Power Company of New York.

A market will start, in the near future, in the shares of the Electric Furnace Company, which has a capital of £200,000 divided equally between 100,000 £1 preferred ordinary shares and a similar number of ordinary, the greater part of which has in each case already been issued. The company was incorporated last year to take over the business originally founded 20 years ago by D. F. Campbell and W. S. Gifford.

Dollar Stocks.

Brazilian Tractions, after being up to 63, reacted to 61, a net fall on the week of one point. Mexico Tramway shares went back to 47; Montreal Light and Power are unchanged at 105; Shawinigan is a point lower at 76½. British Columbia Power shares are dull at 50½ for the "A" and 31 for the "B," while Hydro-Electrics dropped from 37 to 35¾, International Holdings going back at the same time to 8⅞. Mexican Light and Power common shares regained the fall of 4½ points that they sustained last week, and the 7 per cent. preferred shares at 71½ are up 1.

Miscellaneous Shares.

London Electric Wire Co. & Smiths ordinary shares marked 23s. 6d. on the report, which announces 1928 profits of £110,300, being £14,700 better than those of the preceding twelvemonth. A dividend of 7½ per cent. is again to be paid, and at the present price the yield on the money comes to £6 7s. 8d. per cent. The 7½ per cent. preference shares are quoted at 24s. 3d. Reference is made in the report to the increasingly keen competition in the trade. British Insulated ordinary have regained the small fraction that they lost in the previous week. Enfield Cables rose to 4⅛. Other changes amongst the prices of manufacturing companies' shares are negligible. General Electrics hold on to their previous level of 60s. New York has been dealing very slightly in the shares, pending a settlement of the final terms upon which the new issue is to be made. The company denies the rumour of its negotiating with the Associated Electrical Industries. Sphinx Electrics have been active around 1s. 9d., on the contracts secured by the company. The iron and steel group has nothing of fresh interest to show, and rubber shares are dormant.

Share List of Electrical Companies.

	Nom. £	Approx. Dividend. 1927,	1928.	Price April 8 1929.	Rise or fall	Yie'd p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	15	—	64/6	—	... ...
Brompton Ordinary	1	8½	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8 1/7	8 1/7	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 8
City of London	1	10	10	32/-xd	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	23/-xd	—	5 4 4
Clyde Valley	1	8	8	43/3	—	3 14 1
County of London	1	7½	10	52/6	—1/-	3 16 4
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	55/-	—	4 0 0
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	—	30/-	—	5 0 0
London Electric	1	8½	9	27/-xd	—	5 3 8
Metropolitan	1	9	9	2 1/16	—	4 7 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	36/3	—	4 2 9
Newcastle on-Tyne Ordinary ...	1	6	6	1¼	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/-xd	—	5 3 3
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	—	43/3	—	... ...
Westminster Ordinary	1	8 1/5	8 1/5	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	34/-	—	4 14 2
Home Rails.						
Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	3	3½	60½	—	5 15 8
do. District	,,	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	23/6xd	—6d.	5 19 2
do. do. Income ...	Bonds	6	6	112	—2	5 7 3
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24	—	6 3 9
Automatic Telephone	1	10	12½	2 1/16	—	5 14 2
Eastern Extension	10	10	10	28¼	+1½	*3 11 0
Eastern Tel. Ord.	Stock	10	10	280	+12½	*3 11 5
Globe Tel. and T. Ord.	10	10	10	27½	+1	*3 12 9
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	—	32	—	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	10	—	4 1/16	+⅛	... ...
Marconi-Marine	1	12½	15	8½	—	4 16 0
Oriental Telephone Ord.	1	12	—	2¾	—⅛	...
Western Telegraph	10	10	10	28⅜/-	+27/6	3 11 3
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8 11/16	—	7 9 3
do. do. 2nd Pref. ...	5	6	6	8⅜	+1/16	7 14 10
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	—	850	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	61	—1	3 4 0
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	69½	—	7 4 0
Mexican Light Common	100	Nil	Nil	80	+4½	... ...
do. 7% Pref.	100	7	7	75½	+1	9 5 6
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...
Manufacturing Companies.						
		1926,	1927.			
Assoc. Elec. Ord.	1	—	—	38/3	—	... ...
Babcox & Wilcox	1	13	15	3 7/16	—	*¼ 7 3
British Aluminium Ord.	1	10	10	47/6	—	*¼ 4 3
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅝	+1/16	3 5 0
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	4⅜	—	3 9 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-xd	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4⅛	+⅛	4 17 0
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	3	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	6¼	6¼	24/6	—	5 6 1
do. Ord.	1	7½	10	3	—	3 6 8
Henley...	1	25	25	6	—	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	1⅜	—	5 3 1
Siemens Ord.	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction	12	10	10	25½	—	*4 14 3

* Dividends paid free of Income Tax.

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The Electrical Trade of Holland.

A Comparison of Import and Export Figures for 1927 and 1928.

THE following statement, showing the imports and exports of electrical and similar goods into and from Holland during the year 1928 is compiled from the recently-issued statistics. The figures for 1927 are added for purposes of comparison and notes of any increases or decreases are given :—

Imports.

	Thous. Guilders. 1927.	Thous. Guilders. 1928.	Thous. Guilders. Inc. or dec.
Electric generators, motors, transformers and rotary convertors—			
Total	7,205	8,720	+ 1,515
From Germany	4,148	4,540	+ 392
,, Great Britain ...	959	1,320	+ 361
,, Switzerland	556	800	+ 244
,, Belgium	448	890	+ 442
,, United States ...	195	230	+ 35
,, France	427	440	+ 13
Electric locomotives—			
Total	163*	98	− 65
Wireless apparatus—			
Total	4,817	9,460	+ 4,643
From Germany	2,360	4,180	+ 1,820
,, Great Britain ...	1,078	1,760	+ 682
,, France	444	350	− 94
,, United States ...	348	520	+ 172
Telegraph and telephone apparatus—			
Total	5,579	8,340	+ 2,761
From Germany	3,214	4,740	+ 1,526
,, Belgium	520	1,150	+ 630
,, Sweden	1,166	1,470	+ 304
,, Great Britain ...	226	220	− 6
Other electrical apparatus and instruments—			
Total	7,209	8,270	+ 1,061
From Germany	5,176	5,860	+ 684
,, Sweden	214	200	− 14
,, Great Britain ...	529	870	+ 341
,, United States ...	399	—	− 399
,, Switzerland	567	540	− 27
Steam boilers—			
Total	5,769	6,930	+ 1,161
From Germany	2,310	2,270	− 40
,, Great Britain ...	2,011	2,650	+ 639
,, Belgium	524	580	+ 56
,, France	528	1,050	+ 522
Electric cable, insulated—			
Total	9,902	7,840	− 2,062
From Germany	8,221	6,353	− 1,868
,, Belgium	911	950	+ 39
,, Great Britain ...	353	180	− 173
Steam engines and turbines—			
Total	2,836	3,590	+ 754
From Germany	1,051	1,470	+ 419
,, Great Britain ...	810	1,000	+ 190
,, Belgium	230	350	+ 120
,, Sweden	—	110	+ 110
,, Switzerland	259	400	+ 141

Exports.

	Thous. Guilders. 1927.	Thous. Guilders. 1928.	Thous. Guilders. Inc. or dec.
Wireless apparatus—			
Total	9,197	22.000	+13,803
To Germany	1,705	2,800	+ 1,095
,, Great Britain	1,346	2,470	+ 1,124
,, Dutch East Indies ...	285	560	+ 275
,, France	1,400	3,300	+ 1,900
,, Sweden	540	1,140	+ 600
,, Argentina	380	1,950	+ 1,570
,, Australia	430	1,840	+ 1,410
Electric generators, motors, transformers and rotary convertors—			
Total	5,305	7,110	+ 1,805
To Germany	1,780	2,050	+ 270
,, Belgium	515	670	+ 155
,, Dutch East Indies ...	739	790	+ 51
,, Spain	322	390	+ 68
,, South Africa	177	†	—
,, Australia	191	390	+ 199
Telegraph and telephone apparatus—			
Total	758	560	− 198
To Great Britain	318	360	+ 42
,, Dutch East Indies ...	†	100	—
,, Germany	120	40	− 80
Other electrical apparatus and instruments—			
Total	2,792	3,170	+ 378
Steam boilers—			
Total	1,630	2,170	+ 540
To Dutch East Indies ...	1,151	1,350	+ 199
,, South Africa	13	†	—
,, Curacao	56	170	+ 114
Insulated copper wire and cable—			
Total	3,438	4,111	+ 673
Metal filament lamps—			
Total	19,451	23,900	+ 4,449
To Belgium	963	1,600	+ 637
,, Great Britain	1,853	1,400	− 453
,, France	2,479	4,300	+ 1,821
,, Italy	2,067	2,650	+ 583
,, Spain	263	160	− 103
,, Argentina	1,402	2,560	+ 1,158
,, Brazil	865	750	− 115
,, Australia	1,692	1,600	− 92
,, Dutch East Indies ...	785	1,200	+ 415
Steam engines and turbines—			
Total	2,037	2,100	+ 63
To Germany	90	120	+ 30
,, Belgium	143	80	− 63
,, Dutch East Indies ...	1,103	1,200	+ 97
,, Italy	225	140	− 85

(Florin or Guilder=about 1s. 8d.)

It will be seen that while Holland's exports of power plant have increased substantially, they are still below the level of imports, as the latter again show a considerable advance. From being in 1926 an importer of radio apparatus to a slightly larger extent than an exporter, Holland last year exported such apparatus to the value of nearly 23,000,000, while importing less than 9,460,000 guilders' worth. Of other telephone and telegraph apparatus, as well as electric cable, Holland, however, still imports more than she exports.

* Mainly from Germany.

† Not separately distinguished.

Conditions in the Netherlands East Indies.

Advice to British Manufacturers.

THE British Commercial Agent at Batavia (Mr. H. A. N. Bluett) has prepared for the Department of Overseas Trade a report on economic conditions in the Netherlands East Indies. (Stationery Office, 3s. net.) The report is prefaced by a few facts regarding the islands. The population is nearly 50 millions, of which 35 millions live in Java and Madura, whose area is only about 7 per cent. of the total area of the territory. While the official language is Dutch, English and German are extensively used in commercial correspondence. Great Britain is the second largest supplier to the Netherlands East Indies and fourth in the list of customers, Holland, of course, being first in both directions.

In his introduction Mr. Bluett says that the hopes entertained for a return of exceptional prosperity in the period under review were not entirely fulfilled. The main reason for this is that the reduction of the purchasing power of the Western nations has prevented them from keeping pace with the producing power of Eastern countries, with a consequent decline in prices. In some cases this decline has adversely affected the public revenue.

Import Trade.

Mr. Bluett says that the 1929 import prospects appear favourable. It may be anticipated that a steady demand will rule for the specialised machinery required by estates, and also

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for hydro-electric plant, gas engines, oil engines, transformers, dynamos, and motors. In the last year or so there has been an exceptionally good demand for electrical machinery, but, states the author, in this line the United Kingdom is not getting so large a share of the trade as the excellence of British manufacture and our present competitive prices call for. Imports are principally from Germany, Holland, and Switzerland, while sales are effected locally through the branch offices in Java of the leading Continental manufacturers. British manufacturers have preferred to appoint as their representatives locally-established Dutch firms whose multiple interests preclude them from concentrating on the sale of any particular line. It is thought that a far greater share of the valuable orders for electrical equipment which may be expected within the next two or three years would be obtained by the United Kingdom if manufacturers would only strengthen their selling organisation in the territory, either by attaching salesmen to their existing agents or by establishing their own selling organisations in Bandoeng or Sourabaya. There is a demand for insulated copper wire, but British suppliers have been unable to compete with Holland, Germany and Japan. The reverse is the case in copper tubes and fittings, of which over half were supplied by United Kingdom manufacturers.

Railways and Communications.

The report states that although a sum of 10,288,000 florins is being spent during 1929 on improvements and minor extensions to the existing State railways in Java, and 6,334,800 fl. on new construction, only 279,000 fl. (as against 1,131,200 fl. in 1928) is allotted for electrification. This sum is intended for the completion of work already in hand. The present programme will come to an end with the completion of the Batavia complex and the electrification of the Manggarai-Buitenzorg line. Sufficient locomotives, rolling stock and accessories have already been purchased. The cost of the Manggarai-Buitenzorg electrification is expected to reach about 12 million florins, which is about 2 millions less than the original estimate.

Considerable development has taken place in radio-telegraphy, and there is now direct communication with Holland, Germany, France, the United States, French Indo-China and Manila. Greater efficiency has been attained by a more extensive application of the short-wave system and automatic reception. Experiments with radio-telephony have been made, and although considerable difficulties have still to be overcome, it may be expected that the Post and Telegraph Service will shortly inaugurate a public service. So far, no progress has been made in the formation of a local broadcasting company, though it may be anticipated that a concession for radio broadcasting will be granted soon.

The following statistics of the imports of Java and Madura cover the bulk of the trade of the Netherlands East Indies.

Electrical Imports of Java and Madura.

THE statement is based on the recently-issued official statistics, and shows the values of the imports of electrical and allied material into Java and Madura during 1927. The figures for 1926 have been added for purposes of comparison and notes of increases or decreases given. Holland supplies the greater proportion of the Government's requirements, but Great Britain has a small share of the import trade on private account. The guilder is worth about 1s. 8d.

	1926. Thous. Guilders.	1927. Thous. Guilders.	Inc. or dec.
Electric lamps, incandescent—			
Total	868	1,030	+162
From Holland	704	810	+106
,, Germany	122	130	+ 8
Insulators (private)	70	110	− 40
Do. (Government) ...	110	70	− 40
Uninsulated and insulated electric wire—			
(*a*) of aluminium—			
Total (private) all from Great Britain in 1926 and U.S.A. in 1927	92	160	+ 68
(*b*) of iron—			
Total (private)	33	50	+ 17
Total (Government) ...	46	90	+ 44
(*c*) of copper—			
Total (private)	1,050	1,390	+340
From Holland	351	440	+ 89
,, Great Britain	5	7	+ 2
,, Germany	346	530	+184
,, Japan	279	180	− 99
Total (Government) ...	301	450	+149
From Holland	267	360	+ 93
,, Germany	28	70	+ 42
Electric cables—			
Total (private)	704	1,020	+316
From Holland	321	280	− 41
,, Great Britain	—	1	+ 1
,, Germany	332	570	+238
,, Japan	9	40	+ 31
Total (Government) ...	120	310	+190
From Holland	115	100	− 15
Materials for overhead transmission lines—			
Total (private)	330	670	+340
From Germany	*	430	—
,, United States	*	8	—
,, Holland	*	205	—
Total (Government) ...	440	370	− 70
From Holland	*	210	—
,, Germany	*	160	—
Materials for electrical installations in buildings—			
Total (private)	466	670	+204
From Germany	369	520	+151
Batteries—			
Total (private)	119	180	+ 61
From Germany	25	18	− 7
,, Denmark	20	16	− 4
,, United States	27	100	+ 73
,, Japan	27	20	− 7
Total (Government) ...	76	60	− 16
House lighting and small power sets—			
Total (private)	8	10	+ 2
Do. (Government) ...	2	4	+ 2
Accumulators—			
Total (private)	202	380	+178
From Great Britain	32	60	+ 28
,, Germany	50	120	+ 70
,, United States	89	180	+ 91
Total (Government), nearly all from Holland	340	630	+290
Wireless installations and apparatus—			
Total (private)	357	500	+143
From Holland	171	260	+ 89
,, Great Britain	33	70	+ 37
,, Germany	130	130	—
Total (Government) ...	326	550	+224
From Holland	233	410	+177
,, Germany	53	100	+ 47
,, Great Britain	21	*	—
Telegraph and telephone apparatus, &c.—			
Total (Government) ...	58	190	+132
Total (private)	63	100	+ 37
From Germany	35	44	+ 9
,, Great Britain	12	25	+ 13
Electrical installations and apparatus, unspecified—			
Total (private)	394	1,060	+666
From Germany	269	850	+581
,, Holland	81	150	+ 69
,, Switzerland	16	20	+ 4
Total (Government) ...	139	190	+ 51
From Holland	103	*	—
,, Germany	—	130	+130
Electric fans and ventilators—			
Total (private)	105	104	− 1
From Holland	11	10	− 1
,, Germany	57	42	− 15
,, United States	27	40	+ 13
Dynamos, motors, transformers and rotary convertors, not elsewhere specified—			
Total (private)	1,113	1,200	+ 87
From Holland	247	390	+143
,, Great Britain	38	30	− 8
,, Germany	543	1,140	+597
,, United States	225	70	−155
,, Switzerland	—	280	+280
Total (Government) ...	171	250	+ 79
From Holland	83	120	+ 37
,, United States	76	—	− 76
,, Germany	—	120	+120
Automobile dynamos—			
Total (private)	29	26	− 3
Parts of dynamos, electric motors, transformers and rotary convertors—			
Total (Government) ...	19	50	+ 31
Total (private)	152	230	+ 78
From Germany	96	140	+ 44
,, Holland	30	60	+ 30
,, United States	10	6	− 4
,, Great Britain	10	6	− 4

* Not specified.

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A Large Metal-clad Switch Unit.

Messrs. Ferguson, Pailin, Ltd., announce another development of their well-known line of metal-clad switchgear which embodies the vertical isolation principle.

DESIGNED to meet the demand for a switch of 750,000 kVA rupturing capacity that can be accommodated in small space, the gear illustrated below affords at the same time safe accessibility to all parts. The ranges are from 900 amperes at 33,000 volts to 4,000 amperes at 11,000 volts, and the duplicate bus-bar unit incorporates the breaker transfer method of bus-bar selection, which arrangement is quicker and more positive than plug changing. With this scheme, to effect bus-bar transfer the circuit breaker is lowered by the motor operating gear, moved horizontally along its supporting carriage, and then motor-raised to the operating position on the other set of bus-bars.

The gear is built on the unit principle: on duplicate bus-bar systems this enables additional units to be added without shutting the gear down; furthermore, it is jig assembled, so that similar parts are strictly interchangeable. The supporting structure consists of a welded-steel pipe framework, mounted on cast-metal bases. Separate earthed metal chambers are provided for each set of bus-bars, for the current and protective transformers, for the voltage transformer, and for the cable terminal arrangements. They are cast in non-magnetic material for the heavier currents.

The bus-bars are insulated with bakelite bushings and run in solid with compound, whilst the current and protective transformers may be solid compound filled, or immersed in a fluid compound, which makes them accessible for changing for others of different ratio or capacity; the voltage transformer is oil immersed. The cable-terminal chamber is normally arranged to be filled solid with compound, universal type glands being fitted. Special high-pressure chambers can be provided for oil- or fluid compound-filled cables, and expansion boxes are fitted on all compound-filled chambers. The insulation consists of bakelite throughout, condenser bushings being employed for the higher voltages.

The bus-bars and connections consist of copper rod, tube or strip, according to the current and voltage ratings. The secondary connections are rubber-insulated stranded copper conductors, with fire-proof braiding overall, enclosed as far as possible in solid-drawn steel conduit with bushed ends, having inspection elbows where necessary. A valuable feature is the pressed-steel wiring box in which the multi-core cables from the control panel terminate; the terminal boards are fitted with disconnecting links to facilitate testing. In the case of solenoid-operated circuit breakers, ironclad closing contactors are mounted in the box, to which access is readily obtained by means of a pressed-steel swing door.

The movement of the circuit breaker for isolation, inspection of contacts, removal of tank, or for complete removal of the breaker, is downwards by means of motor-operated worm gearing and substantial screws mounted in pairs on each side of the unit. These screws are traversed by nuts to which the supporting carriage is bolted; the operations are controlled by an ironclad switch from the front. The socket members of the isolating features form an integral part of the circuit breaker bushings, and are of the self-aligning type. An effective disconnecting device for heavy currents, which permits easy insertion and withdrawal of the breaker, yet ensures high contact pressure when in operation, has been patented by Messrs. Ferguson, Pailin, Ltd. All operations are mistake proof, a full, yet simple, system of interlocks being incorporated.

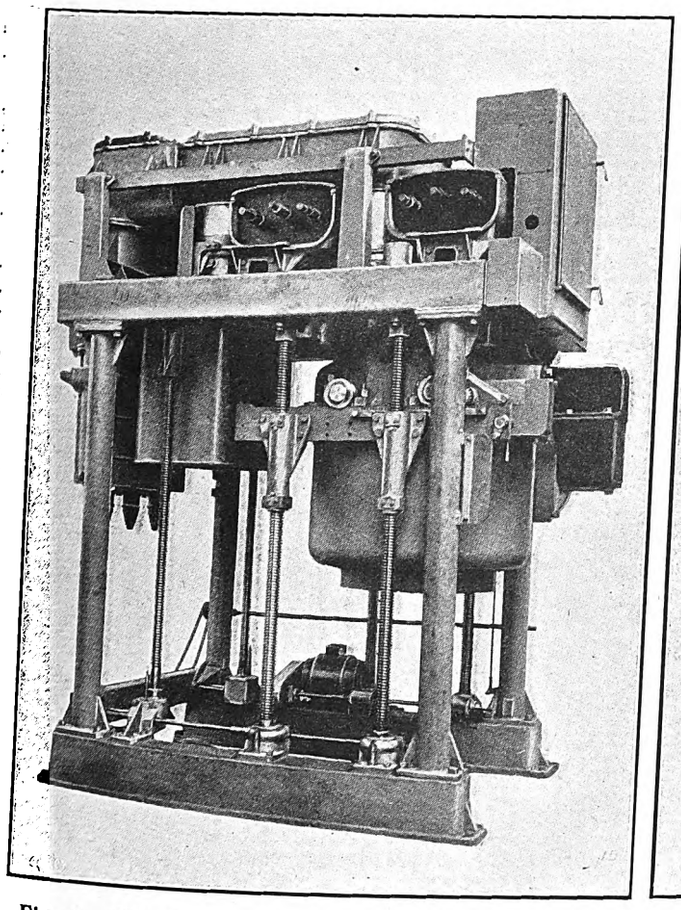

Fig. 1.—Side-front View of Solenoid-operated Unit.

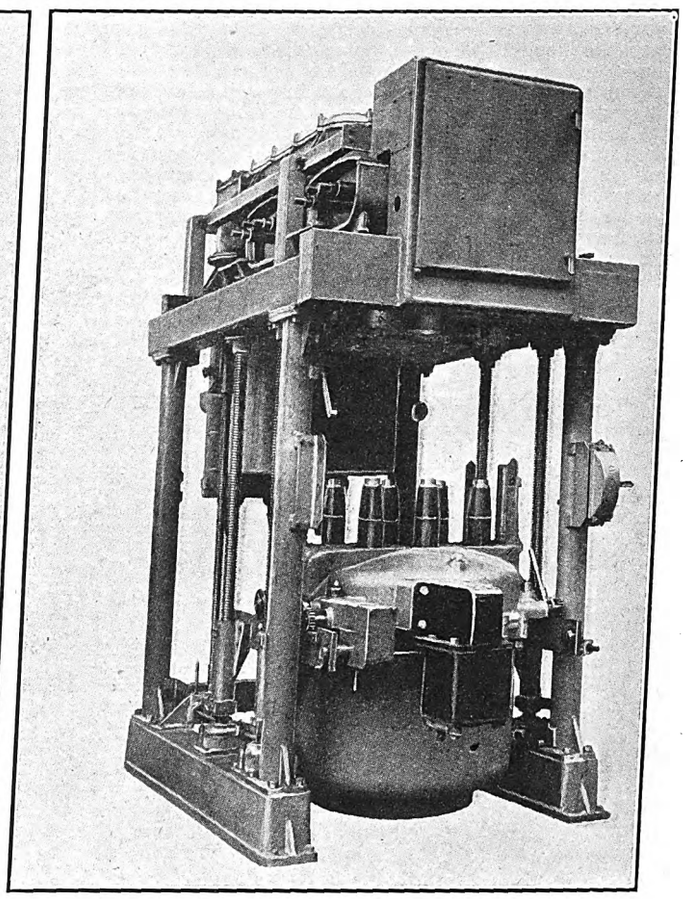

Fig. 2.—Circuit Breaker in Transfer Position.

The circuit breaker is characterised by its massive construction, single-cylindrical welded-steel tank with dished bottom, high domed steel top-plate ensuring an ample air cushion, internal link mechanism, high-pressure oil gauge, and pebble-filled gas vents, which are automatically connected to the exhaust chambers on the fixed portion of the gear when the breaker is inserted. The exhaust gases may be led away as desired. The operating gear is of the patented mechanically trip free type, and is of a simple design which eliminates complicated link gear; it can be arranged for solenoid or motor operation, and means are provided for emergency manual operation. A truck with roller-bearing wheels is supplied with an initial installation to facilitate removal of the breaker or tank.

Both current and protective transformers are located on the feeder side of the circuit breaker, and on account of the heavy short-circuit currents which might be developed, they are of the single-turn-primary pattern. A patented self-compensating

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current transformer is provided when a low ratio is required, and additional secondary windings, or double-ratio transformers, can be supplied. The voltage transformer is mounted (complete with its resistances and fuses) in an oil-filled chamber which is fitted with a breathing device. Independent isolation is provided to enable inspection, or repairs, to be carried out whilst the unit is in commission. The fixed contacts are screened with metal safety covers when the transformer is withdrawn. Simple mechanical interlocks prevent insertion or withdrawal of the transformer, unless it is completely enclosed. The chamber will accommodate three single-phase transformers, or a 3-phase transformer with an additional winding for the operation of an automatic voltage regulator.

The design, which complies with the latest B.E.S.A. requirements, enables the company's well-known duplicate circuit breaker method of bus-bar selection to be installed at a later date, if desired, in place of the transfer breaker arrangement.

High-voltage A.C. Generation.

A proposal to partially abolish the use of step-up transformers by the direct generation of alternating current at high pressure.

By SIR C. A. PARSONS, F.R.S., Hon.M.I.E.E., and J. ROSEN, M.I.E.E.

(*Extracts from a paper read before the* Institution of Electrical Engineers.)

The expression of a wish by an engineer who was responsible for a power supply system (in which the greater part of the energy was transmitted in bulk at 22 kV to a point some distance from the power station, the generating pressure being 11,000 volts) that a reliable generator might be designed capable of generating direct at the higher voltage, led the authors to believe that the problem might be a general one; it came at a time (in 1921) when their thoughts were turning to the design of the largest units which have now materialised, that is, 50,000 and 100,000 kW. With the increasing size of generating unit, the greater were the advantages to be gained in the design of alternators for direct generation at 22 or 33 kV, and in the case of large sets at the lower voltages, to keep the current per conductor low; conductors in two or more adjacent slots would be connected in parallel, thus presenting difficulties in windng, in order that the resultant voltages of each parallel path should be equal in magnitude and also in phase. The number of conductors in series per phase upon which the designer can ring the changes may be as low as 10 or 12. This restriction may impose such limits on the design that an alternator to meet the specified conditions may differ by as much as 20 per cent. from the most favourable proportions, with consequent lowering of efficiency.

On investigation, it was found in many lay-outs that the cost of the leads would be much less and that of the copper bus-bars and switchgear would also be lower; in fact, in the case of the largest sets one switch only would be employed to carry and break the current when two would be necessary at lower voltages.

Considering the cable ducts for an alternator of 94,000 kVA, 11,000 volts, 4,920 amperes, and assuming a density of 820 amperes per sq. in. with lead-covered, paper-insulated, single cables, six cables, each 1 sq. in. in area, would be required for each phase. Assuming that cables are run from the stator earth leads, then there would be a total of 36 cables to be led away from the machine; to suit the requirements of most electrical undertakings, the working density would be lower than that assumed, giving a still greater number of cables. With so many cables grouped together, the maximum output would not be obtained from them.

Most of these difficulties are overcome when an alternator of higher voltage is employed: at 33 kV the current is reduced to 1,640 amperes; against 6 or 7 cables for the lower-voltage machine there are only 2 cables per phase, and they can be loaded up to their full capacity. The leads and sealing ends are readily accommodated in the foundation block, the width of the tunnel being reduced from 14 ft. to 8 ft. 6 in., and the machine placed on a firmer foundation. The sizes of 33-kV cable-sealing bells are only slightly larger than those for 11,000 volts, and cables for the 33-kV machine cost £20 per yard run, and for the 11,000-volt machine £37 per yard run for the above output.

As an example of the necessity for reducing the current in large units, the General Electric Co., of Schenectady, when designing the 208,000-kW unit for the State Line station of the State Line Generating Co., near Hammond, Ind., found it necessary to increase the alternator voltage for this purpose. There are three main units running at 1,800 r.p.m., comprising a high-pressure turbine driving a 76,000-kW alternator (0.85 power factor), and two low-pressure turbines, each driving a 62,000-kW alternator. The main alternators were first designed for a voltage of 18 kV, instead of the standard voltage of 13,400 volts, but it was later found necessary to raise it to 22 kV. The transmission voltages are 33, 66 and 132 kV; it is apparent that the generating voltage has been increased because of the difficulties which arise with the heavy currents.

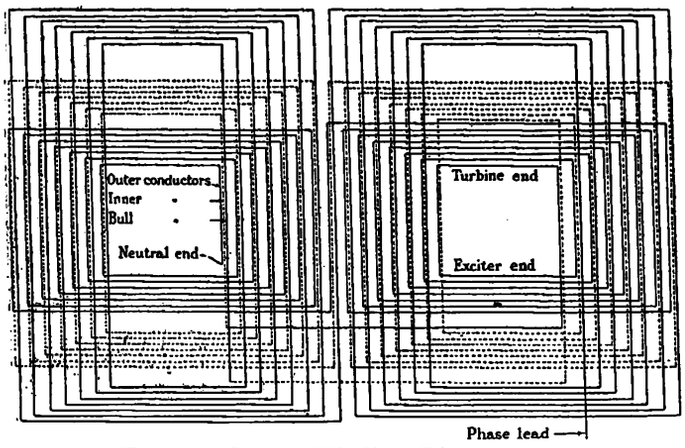

Fig. 1.—Stator Winding Diagram.

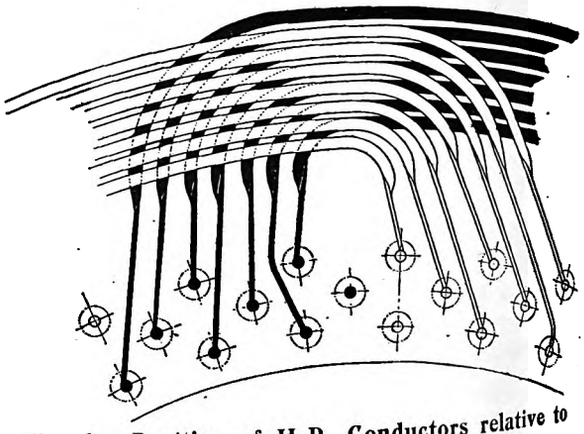

Fig. 2.—Position of H.P. Conductors relative to Adjacent Phases.

The authors have been repeatedly reminded that if they can show sound reasons for generating at a higher voltage, then 66 kV (recognised as one of the standard transmission voltages) would be the most advantageous, but there are many conditions under which 22 and 33 kV would be considered economical, more especially when the station is at the centre of, or at only a few miles' distance from, the main centre of consumption of the power, and when underground cables may be employed for transmission; for example, Barton, Clyde Valley, the proposed site at Carrington, and others, all have surrounding areas which can economically consume power at 33 kV, and enable a saving to be made by direct generation and switching at 33 kV.

When the generator can be constructed to supply the transmission system directly, without the intervention of step-up transformers, the whole sum representing the cost of the transformers and their housing and the capitalised value of their losses, less the additional cost of the high-voltage generator, can be saved. Various other items in which there is a direct financial saving may be summarised as under:—

Transformers will usually be 3-phase up to 20,000 or 30,000 kVA, and banks of three single-phase units for larger outputs. Artificial cooling, either by water or air, will be required

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above 15,000 kVA, and is included in the prices given below. The figures apply to transformers stepping up the generator voltage to 33 kV. The capitalised value of transformer losses represents a considerable part of the total capital outlay, and is so much greater than the extra cost of the high-voltage generator that the saving of this expenditure is alone sufficient to justify the use of higher generating voltages, when transformers can be eliminated.

The cost of switchgear may become excessively high for very large sets at low voltage; the cost of maintenance also will be higher for the very heavy gear required for large currents.

Consider a set of 75,000 kW giving its full output at a power factor of 0.8, the equivalent output thus being 94,000 kVA, supplying a network of 33,000 volts, so that a transformer bank will be necessary in the first case; it is assumed that the switchgear is on the 33-kV side. The following comparison can then be made:—

Set:	"A"	"B"
Generator output kVA	94,000	94,000
Generator voltage	11,000	33,000
Approximate additional cost of generator	—	£10,000
Cost of cables (100 yards' run)	£3,675	£2,000
Cost of transformers	£19,000	—
Transformer losses:		
Fixed, kW	250	—
Variable at full load, kW	400	—
Variable at 60 per cent. load factor, kW	144	—
Transformer cooling equipment:		
Input to motors, kW	50	—
Reduction in cost of buildings, &c., and transformer foundations ...	—	£500
Annual cost of fixed losses [at £1 per kW (0.1d. per unit)]	£1,400	—
Annual cost of variable losses ...	£925	—
Capitalised cost of transformer losses at 10 per cent.	£23,250	—

The 33-kV machine thus shows a capital saving of £44,425, from which the extra cost of the former must be deducted, leaving a net saving of £34,400. When the generator voltage is stepped up to 66 kV it might be possible to take advantage of the low step-up ratio and effect a saving by the use of auto-transformers.

	"A"	"B"
Generator voltage	11,000	33,000
Cost of cables (100 yards' run)	£3,675	£2,000
Cost of auto-transformers	£16,000	£9,750
Capitalised value of losses	£20,000	£12,500
Reduction in building costs	—	£1,000
Cost of switchgear	£9,000	£6,200

The total capital saving on the 33,000-volt generator is then £19,225, less £10,000, or a net saving of about £9,000.

The design of the 33,000-volt, 25,000-kW, 3,000-r.p.m. alternator now installed at the Brimsdown power station, North London, is based on a concentric type of core conductor which made it possible to prepare designs with greatly increased phase voltage, without increasing the voltage gradient across the winding insulation. By its use an alternator can be so wound as to distribute the dielectric stress and to lower its mean value at that part of the machine where there is limited area, and the maximum of heat generation at the regions adjacent to the stator bore. In the designs of alternators at voltages of 33 kV and 44 kV between phases, there is sufficient margin to permit insulated conductor bars to be used with thicknesses of insulation not exceeding those of which experience had proved satisfactory.

A section through one conductor bar is illustrated in fig. 3 A; the insulation between conductors is of micanite, and there are three conductors per slot, nested one within the other, the conductors being wound in such a manner that the voltage is gradually stepped down from the innermost conductor. This formation of conductor is also mechanically very strong, a distinct advantage where the conductor projects beyond the stator core, for coupling to the end connections. The "bull" conductors of each phase are connected in series, and are then connected to the surrounding "inner" conductors which are again connected in series and finally connected to the "outer" conductors, which are starred to the ends of corresponding conductors of the remaining two phases, and then connected to earth.

The diagram of connections shown in fig. 1 is for a 3-phase, 2-pole alternator having 90 slots and three conductors per slot.

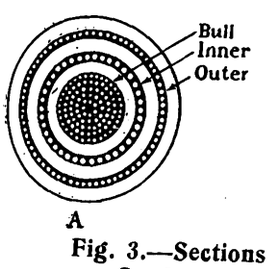

Fig. 3.—Sections through Conductor Bars.

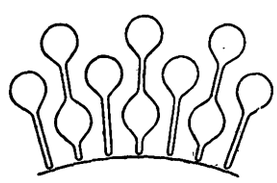

Fig. 4.—Conductor Slots in Three Rows.

The winding of each phase has 88 conductors distributed between 30 slots, the voltage generated per conductor being 217 V. The phase voltage and the maximum voltage to earth is 19,080 V.

The "bull" conductor potentials range from 19,080 to 13,000 volts, the "inners" from 13,000 to 6,500 volts, and the "outers" from 6,500 volts to zero. There is a substantially constant potential difference of 6,500 volts between the conductors in any one slot, and a maximum voltage from the conductor to earth of 6,500 volts, which are moderate and readily dealt with.

The conductors are arranged in three rows as shown in fig. 4; by staggering the conductor slots the flux density in the stator teeth is kept uniform, and it was found possible to use the round conductor, at the same time obtaining increased internal reactance. It is not necessary to bend the core conductors where they project from the stator, in order to provide a reasonable leakage gap between the end windings and the rotor end-caps. The staggering gives a uniform distribution of winding and, in effect, has the advantages of the smooth-core armature, without the disadvantages of an unduly increased air-gap; the excitation energy is therefore retained at a very reasonable figure.

The "bull" conductor was made in the same manner as an ordinary cable, and varnish-impregnated *in vacuo*, cut into the requisite lengths, and alternate layers of mica and insulated copper strands were applied; after the application of every thickness of insulation the conductors were re-impregnated *in vacuo*. In no part of the manufacture were the conductors in any way bent.

From fig. 2 it is seen that two slots per phase contain only two conductors, instead of three; a detail of the conductor is shown at B in fig. 3. The conductors of the highest potential are not carried to the slots adjacent to another phase; this increases the distance between regions of maximum potential, and reduces to 28,000 volts the pressure between adjacent conductors projecting from the core.

Dr. S. L. Pearce, in his paper on "Prospective Development in the Generation of Electricity and its Influence on the Design of Station Plant," read before the Engineering Conference of the Institution of Civil Engineers in June 1928, says: "In the absence of step-up transformers, or external reactance coils, the reactance required for limiting the short-circuit currents to values within the rupturing capacity of the switchgear has necessarily to be incorporated in the stator windings, with the natural consequence that under short-circuit conditions, the mechanical forces on inherently weaker windings are appreciably increased." In the authors' experience, this difficulty has not arisen. The short-circuit tests carried out on the machine described above proved that the windings are equally as robust as those of a low-voltage machine.

Since the plant was installed in August, 1928, it has operated continuously up to its maximum load at voltages varying between 34,000 V and 35,000 V, and it has withstood without any sign of distress the most severe faults on the large overhead and underground network to which it is coupled. The control and regulation have proved eminently satisfactory in every way. It certainly seems in the natural course of design that a reliable high-voltage alternator is essential to the rapid increase in size of power systems and their interconnections. Other units of ever-increasing size, such as motors, motor-generators, synchronous condensers, &c., may be economically designed and coupled direct to the network without the use of transformers.

The authors hope that they have shown that a definite advance has been made in the generation of electricity and in the design of large generators which may be used for connection to the "grid."

Electrical Manufacturing in Canada.

The merger of three large firms engaged in the manufacture of electrical appliances is being arranged under the name of the Amalgamated Electric Corporation Ltd., with a capitalisation of $3,000,000. The firms included in the merger are W. H. Banfield & Sons, Toronto; the Benjamin Electric Co., the Toronto branch of a Chicago firm, and the Duncan Electrical Co., Ltd., Montreal. Messrs. W. H. Banfield & Sons, established in Toronto in 1878, have taken a leading position in the manufacturing of switch and outlet boxes, wiring devices, and equipment for commercial and domestic lighting. The Benjamin Electric Co. is well known for the manufacture of switchboards and panel boxes, and the Duncan Electrical Co. produces electrical porcelain goods. Mr. W. H. Banfield will be president of the new corporation, the headquarters of which will be in Montreal.

Messrs. Ferranti, Ltd., are to establish a branch at Mount Denis, a suburb of Toronto. A modern plant costing approximately $250,000 will be erected, and 200 men will be employed. The principal lines of manufacture will be radio equipment, meters, and transformers.

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H.F. Alternator Developments.

A Description of a Novel Type of High-frequency Inductor Alternator made on the Continent.

At one time alternators of comparatively high frequency were largely used for operating radio spark transmitters. When the latter were replaced by valves high-voltage d.c. generators took the place of the high-frequency alternators in most cases, although alternators (used in connection with high-pressure transformers and valve rectifiers) are still preferred for long-wave transmitters and transmitters of large power. Recently a new field of usefulness for the high-frequency alternator has been developed in connection with induction furnaces, and for this purpose machines of from 350 kW to 2 kW, at frequencies from 500 up to 10,000, are now in regular demand. Such furnaces form inductive loads of low power factor, so that compensation by means of condensers is adopted, and the condensers become smaller and generally cheaper as the frequency increases.

Another use for medium- and high-frequency alternators is for driving high-speed machinery, such as wood-working machinery, by means of 3-phase induction motors. Thus, with a 500-cycle supply a 2-pole induction motor runs at almost 30,000 r.p.m., and can be conveniently coupled directly to the high-speed machine without troublesome gearing. For submarine sound-transmission schemes, again, high-frequency currents up to 8,000 cycles per second are required. Amongst the many other uses for h.f. alternators are the operation of fatigue-testing machines (in which rapidly reversing stresses are applied to the material under test), the production of ozone and other more recent electro-chemical applications, the routine testing of telephone repeating stations, a.c. bridge tests, and so on.

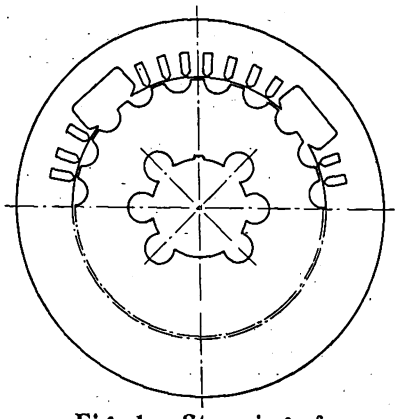

Fig. 1.—Stampings for 100-kW, 500-cycle Alternator.

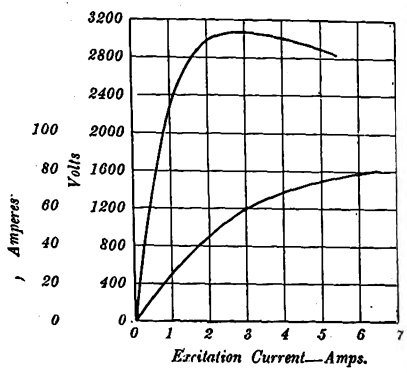

Fig. 2.—No-load and Short-circuit Characteristics.

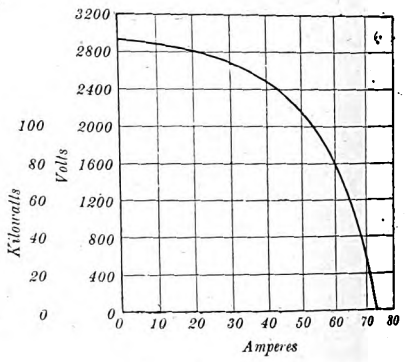

Fig. 3.—Non-inductive Load Characteristc.

In a recent issue of the *E.T.Z.* is described the construction and performance of a somewhat novel type of high-frequency inductor alternator, the "S" type," for which the following advantages are claimed as regards efficiency, size, and cost when compared with the types hitherto used.

The "S type" (1) lends itself to construction in the standard induction motor frame, (2) has a higher efficiency because the whole magnetic circuit is laminated instead of being partly of solid iron as in the ordinary inductor alternator, so that certain additional iron losses are avoided, (3) the cost of winding is reduced, as only a single stator has to be wound, instead of two, and (4) it can be made into a self-exciting alternator by simply placing an ordinary direct-current armature winding in the rotor—in fact, such a direct-current winding can be made to deliver a second output almost as large as that of the main alternator. These double-current generators then develop about twice as much power as any other form of generator of equal size, and have been used successfully in cases where minimum dimensions and weight are essential, such as for aircraft generators.

Fig. 1 shows the stator and rotor stampings of a 100-kW, 500-cycle, 1,500-r.p.m. "S-type" alternator built by the C. Lorenz A.G., of Berlin, for operating a brass-melting induction furnace. As this furnace is worked day and night an exceptionally high efficiency is desired. The generator output is 1,800 volts and 55.6 amperes. It is driven direct by a 3-phase induction motor, and the combined efficiency of the two reached the high value of 84 per cent. The dimensions of the rotor are 498 mm. (19.6 inches) diameter and 420 mm. (16.6 inches) axial width of iron, and a comparison shows that the output obtained is only about 25 per cent. less than that of a standard 50-cycle induction motor of the same size, whilst a standard 50-cycle alternator would have larger dimensions than the "S type" 500-cycle machine.

As can be seen from fig. 1, the machine has four main magnetic poles. Each pole has a d.c. exciting winding of 550 turns of .049 in. diameter wire placed in the large slots shown in the stator. Each pole face has seven slots carrying the main a.c. winding. This winding consists of eight coils per pole of 10 turns each, *i.e.*, each slot contains 20 conductors of copper strip .11 inch by .22 inch. The exciting winding has a resistance of 72 ohms and is loaded at approximately 4½ amperes at 350 volts. The a.c. winding resistance is .88 ohm.

The stator and rotor stampings are made of transformer sheet .013 inch thick. The frame of the machine is similar to that of an ordinary induction motor. As can be seen from the curves reproduced in fig. 2 (no-load and short-circuit currents) and fig. 3 (non-inductive load characteristic), the short-circuit current is not very much greater than the full

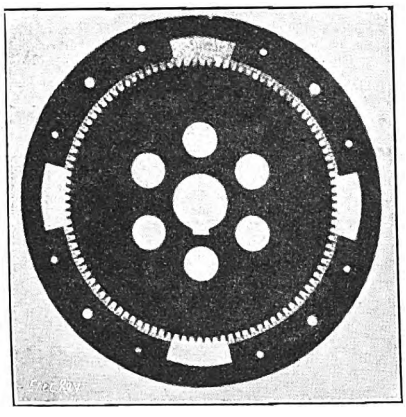

Fig. 4.—Stamping of 2-kW, 8,000-cycle Machine.

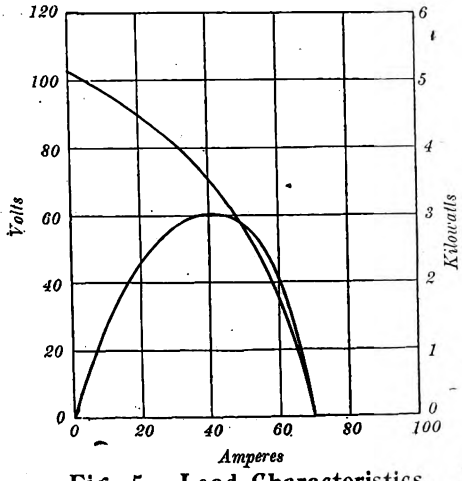

Fig. 5.—Load Characteristics, Tuned and Untuned.

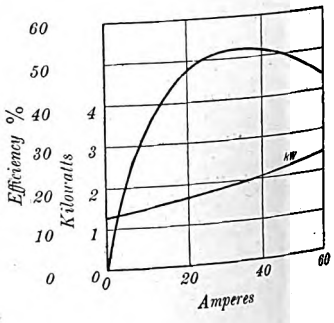

Fig. 6.—Efficiency Characteristic of Combined Machine.

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load current. This is characteristic of these high-frequency generators and makes them perfectly safe against short circuits. Thus in this case the full-load current is 55.6 A at 1,800 volts, with an exciting current of 4½ A, and the short-circuit current at this same excitation is only 72 A, or 25 per cent. greater, and the machine could safely run at this larger current continuously. The temperature rise after a continuous run at full load was 42 deg. C.

The following table gives some efficiency readings taken on the set:—

Motor input, kW.	Alternator exciting current.	Alternator output. Volts.	Amps.	kW.	Combined efficiency.
59.6	1.5	1,425	34	48.5	81.3%
109.8	3	1,810	51	92.5	84.3%
125.3	4	2,400	41.5	100	79.8%
112	3.05	1,850	49	90.6	81%
126.3	4.05	1,875	55	103	81.6%
132.5	4.75	1,850	57.5	106	80.4%

If the machine is run on a leading power factor load, as is generally the case, the maximum output increases decidedly and an overload of 25 per cent. can be developed continously.

The "S type" of alternator is especially suitable when still higher frequencies are required and enables smaller and cheaper machines to be produced than does any other form of construction. The following particulars concern a 2-kW, 8,000-cycle alternator. The machine runs at 4,500 r.p.m., and has a rotor diameter of only 9 inches. Fig. 4 shows the shape of the stampings used. The rotor has 108 teeth, and the stator has a tooth pitch of .132 inch. The slots are round and .087 inch in diameter, and each carries a single copper conductor .059 inch in diameter. The normal output is 36 A at 55 volts, so that the current density in the copper conductors reaches the high value of 13,000 A per square inch. This is permissible because, in spite of it, the total copper losses are low (the resistance of the whole winding is only .15 ohm and the loss, therefore, only 195 watts). In fact, the copper loss might safely be trebled in this machine, which means that the density used might be almost doubled.

Fig. 5 shows the load characteristic curves of this machine, both on ordinary "dead" load (untuned) and on a tuned circuit. In this case the machine was run at 5,500 r.p.m. On "dead" load the maximum output is 3 kW, whilst when the circuit is tuned to resonance a maximum load of 5 kW can be obtained.

Fig. 6 shows the combined efficiency curve of the machine and its d.c. motor at 4,440 r.p.m. The efficiency at 2 kW will be seen to be 52 per cent., the alternator itself having an efficiency of 74 per cent. at this output.

As stated above, this form of machine lends itself readily to the addition of a direct-current armature winding and commutator to the rotor, and it can then be used as a very efficient rotary transformer, taking its input from a d.c. supply and delivering a high-frequency output. Many such machines are in use supplying spark transmitters, &c. Efficiencies of as much as 60-65 per cent. can be reached with outputs as small as 300 watts, whilst 1½-kW sizes reach 80 per cent. An additional advantage is the fact that the speed keeps practically constant from no load to full load, owing to the increasing armature reaction of the alternating current as the load increases.

Small machines of this type are also in demand for a.c. bridge tests of all kinds, the outputs varying from 1 to 50 watts. For this work very exact constancy of frequency (± .01 per cent.) is required, and the writer of the article has developed a speed regulator which meets such requirements, even with supply voltage variations of as much as 30 per cent. The other chief requirement is a true sinusoidal curve shape. This can be attained in one of two ways: either a comparatively large machine with a large air gap and specially shaped pole pieces can be built, or a standard machine can be employed fitted with suitable resonant filter circuits. The latter is found to be the more satisfactory solution, and is also decidedly cheaper.

Sometimes these testing machines are required to give several outputs at different high frequencies at the same time, and for this purpose the "S type" can be very conveniently built with a number of distinct sets of alternator stampings in one frame, all excited by the same set of magnet coils. As many as 10 different frequencies have been obtained from a single machine in this way.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Flexible Cable.

We have received from the Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10, a sample piece of "Saxovac," a special flexible cord which the company has produced for use with portable electrical appliances, particularly vacuum cleaners. The cable is of the tough-rubber-sheathed type, with additional protection and finish by means of taping and braiding overall. The standard type is twin 23/36 s.w.g., circular, with twisted v.i.r.-insulated cores, but larger sizes can be supplied, and also cable with a third (earthing) conductor.

An Electric Paper-cutting Machine.

The "British" electric paper-cutting or perforating machine, fig. 1, a recent production of Messrs. Guy V. Laycock, Ltd., 12, Cloth Hall Street, Huddersfield, has been specially

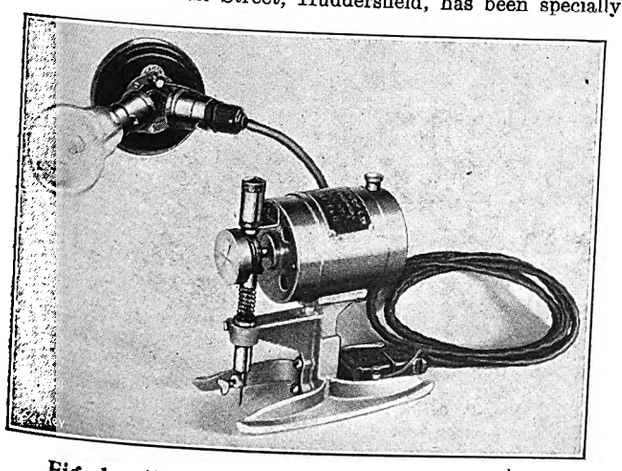

Fig. 1.—"British" Paper-cutting Machine.

designed and constructed for rapidly cutting or perforating intricate designs in wall papers, &c. It will, it is claimed, cut from one to eight or nine thicknesses of paper at once with a loading of about 50 watts. The cutting needle is easily adjusted, and can be replaced at negligible cost. The motor is of the universal type, and is supplied for either 100/120 V or 200/240 V. Ball bearings are fitted, and the only wearing parts are the two carbon brushes. A resistance lamp socket is provided with the machine, enabling the speed of the motor to be set to suit the work in hand, and further, acting as a safety fuse to protect the motor. An 8-c.p., 110-V carbon-filament lamp is usually suitable for 200/240-V machines, but for certain classes of work other sizes can be used with advantage. Provision is made for altering the compression on the spring by raising or lowering the plunger brush. The needle can be raised or lowered, according to the thickness to be cut. The machine is efficiently earthed. The motor drives a reciprocating needle bar through an eccentric mechanism. A steel needle of special shape is clamped in the end of the needle bar, and the reciprocating needle thereby perforates or cuts the paper.

A Self-winding Gramophone.

What is claimed to combine the advantages of both the spring and the electric gramophone motors is the A.E.D. self-winding gramophone, a product of Auto Electric Devices, Ltd., Diamond Works, Brighton, which consists of an electric motor connected to a spring motor of the ordinary standard type through a reduction gear. This is connected to the winding shaft of the spring motor by a coupling consisting of one member fixed to the winding shaft and one sliding member held in engagement by an adjustable coil spring, the actual coupling being effected by two steel balls and sockets. When the spring motor is wound to a pre-determined point at which the tension of the main spring exceeds the tension of the spring which keeps the coupling in engagement, the loose member of the coupling is forced back out of engagement with the fixed member, thus freeing the winding shaft of the spring motor from the electric motor. Attached to this winding shaft at its opposite end is a sprocket wheel, the teeth of which engage with a pivot trigger attached to a steel bar which carries the moving member of the electrical switch. Upon disconnection between the electric motor and the spring motor taking place, the winding shaft of the latter is naturally forced back in a reverse direction by the action of the wound spring. When this occurs, one of the teeth of the sprocket wheel engages with the pivot trigger and moves the switch bar, thus opening the electrical circuit. The pivot trigger is so arranged that in moving it forces a steel pawl into the path of the teeth of the

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sprocket wheel, thus checking any further backward movement. Driven from the gear-wheel of the gramophone spring *via* a worm and worm-wheel is a shaft carrying two slotted circular disks. In the slots of these disks is a yielding pin, and according to the time desired between windings, the gear ratio of this member is arranged for the disks to make one complete revolution, on the completion of which the floating pin strikes against a projection on the switch bar, is forced to the other end of the slot, and then drives the switch bar forward, thus closing the circuit and re-starting the winding operation.

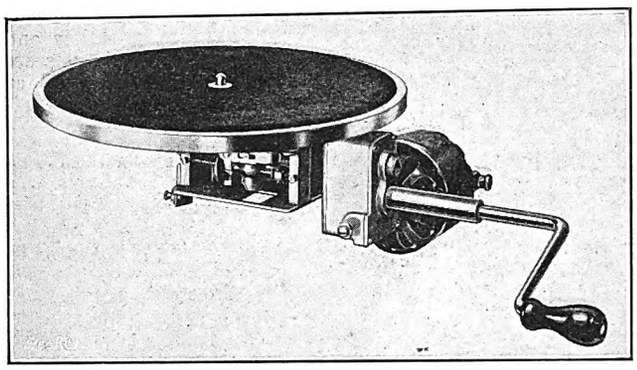

Fig. 2.—A 2.D Self-winding Gramophone Unit.
The apparatus is automatic in action, and therefore can be run indefinitely without any attention at all. Hand winding is provided for emergency use. Fig. 2 shows the motor unit and turntable.

A Large Cable-braiding Machine.

The accompanying illustration, fig. 3, is of a 36-spindle cable-braiding machine produced by Messrs. B. & F. Carter and Co., Lark Works, Hare Street, Rochdale, for covering electric cable up to 3 in. in diameter. It is arranged with a haul-off capstan of 5 ft. diameter, which is sufficiently wide to take three turns of the largest size cable that is to be braided. The machine is fitted with the makers' "Speedway" carriers, which give, it is claimed, a speed of from 20 to 100 per cent. greater than that of the ordinary "weight-and-dropper" type of carrier, and which, being built up practically of steel throughout, are free from breakages. The machine is fitted with machine-cut gearing. Messrs. Carter & Co. have just completed and supplied to one of the large cable companies a machine of exactly the same design as the one illustrated, except that it is arranged for dealing with lead-covered cable up to 5 in. diameter. The

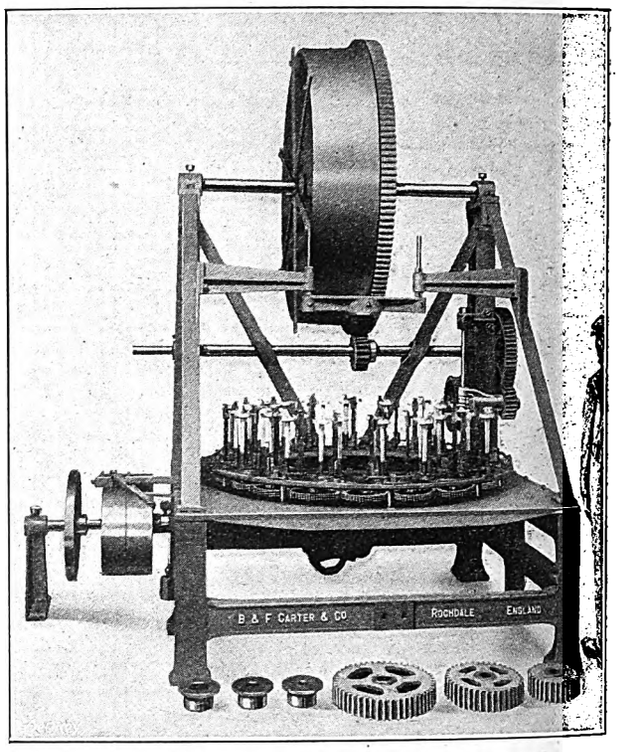

Fig. 3.—Braiding Machine for 3-in. L.C. Cable.

haul-off capstan of this machine is 8 ft. in diameter, which is the smallest diameter that this size of cable will give to. We understand that the machine is the largest that has been made in this country for the class of work referred to.

Electricity in Agriculture.

The salient features of the application of electricity to all kinds of farming, stockraising, crop production, rural dwellings and small industries.

By W. PHŒNIX, A.M.I.E.E.

(*Extracts from a Paper read before the* Western Centre *of the* Institution of Electrical Engineers.)

THE paper is divided into two sections: in Part 1 the condition of the agricultural industry is considered, and it is concluded that its present depression is mainly due to (*a*) cost of labour, and (*b*) reduced area of arable land and stationary yields of crops per acre. It is suggested that an increased application of electricity to agriculture supplies a means of correcting the depression, an increased application of machinery being required to obtain the maximum output per head of labour, whilst electroculture affords a means of increasing crop yields per acre of land. Perhaps the most important function of a rural electricity supply will be to break down the inherent isolation of rural life, which to-day is still crude and not conducive to intellectual advancement.

Up to the present time the lead in development is held in Cheshire, by the Chester Corporation and the Mid-Cheshire Electric Supply Co. Progress has, of course, been made in other counties, but not to the same extent: the Chester Corporation alone has authority to deal with about 140 square miles of rural area. The first Special Order which was granted included only 60 square miles, but after three years of working (during which time 1,152 consumers, including 90 farms, had been connected, and the results had evidently satisfied the Corporation) the area was increased by a second Special Order.

In view of the statement that the new e.h.p. lines of the Central Electricity Board cannot be tapped at a cost of less than £40,000, it follows that the immediate future development of rural electricity supply still depends on the enterprise and efforts of existing supply authorities, who must extend their lines to embrace surrounding districts, gradually penetrating further into the country and so preparing the nuclei of the larger and more comprehensive schemes of the future.

Under the term "agriculture" the whole rural area, its dwellings and small industries, as well as its farms, should be considered. It is to be hoped that the absence of his rival the gas engineer will not cause the electrical engineer to reduce his endeavours, for he will have another competitor, namely, oil, though probably the greatest difficulty he will be called upon to overcome will be that of poverty. Whatever he attempts must be a definite economic proposition, both for himself and his client, and every effort should be made to keep the initial expenditure as low as possible.

The recent easement of the regulations for overhead lines will do much to assist those who are endeavouring to cheapen rural distribution. Underground distribution is to be preferred, and it is regrettable that recourse to overhead lines should be necessary. Every achievable method of cheapening underground distribution should be considered. Much can be saved by the use of multiple service boxes where houses are situated in pairs or small blocks, or, alternatively, there are several excellent ways of supplying houses *en bloc* by means of eaves cables; also road-reinstatement charges are not heavy in rural districts, as the foot-ways are seldom more than cinder paths. Should underground cables, in the face of these possibilities, still prove too costly, overhead distribution becomes inevitable, but it should never be adopted when the former can be employed. When overhead lines are erected the æsthetic aspect should not be allowed to escape attention. The engineer who disfigures the countryside will prejudice the progress of electrification, and the fact that work of an unsightly nature had been done before people had realised the ultimate picture is no excuse for the perpetration of further atrocities "not quite so bad." Still with the æsthetic aspect in mind, efforts should be made to eliminate outdoor substations in rural centres. Small brick buildings

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are more in keeping with the amenities of such districts. Such a substation, of a capacity of 100 kVA and arranged for underground e.h.p. loop cables and three or four l.p. distributors, can be erected at a works cost of less than £50, which amount is easily recovered in the difference between the cost of indoor and outdoor equipment. The result is undeniably a better job, whilst maintenance costs are reduced.

The versatility of the engineer will see him over the difficulties of rural work, but it is not intended to imply that special study is unnecessary. The engineer who hopes to progress in rural electrification must equip himself with a general knowledge of agricultural matters and a certain detailed knowledge of cultivation, whilst a knowledge of the economics of agriculture and an appreciation of the depression existing in the industry will be an advantage. Engineers should show that they have courage in their convictions and should not expect too much from the early stages of the supply. The rural load will be very similar in nature to the urban load, a large proportion, whether in the village or on the farm, being domestic; particularly will this be so at the commencement. The process of education will follow the old course *via* the electric lamp. Specialists will become necessary as developments occur; the authority which hopes to continue with the combined distribution engineer, consumers' engineer, salesman and demonstrator, &c., will soon find itself at a disadvantage and will fail to make the progress which it ought to make. Whoever undertakes the supply of electricity to farmers must be able to see through the eyes of an agriculturist.

Efforts should be made to secure the public lighting service, which constitutes an excellent form of propaganda. If secured before the supply is commenced, the use of cable having an extra core (in the case of overhead distribution, an extra line) will be cheaper than installing separate time-switches.

The system of tariffs applicable to other industries will apply equally well to agriculture. Owing to the diversity of applications of electricity and the long working hours, the farm load-factor compares quite favourably with, and in many instances is better than, that obtained with various other industries. Likewise, there is obviously no difference between the characteristics of rural and urban domestic loads, and rural consumers should be given the benefit of any optional tariffs, such as may exist for night loads or water-heating.

An excellent solution to the tariff problem is to apply exactly the same tariffs in rural areas as are in use in the adjacent towns, but with a certain percentage increase, the actual amount depending on the capital expenditure involved in supplying each district. If the increase is carefully chosen for given load conditions, it will encourage development to advertise the possible reductions after stated load conditions have been obtained. Provided care has been taken in fixing the conditions, it should be possible to effect the first reduction after 1 year of supply, or at the most 2 years, whilst after 5 or 6 years the tariffs will become stabilised at a value a little above those in operation nearer to the power station. The difficulty in this scheme is that any increase in load which necessitates alterations to the transmission lines, or substations, may at the same time bring about the need for a revision of the tariff conditions, unless the stabilised tariff has previously been reached. This point should be made clear at the commencement of supply.

In Part 2 electro-culture is classified under (*a*) air-earth currents, (*b*) earth currents, (*c*) seed treatment, and (*d*) other methods. Air-earth current, or the discharge method, is dealt with in detail and empirical rules for its application are given; experiments with an alternating-current discharge are described, and it is suggested that the simplicity of this system and the success of the experiments justifies further investigation on a larger scale. Other systems of electro-culture are dealt with more briefly, emphasis being placed on the value of a successful seed-treatment process. For the electricity supply industry electro-culture will provide excellent propaganda, whilst meeting an urgent need in agriculture.

An over-optimistic opinion of the merits of electro-culture may lead to ultimate disappointment, but a pessimistic view would be equally absurd. It can be stated quite definitely that electrification is effective in increasing crop yields, and further development of the various systems will demonstrate their respective values and afford means of comparing electro-culture with other methods of intensifying crop yields, as, for example, by applying an extra dressing of fertiliser. This aspect of the case is likely to be accentuated in the future, owing to the large quantities of cheap synthetic nitrogenous fertilisers which will be marketed by Imperial Chemical Industries, Ltd.

The nature of agricultural experiments is such that results can only be expected after long and patient effort, and Prof. V. H. Blackman, assisted by others, has undertaken a lengthy task, but one which, judging by present progress, must eventually yield to him a conclusive result. If this is favourable it will fall to the lot of electrical engineers to put the best system into practice in the most economic manner. Meanwhile, to those who have the opportunity, the subject affords an interesting study. It is only by a large number of experiments spread over a period of years and carried out on different soils, and wherever possible on a large scale, that full details of the conditions of field practice will be obtained. The importance of the subject cannot be over-estimated, for it is to agriculture that we owe, and must continue to owe, our existence. In addition, electro-culture should make a special appeal to the electrical engineer. In the home country where fields are of comparatively small dimensions, the overhead discharge method is not impossible, and to our cereal-growing Dominions, where vast tracts of land are cultivated, an earth-current system, or successful seed-treatment, would be a boon. In cotton and tobacco plantations lie other fields of application, for it has been shown that both these crops are susceptible to electrical influence.

That the Government has been disposed to grant a subsidy to the sugar-beet industry is evidence of the importance with which it is regarded, and it is probably in the same field that the greatest advantages will accrue from an application of electro-culture. The beet contract for the years 1928-30 is based on a price of £2 6s. per ton for beet having a sugar content of 15½ per cent.; £2 9s. per ton for beet having 16½ per cent. sugar; and for each 1 per cent. above 16½ the price is to be increased by 3s. 4d. per ton. Since it is possible to increase the sugar content in addition to the yield per acre by applying electro-culture to beet, it will be evident that the advantage to be derived from the application is twofold. Table I shows the probable results of electrification; the nominal increase of 20 per cent. in yield per acre has been taken; also the prices quoted are for beet delivered at the factory, hence the additional freight costs should be deducted from the increased revenue quoted.

TABLE I.

Growing conditions.	Beet tons.	Sugar per cent.	Sugar (total) lb.	Revenue £	s.	d.
Normal (per acre)	7.6	15½	2,639	17	9	6
Electrified (per acre)	9.1	16½	3,363	22	5	11
Increase due to electrification	1.5	1	724	4	16	5

Finally, the author refers those who desire further information on electro-culture to the bibliography in his paper and to the appendix which gives full particulars of the apparatus used in his own experiments and the results obtained therefrom.

From his experiments, the author draws the following conclusions: (*a*) electro-culture is beyond doubt a means of increasing crop yields, and is also effective in shortening the time required by plants to reach maturity; (*b*) a.c. discharge is quite satisfactory in practice; (*c*) wide variations in the general rules for applying a discharge are possible within limits; (*d*) when the rate of discharge is high a daily application of 4 hours only is better than 6 hours; (*e*) electro-culture, though not a panacea for the distress in agriculture, should by no means be neglected when considering "electricity in agriculture."

The farm of Lieut.-Col. C. Lyon is of interest, since it is one of probably only a few farms where the charge for electricity is based on the maximum-demand (kVA) system, and the monthly demand is therefore recorded. The farm, which is described as arable dairy, is situated in Cheshire, on the outskirts of Warrington, and electricity is taken from the supply mains of the Warrington Corporation. The area of the farm is 237½ imperial acres, of which 91 acres is arable land. An average of 60 head of cattle and from 200 to 300 head of poultry is maintained on the farm. Electricity is used for lighting throughout the farm buildings, the yard and the farm-houses, whilst it supplies power for operating the following machinery:—

TABLE II.

Month.	Maximum demand, kVA.	Consumption, kWh.
September, 1927	28.0 ...	6,785
October, 1927	11.0 ...	427
November, 1927	11.0 ...	163
December, 1927	20.0 ...	359
January, 1928	2.5 ...	273
February, 1928	2.5 ...	132
March, 1928	2.5 ...	155
April, 1928	2.5 ...	160
May, 1928	15.0 ...	1,076
June, 1928	26.0 ...	4,354
July, 1928	24.0 ...	4,513
August, 1928	24.0 ...	3,490
Complete year	28.0 ...	21,885

	Motor h.p.
Threshing machine	10
Fan for hay-drying	8
Baling press	6
Compressor	4
Hay elevator	3
Hay and sack hoist	1½

Several of the motors are portable, and are used wherever opportunity affords. Lieut.-Col. Lyon says "Electricity on my farm has made crop-drying an economic proposition, thereby eliminating almost entirely the weather factor." The electrical installation was completed in June, 1927, and Table II gives the load conditions which prevailed in each of the months from September, 1927, to August, 1928.

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Wireless Short Waves.

An account of investigations of short-wave transmission effects carried out during the past two years in the research laboratories of Marconi's Wireless Telegraph Co., Ltd.

By T. L. ECKERSLEY, B.A., B.Sc.

(*Extracts from a Paper read before the* Wireless Section *of the* Institution of Electrical Engineers.)

THE paper afforded the author an opportunity of revising the conclusions he arrived at in a previous paper.* The chief alteration is in the estimated height of the lowest levels of the Heaviside layer in daytime. The accumulation of evidence from the time-lag experiments of Breit and Tuve, and the interference experiments of Appleton and those of Hollingworth (which, incidentally, both give the group time and consequently an over-estimate of the height) have led the author to a revision of the mathematical result by which he obtained from long-wave measurement the effective height of the daylight ionised layer, and in doing so he has found an error which makes the estimated height just double that previously obtained, for instead of the relation $d_0=4h^2/\lambda$, we have $d_0=h^2/\lambda$, making the estimated height lie between 80 km. for summer and 97 to 100 km. for winter.

Previously the value of τ (the mean time between collisions) was found to lie between the limits 0.5×10^{-6} and 0.5×10^{-7} (on the basis of magnetic storm effects). Calculations based on the kinetic theory would imply a height of between 76 and 92 km. for these values of τ, in fairly close agreement with the above, and there is no necessity to make the rather forced previous assumption that the electronic mean free path is some 10 to 50 times greater than that calculated from the normal kinetic theory, on the assumption that the electron may penetrate the outer rings of the molecules without being appreciably deflected. Apparently this effect occurs only in inert gases, such as helium, and is not likely to occur in the upper atmosphere.

With regard to scattering, the glancing angle for transmission, great-circle bearings of the main rays, and the daylight attenuation, the author has found the previous conclusions to be on the whole well-founded. Some modification of the lower wave-length limit for night transmission is required, for it has been found that it depends on the time of the night, and season. Late-night regions behave very differently from early-night regions, thus confirming Appleton's results showing a progressive change in the Heaviside layer during the hours of darkness. The short-wave daylight limit appears to be close to 10 m., but sporadic long-distance transmissions have been observed on wave-lengths shorter than this.

Perhaps the main interest in short-wave transmission, both from the severely practical and theoretical points of view, lies in echo and scattering effects. The author classes them both together, because in the long run the two effects merge into one. From the practical point of view, signal distortion, accompanying echoes and scattering, imposes a severe limitation on high-speed sending and on the newer development of facsimile transmission. Some of the troubles have been overcome by inserting simple biasing devices to sharpen the signals, but even with these devices a limit is set to the speed of transmission of intelligence.

In the author's previous paper on short-wave transmission, reasons were given for supposing that there existed very considerable short-wave scatterings, and in the two years that have passed since then an intensive study of scattering effects has been made in which the original ideas have been abundantly verified. The conclusions are based on directional observations, the *normal* test of scattering being the absence of bearings on suitably designed goniometers.

The causes of signal mutilation are discussed under the following headings:—

(1) *Long echo*, due to the signals arriving by the two different great-circle paths round the world, or by one traversing an extra complete circumference of the world. These effects are easily recognisable, but, taking due account of them, there are, no doubt, other causes of signal mutilation.

(2) *Dispersion*.—Any signal changes shape when travelling through a dispersion medium, such as the Heaviside layer. The amount of mutilation depends on the distance travelled and the closeness of approach of the actual frequency to the critical frequency. Reasons are given for supposing that this effect is negligible on the short-wave band, although there is evidence of dispersion effects on very long waves, *e.g.*, musical x's.

(3) *Quick echo*.—There are cases of quick echo with a lag of the order of 0.01 second which are probably due to long-distance scattering, such as is evidenced by the observations on the local beams, when the source of scattering may be about 2,000 km. away.

(4) *Blurring*, due to multiple scattering, probably occurs mostly on local signals.

(5) *Double or multiple signals*, due to double or multiple paths, produce double or multiple signals with a time interval between signals of the order of 0.01 second. They are brought to light by the picture-transmission results, and are not likely to mutilate morse signals, but affect picture transmission unfavourably.

The effects under the last three headings are likely to contribute to signal mutilation in different proportions, according to the actual conditions of transmission.

The new conception of the Heaviside layer developed in the paper (a complex structure of scattering clouds) necessitates a revision of the usually accepted ray theory. If the scattering in the lower levels of the layer is particularly intense, the emergent ray may be very highly diffused and the emergent energy may entirely lose its ray formation. Order will again be introduced, however, if we make the assumption, which appears unlikely to the author, that the scattering clouds are regularly spaced at a practically constant distance.

Ponte and T. Rocard† have developed a theory on these lines in which the skip effect and minimum wave for transmission are accounted for; it also accounts for a weak, wholly scattered ray within the skip distance, and is based on the fact that if the scattering centres are regularly spaced, then the scattered rays from a thin element of the layer will have a pronounced maximum on the generating lines of a cone of revolution having as an axis the direction of incidence and as half angle of apex the angle θ given by Bragg's law, $\lambda=2d \sin \frac{1}{2}\theta$.

This theory requires a definiteness of structure which, in the author's opinion, is very improbable; moreover, to fit the observations a height of 324 km. for the scattering layer is required, which, in view of our diffusion calculations, also seems very improbable. The effects described may, of course, play a minor rôle in producing skip effects, but the author does not consider them important. However, it is clear that the ray theory may require considerable modifications, not only on account of scattering, and although the optical method of tracing rays has been used with considerable success, in short-wave theory it is well to realise its limitations.

* "Short-Wave Wireless Telegraphy," *Journal* I.E.E., 1927, vol. 65, p. 600.

† *Comptes Rendus*, 1928, vol. 187, p. 942.

Continental Exhibitions.

Brief Notes on the Electrical Sections of the Vienna and Prague Spring Fairs.

(By OUR SPECIAL CORRESPONDENT.)

ALTHOUGH Austria has by no means an inconsiderable electrical industry of her own, it seems that there are now fields of opportunity there for foreign firms, and that quite a number of electrical machines and accessories of certain types can be disposed of readily in Austria. Germany has fully exploited the possibilities of the Austrian market, and it was therefore not surprising to discover that about two-thirds of all the goods shown of an electrical nature at the Vienna Spring Fair, with the exception of wireless gear, were of German origin. The only British firm represented was Messrs. Black & Decker, of Slough.

Vienna Fair.

The Vienna Fair is yearly becoming more important. It differs from the one held at Leipzig,* because the visiting

* Elec. Rev., April 5th, 1929, p. 627.

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buyers represent the Balkan States, the Near East, and, of course, Central Europe, to a larger extent, and it is in those countries more than any other in Europe to-day in which the possibilities of electricity in every shape and form still remain to be exploited.

Less heavy machinery was to be seen at Vienna than Leipzig, which was natural, as the requirements of Central European industry are chiefly covered by Germany. A few Austrian manufacturers, however, exhibited motors of from 1.5 to 10 h.p., and a large number of such low-power motors were purchased by artificial-silk weavers in the new "Succession" States, which are equipping very small plant under the protection of tariff walls which invite the installation of new manufacturing businesses. Messrs. Siemens & Halske, who possess cable works at Floriedsdorf, near Vienna, exhibited a new cable machine.

Regarding cold storage, both for the home and provision stores, it was noticeable that the old systems had been completely replaced by more practical and economical installations operated by electricity. For butchers many kinds of machinery were shown, designed to reduce the tedium of hand work in the modern butcher shop; amongst such machines were meat choppers and mincers, and Messrs. Wanderer showed two models of elaborate mincing apparatus, costing £37 and £38, respectively.

The furniture industry was also very well looked after, and amongst the novelties shown was new drilling apparatus which found a ready sale. A special part of the motor-car section included electric lighting systems, but nothing new could be reported on. The toy industry is the latest to make use of electrical appliances, and all manner of novelties are not only amusing, but also educational; at the same time they are perfectly safe in use.

New telephone apparatus was shown by Messrs. Eckstein, who quoted £2 for the article complete. It comprised a novel form of mouthpiece on a stand and an earpiece which is easily fitted over the head and allows the listener perfect freedom of his hands; the mouthpiece itself enables the user to talk at a greater distance from the 'phone than hitherto, which is especially useful on an office desk.

A large number of "dippers" were seen, which are used for boiling quantities of water very quickly. They are made of steel with an ebonite handle and connected by a long flex. Messrs. Winter & Hoffmann showed some, one of which, adaptable for 110, 120, 150 and 220 volts, cost only 3s. 6d.; it can be used, however, for only small quantities of water. One of 800 watts is capable of heating 12 pints, and was quoted at £1 16s.; a still larger one for 20 pints cost £2 10s. Another type, which automatically stops directly the water trough is emptied, was quoted at £4 15s.

Prague Fair.

Manufacturers were well represented, but it was obvious that the excellent state of business in the Czecho-Slovakian electrical factories did not necessitate particular efforts on the part of exhibitors. All stands appeared to have been arranged more with a view to propaganda and prestige than to actual business. The most interesting exhibit was a new alarm arrangement for safes and strong rooms, shown by the Danek Co. The side walls, ceiling, and floor are covered all over with patented plates of an asbestos sheet-iron combination, through which a weak current is constantly circulating, but even a raise of temperature or a mere touch of the plates will interrupt the current and raise the alarm.

Messrs. Patzak & Machacek produce a special motor with a flexible shaft, constructed to facilitate the working of very large objects which cannot very well be brought to the particular machine attached to the motor.

A large number of electrical watches included a local patent "Laplace" clock which can be operated by alternating current and is driven by a very small motor fed with current of which the frequency is regulated by the central clock. The turning momentum is extraordinarily large, and the current consumed is 0.2 watt.

The Eta Co. exhibited a new home bell for from three to ten volts with a transformer mounted inside the bell. The same firm also showed electrical massage apparatus on the rubber-rollers system.

Very little was shown this year in the way of agricultural machinery, which is of such great importance for Czecho-Slovakia and her neighbouring countries. Tractors, pumps, and motors for flour mills especially were seen, but neither novelties nor even minor improvements could be noticed. The Bohemian-Moravian Electro-Technical Works produced a new accumulator vehicle of the smallest type with two motors fitted to the two rear wheels; the price, however, seemed prohibitive for Continental conditions. Large numbers of vacuum cleaners and domestic electrical apparatus were shown, but aroused far less interest than at Leipzig and Vienna, as the population of the markets which are reached from Prague is still very backward in the use of electrical apparatus at home.

Rumanian Wireless Exhibition Postponed.

The International Wireless Exhibition, arranged to take place at Bucharest from April to June, has been postponed to August 5th-October 31st.—*Reuter* (Bucharest).

Reviews.

Omnibus Lighting and Starting. By J. W. Houghton, A.M.I.E.E. London: The Fanfare Press. Pp. 49; figs. 29. Price 2s. 6d. net.

In view of the great increase which is taking place in this country in the number of motor-'buses and coaches, in all of which electric lighting is being adopted as the standard means of illumination, Mr. Houghton's little work, which is a reprint of a series of articles he recently contributed to one of the motor transport journals, should prove welcome and useful to engineers responsible for their maintenance in good running order.

In his first chapter the author discusses the pros and cons of the two forms of generator used for motor vehicle lighting —the third-brush constant-current and the constant-voltage types, and not only plumps for the latter, but states that it is the one used on over 80 per cent. of the motor-buses in operation in this country. Mr. Houghton then proceeds to deal very exhaustively with suitable installations for various types of 'buses with six- and four-cylinder engines. Diagrams of wiring arrangements are included to elucidate the text, while a method of testing for voltage drop is given. Several pages are devoted to bulbs and lamps.

Although electric engine starters are not yet so universally used on motor-buses as they are on cars, there is a tendency to a greater following of the example, and to those 'bus owners who have not yet adopted engine starters, but have such a departure in mind, the author's remarks on the points which must be observed in the selection of suitable motors and batteries, should prove helpful, both the lead-plate and nickel-iron forms of accumulator being dealt with. Other sections of the little book discuss the anti-dazzle problem, and the best means of coping with it, and also with the matter of driving in fog.

Although judging from the frequent references thereto, the book has been largely produced in the interests of a single make of motor-'bus lighting and starting equipment, it is none the less one that, as we have said, should strongly appeal to the engineers of motor-'bus concerns, as containing in a condensed and convenient form a good deal of useful information on these important questions.

Industrial Carbon. By C. L. Mantell, Ph.D. Industrial Chemical Monographs. Pp. ix+410; figs. 89. London: Chapman & Hall, Ltd. Price 21s. net.

This book is one of the series of Industrial Chemical Monographs, and the object with which it was written cannot be better stated than in the following extract from the preface: "the author has attempted to cover the technological applications of elemental carbon, aside from its use as a fuel. The term elemental carbon is applied to mean those substances, materials and products which are either carbon in its elemental form, or which consist entirely of carbon, or whose value in industry is due to the physical and chemical properties of the elemental carbon from which they are made or which they contain." The manifold and ever-increasing applications of carbon in industry are probably hardly realised, and the theoretical chemistry of this field is largely unknown to the makers and users. Progress in the development of industrial carbon is taking place so rapidly that the appearance of this volume is particularly opportune at the present time. So much recent work on carbon has been carried out abroad, and the published accounts are so diffused in periodicals and in the proceedings of foreign scientific societies, that all those in this country interested in carbon will find this volume of considerable interest, which, in addition to other merits, has brought together examples of the most recent practice and fundamental theories from which they are the practical outcome. Practical considerations predominate throughout, but the scientific principles are dealt with in a very thorough and lucid manner. The book is characterised by thoroughness of treatment and excellence of illustration.

The contents of this volume fall into several sub-divisions—the truly elementary forms of carbon, such as diamonds and graphites, with their industrial phases; carbon pigments and fillers, such as carbon black and lamp black; absorbent carbon of the gas, decolouring and metal absorbent types, with which bone black is grouped; the manufactured carbon products, such as electrodes, brushes, &c.; and a reference chapter on the physical characteristics of carbon.

The chapters dealing with natural and artificial graphites hardly do justice to the author's reputation as a specialist; subjects of importance are referred to and dismissed in a way which, to the technical reader, must prove somewhat disappointing. Again, exception must be taken to the statement that "a number of the natural graphites are amorphous"; X-ray analysis has shown them to be perfectly crystalline in structure. Criticism of a volume which contains much descriptive matter is a difficult matter, especially as to complain of incompleteness in a book in which so much information is given may seem a little ungracious. We note, however, that no mention is made of the classical researches of Olbrich and Arsem on the theoretical aspects of the conversion of carbon into graphite. The criticism indicated is the more noticeable since as a whole the book is accurate and shows careful preparation.

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The author writes with real enthusiasm when dealing with gas-adsorbent charcoal and decolourising carbons, special reference being made to the applications of charcoal as a means of obtaining high vacua. The employment of activated charcoal has been suggested for the purification of hydrogen and nickel carbonyl for hydrogenation purposes and the purification of ammonia before its catalytic oxidation into nitric acid. The field for activated carbon as a gas adsorbent is very large, and at the present time little explored. An interesting application of activated carbon has been the adsorption of sulphur dioxide from industries, particularly of the metallurgical type, to prevent the destruction of outlying farm and forest lands by the sulphur dioxide in the waste gases. The adsorption by charcoal of electronegative, electropositive and amphoteric substances are greatly affected by the reaction of the medium from which material is being adsorbed. The explanation of the influence of pH may be found in the electrical theory of adsorption and the effect of hydrogen and hydroxyl ions on the size of the charges on particles. Results show that in general the adsorption efficiency of carbons is dependent largely on the difference in electrical potential between the carbon and the adsorbate. The industrial value of carbon might be increased if a carbon were produced which would be active at the permissible pH for the substance to be adsorbed. The electrical properties of carbon can be greatly modified by activation. Perhaps future research will bring forth for decolourising use a carbon which will be positively charged at all pH values. This would be an excellent addition to our present charcoals, since most coloured impurities met in the industries are negatively charged.

The book may be recommended as a critical compendium of information on the subject. In addition to the care which the author has exercised in the preparation of this work, he has supported his effort by embodying contributions from authorities on the various phases of his subject. Dr. Mantell has employed much discrimination in selecting the really useful information from the mass of material available. The volume constitutes not only a *résumé* of the position of the subject up to date, but contains much original matter. The book throughout is exceptionally well annotated with references to existing publications. The volume is a valuable contribution to the literature of the subject.

Railway Electrification and Traffic Problems. By P. Burtt. Pp. vii+197; figs. 23. London: Sir Isaac Pitman and Sons, Ltd. Price 10s. 6d. net.

A technical reviewer is in a somewhat difficult position with regard to this book. It does not pretend to be a technical treatise, and yet certain engineering aspects of the subject must perforce be introduced. The author was formerly deputy general manager of the North-Eastern Railway, and he has written the book as an expansion of his lectures on "Traffic Problems" at the London School of Economics. He is a believer in railway electrification, and is confident that such conversion provides the chief of two or three possible ways whereby the railways can do something to re-establish their financial status and popularity. This belief he substantiates to his own satisfaction—and presumably to that of the uncritical reader who swallows it whole. Yet to the initiated there are certain discordant notes which detract in some measure from a thorough agreement with the author. That electrification of suburban railways enables a regular, rapid and attractive service to be maintained, and that the electrification of main lines results in a speeding-up of traffic and an increase of train weights, can readily be granted. That the conversion from steam to electric haulage is *economically* sound, however, is by no means so conclusively demonstrated, although we gather that this is the author's contention. For example, the Tynemouth electrified zone is shown to have transported twice as many passengers in 1913 as in 1904, at which time a severe tramway competition was being felt; but since 1918 increasing tram and 'bus competition has again reduced the number of railway passengers below the 1904 level! Again, on pp. 69-70, and on p. 120, the author praises the South African Pietermaritzburg-Glencoe electrification as typifying all that is most attractive; but it is depressing to recall the statement published at the end of last year to the effect that the financial results were disappointing. The administration of the Austrian Federal Railways, for financial reasons, also seems to have grave doubts about extending its main-line electrification. Even the Swiss Federal Railways Administration only "estimates with confidence" that financial results will be well.

Several aspects of railway electrification and its psychological effect on passengers are treated fully and convincingly. A good case is made for the relaxation of the rigid rules at present enforced in Great Britain regarding the uneconomically-high standard of railway construction and rolling stock. Using certain Dutch light railways as a model, it is well shown that with present standards light railway construction in this country can scarcely be contemplated, however urgent the need. Road transport is being rapidly developed to deal with the available traffic (although scarcely any mention of this is made in the book), so that in a very short time any hope for light railways will be gone.

Criticism might be levelled at the arrangement of the book. The thread of the argument is apt to be broken by interjected matter, which might have been collected elsewhere with advantage. A number of errors appear, *e.g.*, the percentages of increase of population given on page 165 are all too great by 100, but the most glaring slip is the statement, on page 140, that the Swiss Federal Railways run on 1,500 volts d.c.!

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Climate and Overhead Lines.

Referring to the letter from Mr. G. Molle in your issue of March 29th, the writer refers to the blizzard of March, 1916, and draws attention to the fact that telegraph and telephone lines are much more liable to damage than power lines. Further interesting information on this subject was provided on April 26th, 1917, by Sir William Slingo, at a discussion before the Institution of Electrical Engineers (see Vol. 55 of the I.E.E. *Journal*, No. 267, June, 1917, page 435). Sir William Slingo here draws attention to the fact that in that storm not a single wire weighing 600 lb. per mile was broken down by the weight of snow and ice, or the pressure of wind, whereas wires of 400 lb. per mile were broken in all directions.

N. E. P. Harris.

Trysull, *April 5th*, 1929.

Radio Anode Battery Eliminators.

When changing a system of supply from d.c. to a.c. is it the general rule to change wireless h.t. eliminators for consumers, and, if so, on what terms? A d.c. unit may only be listed at 30s., or so, whereas the cheapest a.c. unit is about £5. As these devices consume but a negligible quantity of electricity, a free exchange seems out of the question. In some towns no allowance has been made for such instruments whatever.

Enquirer.

April 6th, 1929.

[See p. 645 of this issue.—Eds. Elec. Rev.]

Pilot-wire Street Lamp Control.

There are quite a number of statements in Mr. A. C. Johnson's article on "Pilot-wire Street Lamp Control" with which we cannot by any means agree, but there is one particular statement that we really must find time to refute.

In reply to Mr. Johnson's remark ". . . whereas time switches have a very short life and require constant attention for maintenance and repairs," we may say at once that we have been shown records of our own time switches in the test rooms of several undertakings showing that the switches have been on circuit *without cleaning or repairs* continuously for 15, 16, and 17 years!

The huge numbers of our pre-war switches still on circuit are ample evidence of the reliability of a good time switch.

We do not propose at the moment to press the advantages of the wholly automatic electrically-wound time switch, or to deal with several other of Mr. Johnson's remarks, but we feel that the statement referred to above calls for a reply from

Venner Time Switches, Ltd.
(R. C. Graseby, *Managing Director.*)

London, S.W.1, *April 5th*, 1929.

Legal.

Marconi Radio Patent Royalties.

We reported in our issue of March 8th (p. 455) that the hearing of the appeal of Marconi's Wireless Telegraph Co., Ltd., against decisions of the Comptroller-General of Patents in connection with applications by the Brownie Wireless Co. of Great Britain, Ltd., and the Loewe Radio Co., Ltd., was brought to a halt owing to the fact that the Comptroller-General had not made a definite order in the matter. The *Wireless Trader* reports that an order has now been made in which the Marconi Co. is directed to grant a licence to the Brownie Co. enabling it to use the patents in question, with a royalty payment of a minimum of 5s. for the first valve-holder and 2s. 6d. for each subsequent valve-holder fitted in the apparatus produced.

Following upon this the resumption of the hearing of the Marconi Co.'s appeal has been fixed for April 24th.

Alleged "Long-Firm" Frauds.

Charges of obtaining goods by false pretences were preferred against Arthur Stanley Mason, carrying on business as a wireless dealer at 29, Hill Street, Stoke, at Stoke Stipendiary

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Court on April 5th. Walter Champ, general dealer, of Shrewsbury Road, Market Drayton, was charged with aiding and abetting in the commission of five offences.

The offences were obtaining wireless receiving sets to the value of £95 from Wingrove & Rogers, Ltd.; electrical accumulators to the value of £58 from the Ever-Ready Co. (Great Britain), Ltd.; 6,000 yards of electric cable, valued at £89 from the Greenwich Cable Works, Ltd.; a wireless receiving set, valued at £71, from R. I. and Varley, Ltd.; and wireless receivers to the value of £6 from the Bedford Electric Radio Co., Ltd. On an alternative count, both Mason and Champ were charged with conspiring together to obtain goods to the value of about £318 from the firms mentioned by false pretences. Mr. H. Taylor, who prosecuted, stated that Mason, by means of false representations, succeeded in obtaining a large quantity of wireless goods between January and February of this year. He took up a lock-up shop, and had billheads printed in the best style, in which he used the title of the "Potteries Electrical Supply." From those premises it was alleged he sent out orders for goods. The offences were all of the "rush" type, orders to the various firms following in rapid succession. As no payment was forthcoming for the goods, inquiries were set on foot, and it was found that Mason had no proper warehouse, but merely received the goods from the victimised firms, and dispatched them to an unknown destination. The suspicions of the police being aroused, investigations were pursued, and it was then discovered that the goods were being received by Champ, who was charged as co-defendant. Mr. Taylor asked for both defendants to be committed for trial at the next Quarter Sessions.

Settlement of Greenock's Claim Against the Admiralty.

A cheque for £50,200 has been paid over to the Town Chamberlain of Greenock by the Admiralty in settlement of the claim made by the Corporation Electricity Department for the recovery of part of the expenditure incurred by the town in installing new plant at the electricity works to meet the demands of the Admiralty for electricity during the war. The claims, it will be recalled, were the subject of protracted litigation, and a settlement was eventually reached for the sum which has now been paid to the Corporation.

A Successful Appeal.

At the Brighton Quarter Sessions, on April 8th, Capt. J. J. Crowe, V.C., appealed against a conviction and a fine of £5 imposed upon him in January for the alleged fraudulent consumption of electricity.

The Recorder, who considered that an inspector had made a mistake, allowed the appeal.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

26,627. "Power-operated vacuum tube construction, and circuit therefor." Arcturus Radio Co. December 24th, 1926. (282,632.)

28,092. "Engine-starting apparatus." A. E. White (Delco-Remy Corporation). October 21st, 1927. (307,981.)

30,336. "Dirigible headlight mechanisms for automobiles." International Controlled Lamp Co. February 23rd, 1927. (285,846.)

31,082. "High-tension ignition devices." British Thomson-Houston Co., Ltd., L. M. T. Bell, and F. E. Smith. November 18th, 1927. (307,955.)

31,277. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 21st, 1927. (307,982.)

32,969. "Thermostatic controls for dynamo-electric machines." J. Stone and Co., Ltd., and A. H. Darker. December 6th, 1927. (307,718.)

33,141. "Protective gear for alternating-current systems." H. G. Bell and Associated Electrical Industries, Ltd. December 7th, 1927. (307,957.)

33,359. "Mounting of vibrating reeds, more particularly for use in connection with electromagnetic gramophone pick-ups, loud-speakers, and the like." P. Wilson. December 9th, 1927. (307,767.)

33,481. "Mechanical relay for transmitting moving impulses." Siemens-Schuckertwerke Akt. Ges. December 24th, 1926. (282,739.)

33,753. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. December 13th, 1927. (307,857.)

33,614. "Methods of and apparatus for electrolytically depositing metal on tubes." J. Stone & Co., Ltd., C. J. Lyth and F. J. Pike. December 12th, 1927. (307,726.)

33,670. "Automatic or semi-automatic telephone systems and apparatus." Standard Telephones & Cables, Ltd., and J. R. Gould. December 13th, 1927. (307,959.)

33,688. "Thermionic valves." British Thomson-Houston Co., Ltd., and L. J. Davies. December 13th, 1927. (307,812.)

33,699. "Telegraph printers." F. Warburton. December 13th, 1927. (Cognate application 26,162/28.) (307,960.)

33,702. "Electric lamp standards and fitments therefor for use on armchairs and other articles of furniture." N. Evill. December 13th, 1927. (307,774.)

33,711. "Electrically-driven tuning forks or reeds." Muirhead & Co., Ltd., E. S. Heurtley and J. V. Foll. December 13th, 1927. (307,855.)

33,724. "Mounting arrangements for fuse panels and the like as used in telephone exchanges." Automatic Telephone Manufacturing Co., Ltd., and C. R. Woodland. December 13th, 1927. (307,781.)

33,751. "Apparatus for the production of ultra-violet light." A. Eidinow and Hewittic Electric Co., Ltd. December 13th, 1927. (307,961.)

33,752. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. December 13th, 1927. (307,856.)

33,831. "Process for securing good electrical contact with crystalline cuprous oxide." A. K. Croad (Hanovia Chemical & Manufacturing Co.). December 14th, 1927. (307,962.)

33,837. "Electrically-operated typewriting machines." W. A. Maas and P. F. Grinstead. December 14th, 1926. (282,401.)

33,906. "Telephone systems." Associated Telephone and Telegraph Co. January 7th, 1927. (283,201.)

33,975. "Electrically-controlled fluid-pressure apparatus, particularly applicable for operating brakes." A. V. Tomlinson (Westinghouse Air Brake Co.). December 15th, 1927. (307,964.)

34,043. "Insulating materials and methods of production thereof." W. E. Beatty (Bell Telephone Laboratories Inc.). December 15th, 1927. (307,966.)

34,056. "Impulse-transmitting devices for electric switches or make-and-break contacts." A. Green. December 16th, 1927. (307,967.)

34,177. "Loaded electrical conductors." W. S. Smith, H. C. Channon, A. L. Meyers and N. G. R. Partridge. December 16th, 1927. (307,973)

34,235. "Automatic or semi-automatic telephone systems and apparatus." Standard Telephones & Cables, Ltd., and E. P. G. Wright. December 17th, 1927. (307,977.)

34,650. "Radio telegraph, telephone, and like signalling circuits and apparatus." A. E Watkins. December 21st, 1927. (307,989.)

34,656. "Illuminated signalling devices for road vehicles." E. D. Sykes. December 21st, 1927. (307,991.)

34,928. "Electrical relays." Johnson & Phillips, Ltd., and D. M. Broughton. December 23rd, 1927. (307,995.)

1928.

407. "Electric vehicles." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. January 5th, 1928. (Addition to 234,571.) (308,002.)

922. "Electric resistance furnaces." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. January 11th, 1928. (308,009.)

2,501. "Boxes or cases for electrical apparatus." H. Heath and R. W. Bill. January 26th, 1928. (Cognate application, 30,096/28.) (308,021.)

3,873. "Electric gas-lighters." F. O. Seyd. February 7th, 1928. (308,037.)

4,054. "Electric rotary convertors." J. C. Macfarlane and W. A. Macfarlane. February 9th, 1928. (308,041.)

5,093. "Terminal arrangements for electrical devices." General Electric Co., Ltd., and A. Wardle. February 18th, 1928. (308,052.)

5,589. "Electric motor control systems." General Electric Co., Ltd., and E. H. Croft. February 22nd, 1928. (308,056.)

6,616. "Duplex signalling systems." Siemens & Halske Akt. Ges. March 12th, 1927. (287,048.)

7,492. "Electric speed indicators." G. Mombur. March 10th, 1927. (286,737.)

8,336. "Thermionic generators and the like." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 19th, 1928. (308,085.)

8,987. "Telephone sets." Siemens & Halske Akt. Ges. June 25th, 1927. (292,903.)

15,168. "Process for preparing lead electrodes for electric storage batteries." I. G. Farbenindustrie Akt. Ges. May 24th, 1927. (291,032.)

15,389. "Portable electric lamps." J. Downs and Watts, Fincham and Co., Ltd. May 25th 1928. (308,118.)

15,855. "Lamps, particularly headlights for motor vehicles." P. A. Peters. December 31st, 1927 (303,344.)

18,959. "Metal-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. June 30th, 1927. (293,046.)

19,511. "Supporting frames for Röntgen-ray photographic apparatus." E. Pohl. July 12th, 1927. (293,796.)

19,702. "Process and mould for casting accumulator grids." W. Petri. July 6th, 1928. (308,131.)

21,867. "Telephone systems." Associated Telephone & Telegraph Co. January 7th, 1927. (Divided application on 283,201.) (294,618.)

23,876. "Electric rotary convertors." J. C. Macfarlane and W. A. Macfarlane. February 9th, 1928. (Divided application on 308,041.) (308,144.)

25,623. "Telegraphic printing systems." Ateliers J. Carpentier. September 30th, 1927. (297,825.)

25,881. "Electric meat and like roaster." J. Seegmuller. September 16th, 1927. (297,117.)

28,480. "Electromechanical amplifier." L. Thurm. October 4th, 1928. (308,156.)

31,289. "Starting device for electromotors equipped with a clutch." K. Kaisser. October 12th, 1927. (Divided application on 303,578.) (307,730.)

1929.

2,535. "Telephone systems." Associated Telephone & Telegraph Co. January 7th, 1927. (Divided application on 283,201.) (304,702.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned :—

MARCH 27th.

Busy Bee. No. 497,618. Class 6. Electric vacuum cleaners.—Drake and Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.

Charide. No. 495,130. Class 8. Radio-telephonic instruments and gramophones.—R. May, 48, Canning Road, Croydon.

Igranophone. No. 499,862. Class 8. Radio-telephonic apparatus in combination with gramophones and parts thereof.—Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.

Okoscope (lettering and design). No. 499,913. Class 8. Electrical resistances, fitted switchboards, and electric accumulators (not for medical purposes), &c.—Okoscope & Camera Developments, Ltd., 10, Lancaster Place, W.C.2.

Twelco. No. 496,912. Class 13. Electric lamps (ordinary).—J. M. Fairhurst, trading as the Western Electric Lamp Co., 122, Royal Exchange, Manchester.

Eta. No. 497,286. Class 13. Electrical switches, fusible cut-outs, and contact plugs.—Siemens-Schuckertwerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Projectolux, No. 499,539, and Intensolux, No. 499,540. All goods in Class 13.—Benjamin Electric, Ltd., Tariff Road, Tottenham, N.17.

Dakol. No. 497,629. Class 15. Glass.—Dakol Electric, Ltd., Byron Street, Newcastle-on-Tyne.

Isco. No. 498,269. Class 50. Mouldable compositions and articles made therefrom for electrical insulating purposes.—W. T. Henley's Telegraph Works Co., Ltd., 11, Holborn Viaduct, E.C.1.

APRIL 3rd.

Distaset. No. 497,574. Class 8. Radio-telephonic apparatus.—Truphonic Co., Ltd., 121-129, Rosebery Avenue, E.C.1.

Osram. No. 498,860. Class 8. Apparatus and parts thereof for use in connection with television and telegraphy.—General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Polyfar. No. 499,193. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof, &c.—Polyphonwerke Gesellschaft, Berlin. British representative: F. W. Golly, 3, John Street, Bedford Row, W.C.1.)

Gothic. No. 500,032. Class 8. Loud speakers.—M.P.A. Wireless, Ltd., 62, Conduit Street, W.1.

Kelstom Wireless Specialities (lettering and design). No. 499,987. Class 8. Instruments and apparatus for use in connection with radio-telephony and telegraphy.—Kells & Thompson, 100, George Street, Portman Square, W.1.

Sunbeam. No. 498,582. Class 18. Electric lighting, power and ignition sets for cycles and motor-cycles.—John Marston, Ltd., Paul Street, Wolverhampton.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABENHALL.—School (£7,450), for Gloucestershire E.C.; education architect, Gloucester.

ARDROSSAN.—Post office; architect, H.M. Office of Works, 122, George Street, Edinburgh.

AUDLEY.—School (£30,000), for Lancs. E.C.; Woof, Cronshaw & Sons, builders, Blackburn.

BAILDON.—Housing scheme (30), for the U.D.C.; James H. Hall & Son, architects, 19, Exchange Buildings, Market Street, Huddersfield.

BARKING.—Factory, Wakering Road; H. Brown & Son, Ltd.

BATH.—Conversion of hospital into technical college (£50,000) for the City E.C.; director of education.

BECKENHAM.—Electricity showrooms and offices, Rectory site, for the U.D.C.; Lanchester, Lucas & Lodge, architects, 19, Bedford Square, W.C. Nurses' hostel, Beckenham and Penge Maternity Home; U.D.C. surveyor.

BENFLEET.—Extensions, South Benfleet School (£4,500); Essex county architect.

BEXHILL.—Additions to Collington Rise School; T. L. McCormick.

BILLINGHAM (Stockton-on-Tees).—Additional 500 houses, for the U.D.C.; surveyor.

BIRKENHEAD.—Rehousing scheme, Whetstone Lane; borough engineer.

BIRMINGHAM.—Extensions of Hartfield Crescent Council School (£19,500); chief education officer, Education Department. Baths, Sparkhill (£37,000); baths manager.

BISHOPS STORTFORD.—Factory, Hockerill Street, for the United Match Industries, Ltd.

BOURNEMOUTH.—Theatre, for the Bournemouth Dramatic and Orchestral Club (£15,000); secretary. West Undercliff promenade extension (£37,500); borough engineer.

BRADFORD.—Proposed extensions, College of Arts and Crafts (£8,500); city architect, Town Hall.

BRISTOL.—School, Portway (800 places), for the City E.C.; Holbrow & Oaten, architects, 22, Clare Street.

CAMBRIDGE.—Café, restaurant, ballroom, &c., for G. P. Hawkins, Ltd., Dorothy Café.

CHEADLE AND GATLEY.—Housing scheme (56), for the U.D.C.; surveyor.

CHELTENHAM.—Shop and warehouse, Libertus Road; Gloucester Co-operative Society. Nurses' home, Workhouse, Swindon Road; Board of Guardians. 150 houses, Whaddon Road and Gloucester Road; Mr. Malvern, architect for Corporation.

CLOWN.—Housing scheme (42), Whitwell, for the R.D.C.; J. Haslam, architect, Ryton Chambers, Bridge Street, Worksop.

CRANFORD.—Aerodrome; Blackwell & Meyer, builders, Erith Road, Bexley Heath.

DARTFORD.—Block of offices and shops, for J. B. Walton; G. E. Burgess, architect; Blackwell & Meyer, builders, Erith Road, Bexley Heath.

DEWSBURY.—Girls' secondary school, for the governors of Wheelwright Grammar Schools; clerk.

EASTBOURNE.—Aerodrome; borough engineer. Alterations, New Central Cinema, Seaside Road, for Central and Eastern Cinema, Ltd.; S. Ford, architect.

GLASGOW.—80 houses, Shettleston and Tollcross; housing director and trade contractors.

GRAVESEND.—Development, Golf Links Estate, for Gravesend Land Co.; L. F. L. Bridgland. Alterations and additions, Milton Road; Gravesend Co-operative Society, Ltd.

HAMILTON.—Police Court house, with electrical work, for Lanarkshire C.C.; P. C. Smith, architect, District Offices, Hamilton. (Applications for schedules by April 10th.)

HARLESCOTT.—School (350 places), for Salop E.C.; W. H. Pendlebury, secretary, County Buildings, Shrewsbury (returnable deposit of £2 2s.).

KEIGHLEY.—Extension of School of Art; E. Ratcliffe, director of education.

KINGSTON-ON-THAMES.—Additional 94 houses for the T.C., borough surveyor.

LANARKSHIRE.—198 houses for District Committee of Lower Ward of Lanarkshire; the county clerk, Hamilton. Justice of Peace Court-house in Hamilton (electric lighting); P. C. Smith, architect, District Offices, Hamilton.

LEICESTER.—Secondary school (£45,000); director of education.

LINCOLN.—Additional 32 houses, St. Giles' Estate, for the T.C.; S. C. Baggott, city engineer (returnable deposit of £1 1s.).

LONDON (Ilford, E.).—Factory extensions, Vicarage Lane; Plessey Co., Ltd.

(Abbey Wood, S.E.).—Billiard hall and shops, Abbey Wood Road, for W. A. Gallier.

(Lambeth, S.E.).—Buildings for St. Thomas Church, Westminster Bridge Road and Pearman Street; R. E. Smith. Partial reconstruction General Lying-in Hospital, York Road; governors. 100 flats, Cottington Street (£51,000); borough engineer.

(Southwark, S.E.).—School for 280, Pastors' College, Newington Butts; Spurgeon's Tabernacle trustees.

MARGATE.—Secondary school, for Kent E.C.; E. Salter Davies, director of education, Sessions House, Maidstone.

MIDDLESBROUGH.—Additional housing schemes (666), for the T.C.; S. E. Burgess, borough engineer. Municipal aerodrome, Marton Road, for the T.C.; borough engineer.

MOTHERWELL.—Extensions at silk factory, for Anderson and Robertson; the manager.

NORTHERN IRELAND (Cavan).—Additions to Surgical Hospital, for County Board of Health; T. J. Brady, secretary, County Home.

NORTHWICH.—Houses (100), for Brunner, Mond & Co., Ltd.

PETERBOROUGH. — Municipal buildings and shops (£186,000), for the T.C.; John Thompson & Sons, Ltd., builders.

PLYMOUTH.—Houses (70), at Laira, for the Great Western (Plymouth) Housing Society, Ltd.; T. Alwyn, Ltd., architects, 6, Cathedral Road, Cardiff.

ROMFORD.—Intermediate school (£28,193), for Essex E.C.; J. Stuart, county architect, Chelmsford. Hospital block and extensions to nurses' home, and premises for 50 tuberculosis patients, for the B.G.; clerk.

ROTHERHAM.—Extension of refrigerator manufacturing works (Thos. Hall & Son, Ltd.); for British Automatic Refrigerators, Ltd., 82, Victoria Street, London, S.W.1.

SALTBURN.—Dance hall; secretary, Saltburn Pier Co.

SHEFFIELD.—Shear factory, Cross Smithfields; D. Reynolds. Social institute, Manor Estate (£5,000); city architect.

SHREWSBURY.—Senior schools (£27,500), for the Borough E.C.; Bernard Widdows, architect, Derby; Walter Danks, builder, Eccleshall, Staffs.

SIDMOUTH (Devon).—Extensions to hospital (£9,000), for the Committee; Mr. Moore, architect.

SLEAFORD.—40 houses, various sites; U.D.C. surveyor.

SMETHWICK.—Cinema, Gaumont British Picture Corporation, Ltd. Extensions, Dale Street Works; E. Clarke and Co. Boxing booth and assembly hall, Union Street; H. Higgins.

SOUTHEND-ON-SEA.—Block of shops and flats, Hamlet Court Road; Arthur H. Holmes, architect, 99, High Street.

SOUTHPORT.—Re-erection (after fire) of The Palladium (electrically equipped); W. Hughes, manager (over £60,000).

STOCKTON-ON-TEES.—Houses (38), Wolviston, for P. Duffy, Norton.

TAUNTON.—Housing scheme (38), for the R.D.C.; surveyor.

TWICKENHAM.—38 houses, Red House Estate, Heath Road; Messrs. A. Mason & Co.

WAREHAM (Dorset).—Re-erection (after fire) of printing works, West Street (electrically equipped), for F. T. Symonds.

WELCOMBE (Bideford, Devon).—Re erection of Welcombe House, residence of Mr. Gifford, South Hole (£15,000).

WELWYN GARDEN CITY.—Post office, Howardsgate, for H.M. Office of Works, King Charles Street, London, S.W.

WISHAW.—Additions at Wishaw Public School, for Education Authority of the County of Lanark; clerk of the Authority, Hamilton.

WOTTON ST. MARY.—School (£6,945), for Gloucestershire E.C.; John Simmons, builder, Gloucester.

YORK.—Estate development, Millfield Lane and Tang Hall Lane; Millfield Estate Co., Ltd. Additions, The Shambles; Dean and Chapter of York. Alterations, Technical Institute, Clifford Street; F. Shepherd & Son, Ltd. Additions, Central Hostel, Micklegate, Y.W.C.A.

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The Electrical Review

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The Printing Exhibition.

THE eighth International Printing and Allied Trades Exhibition, which is referred to elsewhere in this issue, affords a remarkable insight into the progress of both the art of printing and of printing machinery. The exhibition gives an exceptionally complete idea of most of the well-known makes, both home and foreign, of printing press, ranging from the small jobbing press to newspaper presses of the largest size, besides all kinds of accessories.

From the electrical point of view the progress of electrical accessories is very marked. An ingenious electric furnace for keeping type metal molten, which we understand will shortly be manufactured in this country, for instance, is noticeable, but of course the main electrical problem of printing work is the drive. A variable-speed drive is a necessity, or at any rate an advantage in most cases, its importance growing with the increasing size of the plant. The other main electrical problem of printing-press work is automatic control, and while one notices the increase of pillar-type automatic controllers for small motors, this is chiefly a problem of the large newspaper press.

Returning to the subject of variable speed, it is noticeable that the old nervousness of the commutator machine, which blocked its progress for so long, seems to be yielding to experience. Dealing first with the small sizes, several commutator machines are shown, usually of the repulsion type, the brush shift by which the speed is regulated being accomplished either by a small pilot motor, or by a lever and flexible wire from a short distance. In this connection attention may be drawn to two very ingenious variable-speed gears which may well find a considerable field of application alongside the commutator motor. One of them provides a large number of distinct steps at small intervals, and the other truly continuous variation of speed combined with positive drive. The movement in favour of quantity production of small constant-speed motors at low prices is very strong, as most of us know, and this favours the use of a gear.

Coming to the larger sizes, the problem before the designer of the electrical equipment is to provide apparatus which will run for inching purposes at as low a speed as 12 r.p.m. and will give perfectly steady and

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regular acceleration under full automatic control from that speed to perhaps 700 to 800 r.p.m. The need for absolutely steady acceleration of course arises from the delicate nature of the paper band on which the type roller acts, which would break if any jerk were applied to it.

The inching speeds are still obtained, as heretofore, by the use of a pony motor driving the press through a "free wheeling" device, so that as soon as the main motor exceeds the speed of the gear driven by the pony motor, the "free wheel," which is a ratchet device, engages, and the main motor takes up the load. With direct current no serious difficulty arises in obtaining speed variation with regular acceleration from the lowest speed at which the press is required to run continuously to the highest, which means a speed range of three or four to one. This is effected by shunt control, and several examples are shown at the exhibition, which do not, however, present any striking developments.

With alternating current it was customary a few years ago to use an induction motor with resistance control, the motor only operating with resistance entirely cut out when driving the press at its highest speed, a speed which might not be required perhaps more than once a week, or so, for stop-press editions. Consequently the electrical equipment always consumed the same power as it consumed at top speed, and the difference was wasted when running at lower speed. Having in view the large number of printing works operated on this plan, it is impossible to deny that it gave satisfactory service from the printer's point of view. This method of operation, always rather shocking to the electrical engineer, now seems to be going out of favour, no examples, so far as can be judged, being shown at the exhibition.

Commutator machines of considerable h.p. are now being shown. One of them is of the well-known Schrage type, the primary current being led into the rotor by slip-rings, the rotor carrying a commutator on which two sets of brushes rest that are capable of movement in opposite directions, the movement being effected by means of a small pilot motor. The machine has a shunt characteristic, and its speed therefore varies very little between no load and full load for a given setting of the brushes. This is, however, in reality, of less importance in printing-press work than for many other applications, since a printing-press load consists almost entirely of the friction of the large mass of machinery and of the paper passing between the rolls. It is as steady a load as one can well imagine, and therefore extremely well adapted to a motor having series characteristics.

The other large commutator motor exhibited is of this type, being substantially a three-phase series motor in which the brushes are connected in series with the stator winding, the voltage being reduced by a transformer to a value adapted to secure good commutation. Both types of alternating-current motor carry out the inching operation by means of a pony motor as just described.

The other problem which faces the designer of electrical printing equipment is that of full automatic control. The printing press must be operated by means of a set (usually four) of push buttons, which are duplicated at various parts of the press, so that the operators can control the press from wherever they happen to be working. In addition, a large press is made in sections, and it is necessary that one section be capable of being made dead while work is proceeding on others. This leads to extremely complex control gear, which has, however, been worked out successfully for all the different kinds of drive. The absence of resistances, and the fact that control is effected by means of a pilot motor moving the brushes, tend to make the switchgear used with the commutator motors somewhat simpler than that of other types.

Though, strictly speaking, not of electrical interest, one cannot help being impressed by the many beautiful examples of colour printing shown and, in particular, by some beautiful results of the new process of colour photography now being developed.

Load Building.

In the United States the development of electricity has proceeded so far that the main work of the supply companies is not extension, but intension, *i.e.*, the cultivation of increased consumption for expenditure already incurred. That is the principal difference between conditions in the States and in this country. Here, only about one sixth of the houses immediately available are wired for electricity, and extension must still remain a very important part of the supply authority's work. That, however, does not preclude special efforts to make the most of what they already have, and in this respect the article on electrical merchandising, by Mr. S. M. Kennedy, which we print in this issue, is very apposite, although written from the American point of view. Mr. Kennedy has had considerable experience of electrical development work in the United States, having been vice-president in charge of business development and public relations of an important American public service company.

Although due allowance must be made here and there for differences between British and American ideas and practice, it is certain that the fundamental truths remain unaffected by these differences. The problem is the same in each country (as in every other country): how to interest, educate and retain the consumer; and, as human nature is much the same all over the world, the methods of dealing with the problem cannot be very dissimilar.

Therefore, we consider that Mr. Kennedy's article is a useful study of the subject of selling electrical appliances, which, although it may be considered elementary in places, really gets down to basic facts upon which practice, whether British or American, has to be built.

Underground or Overhead Cables?

In his paper on electricity in agriculture, with special reference to electroculture, recently read before the Western Centre of the Institution of Electrical Engineers, and abstracted in our April 12th issue, Mr. W. Phoenix, A.M.I.E.E., again stresses the desirability, whenever economically possible, of adopting underground distribution for rural areas in preference to overhead, and of considering every possible method of cheapening distribution schemes employing underground cables.

The advantages of underground mains for low and medium voltages over air lines are well known, and great prominence—perhaps too much—has been given in recent years to the short-comings of overhead lines in respect of the æsthetic consideration and the point of view of decreased factors of continuity of supply and general security; but the one and most important consideration which nearly always turns the scales in favour of the overhead system is economics.

It is particularly interesting to recall that in the large rural area of the Bedford electricity undertaking (Electrical Review, May 27th, 1927, p. 834) underground cables in most cases have been found to be an economical proposition, and that, among others, Mr. G. Porter (Worthing), and Mr. R. W. L. Phillips (Bedford), during the discussions at the I.M.E.A. Convention at Bath last year, expressed the belief that underground cables could be laid and operated ultimately as cheaply as overhead lines.

It is not suggested that a case has been proved against overhead lines—far from it—or even that underground cables can be adopted at present for many rural distribution schemes, but it is strongly urged that the underground system should not be definitely "shelved," and that efforts should be continued to make possible the use of conductors below ground. As Mr. Phoenix points out, much can be saved by the use of multiple service boxes and eaves cables where houses are situated in blocks, and road-reinstatement charges are much less, generally, in rural districts than in towns. Considera-

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tion should also be given to the possibilities of using rubber-sheathed and other less costly types of cables buried.

If underground distribution can be made economically possible in country districts, then one big obstacle to rural electrification will be overcome, and the result will be more in keeping with the tradition of this country in respect of the soundness and reliability of her engineering.

High-Voltage Cable Development.

In a paper on this subject presented at the recent Convention of the American Institute of Electrical Engineers, Messrs. E. W. Davis and W. N. Eddy state that reliability of insulation quality determination is essential to satisfactory progress in high-voltage cable development. The most reliable test available at present for this purpose is the over-voltage life test, but there is some evidence that it may not always give a true indication of insulation quality. Efforts are being made to increase its reliability by causing failure on test by the exaggeration of the causes of failure in service, rather than by increasing the operating voltage alone. While the ionisation test is usually in fair agreement with the over-voltage life test as an indication of insulation quality, there are some instances, such as that of a re-saturated cable, in which an indication of quality by the ionisation test is not confirmed by the life test. The air resistance of the paper used has a material influence on the insulation quality of the completed cable, regardless of whether the paper is of the kraft or manila type. While voltage tests on miniature samples of insulation are of considerable value along some lines, they are not believed to be a reliable basis for the comparison of compounds. The interdependence of the contraction-temperature and viscosity-temperature characteristics of the compound in their controlling influence on the formation of voids should receive more general consideration. Tentative indications have been found that a decrease in air content of the insulation might increase the tendency towards ionisation, because of the resulting decrease in void pressure. It is worth recording that it has been suggested that ionisation might be decreased by the presence of moisture, because of the resulting more complete void distribution and consequent smaller size of each void.

French Industrial Conditions.

The shortage of skilled labour in France, which was discussed here last week, continues to be one of the subjects which are engaging attention in the technical industries in France. In obedience to supply and demand, the skilled labour which is available, being insufficient to satisfy everybody, continues to increase in price, and fears are expressed that as labour is one of the more important factors in the cost of a finished article, if its price keeps on advancing as it has done lately it may become impossible for French industrial manufacturers to face competition. Equally difficult will it be to reduce the cost of wages when trade is less brisk. At the present moment, however, employers are practically competing with each other in order to obtain skilled workmen, and one of the inducements often offered is a guarantee that the workman will be provided with living accommodation. This accommodation is generally provided by the firm, and frequently consists of a small portion of a long shed which is divided into "quarters" by thin partitions and may be lengthened as required by the number of workmen to accommodate. Sometimes the building is constructed entirely of wood with felt roofing, and, generally, the conditions are such as would not be tolerated by any local authority in England. The question has been discussed whether it would not be possible for firms to take advantage even of the Loucheur Act, which grants Government assistance—similar to that of a building society—to persons desirous of purchasing their own houses, as it is argued that with financial assistance many firms would be able to build more extensively, but it appears that this Act cannot be applied to employers of labour, and that assistance should be sought by them rather in a reduction of taxes. Other dominating features in present conditions of French technical industries are: an increase of production, diminution of exports, and the higher absorbing power of the home market. In the metallurgical industries, for example, this development of production started about a year ago. During 1928 the output of pig-iron exceeded 19 million tons, which shows an increase of 10 per cent. over 1913, and 6 per cent. over 1926. Nevertheless, the diminution of exports is regarded as of primary importance, because hitherto French production has been much in excess of national requirements, and foreign markets have therefore been essential. However, with the "safeguarding" 33 per cent. in England, the United States developing her exports, Germany extending her foreign commerce in every possible direction, and several new countries starting national industries themselves, it is feared that an increase in French exports of electrical and metallurgical articles will not be obtained for some time, and that in the meantime the development of the French domestic market offers the path of least resistance.

Lifting Magnets in Foundries.

The electric lifting magnet has become so popular for many engineering purposes, and has so much to commend it, that it is surprising that it has not come into more general use in ferrous foundries. For transporting pig iron from the stockyard to the cupola charging platform it has distinct advantages over the crane, and it is also a labour saver in unloading the pig iron when it arrives in railway wagons. For a number of years certain large foundries have made use of the magnet for sorting out chaplets, pieces of core iron, and nails from moulds and cores after castings have been made, and this is probably one of its most labour-saving uses. In every foundry, large and small, the breaking up of waster castings and especially of heavy scrap is a difficult problem, and even otherwise well-equipped foundries still make use of a heavy cast iron ball, sometimes called "a skull cracker," which is released by the time-honoured monkey. The chief objection to the monkey is the danger attendant on its use, because it has to be released by a rope held by a labourer, but by means of an electric magnet the ball can be lifted quickly and safely to the necessary height and dropped on to the scrap iron, or waster casting, when desired. Magnets are now obtainable that will lift up to 80 lb., but for foundry purposes a small-capacity magnet is quite satisfactory. Their operation is so simple, and the fact that the crane driver does not really require an assistant, constitute such a reduction of labour cost that it would appear to be only necessary for foundrymen to be made aware of the advantages attaching to their use for lifting magnets to be more generally employed in foundries, especially those which produce a large tonnage of medium and heavy-weight castings.

A New Trade Association.

The Ultra-Violet and Allied Trades Association has been formed to promote closer co-operation between manufacturers with a view to introducing improvements in apparatus coming within the scope of the title; arranging consultations with the profession on points of mutual consequence; and forming a clearing house for information—technical and constructional—respecting electro-therapy, as well as fostering the development of this branch of medical science. Some further particulars appear in our "Business Notices" to-day concerning the new Association, of which Mr. C. Rodgers is the secretary.

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Electricity Supply in Wellington.

An outline of the history and progress of the Electric Lighting Department of the Wellington Corporation, New Zealand.

By M. CABLE, M.I.E.E., General Manager.

IN the year 1888 an agreement was entered into between the Wellington Corporation and a private company to provide 500 20-candle-power street lamps, the electricity to be generated by water turbines supplied from the city's water mains. In 1891 the company sought Parliamentary powers to supply electricity to private consumers, and two years later four 75-kW steam-driven alternators were commissioned; the supply system was at 2,200 volts, 80 cycles, single-phase, with a 105-volt two-wire secondary system, all lines being overhead.

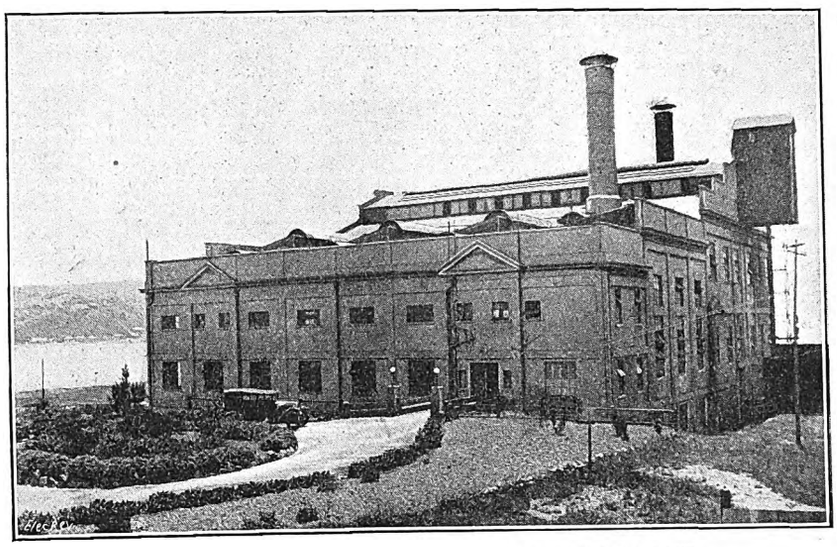

Fig. 1.—Evans Bay Power Station, 10,000 kW.

In 1904 the Corporation inaugurated an electric tramway system and laid down a new steam power station generating at 550 volts, and shortly afterwards provided a supply for private power from an underground reticulation. After prolonged negotiations, the Corporation purchased the business of the private company in 1906 and immediately ordered its first 1,500-kW turbine, which set was duplicated in 1913. During the 1914-18 European War period it was impossible to purchase plant for either power station, and in 1919 both sets of plant were seriously overloaded, and the problem of modernising the two systems was complicated by the fact that the Government had commenced to construct the Mangahao hydro-electric system from which power was to be purchased in bulk at 11,000 volts, three-phase, 50 cycles; but the supply was not available until 1925. In 1922 it was finally decided to construct a new power station at Evans Bay (fig. 1) and a 5,000-kW, three-phase, 11,000-volt turbo-alternator was ordered and placed in commission. Later, a 1,000-kW d.c. geared turbine was removed from the tramway station to Evans Bay and also the two turbines from the old 80-cycle station, to which new 2,000-kW alternators were fitted. This brought the new station up to 10,000-kW rating.

Evans Bay Power Station.—The boiler plant consists of six B. & W. boilers, two coal-fired marine-type boilers of 220 lb. per sq. in. pressure, with 7,000 sq. ft. of heating surface, including economisers, and two coal-fired land-type boilers with 6,182 sq. ft. of heating surface; all grates are of the chain type. Two B. & W. land-type boilers with 7,740 sq. ft. of heating surface and of 160 lb. per sq. in. pressure were removed from the old stations and re-erected and fitted with oil-fuel burners, nine burners to each boiler (fig. 2). The oil is heated to a temperature of from 150 to 170 deg. F. and injected at a pressure of from 60 to 150 lb. per sq. in., depending on load requirements. The oil-fired boilers have proved invaluable in meeting urgent calls for power and also for taking large peak loads over short intervals.

When the whole station is operating under purely stand-by conditions, it is probable that the whole of the boiler plant will be oil fired in order to reduce the operating staff to a minimum and also to save the cost of stand-by fuel.

Oil fuel is stored on site up to 30,000 gallons, and the supply tanks are supplied by a 3-in. pipe-line direct from a large oil company's works half a mile away. Coal having a calorific value of 13,500 B.th.u. per lb. costs 36s. per ton at the station and oil fuel £4 per ton, so that on a heat basis oil is considerably more expensive than coal.

Government Supply.—Bulk supply at 11,000 volts is taken from the Government sub-station at Khandallah (fig. 3), three and a half miles north of the centre of the city. Power is purchased at the Government standard rates of 0-200 kVA, £2 10s. per kVA per quarter; 200-5,000 kVA, £2 per quarter; 5,000 kVA upwards, £1 15s. per quarter, with no "unit" charge. The city pays on a kW, not a kVA basis, provided that the power factor on the peak load is above 0.9 lagging.

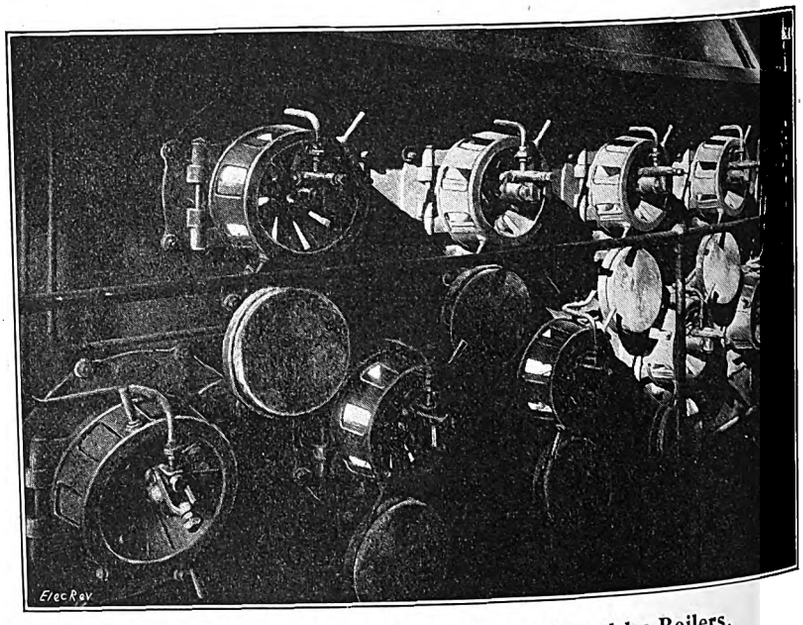

Fig. 2.—Oil Burners in Operation on Stand-by Boilers.

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The power is metered at Khandallah and recorded by printometers every half hour. The city has to guarantee a minimum of power purchased per annum, on a rising scale for the period of the contract, which is ten years.

Due to very dry seasons during the last two years and also to very rapid increase in load, the Government hydro-station at Mangahao has been unable to supply the whole of the city's requirements, and on numerous occasions the Evans Bay plant has been operating on continuous full load for two or three weeks at a time. Under these conditions, power is supplied back to the Government in the night hours and during part of the day, if the load permits. Had it not been for the city's steam plant, the electricity supply in the city and surrounding districts would have been severely curtailed for several weeks at a time. Early this year the new hydro station at Waikaremoana will be in commission, and it will relieve the situation, providing that the 110-kV line connecting the city and the Waikaremoana station, 234 miles away, gives reliable service. When the new line is put into commission, voltage control will be effected by means of a 10,000-kVA synchronous condenser at Khandallah. The principal operating troubles have been due to short circuits on the Government 110-kV system putting all the city's synchronous plant out of step and, as the latter includes two 2,000-kW frequency changers with motor-operated moving stators, fig. 5, supplying public lighting on the old system, the interruptions have occasionally been serious. With improved methods of inspection and testing, the interruptions have been greatly minimised.

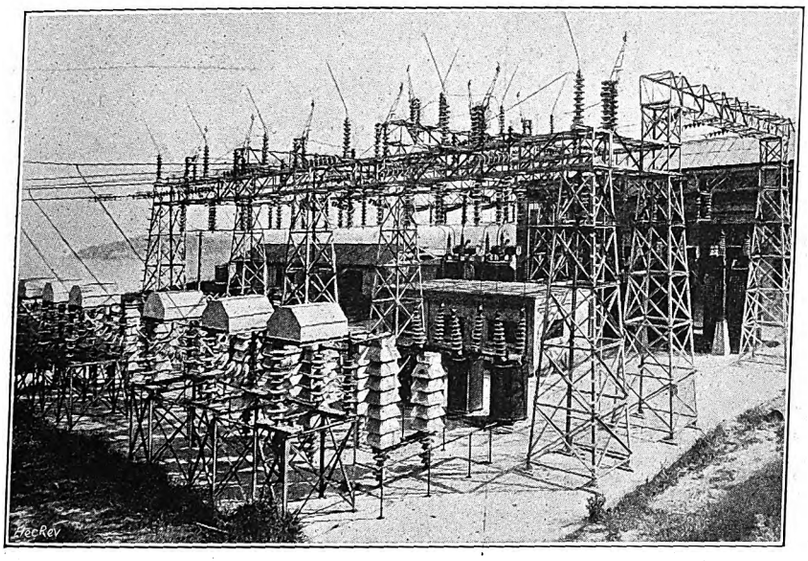

Fig. 3.—Government Sub-station at Khandallah; two 10,000-kVA Banks, 110/11 kV.

Distribution System.—The old 2,200-volt, single-phase, 80-cycle system consisted of overhead v.i.r. mains with pole-mounted transformers of from 50 to 2 kVA, with a 105-volt two-wire secondary system. This system supplied all public and private lighting and a small amount of industrial power. The major portion of the power was in the centre of the city and supplied by an underground system from the tramway 550-volt d.c. station. In 1923 lengthy consideration was given to the type of system to be adopted, and it was finally decided to lay down a 400/230-volt, 3-phase, 4-wire, 50-cycle system, the standard adopted in N.Z., and now in England. The d.c. power system has been retained, but new extensions are limited principally to lifts, of which large numbers are in use.

The new 50-cycle primary distribution is at 11,000 volts, practically all underground, with a 3,300-volt system in the lightly-loaded suburban districts, most of which is overhead (see figs. 4 to 8). The layouts of these systems are such that all the 11,000-volt sub-stations are designed for duplicate banks of three-phase transformers, and the following ratings have been standardised: 200, 300, and 400 kVA, with possibly 500 kVA as a future limit. All 400-volt feeders are taken out of the sub-stations underground through oil switches with either 0.3- or 0.15-sq. in. 4-core l.c. and s.t.a. cable, even in areas where the l.p. distribution is all overhead.

The 3,300-volt sub-stations vary from 60 and 100 kVA, pole-type, to buildings designed to take two 200-kVA banks. Only three sizes of transformer are used, *viz.*, 60, 100, and 200 kVA. All the 11,000-volt, as well as the 200 kVA, 3,300-volt, transformers are provided with external tapping switches, while the two small sizes are provided with tapping plugs under the oil.

The 11,000-volt underground cables are all lead covered and steel-tape armoured, laid direct in the ground, and the conductor sections vary from 0.3 to 0.04 sq. in. All 3,300-volt cables have a section of 0.04 sq. in., while the v.i.r. overhead-line sizes are 0.06, 0.04, and 0.025 sq. in. Under Government Regulations all 3,300-volt overhead lines have a minimum ground clearance of 21 feet at maximum temperature. All the 400-volt distribution system is overhead, except in the centre of the city, where it is all underground.

The overhead phase wires are triple braided and weather-proofed, the neutral being bare. The phase-wire sizes are 0.10, 0.06 and 0.04 sq. in. in section, the maximum size being limited by the pole loading at street corners. All poles are Australian ironbark, square hewn. At the intersections between sub-station areas having overhead lines, weatherproof ironclad three-pole knife switches are being mounted on the poles just below the wires, so that in case of failure of supply in one area, or when it is required to cut out a sub-station for overhaul, the area can be supplied from adjacent areas.

The underground 400-volt system consists of 0.3- and 0.15-sq. in., 4-core, l.c. and s.t.a. cables laid direct in the ground. In most of the main streets 0.3-sq. in. cables are laid on both sides of the streets. The distribution cables form a continuous network through underground link boxes of the bus-bar type, the system being divided up into small sections, each of which can be fed from more than one direction; most of the link boxes are of the four-way type. All services are made with four-core l.c. and s.t.a. cable, the minimum size being 0.04 sq. in., and for small consumers a multiple service box

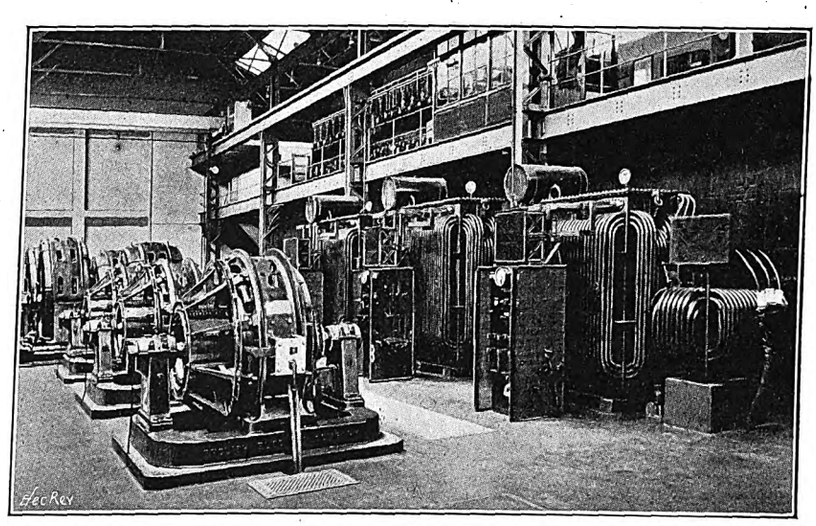

Fig. 4.—Jervois Quay Sub-station; 1,500-kW Rotaries and E.H.P. Control Board.

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is placed in doorways, &c., arranged to take up to five conduit services to adjacent consumers.

Tramway Supply.—The City's Electricity Department supplies power to the tramway system at 550 volts d.c., the Tramway Department providing its own underground distribution system. The traction load is approximately ten million kWh per annum, with a maximum demand of 4,500 kW. Supply is given from three

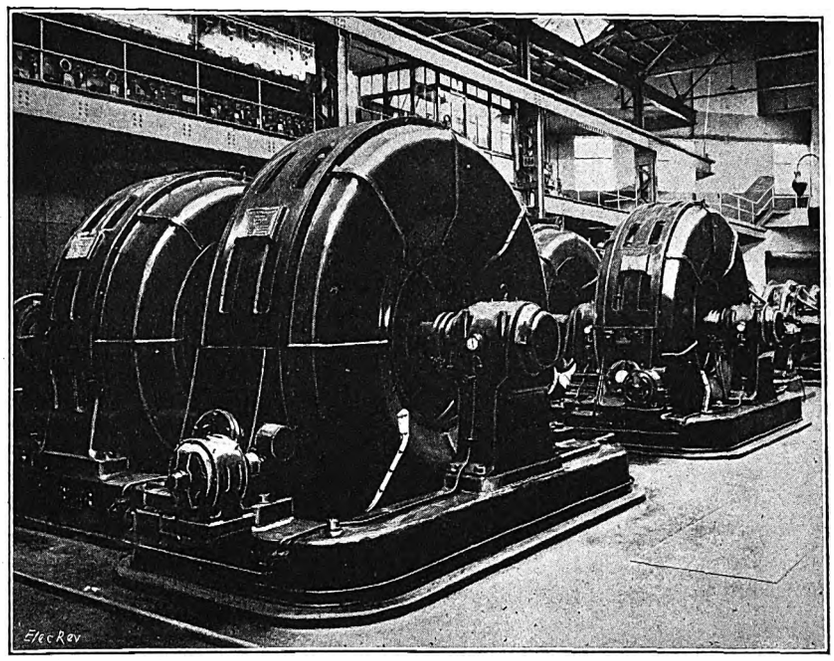


Fig. 5.—Two 2,000-kW Frequency Changers in Jervois Quay Sub-station.

1,500-kW rotary convertors in the centre of the city, three 750-kW automatic rotary convertors in suburban districts, and one 500-kW convertor at the Evans Bay power station. All the automatic stations are controlled by pilot wires for stopping and starting as well as reclosing d.c. traction breakers. In one case, each individual feeder, as well as the machine, is controlled by supervisory equipment which gives independent control "in" or "out" for each switch, as well as a "red" or "green" light to show the switch positions.

Change-Over of A.C. Supply.—A commencement to change over the 80-cycle, 105-volt, single-phase, two-wire system to the 50-cycle, 400/230-volt, three-phase, 4-wire system was made in 1925, and it is anticipated that, apart from a few old buildings in the centre of the city, the change-over will be completed in four years' time. The change-over is being carried out under special regulations issued by the Government, as follows:—

Classification.—The consumers' installations shall be classified as follows:—

Class (*a*)—Installations of which the wiring is found to be in accordance with the licensee's rules and regulations adopted on December 17th, 1908, and only require alterations necessitated by the change of system.

Class (*b*)—Installations of which the wiring is found to be defective under the licensee's rules and regulations adopted on December 17th, 1908.

Class (*c*)—Installations of which the wiring is worn out by effluxion of time, or service, and under any conditions would require to be re-wired within a short period.

Allocation of Cost.—The cost of alterations shall be allocated as follows:—

Class (*a*)—The whole of the cost shall be paid by the licensee, provided always that in the case of extensions and alterations which have not been authorised by the licensee the cost of alterations thereto shall be borne by the consumer.

Class (*b*)—The cost of removing all defects shall be paid by the consumer, and the cost of alterations due to change in system shall be paid by the licensee.

Class (*c*)—The whole cost shall be paid by the consumer.

In cases in which the consumers do not desire to pay in full at the time of the alterations the cost for which they are liable, the whole of such work shall be carried out by the licensee through contractors, or its own servants, and the whole of such cost, or any portion of it, shall, unless the licensee and the consumer shall agree otherwise, be carried out under the provisions of the Municipal Corporations Act, 1920, or any statutory modification thereof as to payment.

Provision may be made for consumers to pay the instalments due with their regular accounts for the supply of electricity.

All work under clauses (*a*) and (*b*) affected by this clause shall, unless otherwise agreed upon between the licensee and the consumer, be carried out by the Corporation.

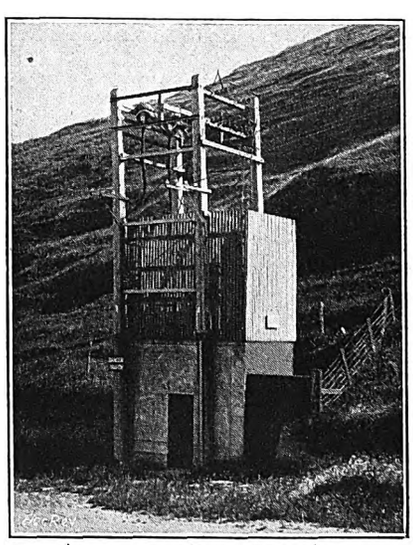
In case of any dispute arising in respect of matters affected by this clause between the licensee and a consumer, a Board of Appeal (whose decision shall be final) shall be set up to decide such dispute; the Board of Appeal shall consist of the following:—

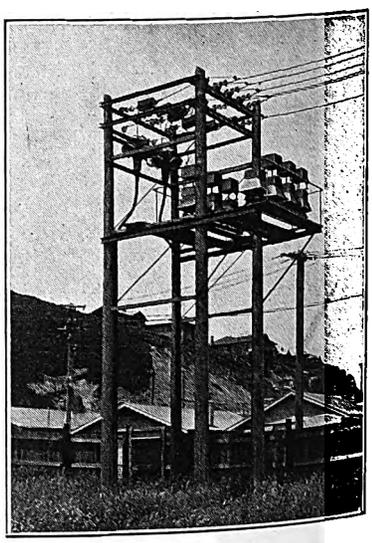
(1) One representative appointed by the licensee.

(2) One representative appointed by the consumer on whose premises the alterations are to be made.

(3) The senior stipendiary magistrate for the City of Wellington (who shall be chairman).

In the suburban districts the new distribution system has been superimposed on the old system, and the whole area changed over in the course of a few months, but in the city area where there are many old buildings that are being gradually pulled down, and where there are many expensive installations that require completely rewiring for the new voltage, the new system of supply is at present only being used for new buildings, or where a consumer requires any extensions to an existing supply from the old system, such extension is only made on the new system when the whole of the installation is changed over. In the domestic area the change-over has resulted in a large increase in the number of lighting and heating points installed. In order to supply the old system two 2,000-kW frequency changers were installed in 1924,





Figs. 6 and 7.—Terminal Towers, 11,000 V, with Indoor and Outdoor Arrestors.

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as the main supply to the system then became 11,000 volts, three-phase, 50 cycles.

Tariffs.—The following is a summary of the net tariffs at present in force :—

Commercial lighting : 6d. per kWh for the first 200 kWh per month, with a sliding scale down to 3d. per kWh for all over 1,000 kWh per month.

Commercial heating and radiators : 2d. per kWh.

Power : 2¾d. per kWh for the first 300 kWh per month,

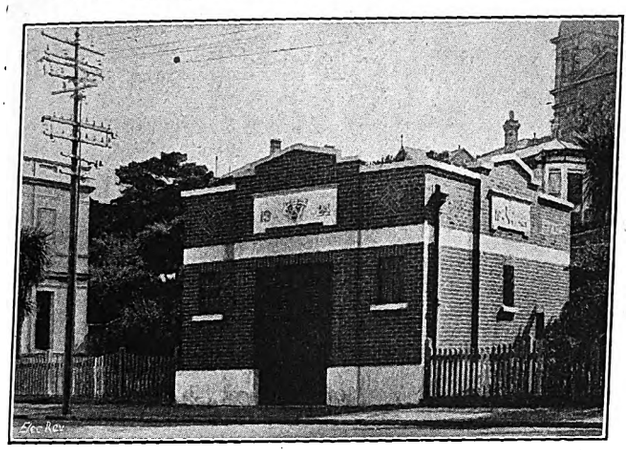

Fig. 8.—Typical Transformer Sub-station, 11,000/400 Volts. Two Banks.

with a sliding scale down to 1¼d. per kWh for all over 2,000 kWh per month.

Alternatively : 25s. per kVA of maximum demand per quarter up to 50 kVA, and 20s. per kVA over 50 kVA, plus ½d. per kWh. The maximum demand is taken over 30 minutes.

Domestic supply: with one meter, 5d. per kWh per month for the first 2 kWh per living room, minus one room, with the balance at 1½d. per kWh for ordinary consumers and at 1d. per kWh for cooking consumers. Energy for water heating is supplied at 9d. per 100 watts per month, fixed charge, for a nine-hour night supply with a time switch.

Size of System.—The system's maximum demand to date is 13,700 kW, with a monthly load factor of 42 per cent. in midwinter and 50 per cent. in midsummer. Electric lighting is universally used for residences and shops, and in commercial offices there is a winter load of from 2,000 to 3,000 kW due to office radiators. The industrial load consists of approximately 20,000 h.p. of motors.

The domestic supply for electric cooking and water heating is rapidly growing, due to recent reductions of the tariff. When the change-over is nearly completed it is anticipated that further reductions of the tariff will bring a rapid increase in the load and plans are being considered for extensions for a ten per cent. increase per annum over the next ten years.

Government Regulations.—Authority to generate, distribute, and sell electricity is given to the Corporation by Government licence and all works must be erected and operated to the Government Electrical Regulations, 1927, which are in force throughout the country. The Regulations also apply to the construction and operating conditions where the Post and Telegraph and Railway Departments are concerned. The electrical installation of consumers' premises is also governed by Government Regulations, 1927. They require a high standard of material and workmanship and are based on the best British practice.

All installation work is carried out by wiremen who have passed theoretical and practical examinations under Government regulation, and who receive the necessary licence which permits the holder to work anywhere in the country. In the event of any serious defects being found on an installation, the wireman's licence is liable to be cancelled.

The Lighting of St. Martin's.

Some Particulars of the Remodelled Installation.

WHILE the fame of most well-known churches depends on their antiquity, that of St. Martin's-in-the-Fields, London, is due mainly to its modernity—the fact that it is the "parish church of broadcasting."

The present building is only about 200 years old and it is of the classic style favoured in the early 18th century. The interior, from the illumination point of view, does not present so many difficulties as the usual style of church in which the nave is of great height. In St. Martin's there is a ceiling, richly decorated with cerulian and gold panels, which permits of a very definite lighting scheme.

As will be seen from fig. 1 the lighting of the nave is accomplished by means of a series of enclosed units, which, being suspended mid-way between the ceiling and floor, provide adequate all-round illumination. The fittings were entirely remodelled by the General Electric Co., Ltd., having been in use in the earlier installation. In the course of the conversion special glass was employed, and the wiring was improved. Each is now provided with a highly-concentrated "Gecoray" reflector; the base of the fitting is of diffusing glass of low absorption, and the side panels are of flashed opal glass. They are also equipped with three 40-W lamps for auxiliary lighting, on separate circuits, to slightly increase the illumination on the ceiling and to enable the intensity of illumination to be evenly reduced as required. One of the nave units is illustrated in fig. 2; from this it will be seen that the design is in harmony with the architecture of the church and, in

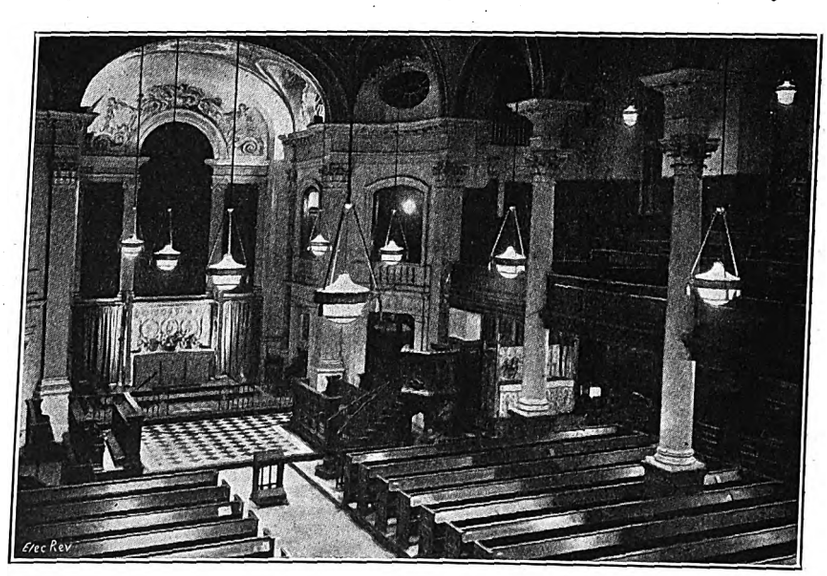

Fig. 1.—The Lighting of the Nave.

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fact, rather closer to the classic style to which the building was evidently intended by its architect to conform.

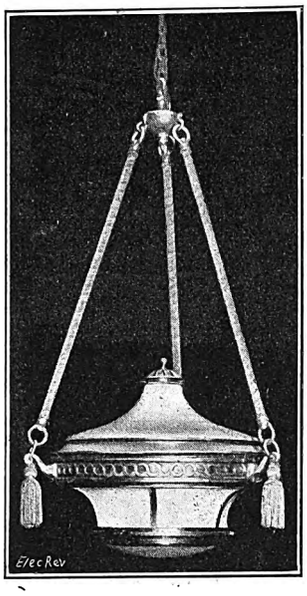

Fig. 2.—One of the Nave Units.

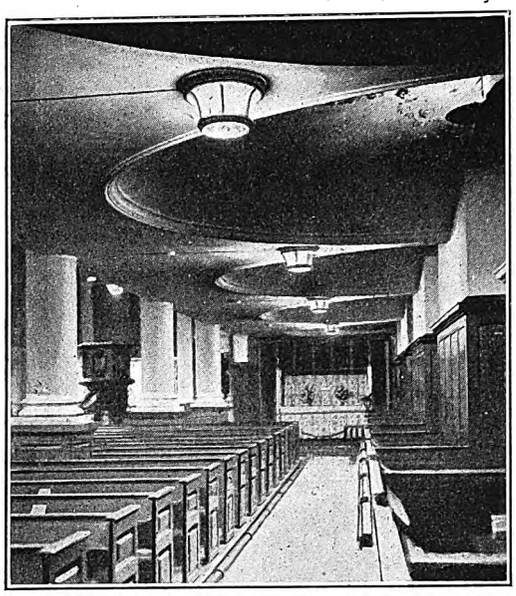

Fig. 3.—Illumination under the Gallery.

The gallery units are on very similar lines, though without the auxiliary lighting, and these, too, have been re-modelled. Under the gallery there are fittings of the same pattern adapted for ceiling fixing. These are equipped with a shallow white vitreous-enamelled top reflector, giving a wide angle of reflection, the base and sides being glazed to match the nave and gallery units. The even distribution obtained in this way on the pews and walls is apparent from fig. 3.

The lighting of the altar and chancel by floodlights and reflectors has not been revised, while the royal boxes, one of which can be seen behind the pulpit in fig. 1, are suitably illuminated. It is stated that although the new system gives a much greater intensity, owing to the improved distribution, the consumption of energy is actually lower than before. At pew level the illumination is sufficient to enable the smallest print to be read with ease, in spite of the fact that the whole of the seating accommodation is of dark woodwork with very poor reflective qualities.

The installation was designed by the G.E.C. Illuminating Engineering Department, which prepared the scheme in accordance with the wishes of the church authorities, and the work was carried out by Messrs. Maxwell, Butcher & Co., Ltd.

The Fundamentals of Electrical Merchandising.

The author, who has had some years of experience in the work with which he deals, with a large American public utility company, sets out the necessity for encouraging the fullest use of electricity by existing consumers and suggests means by which this can be realised.

By S. M. KENNEDY (California).

It is an undisputed fact that this world in which we live has never known of an industry whose growth and development has been as full of romantic history as that of electricity. The romance must continue as time goes by, for the wonderful usefulness of this mysterious energy now seems to have no limitations.

The progress of the electric power business has been marked by very pronounced periods of development In the earlier stages of the history of the electrical business, lighting by electricity seemed to be the only object, and it must now be acknowledged that for many years electric lighting was crude and expensive, but even in that condition was better than any other means of illumination in these pioneer days. Several years elapsed before electric power service was used for industrial and domestic purposes, this time being occupied in educating the people to establish the necessary confidence in order to bring about the more general use of electricity for other purposes than illumination. All the development work in steam and water power generating plants, transmission lines, sub-stations, and distribution systems gradually pointed to the necessity of supplying more service, and at the present time, the paramount idea of all operators in the electrical business is what is now termed "load building." Load building reaches out in many directions, and one of the most important phases to-day is that of electrical merchandising. It is not necessary here to enumerate the many and various kinds of current-consuming devices which are now available, but rather to consider the reasons for a far-reaching system of disposing of these appliances so that load building may be carried on consistently and continuously.

What may be considered the different angles of approach to this very important work have been outlined in a verse by Rudyard Kipling:

"I keep six honest serving men,
(They taught me all I knew),
Their names are WHAT and WHY and WHEN
And HOW and WHERE and WHO."

The idea of electrical merchandising may well be considered from these six standpoints—the first one being WHAT does this kind of load building mean to the power companies? It is the creation of a demand for electrical energy and the supplying of a great need in the territory served. The creation of a demand means the education of the company's customers so that they will feel the necessity of purchasing certain useful, convenient, and time-saving apparatus, this apparatus to be operated by electrical energy. In all directions there is a real need for such service. The trouble is that many consumers do not know what they need until it is clearly and carefully pointed out to them that they will be better off than they were before with comparatively little, if any, increased expense. In fact, in many instances where electricity is used in place of other means to do certain work, there is a distinct saving of money. Now it so happens that there are numerous classes of merchants who are anxious and willing to sell electrical merchandise. Their object, however, is to make a profit on each

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piece of merchandise that is sold and their interest ends when the sale is consummated. The power company has an entirely different object and the profit on the sale of electrical merchandise, while important, is not the reason why the power company is doing this kind of work. The real object is load building. It is in the interest of the power company to encourage all classes of merchants to sell electrical equipment to their customers, and in addition for the power company to do missionary work and to stimulate such sales by merchants as well as through salesmen. For this reason there should be a maintenance of standard prices so that there will be complete harmony between the merchants and power company, and the merchants will be enabled to get a reasonable profit and the power company a proper return on the merchandise which it sells in order to meet the expense of salesmen's salaries and commissions, the maintenance of showrooms and necessary advertising, and promotion work. Price-cutting is demoralising and entirely unnecessary. If the demand for the merchandise is created, the question of price is of minor importance.

The second phase of this great subject is WHY should electrical merchandising be carried on by the power company? It has been pointed out that the primary object of these sales is load building. Load building naturally increases load factor, and this automatically reduces the operating expenses which eventually means a lower cost per kilopatt-hour. A lower cost per kilowatt-hour points to a lower rate for service to the customer and the lower rate inevitably means increased consumption and greater revenue. Now then, if you obtain a greater revenue with a decrease in the unit cost for energy, you have undoubtedly added stability to the power company's business. Further, the more appliances which the company's customers have in use in their homes the more the power company becomes necessary to the customer because of the greater service. If this greater service is supplied under conditions which abound with courtesy, consideration and efficiency, then the standing of the power company in the community in which it operates becomes ideal. The company's customers under such conditions are easily induced to become stock-holders and partners, and a great bulwark is eventually built up to protect the company's property and forward its best interests.

The third division of this subject is WHEN should electrical merchandising be carried on? There is no limit as to time, and it will be found that after a customer has been using one or more electrical appliances in his home or place of business, he becomes open minded and is usually ready to listen to what a salesman has to say regarding other and perhaps newer devices which are available for his use. There never has been, and probably never will be, such a thing as saturation among any class of consumers in a power company's business On the other hand, in a well-organised and well-operated power company business, there should be a constantly increasing consumption of electrical energy among all classes of consumers. After a customer has been convinced that he needs, or would be better off with, any particular kind of electrical appliance, it may be discovered that he has not the cash to make the purchase. In such circumstances it is to the advantage of the power company to assist the customer in purchasing this apparatus. If the power company has to wait for the time when the customer has the cash, there is a postponement of additional load which should be acquired at once if handled properly. This, of course, means that the company should arrange a deferred-payment plan. The available records indicate that sales of this kind are usually satisfactory and that repossessions by the power company of appliances sold under such conditions are comparatively rare. Salesmen soliciting business for electrical merchandise should always be carefully trained before they are turned into the field. This is important and will save much time in obtaining proper results from their work, and time is money.

The next question is HOW? The answer is easy—it is by spending money, but the money must be wisely spent. A power company's customer will not usually walk into the company's office and say, "Send me this appliance or that device," and then go home and await its arrival. Instead, a demand must be created by some accepted and proven means. Advertising in daily papers and periodicals is a sound method, but the advertisements must be carefully written and displayed by those who have had experience in the work. The first function of advertising is to get merchandising messages read; the second is to make sales. In order to obtain the attention of the reader—to arrest the eye and arouse interest—advertising must be attractive in its physical presentation, that means lay-outs, illustrations and typography. Satisfactory results must surely follow.

Then there is the display in windows and showrooms which tells the story silently, but often effectively. Next are demonstrations in public rooms and private houses which show the actual application and use of appliances. Last, there are the salesmen and saleswomen, who call on customers in their homes and places of business; who go about their work thoughtfully and tactfully. These emissaries arouse interest, create a demand and make sales day by day, and pile up lists of prospects for attention later on. Such representatives of the power company should regularly "check themselves up" to see if they look, speak and act the part and do the company justice. They should realise that each one is an individual with a mission and not simply a cog in a wheel. If they understand this they will accomplish much more and their work will become many times more interesting.

The fifth point to be considered is WHERE should electrical merchandising be carried on? The answer to this question is: Wherever the company's lines extend and the service is being supplied, the business of electrical merchandising should be pushed to the limit. Further, with the constantly increasing number of current-consuming devices for new uses, opportunities develop for making profitable extensions to distribution systems in order to supply new territorities and additional customers, especially in rural and interurban districts. Take, for instance, the subject of electric cooking and refrigeration. In many suburban districts, gas has not been available and ice has been difficult to obtain when it was most wanted. With the modern equipment of electric ranges and electric refrigerators, this class of service is recognised as a blessing, and in addition to the convenience and satisfaction of such service, there is a real saving to the consumer in dollars and cents in his monthly expenses. The cost of electrical energy for cooking and refrigeration when properly used is much less than the cost of fuel for ordinary ranges and for ice purchased and delivered in rural districts. All that is needed to make sales is education by means of personal solicitation and carefully prepared advertising matter distributed where it will do the most good, and create interest and demand.

The final query is WHO shall do this electrical merchandising which is such an important branch of load building? It may be assumed that every progressive power company has a regular sales organisation which works continuously and efficiently. It may be further assumed that all merchants, such as electrical dealers, department stores, furniture stores, drug stores and hardware stores are encouraged to make as many sales of electrical appliances as they possibly can. But what about all other employés connected with the power company? Think of their opportunities to say a favourable word or two regarding this or that appliance! Think of the questions that are asked concerning the price or cost of operation of certain devices that consumers may have heard of from neighbours and friends! Think of the curiosity and interest that may be aroused in some consumers by the leaving or mailing of a timely folder! Clerks, collectors, meter readers and trouble men have an endless number of contacts with customers which should be capitalised without taking up much of

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their time. So have all other company employés—among their friends and neighbours. But, some will say, such employés are not salesmen. Quite true—but they have sufficient knowledge to fill in prospect cards and send them in to the sales manager. Innumerable sales may be made in this way. Employés sending in prospect cards should be encouraged by means of a cash commission whenever a sale is made through their interest and effort. In short—"WHO" is every one connected with the power company that has the growth and prosperity of the company at heart.

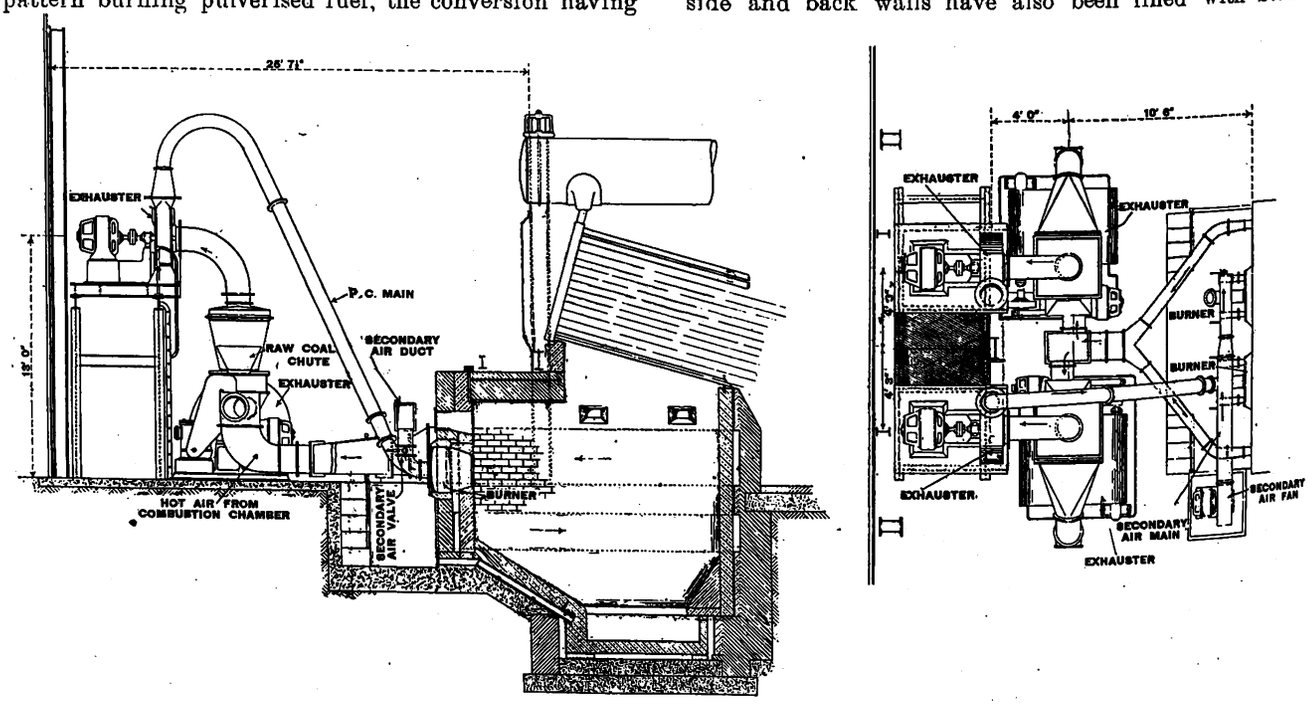
After all, the entire work of a power company's organisation leads up to the meter. Find a department that is not functioning in the ultimate direction of the meter, and you will find a department that may be closed down. Discover an officer or employé whose work does not eventually point toward the meter and you will discover a man whose services may be dispensed with. Think, then, how desirable it is to load up the meter and the lines leading up to it, so that a greater revenue may be obtained from present investment. That's what electrical merchandising means! But, it cannot be done in a haphazard fashion to get the desired results. The plan of operation must be scientifically worked out. Estimates should be prepared regarding the average number of appliances which should be absorbed yearly for each thousand consumers. Quotas should be figured as to the number of merchandise sales expected from each district in proportion to the number of consumers served. Quotas should also be estimated as to the horse-power added by the merchandise sales—because one district may sell fewer electrical appliances but representing a much greater amount of horse-power than another district with heavier individual merchandise sales. A friendly emulation should be stimulated between the various districts, and prizes might be offered to those districts that show the greatest excess over quotas—both as to number of sales and horse-power added.

It is beyond a shadow of doubt that electricity has done more than anything else to make life easier and more agreeable than it ever was before in the history of the world. It has been the great time saver; it has lightened labour; it has added conveniences never before dreamed of; it has brought entertainment and pleasure to our doors and in our homes; and has connected the ends of the earth together so that we are familiar with what is going on in far-away places. It is a pleasure and honour to be connected with the great industry that has done so much for the world and a joy to know we are doing our share. The man who invents a great generating machine deserves full credit for his accomplishment. The man who is the means of putting a modern electrical appliance into a home also deserves credit for what he has done, and he has a right to be proud of his work. Electrical merchandising is a big job, and needs big men. The best test of all work is results, and electrical mechandising points to far-reaching and highly satisfactory results in very many directions.

A Pulverised-fuel Boiler.

A description of the conversion of a water-tube boiler to burn powdered coal at the Stretford Urban District Council's electricity works.

A RECENT visit to the electricity generating station of the Stretford Urban District Council at Trafford Park, Manchester, afforded an opportunity of seeing a water-tube boiler of the ordinary pattern burning pulverised fuel, the conversion having been successfully effected with a minimum of alteration and at small cost.



Figs. 1 and 2.—Pulverised-fuel-firing Arrangements; Section and Plan.

The boiler is of the Babcock and Wilcox land type, working at 175 lb. per square inch and rated at an evaporation of 25,000 lb. of water per hour, with chain grate stokers; the grate has been removed, and the ash-pit lowered a little, and in front of the boiler there has been built an annexe of the Dutch-oven type, occupying the space formerly covered by the chain grate. The side and back walls have also been lined with Stein bricks (Thistle brand), with air channels, the heated air being led to the mills; but the internal surface of the combustion chamber consists entirely of unshielded brick. A Liptak suspended arch extends across the whole width of the furnace. Some trouble was

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experienced with the floor, which is below the standing water level, so that seepage of water and its conversion into steam disturbed the brick floor; this local trouble was overcome by relaying the floor with large tiles on cast-iron blocks, providing an air space between them and the soil, which effectually prevents access of moisture and has solved the problem satisfactorily. Ash falling to the floor is raked out through a side aperture.

The burners, two in number, are of the Buell type, mounted horizontally in the front wall of the boiler. The floor space occupied by the boiler is unchanged.

From the existing overhead bunker the coal (dry slack) is fed through a magnetic separator to an automatic feeder, whence it passes into the mill. Then the powdered fuel is drawn by an exhauster fan through the classifier into a pipe leading to the burner. Hot air, as previously mentioned, from the hollow walls of the combustion chamber, at a temperature of 250 deg. F., is led into the mill, where it dries the fuel, and passes with it into the burner; auxiliary air is fed in outside the burner, and dampers are provided below, but are not used. A secondary air fan is also provided for extra air admission. The air pressure at the inlet of the burner is 2 inches of water, and the draught at the outlet of the boiler about $\frac{3}{8}$ inch.

The mill is of the Fuller-Bonnot type, with a serrated liner half filled with small balls, revolving at 37 r.p.m., and driven by a motor rated at 30 h.p. The construction of the mill is such that coal which has not been reduced to a sufficiently small size automatically returns to the inlet and again passes through the mill. The exhauster fan requires 4-5 h.p. A complete set of pulverising plant is provided for each burner.

The injected air and fuel enter the combustion chamber horizontally, and the flame starts close to the nozzle of the burner; the character of the flame can be controlled by a hollow cone valve.

With this arrangement the boiler has been worked at an evaporation of 33,000 lb. per hour, and a CO_2 content of from 10 to 15 per cent., depending somewhat on the class of coal in use. This simple plant has been at work for two years, with the exception of the mills, which were changed a few months ago. The normal consumption of fuel is about 1.3 tons per hour; the burner can be lighted up in about five minutes, and full steam pressure is attained in $1\frac{1}{4}$ hours with one burner at work. Both burners can, of course, be used to raise steam more quickly. Starting up at 5 a.m. on Monday morning, the boiler usually runs through till Friday night without going off load, and has run for two weeks continuously with every satisfaction.

Coal brought to the works in barges on the canal is carried into the bunkers by suction plant, which has been operated at the rate of 300 tons per day. The same plant can draw the coal from a store on the further side of the canal, or from a wagon tippler. The coal pipe is 6 inches in diameter, and the exhauster is driven by a 50-kW motor.

The burners used on this boiler are of the Buell patent dispersive type, giving a short flame with low velocity; as shown in the cross-section, fig 1, the stream of powdered fuel is opened out by passing over a hollow cone, through which flows a stream of air; the cone can be moved in or out by means of a hand-wheel, to regulate the length and diameter of the flame. The particles of fuel, passing through the conical rings, strike the inside of the conical outer housing and are deflected inwards, mixing thoroughly with the curents of air admitted through the centre pipe, through the air ports round the fuel pipe, in the face of the inner housing, and through the ports between the inner and outer housings. Curtains of air from the secondary air fan are also admitted through pipes inside the outer housing. It is claimed that intimate mixture of fuel and air is obtained; the flame is short and white-hot, yet the burner is kept cool by the air-jets which play upon it: and the flame is under efficient control by means of the hand-wheel.

Soon after the pulverised-fuel plant had been installed an efficiency test was carried out, with coal having a gross calorific value (dry) of 13,270 B.th.u. per lb. The rate of evaporation was 25,633 lb. per hour, and the CO_2 in the flue gases was over 11 per cent. The actual evaporation per lb. of fuel was 8.26 lb. of water, and the fuel consumption per hour per cubic foot of furnace volume was 1.7 lb., generating 20,600 B.th.u. The efficiency of the boiler, based on gross calorific value, was found to be 83.9 per cent., corresponding to an efficiency of about 88 per cent. based on the net value of the fuel.

Although not a large undertaking, the Stretford power station, which contains in addition to reciprocating plant, turbo-generators of 15,250-kW capacity, is run at a high all-round efficiency. The output for the year 1927-8 was 42,025,223 kWh generated, and (with bulk supply) 54,341,792 kWh sold. The maximum total demand was 18,040 kW, and the annual load factor (sold) 34.4 per cent. The average consumption of coal was 2.4 lb. per kWh generated, and the average price obtained per unit was 0.91d. No new generating plant has been installed since March, 1921.

We are indebted to the engineer to the Council, Mr. T. A. Kerr, M.I.E.E., for the opportunity of obtaining particulars of this interesting example of adaptation of a water-tube boiler of standard construction to pulverised-fuel operation.

Lanoline Rust Preventers.

In Special Report No. 12, "Lanoline Rust Preventers," of the Department of Scientific and Industrial Research (Engineering Research) (H.M. Stationery Office, price 1s. net) are described investigations which have been carried out at the National Physical Laboratory, Teddington, under the supervision of the Engineering Co-ordinating Research Board of the Department of Scientific and Industrial Research, following an inquiry by a Government Department for the best material for the preservation of the bright steel parts of stored machinery. In a preliminary investigation a number of representative preservatives, greases, varnishes and bitumen were used, and tests were made on flat plates and cylindrical bars coated with the materials under test by exposing them to the weather, or immersing them in fresh water, sea water, and aerated hot water. In all the tests the hardening varnishes of all kinds cracked after a short exposure and corrosion occurred at the bottom of the cracks, although the intermediate portions of the test pieces remained quite bright. In some cases the cracks were not visible on the surface until after some weeks of exposure, but the depth of corrosion found on the metal indicated that the cracks had been present long before they were visible to the eye. The coatings of grease showed no sign of the formation of cracks in this manner, and such corrosion as occurred consisted of isolated spots or of discoloured patches. The coatings of lanoline grease, applied as grease or deposited from solutions, appeared to be generally superior to those of petroleum grease, and various trials of a crude lanoline grease showed very great adhesion of the grease film to metal. White spirit and solvent naphtha are inexpensive and satisfactory solvents for lanoline preservatives. Lanoline is capable of absorbing a very small quantity of moisture, and for this reason can be applied to metal without previous preparation for removing a trace of moisture, as should be done when applying petroleum grease. Lanoline may be used as a grease applied by means of a rag and should be well rubbed on the surface of the metal. If the lanoline is mixed with about 10 to 15 per cent. of white spirit it adheres to the metal more readily and a thinner coat may be obtained. Croda, Ltd., Rawcliffe Bridge, Goole, Yorks., will send copies of the Report free to interested firms.

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The Printing Exhibition.

Electrical Features of the Exhibits at the Eighth (1929) Show.

THE eighth International Printing and Allied Trades Exhibition was opened at Olympia on April 11th and is to continue to April 25th. As a whole the exhibition emphasises two main points: first, that the electrical equipping of printing plant is the work of the specialist—the amount of electrical equipment about the show is very large and the number of electrical firms represented is very small; secondly, electric driving in the printing industry has won the day practically entirely—it is believed that electric driving is adopted in the case of every working exhibit. Electrical control is becoming more and more necessary in printing machinery. Automatic control is almost general, and speed setting also has become very common; a regulator is set to the required speed to suit the forme and the paper, and thereafter each time the motor is started it will run to the set speed. For rotary presses it is necessary to make provision for speed control from the press itself. In the case of small rotary presses the control panel may be of the solenoid type, but with the addition of a solenoid-operated regulator, instead of the hand-operated regulator provided for a flat-bed press. Larger rotary presses of the two- and three-motor type, and requiring a full range of speed regulation, are controlled by panels of a somewhat similar design, but embodying an auxiliary pilot motor for remote speed control. Auxiliary machinery, such as guillotines, envelope machines, and litho-plate graining machines, which does not require starting and stopping so frequently, is usually controlled by a small panel of the faceplate type.

Among the exhibitors whose attention is directly given to the electrical equipment are Messrs. J. H. Holmes & Co., Ltd., who are showing a model of the Holmes-Clatworthy newspaper press-driving equipment, and also a complete fully automatic controller for operating the actual set. The latter consists of two motors mounted at right angles on a common bedplate. The small motor is used for starting, inching and creeping, and the large motor takes up the load. An example of a new line of motors developed by this firm is being shown. The main feature of these machines is that they employ a standard frame which can be modified so as to convert the motor into the following types: totally enclosed; enclosed ventilated; open protected; pipe ventilated and drip proof. Another interesting machine which is being displayed by Messrs. Holmes is the totally-enclosed, external-fan motor. This type of totally-enclosed motor has been developed to provide machines for duty in situations requiring complete enclosure of the windings and working parts, but at a price very much below that of totally-enclosed motors of the conventional type. The sectional drawing, fig. 1, shows the principle. The motor proper is completely enclosed by the inner casing, which is, it is claimed, dust and weather-proof. The motor frame incorporates an outer casing, and is designed to provide an annular space between the outer and inner casings of the motor; a fan mounted on the spindle blows air through this space between the two outer covers, and over the outside periphery of the stator core plates. The machines have been built to run with

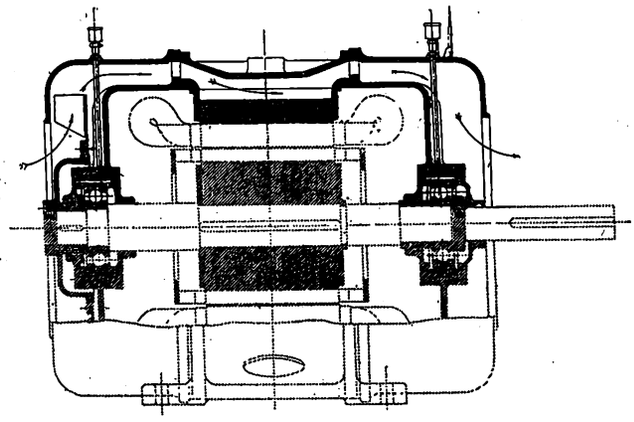

Fig. 1.—Totally-enclosed, Fan-ventilated Motor; Section.

a minimum of attention, and to work in places where there is a damp or dusty atmosphere. The outer end shields are of robust design to withstand rough usage, and are easily detachable for cleaning purposes. Ball or roller bearings are used throughout.

The British Thomson-Houston Co., Ltd., is displaying a number of illustrations and models of electric motors and control equipment for driving rotary and flat-bed printing presses, paper-making machines, auxiliary plant and machinery in printing works and paper mills. The motors are of both the a.c. and d.c. types, for constant and variable speeds on three-phase and direct-current systems, specially designed to meet the varied requirements of the different classes of machinery. A feature of the B.T.H. variable-speed a.c. commutator motor is its use for driving rotary presses, super-calenders, reelers and paper-making machines, particularly wide fast-running machines making newsprint, as it gives an efficient, steady and easily-controlled variable-speed drive with a.c. supply. The speed range is 3 or 4 to 1; any speed within this range is obtained direct by turning a handwheel, or electrically by push-buttons located in convenient positions. The power taken is

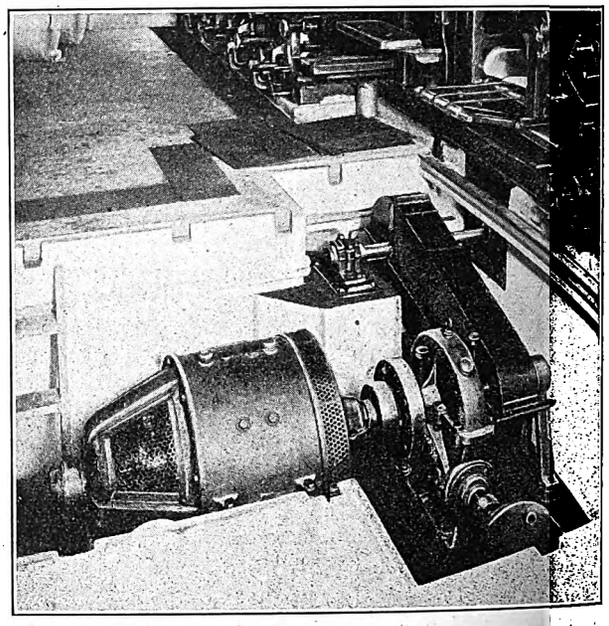

Fig. 2.—Press-driving Equipment; 50-h.p. Driving and 7½-h.p. Barring Motors.

roughly proportional to the speed. Inching and creeping speeds are obtained direct or through the medium of a barring motor according to requirements. The complete driving equipment for a super-calender or reeler consists of a variable-speed a.c. commutator motor for normal operating speeds, an induction motor with worm gear and over-running clutch for driving at feeding-in speeds, and control gear giving simultaneous control of both motors. The advantages include low and very steady feeding-in speeds, acceleration without jerk or shock to the highest operating speed, and economical running at all speeds. These features make B.T.-H. variable-speed a.c. commutator motors specially suitable for driving rotary presses and paper-making machines, using either single-motor drive or sectional drive on the company's patented system, as wastage of paper is cut down to a minimum and increased output obtained in the former case, while increased output of the highest quality paper is obtained in the latter.

Fig. 2 shows the driving equipment at a newspaper office at Burnley. The press is driven by a B.T.-H. 50-h.p. variable-speed d.c. motor, with a 7½-h.p. barring motor with speed-reducing gear. Fig. 3 shows a 4-deck Foster press installed in a newspaper office at Ashton-under-Lyne. The B.T.-H. power unit consists of a 55/18½-h.p., 870/290-r.p.m., a.c., variable-speed commutator motor and a 5-h.p. barring motor with speed-reducing gear. Full-automatic push-button control is fitted.

Messrs. F. Canning & Co., Ltd., have a representative display of plant and apparatus for the deposition of metals as applied to the printing and allied trades, including a new model equipment for the production of electro-deposited copper cylinders. Compared with an exhibit for the same purpose shown at the last Exhibition, the present model is extremely simple and efficient in operation. Also on this stand may be seen a standard electro-typing vat for the production of copper electros, this being an apparatus largely used with which many manufacturers are already familiar. In addition, Messrs. Canning are showing a standard nickel facing vat for the production of nickel-faced stereos. The same apparatus can, of course, be used for the production of nickel electros from lead moulds. It is claimed that the plating increases the life of the stereo by ten times. A large 5,000-A six-volt generator is displayed on this stand, and a standard type of motor-generator is also shown to illustrate the compactness of self-contained electric drives which permit of the electro-typing department being run when other parts of the factory are closed down. Various kinds of brushes for the process block making are shown, together with a range of chemicals and materials specially adapted for the printing trade.

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Electromotors, Ltd., are showing both direct- and alternating-current printing-press motors, with control gear for hand or automatic push-button operation, with pre-set speed determination. It is interesting to note that Electromotors have some 50 or 60 motors driving printing machines on various manufacturers' stands.

S.D. Syndicate, Ltd., has an interesting display of British copper for the process trade, as manufactured by British Insulated Cables, Ltd.

P.I.V. Chain Gears, Ltd., have displayed a comprehensive range of their equipments, demonstrating various applications.

Several electrically-heated type- and metal-melting furnaces are to be seen scattered about the Exhibition, including interesting examples of electro-Funditor heaters on the stands of Fry's Metal Foundries, Ltd., and Funditor, Ltd. The electro Funditor is made in models for every kind of composing and casting machine, for linotype, intertype, and so on, and is equally suitable for either a.c. or d.c. The regulating box automatically controls the heat precisely, maintaining the temperature at the mouthpiece, it is claimed, absolutely constant. There is adjustment for five different temperatures. The Funditor is mounted inside the existing metal pot, and a neat switch-box is mounted on the composing machine itself. The elements are claimed to have an unusually long life.

A.S.E.A. Electric, Ltd., has a very interesting display designed primarily to stress the advantages of the 3-phase a.c. variable-speed commutator motor for use in the printing trades. A 4 to 1 speed variation is obtained by movement of the brushes over the commutator, and the power output is approximately proportional to the speed. The efficiency, it is claimed, is not impaired and the p.f. is high. There are, of course, no resistances used in the control of the motor. On the stand is a 5-h.p. motor driving a Miehle 4-roller press, showing the push-button control and the regulation of the brushes remotely from one point. There is also on this stand a complete web-press driving equipment of the two-motor type. The inching and creeping motor is of 26-h.p., and drives through worm gearing and an over-running clutch to the main driving shaft. The main motor is of the 3-phase variable-speed commutator type of 125 h.p. The speed variation is 4-1 and the maximum speed is 750 r.p.m. Remote push-button control is provided. The control panel is of interest; it is specially constructed on the steel-and-mica principle and runs on wheels.

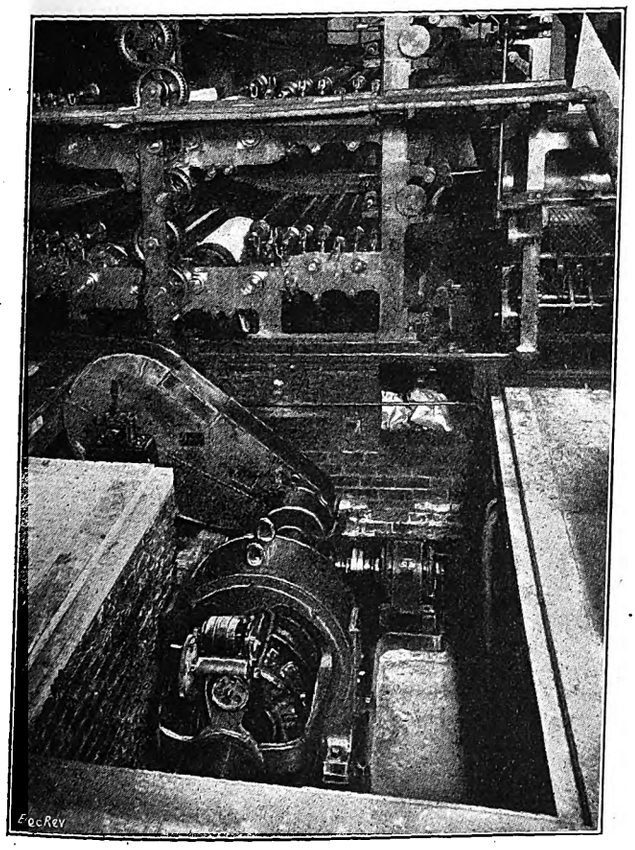

Fig. 3.—Drive for 4-deck Foster Press; 55/18½-h.p. Driving and 5-h.p. Barring Motors.

An example of the "Century" 3-phase commutator motor is on show. This has two entirely separate windings and in the same rotor. The machine has, it is claimed, slip-ring starting characteristics and s.c. running characteristics.

The outstanding feature of the exhibits by Meech Electric Drives, Ltd., is the M.E.D. variable spur gear which is designed to overcome the inherent disadvantages of the existing methods of speed variation in consequence of a.c. supply, and it is claimed that, used in conjunction with a standard high-efficiency a.c. constant-speed motor, the apparatus will give the same flexibility as is at present obtainable with the variable-speed d.c. motor. Practically any desired speed ratio can be arranged, and a true positive drive is produced at all speeds. The gear is of cone formation, and comprises a number of gears of different diameters set up on a countershaft, in close proximity to each other, and married together by dogs. The whole train of gears has the appearance of a solid mass, but in operation each gear has an entirely independent action of its own, and has free movement until it takes up its load, when it is immediately held solid by the dogs of the gears on both sides of it. On the main shaft is mounted a

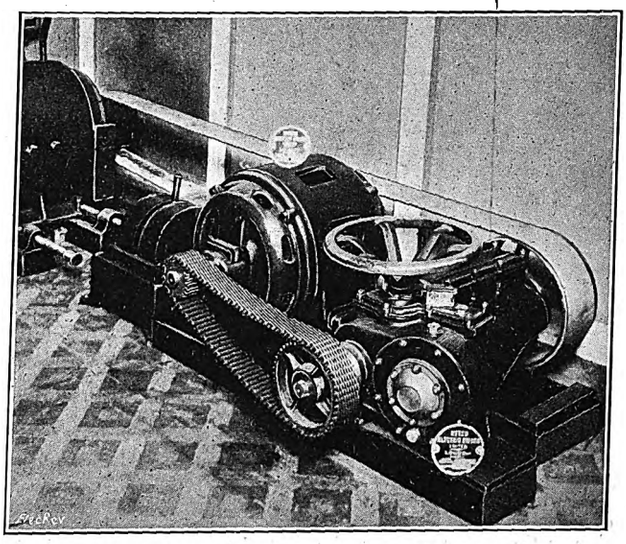

Fig. 4.—M.E.D. Variable-speed Equipment.

driving pinion, mounted on balls. This pinion is so constructed that it can slightly deflect from the perpendicular of the side of the frustrum of the cone wheels while driving, and make perfect line contact along the whole frustrum of the cone, or train of gears of uniform varying diameters. Normally, speed changes are made while the machine is in motion by turning a hand-wheel fitted to the gear box. When more convenient, a small push-button station with "raise" and "lower" buttons can be mounted on the machine. In that case the attendant merely presses one of the buttons until the desired speed is reached, and a device can be incorporated to automatically return the gear to the low-speed position each time the motor is stopped. The following claims are made for the M.E.D. equipment: provides any required number of speeds, neutral and reverse; simplicity in operation; silent and instantaneous; no chains and friction; few parts; freedom from clashing and shocks; robust construction; high efficiency; foolproof. Fig. 4 shows a M.E.D. variable-speed gear working in conjunction with a standard squirrel-cage motor. On this stand are also shown examples of the makers' low-speed electrical power units and d.c. and a.c. motors, wound rotors fitted with slip rings, s.c. and special high-torque rotors.

Messrs. Witton-James, Ltd., are exhibiting a representative line of electric power plant and switch control apparatus for use on a.c. or d.c. services for the newspaper office and jobbing press plant. The company has on view a 40-h.p. d.c. two-motor-type standard variable-speed web press driving equipment, with full automatic push-button control, incorporating a number of recent developments of considerable interest, the combination interlocked with: one magazine reel stand and control gear-operating motors and selector switches; a 60-h.p. variable-speed a.c. web press driving plant with a commutator-type main motor and a fully-automatic control system; a d.c. matrix mangle driving equipment with automatic control; a 3-h.p. d.c. reel hoist outfit with automatic control, underwind and overwind geared limit switch; a single-cylinder unit brake with automatic control system; and a web-break automatic cut-off and stop-press device.

The exhibit of Brookhirst Switchgear, Ltd., comprises representative switchgear panels for the control of motors driving various classes of printing and allied machinery. In addition to the exhibit proper, some 45 Brookhirst panels are to be seen controlling presses in other parts of the Exhibition. Perhaps the most interesting design from the electrical point of view is the "Junior" solenoid type, in which the wedge-type automatic starter eliminates the sliding-face contact and substitutes a contact of the combined butt and sliding type. The fixed contacts of the starter consist of spring-controlled self-adjusting carbon blocks carried in suitable holders. The design secures, it is claimed, immunity from serious burning of the fixed contacts and of the short-circuiting contact bar, due to the fact that the initial connection on each step is established on the "full-face" and not at the edge of the carbon block. The controlling mechanism for the starter takes the form of an eddy-current retarder—a device which possesses the ideal characteristic of proportioning the starting period in accordance with the starting load. The time of starting is proportional to the load on the motor, which latter accelerates rapidly under light loads and slowly under heavier loads. Through

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the provision of a one-way clutch, retardation is not applied during the downward movement of the solenoid core, which is thus free to fall to "off" immediately the solenoid is de-energised. In addition to the inherent automatic braking

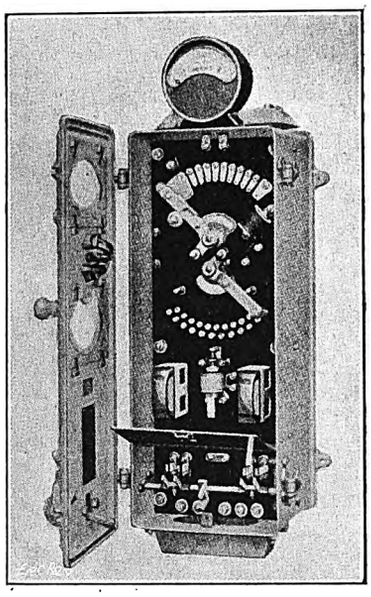

Fig. 5.—Hand-operated Press Control Panel.

effect, the speed of travel of the solenoid is variable by means of an adjustment of the poles of the electro-magnet. In addition to the starter proper, the control gear comprises a single-pole inching contactor, double-pole "safety first" isolator and a speed regulator complete with accelerator. This type of panel is controlled by start, inch and stop push buttons at the operating position. The panel is reasonably compact, having been specially designed for printing service, and particularly for flat-bed presses.

Examples are to be seen controlling "Perfector" and Miehle presses on the stand of Linotype & Machinery, Ltd., controlling offset presses on the stand of Waite & Saville, controlling a Miehle press on the stand of H.T.B., Ltd., and so on. A special adaptation of this type of gear is employed for controlling the four-roller two-revolution press and the No. 70 cutter and creaser on the stand of the Miehle Printing Press & Manufacturing Co., Ltd. In these cases, in addition to the switchgear already detailed, the control panel includes a small starter, also push-button operated, for the feeder motor. The control station on the press consists of five push buttons—start, inch, stop, feeder on, and feeder off.

For the "Mann" offset machine, the control panel is usually of the hand-operated type, fig. 5, and consisting of a hand-operated faceplate starter, hand-operated regulator, and main switch with fuses. This type of control gear does not involve so many points of technical interest, but attention must be drawn to the fact that the main switch acts also as an isolator, thus making it very difficult to expose "live" parts. A number of such control panels are in use on the stands of George Mann & Co., Ltd., and John & Wm. Burt & Sons, Ltd. For the platen press on the stand of John Haddon and Co., a similar type of control panel is employed, but without a speed regulator. Similar hand-operated control panels—again without speed-regulation facilities—are also employed for auxiliary machinery such as guillotines, box-making machinery, and the like. Examples of corner staying machines so controlled are to be seen on the stand of M. C. Ritchie, Ltd.

Larger control panels—both hand-operated and automatically controlled by push buttons—are shown on the Brookhirst stand, as well as parallel designs for the a.c. drives. Photographs of equipments for small and large rotary presses are also on view, and altogether the exhibit constitutes a very effective proof of the extent to which the company's gear of a specialised type has been developed for practically every type of drive in the printing and allied trades.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Budget.

On Monday last Mr. Winston Churchill, Chancellor of the Exchequer, opened his Budget for the ensuing year before the House of Commons. In the course of his speech he maintained that during the last five years the country had made a steady advance. Unemployment could not be reduced to normal proportions by the mere spending of large sums of borrowed money. In the Government's view this could only be done by the revival of industry as a whole, and especially by the revival of the basic industries. Referring to the de-rating scheme, he said that it was proposed to apply the relief at once to the agricultural industry. Income tax and super-tax would remain unchanged. The whole of the tea duty would be remitted, and certain concessions would be made in motor vehicle duties. The Chancellor, however, introduced a proviso that in future vehicles would only be considered electric vehicles for the purpose of the duty if the electrical motive power was derived from a source external to the vehicle or from a storage battery not connected with any source of power while the vehicle was in motion. After dealing with certain changes in betting and licensing taxation, the Chancellor proceeded to announce concessions with regard to the telephone service. It was proposed to extend from 1½ to 2 miles the radius from the nearest exchange within which a telephone is provided without extra mileage charge, and to provide call offices without charge or guarantee at about five-sixths of the rural post offices and railway stations not already equipped.

Ultra-Violet Trades Association.

We are informed that, as a result of a recent meeting, a body has been constituted under the title of the "Ultra-Violet and Allied Trades Association," consisting of a number of the leading firms engaged in the design, manufacture and marketing of ultra-violet, physic-therapy, and other electro-medical apparatus in this country. The Secretary of the Association is Mr. C. Rodgers, O.B.E., B.Sc., M.I.E.E., and the offices are situated at Kern House, 36, Kingsway, London, W.C.2. The objects of the Association are:—

(*a*) To promote a closer co-operation between manufacturers with a view to improvements in apparatus;
(*b*) To provide a medium through which the manufacturers may be taken into consultation by the profession on points affecting their mutual interests; and
(*c*) To form a clearing house for information on all points affecting the technical and constructional aspects of electro-therapy, and to foster the development of this important branch of medical science.

The Association feels that it can render much useful service to the profession, and any comments or suggestions will be welcomed.

British and American Aluminium Prices.

The Federal Trade Commission was informed last week that the British aluminium industry, by underselling American manufacturers of aluminium, has made large inroads into the business of American producers. An official of a large manufacturing company of Sidney, Ohio, gave evidence that his company for several years had bought its supply of aluminium from British concerns, although ten years or more ago the Aluminium Company of America had supplied the metal. He added that the British metal was more satisfactory for the manufacture of thin aluminium ware.—*Reuter* (Pittsburgh).

Large Russian Orders.

According to a Moscow report dated April 8th, the foreign orders for the first instalment of the projected great hydro-electric works on the River Dnieper, which is now in course of construction, have just been placed. Although international tenders were invited from, among others, German firms, none of the large orders has been allocated to the latter. A contract for steelwork has been awarded to the Wittkowitz Iron-works, Czecho-Slovakia; the generators are to be supplied by the General Electric Co. (United States) within the limits of the five years' credit scheme, and the turbines by the American Newport News Co. The management of the Dnieper undertaking is in the hands of the Russian engineer M. Winter, who has the technical assistance of Mr. Cooper, an American

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engineer, and of the German Siemens Bau-Union. Before the allotment of the orders the managers of the undertaking paid visits to Germany, Sweden, Switzerland, and America. It is stated that the German share in the technical assistance has not had any effect in the placing of orders in Germany, while the expectations of the Siemens Bau-Union, through the establishment of an office in Moscow for giving technical aid, have also been unfulfilled because, as a German report says, in the allotment of orders apparently other considerations than economics frequently play a part.

Book Notices.

"The South African Mining and Engineering Year Book and Directory, 1929." (Pp. 628, illustrated.) London: Argus South African Newspapers, Ltd. Price £1 1s.—This edition of the year book has been brought up to date and, as usual, contains a number of sections likely to be of interest and use to electrical exporters who do, or desire to do, business with South Africa. We may especially mention the list of mining, municipal, railway and industrial buyers, with the names of the concerns for which they purchase, and the list of mining and industrial companies. There is again an electrical section, occupying 18 pages, in which new power station installations are described, the progress of automatic telephony is dealt with, and a table giving particulars of the public electricity supply undertakings is included.

"The *Journal* of the Royal Technical College, Glasgow." Vol. 2, Part 1, January, 1929, pp. 155; illustrated. Price 10s. 6d.—It has been decided that the first four issues (1924-27) shall constitute Volume 1 of the *Journal*, and that the fifth issue, which is dated January, 1929, instead of December, 1928, shall be designated Volume 2, Part 1. This part contains the abstract of a paper by Mr. M. G. Say, Ph.D., on the "Design of High-voltage Condenser-type Insulator Bushings."

"Relay Automatic Telephones." Pp. 31; figs. 14. London: Relay Automatic Telephone Co., Ltd.—A well-illustrated brochure descriptive of the company's public exchange system, including full details of the automatic network recently completed in Moravska-Ostrava, an important industrial centre of Czecho-Slovakia.

"The Post Office Engineers' *Journal*." Vol. XXII. Part I. April, 1929. London: Electrical Review, Ltd. Price 1s. 3d. net.

"Sir Joseph Wilson Swan, F.R.S.: A Memoir by M. E. S. and K. R. S." Pp. 183; illustrated. London: Ernest Benn. Ltd. Price 7s. 6d. net.

"Electric Wiring Theory and Practice," by W. S. Ibbetson. Third edition. Pp. viii+424; figs. 208. London: E. & F. N. Spon, Ltd. Price 7s. 6d.

Australian Investigators Entertained.

The members of the British Economic Mission who recently returned from Australia were welcomed home at a dinner given by the High Commissioner for Australia (Sir Granville Ryrie) at Australia House, London. Sir Arthur Duckham, the leader of the Mission, was prevented by illness from attending, and the Prime Minister, who had been invited, was also unable to be present. Responding to the health of the Commissioners present, Sir Hugo Hirst referred to the way in which any advantage likely to accrue from tariff increases was swallowed up by wage increases. The Mission had succeeded in persuading the employers and employed to meet and discuss their differences. He emphasised the fact that Australia could not solve her problems unaided. It was necessary to treat them as Empire matters and to secure the aid of our most prominent scientists, engineers, financiers, and industrialists in finding solutions.

Price Increase.

The Benjamin Electric, Ltd., announces that, owing to the increased cost of raw materials, it is compelled to advance the prices of certain "Benjamin" electric light fittings by 5 per cent. as from April 15th, 1929. We understand that this increase has been applied by other manufacturers.

Trade Papers Amalgamate.

The amalgamation will take place as from May 1st of "The Engineer," Ltd., proprietors of our contemporary, *The Engineer*, and Morgan Bros. (Publishers), Ltd., proprietors of the *Ironmonger* and *The Chemist and Druggist*. The new company to be incorporated for effecting the amalgamation will be known as Morgan Bros. (Publishers), Ltd., will have a capital of £500,000, and its registered offices will be at 42, Cannon Street, E.C. The publishing offices of all the journals will remain unchanged for the present, and the policy that each has established over a very lengthy period will be maintained.

Electricity in Betting.

As electricity has penetrated practically every sphere of human activity, it is not surprising that it should find applications in the field of sport. The "electric hare" has had a considerable vogue, but the latest departure, and an innovation so far as this country is concerned, is the electrically-operated totalisator. Among the contracts placed recently for totalisator equipment by the Racecourse Betting Control Board is one for electrically-operated machines awarded to Graham Amplion, Ltd. It is strange that loud-speaker manufacturers should be a means of displacing the too-vocal bookmakers.

Proposed American Cable-Wireless Merger.

The proposed amalgamation of the Radio Corporation of America's subsidiary, Communications Incorporated, with the International Telephone and Telegraph Company, is prohibited under the last radio law. The proposed merger, which is the outcome of the present policy of the American wireless and cable companies of combining against the British cable and wireless merger, was announced several weeks ago. —*Reuter* (Washington).

The C.M.A. Football Cup Final.

The final tie for the Cable Makers' Association Football Cup will be contested on Saturday next (April 20th) at the Woolwich Stadium, Woolwich Common, between teams representing the Anchor Cable Co., Ltd., of Leigh (Lancs.), and Standard Telephones and Cables, Ltd., of London. The time for the "kick-off" is 3.30 p.m., and admission to the match will be free. Callender's Cable Works Band will provide music. This is the first appearance of the London team in the final round, and as the Lancashire team are past holders (winning the cup in 1927), a keen contest is anticipated. This competition was founded in 1924 to provide additional opportunities for the employés of the cable-making industry to meet together socially, and to promote a friendly sporting rivalry between them. At the conclusion of the match, the fifth annual dinner will be held at 6.30 p.m. at the "Welcome Inn," Well Hall Road, S.E.9.

Radio Trade Meetings.

The annual meeting of the Radio Wholesalers' Federation was held at the Connaught Rooms, London, on April 10th, Mr. E. W. Houghton (the chairman) presiding. In moving the adoption of the report, the chairman said that the membership was already practically 50; the number might well have been doubled had not the Council paid strict regard to the principles upon which the Federation was founded. Applicants had to have clean sheets in respect of price-cutting, and their retail business (if any) had to represent an extremely limited proportion of their turnover and be quite separate. The whole future of the Federation depended upon the maintenance of those standards by the members. The list of approved wholesalers which the Council was preparing would no doubt be welcomed by many manufacturers who desired to deal equitably with the distributing trade. In referring to negotiations with the Radio Manufacturers' Association, the chairman said that relations were somewhat hampered by their inability to deal with the R.M.A. as a body on certain questions. In a subsequent discussion a member urged that the Radio Exhibition should be held on a more suitable date from the trade point of view, or, in the alternative, that a preliminary trade show should be held in May or June. Another member suggested that there should be a trade day at the Exhibition. Attention was called to the fact that valves were still being sold at "cut" prices, and it was suggested that they should be marked in such a way as to leave no doubt of the source from which they emanated. After the adoption of the report, there was a ballot to fill three places on the Council. As a result the following were elected:—Mr. E. H. Burris (F. Burris & Sons, Bristol), Mr. E. U. Redway (Southern Motor Factors, Ltd.), and Mr. J. W. Riddiough (F. Riddiough & Son, Bradford). Mr. A. G. Beaver initiated a discussion upon methods of investigating the status of retail applicants for trade terms. He suggested that a form bearing the imprint of the Federation and universally adopted would be the most suitable arrangement. The chairman asked members to send in copies of the forms which they used and a description of their methods so that the best possible form could be evolved.

On the same day the annual meeting of the Wireless Retailers' Association was held at St. Bride's Institute, E.C.4. Mr. F. S. Horsey (chairman) presided, and in submitting the annual report said that in the last six months the membership had about doubled. The elimination of "dabbling" and the granting of discounts to unauthorised persons was a difficult matter. A prime essential was the combination of all reputable wholesalers in one body, and he was glad to say that the Radio Wholesalers' Federation had been formed and was working in co-operation with the Association. This was bound to have far-reaching consequences to the trade. Many new branches of the Association had been formed and several existing bodies had become affiliated.

Cable Manufacturing in Poland.

The Polish branch of the Skoda Works Co., of Pilsen, Czecho-Slovakia, established some three years ago for the construction of electric motors and motor vehicles, has lately opened a section for the manufacture of telephone cables at Okenicio, near Warsaw, Poland now possesses three cable factories, the others being at Bydgoscz and Cracow.

New Italian Companies.

Among the companies recently formed in Italy are the Società Italiana Diffusione Applicazione Elettrodomestiche, Turin, capital 100,000 lire; La Società Elettrovie Romagnole, Bologna, capital 5,000,000 lire; and La Compagnia Forni Elettrici Automatici, Milan, to manufacture electric furnaces.

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A Polish Travelling Exhibition.

The Polish Association of Central Electricity Stations has recently dispatched on a tour of the country a travelling exhibition of electrical appliances for domestic and small industrial use with the idea of making their advantages better known to the general public.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during February last amounted to £30,886, bringing up the total for the first two months of the year to £71,690, as compared with £81,362 in the corresponding period of 1928.

Bankruptcy Proceedings.

J. Harrison, 144, St. Mary's Road, Prittlewell, Essex, dealer in electrical fittings.—The receiving order herein was made on March 14th on the debtor's own petition, and according to the statement of affairs there are liabilities of £1,393, against assets amounting to £23, leaving a deficiency of £1,370. The debtor attributed his failure to depreciation of shares in a limited company, liability under a judgment for a partnership debt, and law costs. He commenced trading in partnership in September, 1924, providing stock estimated at £300, purchased with moneys lent him by his wife, which amount is still owing. His partner provided £300 in cash. In 1925 a limited company was formed with a nominal capital of £600. The debtor was allotted 300 £1 shares in consideration for his interest, and was appointed a director of the company. As a result of the general strike in 1926, the company lost the greater part of its business, and in March, 1927, discontinued trading. He and his former partner afterwards carried on business at the debtor's present address until March, 1928, when the partner withdrew from the business. In March, 1926, the debtor and his former partner entered into a temporary agreement with another in connection with the sale of electric lamps, &c., on a profit-sharing basis, but illness prevented his carrying out the terms of the agreement, with the result that judgment was obtained against him and his former partner for the return of £50 which had been provided by the third party. The debtor had not kept any books of account, and states that he became aware of his position in August, 1926.

E. F. Lee, electrical engineer, 340a, King's Road, Chelsea.—The public examination of this debtor was held at the London Bankruptcy Court on April 12th before Mr. Registrar Francke, the accounts showing liabilities of £385 against assets valued at £106. Replying to the Official Receiver, debtor said that after having served approximately ten years in the army, he resigned, receiving a gratuity of £1,000. He started business in partnership under the style of "Francis Mewton," and provided £700 as capital. The trading from its inception was unsuccessful, and his partner retired in July last, receiving £27 for his interest. Witness attributed his failure and insolvency to bad trade, heavy overhead expenses, and bad debts. The examination was concluded.

T. C. Wheeler, 6, South Scarborough Street, lately 30, Stockton Street, West Hartlepool, electrician.—The public examination herein was to have been held on April 11th at the Court House, Stockton-on-Tees, but the debtor did not attend. It was stated that there was a deficiency of £139, and that the debtor attributed his failure to his earnings not having been sufficient to maintain his family, and having to pay heavy interest on loans. The examination was adjourned.

S. W. Richards, radio engineer and electrical contractor, Blackwood Radio and Electrical Supply Depôt, High Street, Blackwood, Mon.—Receiving order made April 3rd, on debtor's own petition. First meeting April 19th, at 34, Park Place, Cardiff. Public examination, May 23rd, at the Town Hall, Tredegar.

C. K. Wallis, electrical engineer, Bedford Street and Longford Road, Bognor, Sussex.—Supplemental dividend of 3s. 8d. in the £, payable at the Official Receiver's office, 12a, Marlborough Place, Brighton.

B. Smith (H. Worton), electrical engineer, The Crescent, Spalding.—Trustee, Mr. C. E. Turton, 4 and 6, West Street, Boston. Appointed April 9th.

M. Kelly, radio apparatus dealer, 12, Jackson's Row, Manchester.—Trustee, Mr. J. F. Warburton, 28, Queen Street, Manchester, released, January 16th.

H. B. Powell, wireless dealer, 10, Union Street, Hereford.—Last day for proofs for dividend, April 26th. Trustee, Mr. O. B. Wallis, Official Receiver, 133, St. Owen Street, Hereford.

R. Yeend (Central Electrical Works), electrician, 57, West Street, Wisbech, and Red Lion Street, Spalding.—Last day for proofs for dividend, April 26th. Trustee, Mr. F. H. Langmaid, Official Receiver, 41, Sidney Street, Cambridge.

Company Liquidations.

W. J. Hilland & Co., Ltd., 9, Linenhall Street, Belfast, electric lamp factors, &c.—The creditors in this matter met recently in Belfast, when a statement of affairs was submitted which showed ranking liabilities of £2,875 and net assets of £357, leaving a deficiency of £2,518. The company was registered in May, 1928, when it took over an existing business. Debentures amounting to £1,500 were created, but £1,300 had been paid off. No offer was submitted to the creditors, and it was decided that the voluntary liquidation of the company should be continued. The following are creditors:—

	£		£
International Lamp Co., Ltd.	111	Central Sewing Machine Co.	52
Chloride Electrical Storage Co., Ltd.	78	Harper & Pettigrew ...	50
Bae & Rempel	66	Lees, Hyman & Lees ...	43
		Adler Machine Co. ...	40

Helikon Wireless Co., Ltd., 6, Park Royal, North Acton, Middlesex.—The winding-up order herein was made recently, and according to the statement of affairs filed, there are liabilities amounting to £1,187 against assets of £23. The first meeting of creditors was held recently at 29, Russell Square, W.C.1. The following are creditors:—

	£		£
J. M. Naylor ...	1,061	Nox Electrical Lamp Works	36
Van Heteran & Co. ...	23		

Oxford Wireless Telephony Co., Ltd.—Winding up voluntarily. Liquidator, Mr. E. R. White, 55, Cornmarket Street, Oxford. A meeting of creditors was to be held on April 18th, at the office of the liquidator.

Handcross Electricity Co., Ltd.—A meeting of members is called for May 13th at The Market Hall, Redhill, to hear an account of the winding up from the liquidator, Mr. A. R. Thompson.

Private Arrangements.

S. K. Y. Cochran, wireless dealer, trading as the Popular Wireless Stores, 26, Moorfields, and 3, Byrom Street, Liverpool. A meeting of creditors was held on April 5th at the offices of Mr. P. S. Booth, 2, Bixteth Street, Liverpool, when the representative of the Chorlton Metal Co. was elected to the chair. The statement of affairs submitted showed ranking liabilities of £894, and net assets of £180, leaving a deficiency of £714. Mr. Booth reported that the debtor commenced trading with a capital of £350, the whole of which was borrowed, and was still owing. The business was satisfactory, and in February last he opened a branch shop. The takings at the original establishment had ranged from £50 to £60 a week, and the takings at the branch shop from £5 to £6 a week. The debtor's drawings had been at the rate of £6 a week. A resolution was passed confirming a deed of assignment already executed to Mr. Booth, and a committee of three of the creditors was appointed. It was also decided that the debtor should be given 14 days in which to submit an offer of a composition. The following are creditors:—

	£		£
Humphrey Bros.	26	Accumulators Elite ...	29
Hewitt & Co.	23	Charlton Metal Co. ...	104
Lever, E. T., (Trix), Ltd.	60	Cossor, A. C., Ltd. ...	29
Luhtenberg & Jones, Ltd.	26	Victor, T., Ltd.	23

Dissolutions of Partnership.

Bentley-Hunt & Vanstone, electrical and radio engineers, 4, Wood Street, Bath.—Mr. J. E. Bentley-Hunt and Mr. C. P. Vanstone have dissolved partnership. Mr. Bentley-Hunt will attend to debts and continue the business, but not under the same firm name.

H. G. Westlake, electrical and wireless engineer, 16, Fountain Street, Halifax.—Mr. H. G. Westlake and Mr. A. S. Waterton have dissolved partnership. Mr. Waterton will attend to debts and continue the business under the same style.

Aldrich & Butland, electrical engineers, 6, Castle Street, Ruthin.—Messrs. E. G. & D. A. Aldrich and R. E. Butland have dissolved partnership.

Henley's Staff Dinner.

On Saturday evening last the staffs of W. T. Henley's Telegraph Works Co., Ltd., and Henley's Tyre and Rubber Co., Ltd., met at dinner at the Great Central Hotel, Marylebone, N.W. Mr. Percy Rosling presided over a record attendance—about 500—from all departments of the companies. After the loyal toast, Mr. W. G. Smale (secretary of the Tyre Co.) proposed the toast of "The Cable Company." He briefly reviewed the progress which he had seen the company make during his service over a period of 30 years, and said that after a bad period the Tyre Co. was forging ahead.

In responding, Mr. Rosling said that his association with the company went back 42 years, when the staff was fewer than a dozen; to-day it numbered over a thousand. He pointed out that the interests of the board, the management, the staff, and the workpeople were all bound up together. The secret of success was to give a little more than one was expected to give. He wondered what the position of the company would be in 42 years' time, and said that the chair would then most probably be occupied by one of the young men present—or even one of the young women.

Sir George Sutton (chairman of the company) said that he had been able to come at the last moment. The company had entered upon its 50th year, although the business had existed in one form or another for upwards of a hundred

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years. He and Mr. W. J. Potter were the only original members now living; he regretted that ill-health prevented Mr. Potter from attending; they wished him a speedy recovery, for he was a man beloved by all at Henley's. He thought that the company's past was a guarantee of its future success. An important factor in its advance had been its system of humanised labour.

Mr. W. F. Bishop proposed the toast of "The Tyre Company," and in a humorous manner dealt with "Tyres and the Ordinary User." He said that the company had pulled through its bad times, and he hoped that its prosperity and progress would continue. Mr. J. Traxler replied to the toast, stating that 1928 had been a record year for the company, while the business so far this year pointed to even better results.

The remaining toasts were "The Ladies," proposed by Sir Montague Hughman and replied to by Mr. P. Dunsheath; and "The Chairman," proposed by Mr. E. Lefeaux.

Musical and vocal items were interspersed with the toasts, and after dinner there was a most enjoyable dance in the Winter Garden of the hotel.

Works Visit.

A visit to the works of the London Electric Firm, Croydon, was recently made by members of the Regent Street Polytechnic Engineering Society. The visitors were shown details of what the company claims to be the largest searchlights in the world, which have three separate methods of control, namely, hand local control, pan-handle control, and electric distance control. They also inspected the mobile combined beacon floodlight for aerodromes, as used at Croydon.

Income Tax on Hire-Purchase Transactions.

After 25 years of negotiation with the Income Tax Commissioners, the Hire Traders' Protection Association has obtained their approval of a new form of assessment which it is claimed will be of great advantage to the trade. The H.T.F.A. have engaged the Holborn Hall, Gray's Inn Road, W.C., for a meeting on April 24th, at 3 p.m., of hire traders, at which the new arrangements will be fully explained, and opportunities will be given for the clearing up of doubts and, if time permits, other questions of interest to hire trading will be discussed. Tickets can be obtained from Mr. S. J. Sewell, secretary of the Association, 27, Chancery Lane, W.C.2.

Electrically-heated Gold-blocking Machines.

For several years past the Ray Manufacturing Co., 25b, High Street, Wimbledon, S.W.19, has been engaged in commercial experiments in the conversion of gas-heated gold-blocking machines to electricity to procure flexibility of temperature control and eliminate noxious fumes. The firm has sent us a sample of its work in the form of a small leather fuse-wire case. This demonstrates the success of the process, there being no sign of burning or other defects common when gas is employed for the purpose.

New Catalogues and Lists.

X-Rays, Ltd., 47, Red Lion Square, W.C.1.—A very full descriptive brochure of the company's electro-medical apparatus, including X-ray couches, tubes and stands, quartz lamps, X-ray photographic apparatus, &c. Illustrated.

Messrs. G. Dikkers & Co. (England), Ltd., Avenue Chambers, Southampton Row, W.C.1.—Three illustrated leaflets, advertising, respectively, the company's portable h.p. testing transformer sets; induction regulators and phase shifters; and reactors.

The Benjamin Electric, Ltd., Tariff Road, Tottenham, N.17.—The "Benjamin Reflector" for March-April, dealing with the lighting of tobacco factories.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—April calendar-blotter, advertising the Jackson "No. 46" electric cooking cabinet.

The A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—April stock list of electrical machinery and appliances. Priced.

Mr. H. C. Slingsby, 97, Kingsway, W.C.2.—List No. 366, containing illustrations and details of trucks, lifting apparatus, ladders, &c.

Messrs. George Cohen, Sons & Co., Ltd., Park Royal Road, North Acton, W.10.—An illustrated catalogue of drilling machines, lathes, milling machines, grinders and other machine tools of all makes.

Messrs. Adam Hilger, Ltd., 24, Rochester Place, N.W.1.—Illustrated brochures dealing with Prof. Coker's photo-elastic apparatus for determining the distribution of stress in structural and machine members, and lateral extensometer and recording device.

Mr. J. Martin Blair, Audrey House, Ely Place, E.C.1.—A booklet dealing in some detail with the design and employment of the "Ramie" ceiling rose and the "Isola" safety connector. Illustrated and priced.

Messrs. John Shaw & Sons (Wolverhampton), Ltd.—An illustrated circular setting forth details of the company's special selling scheme in connection with "Trojan" electric vacuum cleaners, including a hire-purchase arrangement.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—A neat illustrated pamphlet containing reduced prices of "Argenta" opal lamps and a sheet announcing other reductions.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—A net trade price list (No. 20) of "C.M.A." and "Nonazo" cables, wires and flexibles.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, E.C.4.—Leaflet No. 251, arranged for overprinting, containing the reduced prices of the company's "Pearl" and "Silvalux" lamps.

Messrs. Long & Crawford, Ltd., 2, Gorton Road, West Gorton, Manchester.—Catalogue Section F, containing illustrated information regarding the company's self-isolating oil-immersed switch-fuses.

Messrs. Lane & Girvan, Ltd., Caledonia Stove and Electrical Works, Bonnybridge, Glasgow.—A first electrical list (No. 429), containing illustrated particulars and prices of "Caledonia" electric cookers, breakfast cookers, boiling plates and bowl fires, the first of a range of domestic and commercial appliances.

The Electric Heating Co., George Street, Croydon.—Priced and illustrated pamphlets advertising "Elect" fires, egg boilers, coffee percolators and soldering irons.

Messrs. C. A. Vandervell & Co., Ltd., Acton, W.3.—A wall chart of replacement batteries for all makes of British and foreign vehicles.

The Fuller Accumulator Co. (1926), Ltd., Woodland Works, Chadwell Heath, Essex.—List No. 103, containing full details, illustrations and prices of "Sparta" batteries for automobile lighting, starting and ignition.

Glareless Electric Lamps.

The recent reductions in the prices of "Pearl" electric lamps were designed to encourage the use of this glareless lamp in preference to the clear-glass type, and in pursuance of this policy the Lighting Service Bureau has arranged for lectures on the advantages of glareless lamps to be delivered in the principal centres of the country by Messrs. W. J. Jones and H. E. Hughes.

The advantages of "Pearl" lamps from the retailer's point of view are set out in a pamphlet which the Electric Lamp Manufacturers' Association has circulated. Briefly, these are: A smaller range permitting some degree of standardisation and reduced stocks; higher profit; and protection in competition with non-Association lamps. Standardisation is further encouraged by the extra reduction in the prices of 230-V lamps.

The Leipzig Spring Fair.

In the review of the above-named Fair in our April 6th issue our correspondent mentioned "Tenazit." The word should have been "Tenacit," which is the name of the whole range of synthetic and mineral moulding compounds manufactured by the A.E.G.

Recent Contracts.

A sign of the progress of Sheffield industry towards recovery may be discerned in the new electric power station to be built at Blackburn Meadows, which will eventually supersede the war-time emergency station in the same locality and the older Neepsend Station. The new power station is one of the "selected" stations under the 1926 Electricity Act, and will form part of the Mid-East England scheme which has recently been adopted by the Central Electricity Board. An order for the first generating unit, amounting to nearly £100,000, has been placed with the English Electric Co., Ltd., who will manufacture the 35,000-h.p. multi-cylinder steam turbine at its Rugby works and the electric generator at Preston. The generator will have an output of 25,000 kW, and will run at 3,000 r.p.m. The condensing plant is included in the contract, and an "English Electric" shunting locomotive is also being supplied for the haulage of coal, ashes, &c.

The 66,000-V switchgear recently ordered from the British Thomson-Houston Co., Ltd., by the Central Electricity Board for the South-East Electricity Scheme is required in connection with the inner London network of the national "Grid." The switchgear is of the "indoor-outdoor" type, and each oil-immersed circuit breaker is rated at 600 A, with a rupturing capacity of 1,500,000 kVA. The buildings housing the switchgear have three floors, the two upper being glazed and provided with access facilities at each end, the lower being unenclosed but having a retaining wall from end to end. The circuit-breakers are located on either side of this wall, the busbars and busbar isolating switches being in the two enclosed floors above. All busbars are in duplicate on each site. Oil-filled bushings of special construction are used where the connections pass through the floor of the top chamber. In most instances copper tube is used for the connections, and all isolating switches are remote operated from ground level, a comprehensive system of interlocks preventing danger to operators. The oil circuit-breakers are of the multi-break type, each phase being self-contained in a cylindrical tank mounted on a frame structure. Purification of circuit-breaker oil is carried out by equipments provided on each site, without removal of any single unit being necessary, but, by means of motor-operated tank trucks, circuit-breaker tanks and complete single-phase units can be removed for inspection. Special electrical tubular heaters are also included to ensure that the temperature of the busbar chambers is kept above that of the surrounding atmosphere.

Two contracts totalling £700,000 in value have been placed with the Metropolitan-Vickers Electrical Co., Ltd. One

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is for equipments for the extended electrification of the Buenos Aires suburban lines of the Central Argentine Railway, and the other for equipments for the north-western section of the 132,000-V transmission scheme of the Central Electricity Board.

Trade with Russia.

At the annual meeting of the Association of British Chambers of Commerce in London last week, Mr. W. L. Holland (Preston) asked leave to submit a resolution in which the visit of British industrialists to Russia was welcomed as likely to lead to the provision of employment in this country. It also called upon the Government to take all possible steps to resume relationships with Russia. After a brief discussion, in which Sir Stanley Machin pointed out that it was the Association's decision that trade with Russia should not be resumed until pre-war debts were acknowledged by the Soviet Government, leave to submit the resolution was refused.

Trade Announcements.

The Foster Engineering Co., Ltd., has opened a service store at 11, Fitzroy Square, W.1 (telephone: Museum 2412-3), where it will maintain stocks of "Apex" switchgear and Association lamps.

Messrs. Pritchett & Gold & E.P.S. Co., Ltd., have moved their Glasgow depôt to 45, Clyde Place. (Telephone: South 1246.)

Messrs. J. Dyson & Co., Ltd., have transferred their Hull branch to more commodious premises, with radio and electrical showrooms at 39, Beverley Road, Hull, immediately opposite their old address.

The business formerly carried on by Mr. G. Morrison is now conducted by Geo. Morrison (Electric Lighting and Plating), Ltd., at 22, Upper Talbot Street, Blackpool. Showrooms have been opened at 17, Station Road, Kirkham.

Southern Motor Factors, Ltd., states that it is about to open a wholesale electrical department at its Bournemouth branch, and asks for manufacturers' catalogues and quotations to be sent to 6, Avenue Lane, The Square, Bournemouth.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price April 16th.	Fortnight's inc or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	"	£52	...
a Bisulphide of Carbon	"	...	...
a Borax	"	£25	...
a Copper Sulphate	"	£25 10s.	...
a Potash, Chlorate	per lb.	8½d. to 4d.	...
a " Perchlorate	"	5½d.	...
a Shellac	per cwt.	£13 10s.	...
a Sulphur, Commercial	"	£11	...
a " Roll	"	£11	...
a Soda, Chlorate	per lb.	3d.	...
a " Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	3½d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£95 to £100	...
b " Wire	per lb.	1/1 to 1/9	...
b " Sheet	"	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metal—			
Grade I	per ton net.	£188	£16 dec.
Grade II	" "	£132	£10 dec.
Grade III	" "	£74	£5 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	11⅜	1½d. dec.
c " Tubes (solid drawn)	"	1/1½ to 1/1¾d.	1½d. dec.
c " Wire, basis	"	11⅝	1½d. dec.
c Copper Tubes (solid drawn) ...	"	1/4	2½d. dec.
c " Bars (best selected) ...	per ton.	£119	£19 dec.
c " Sheet	"	£119	£19 dec.
c " Rod	"	£119	£19 dec.
d " (Electrolytic) Bars ...	"	£89	£21 dec.
d " " Sheets ...	"	£148 10s.	...
d " " Wire Rods ...	"	£99	£22 dec.
d " " H.C. Wire	per lb.	1/-$\frac{3}{16}$	2½d. dec.
f Ebonite Rod	"	2/8 to 2/6	...
f " Sheet	"	2/8 to 2/6	...
n German Silver Wire	"	2/2	...
h Gutta-percha, fine	"	nom.	...
h India rubber, Para fine	"	1/0	½d. dec.
j Iron Pig (Cleveland No. 3.) ...	per ton.	68/6	1/6 inc.
" Wire, galv. No. 8, P.O. qual.	"	£21	...
g Lead, English pig	"	£25 15	£2 dec.
e Mercury	per bot.	£22 2s 6d. to £22 5s.	...
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e " " medium	"	4/- to 8/-	...
e " " large ...	"	10/- to 20/- & up	...
o Phosphor Bronze, plane castings	"	1/8½	...
o " " drawn bars & rods	"	1/5½	½d. inc.
o " " rolled strip & sheet	"	1/4½	...
o " " wire...	"	1/7½	1½d. inc.
o Platinum	per oz.	£13 17s. 6d.	...
d Silicium Bronze Wire	per lb.	1/3	2d. dec.
r Steel, Magnet, in bars	"	7½d.	...
n Tin, Block (English)	per ton.	£205 5s. to £205 10s.	£14 to £14 5s. dec.
n " Wire, Nos. 1 to 16	per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated April 13th, Messrs. James Forster and Co. stated that a feature of the lead market last week was the appearance of a backwardation on prices, presumably owing to the fact that Mexican supplies have been delayed through the revolution, while shipments from Australia last month fell below normal. However, at present there is no shortage, whatever may happen in the future. A little buying has been done by consumers this week chiefly for early delivery, but until the market settles down on a stable basis more extensive buying cannot be expected. "It seems to us that an economic price for lead under present conditions is round about £24 per ton, but just as the advance was carried too far it is more than likely that the present fall will be overdone and prices temporarily decline below an economic level before the market eventually settles down."

A Name for Moulded Insulation.

The word "resoid" has been chosen from 521 suggestions submitted in the recent contest, sponsored by the Moulded Insulation Section of the National Electrical Manufacturers' Association (United States), to determine a generic name for moulded products. The Section having selected the name "resoid," will consider matters relating to its general adoption and use at its next meeting.

For Sale.

Messrs. Leopold Farmer & Sons will sell by auction on April 30th, at 79, Kilburn Lane, N.W., plant and machinery, including electric motors, &c. Coventry Corporation Electricity Department invites offers for two 3,000-kW steam turbo-alternators with condensing plant, four water-tube boilers with superheaters and chain-grate stokers, two c.i. fuel economisers, and one induced-draught plant. The Central (Unemployed) Body for London invites offers for surplus lighting plants lying at Hollesley Bay Labour Colony, near Woodbridge, Suffolk. (See our advertisement pages to-day.)

Lighting and Power Notes.

Argentina.—Electrical Development.—According to the *Review of the River Plate*, plans are being prepared for the reorganisation of the services of the Compania Italo-Argentina de Electricidad. The scheme includes the erection of new power stations during the current year, at a cost of $60,000,000 paper. The largest of these stations will be erected at Bahia Blanca with distributing connections to Ingeniero White and Puerto Militar.

Barnard Castle.—Overhead Lines.—As the result of a petition from ratepayers, the Urban District Council has decided to withdraw for the present its consent to the erection of overhead lines by the Cleveland and Durham County Electric Power Co. for the supply of electricity to the town.

Bradford.—Change-Over.—The system of electricity supply is to be changed over from d.c. to a.c. in Upper Woodlands Road and district, at an estimated cost of £3,092.

Brazil.—Electrical Development.—A report on the water-power of Brazil, made for the Department of Transportation and Public Works, places the number of important waterfalls at 378, of which only 154 have been measured. The latter are estimated to have a power of at least 50,000,000 h.p., and it is believed that the remaining 224 would bring the figure up to a minimum total of 60,000,000 h.p. In addition to the larger waterfalls there are several sources having between 6,000 and 50,000 h.p. About 50 per cent. of the power used in Brazil is generated at 50 cycles and 50 per cent. at 60 cycles a.c. There are some relatively small plants in the north and south, where steam-power is employed, and at Puerto Alegre direct current is generated. It is proposed to replace these plants gradually by more modern installations generating a.c.—*Reuter's Trade Service* (Rio de Janeiro).

Burton-on-Trent. — Loans. — The Corporation Electricity Committee is applying for sanction to borrow £6,716 for the supply and laying of cables from the power station to the new factory of Messrs. Pirelli, Ltd., on Derby Road; £782 for switchgear at the factory sub-station, and £1,360 for switchgear at the power station in connection with the supply.

Canada.—Hydro-Electric Development.—Details of an important hydro-electric development in Northern Ontario were laid before the Provincial Legislature during the Budget debate by the Hon. J. R. Cooke, Government Representative on the Hydro-Electric Power Commission of Ontario. The plan involves the connecting-up by h.p. transmission lines of 16 power sites, affording a total development of 570,900 h.p. The map also shows a proposed transmission line stretching for nearly 200 miles from North Bay to Toronto. It is proposed on this line to transmit power surpluses over and above the industrial requirements of the north to the Georgian Bay and

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Niagara distribution systems of the Commission, where the power demand is constantly growing. The first step in the proposals to tap the water power of the north has already been taken in the purchase of the Wahnapitae plant from the Wahnapitae Power Co., Ltd., which, with extensions, involves an expenditure of $2,700,000. This plant will yield 13,300 h.p. Four proposed plants on the upper waters of the Ottawa River would yield 265,000 h.p., while two on the Mississaga River are indicated at 115,000 h.p. Intervening sites along the proposed 275-mile stretch, taking in the Petawawa, French Maganatawan, and Spanish Rivers, would make up the total of 570,900 h.p. in the new super-power belt.

It is anticipated by engineers of the Hydro-Electric Power Commission of Ontario that within the next seven years all the rural homes in old Ontario which can be economically served by transmission lines will have a connection available. In 1923 only 320 miles of rural power lines existed. Last year alone 960 miles were erected, and this year the mileage added will be 1,200. The Commission is being urged to bear, with the consent of the Union of "Hydro" Municipalities, all the maintenance costs on rural transmission lines now paid by the consumers, and which amounts to about $66 per year per mile of line. If the Government or the Commission paid it the average service cost would be brought down to about $1.50 per year per consumer.

Carlisle.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £100,000 in respect of additional plant. The Electricity Commissioners have intimated that they will be prepared to consider the sanctioning of further amounts in respect of this application upon receipt of a revised estimate of cost, based upon tenders accepted, or proposed to be accepted, for the various works concerned.

Chesterfield.—Electricity Supply.—At the last meeting of the Corporation the following business was transacted. The question of supplying electricity to Grassmoor Village was adjourned for twelve months. The borough electrical engineer (Mr. D. H. Davies) submitted a report on the lighting by electricity of the main roads in the borough, and this report is to receive further consideration. The town clerk was authorised to inform the Central Electricity Board that, after due consideration, the Corporation perfers its undertaking to become a "temporary arrangement" station instead of a selected station in the Mid-East England Electricity Scheme, and the Central Electricity Board has agreed to the request.

Colchester.—Loan.—The Town Council has applied for sanction to a loan of £50,000 for prospective works in connection with the extended area of supply.

East Ham.—New Cables.—The Corporation Electricity Committee has approved an estimate of £7,290 for laying distributor cables in various streets.

Finchley.—Electricity Extensions.—At a recent meeting of the Urban District Council Electricity Committee, the chief electrical engineer reported that, owing to the abnormal increase of over 1,400 kW in the demand during the last two years, it is essential that more substantial and immediate provision should be made for the next winter than has been done during the last two years. The increased demand has been more particularly confined to the central portions of the district. He proposes, therefore, to utilise the site and adapt buildings in Hamilton Road by looping in the Hill Rise h.p. feeder and installing rectifying plant with a capacity of 300 kW, also by installing 300 kW on the Percy Road site, an additional 300 kW on the Holly Park site, and 150 kW on the Hill Rise site. A h.p. main at present terminates in Hill Rise sub-station and another at Holly Park sub-station. He proposes to join these together by a h.p. main between Hill Rise and Holly Park, this forming a loop. The cost of the h.p. and l.p. mains is £7,320, and sub-station buildings, h.p. and l.p. switchgear, rectifying plant, &c., £12,465.

Glasgow.—Dalmarnock Station.—At a meeting of the Corporation Electricity Committee on April 12th it was reported that from May 1st the Dalmarnock power station, which is one of the stations selected by the Central Electricity Board, will be worked for the Board. Under the scheme the Corporation will operate the station to the Board's requirements and will purchase electricity required for the supply of consumers in the city.

Gravesend.—Mains Extensions.—The Corporation Electricity Committee is to carry out mains extensions, at a cost of £4,150.

Hastings.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to a loan of £1,000 for mains and sub-station equipment in connection with the supply to Peasmarsh.

Hull.—New Plant.—The Corporation Electricity Committee has authorised the purchase of a 12,000-V switchboard at a cost of £475, two sets of televisory remote control equipment at £950, and two 500-kVA special transformers at £1,270.

Irish Free State.—Queenstown.—The Urban District Council has instructed the town clerk to write to the Minister for Industry and Commerce, requesting him to hold an inquiry into the charges made by the Cork Electric Supply Co.

Leeds.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to borrow £400,000 for provision of mains, £50,000 for sub-station equipment, and £50,000 for the wiring of consumers' premises in connection with the assisted wiring scheme.

Manchester.—Progress During February.—During the month of February the Corporation electricity undertaking showed an increase in connections of 1,804 kW, bringing the total up to 373,848 kW; and the number of applications received for supply, including those for additional supplies, was 1,054, representing a total of 1,995 kW. The number of hired cookers connected increased by 31, bringing the total of hired cookers actually connected to 5,112. Applications for the hire of cookers totalled 89. A new sub-station was put into commission at Fairfield, and additional plant installed at four existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 4,581 consumers, work was in progress involving 1,290 consumers, and sanction had been received in respect of an additional 235 consumers.

Masham.—Sale of Undertaking.—The Urban District Council at its last meeting adopted recommendations of the Electricity Committee to dispose of the Council's electricity undertaking to the Cleveland and Durham County Electric Power Co. The transfer is to be carried out forthwith.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the East Grinstead Urban District Council authorising it to supply electricity in certain parishes in the rural district of Godstone, and Mr. W. G. Heath to supply electricity in the urban district of Ivybridge and parts of the rural districts of Kingsbridge and Totnes.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the South Somerset and District Electricity Co., Ltd., to supply electricity in part of the rural district of Axminster, and the Shropshire, Worcestershire and Staffordshire Electric Power Co. to supply in the urban and rural districts of Bromyard and part of the rural district of Ledbury.

Tunbridge Wells.—Loan.—The Town Council has applied for sanction to a loan of £13,302, for mains, sub-station, sub-station pillars, &c.

Weymouth.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £1,355 in respect of the Upwey, Wyke Regis, and Two-Mile Coppice sub-station buildings and sites.

Tramway and Railway Notes.

Bournemouth.—Year's Working.—The Corporation tramway undertaking during the year ended March 31st last, carried 32,171,930 passengers, the gross receipts being £227,187. These figures represent a decrease of only 286,452 passengers and £2,293 in receipts, in spite of the fact that since January 1st last one route to Poole has been abandoned in favour of motor-omnibuses. A contribution of £2,000 is to be made to the borough fund.

Bradford.—Railless Cars.—An inquiry was held by Mr. A. D. Erskine, for the Minister of Transport, on April 10th and 11th, into the application of the Corporation to run railless cars on 40 routes, 29 within the city and 11 outside. For the Corporation, Mr. J. G. Gunter said that objections against the proposals of the Corporation in respect of the 11 routes outside the city had been lodged by the West Riding County Council, Pudsey Corporation, and the Urban District Councils of Birkenshaw, Calverley, Farsley, Hipperholme, Hunsworth, and Shipley. No objection had been raised to the 29 routes within the city boundary, and consent had been given already in respect of the routes outside the city by the Queensbury, Clayton, Drighlington and Bingley Urban District Councils, and by the Halifax Rural District Council. On all of the 40 proposed routes, with the exception of eight, tramways were in operation. The eight to which he had referred would be in the nature of connecting links. It was proposed to convert the tram routes to railless-car routes as and when circumstances demanded, or when the tramway tracks became worn out. Mr. R. H. Wikinson, city tramway manager, said the granting of the Provisional Order would not necessarily mean that all the tramway routes would automatically be converted to railless cars. Each route would be considered on its merits, and either the tramway would be reconstructed or railless cars or motor-'buses substituted as experience dictated. The cost of reconstructing the tramway track would be £916,000, and of re-making the road after taking up the track and preparing for railless cars, £226,000. Mr. J. E. Lightburn, representing the County Council and several of the opposing Urban District Councils, said that if the order was granted a proviso should be inserted that the route to the depôt of the railless cars should be used only for getting to the depôts, and not as a vehicle route. The County Council submitted a proviso that the Corporation should not be relieved from offences in respect of overcrowding

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in trolley vehicles. It also wished Sections 5 and 6 of the Town Police Clauses Act of 1890 relating to the control of public vehicles to apply to railless cars, that it should have a complete veto on poles on the highway, and that the Corporation should pave with granite the main roads at all the termini. It strongly objected to turning points at Stanningley and other places. The Ministry will give its decision in due course.

Continental.—Austria.—A new hydro-electric power station has recently been completed at Pinzgau for the supply of power to the Innsbruck-Salzburg section of the State railways. The plant utilises the upper falls in the Stubach valley, and has a capacity of 32,000 h.p., to be extended later to 48,000 h.p.

Poland.—It is reported that plans for the electrification of the railway between Warsaw and Radom are under consideration.

Hull.—Railless Cars.—At a recent meeting of the Corporation Tramways Committee the general manager drew attention to the recent increase in the cost of petrol, and suggested that the Committee should consider the question of introducing railless cars on certain routes in the city, which he was of opinion could be done at less cost. The Committee has visited Doncaster and Rotherham and inspected the system of railless cars in operation, and has decided that it is advisable to put this system of transport into operation on existing petrol-driven 'bus routes as far as it is deemed economically expedient. The general manager has been requested to furnish the Committee with a detailed estimate of the cost per mile of construction and operation.

Manchester.—Motor Omnibuses.—The Corporation Tramways Committee has decided to introduce a motor-omnibus service instead of tramcars to Wythenshawe, as it is considered that the laying of track to the new Corporation estate would be too costly. The cost of the proposed track was estimated at £75,000.

Railway Electrification.—The *Financial News* reports that the L.N.E.R and L.M.S. announce that work is being commenced this month on the erection of the overhead equipment in connection with the electrification of the Manchester South Junction and Altrincham line. Increased and accelerated train services will be provided when electric traction commences, representing a 50 per cent. increase in train mileage over the augmented steam service, or 80 per cent. over the steam service in 1927. Two new stations at Dane Road and at Navigation Crossing (North Altrincham) are to be constructed, and it is intended to open the Old Trafford Cricket Ground station permanently.

New Zealand.—Auckland.—The *Electrical Engineer of Australia and New Zealand* reports that, following on the recommendations of the Royal Commission which investigated street passenger transportation last year, a transport board has been formed to supervise and operate transportation facilities in the city and its suburbs. The chairman is Mr. J. A. C. Allum, who was previously chairman of the City Council's Tramways Committee, and the deputy chairman is Mr. G. Baildon, mayor of Auckland. The members represent various municipalities. The board took over the city council's tramway and motor-'bus undertakings on January 16th. It is considering plans for extensions of routes, and is reviewing the programme of works recommended by the tramway manager, Mr. A. E. Ford, last year, which involves an expenditure of £500,000. Mr. Ford recommends that 24 single-truck cars and six converted double-deck cars be replaced as early as possible with new rolling stock, and that 50 new tramcars be built. He states that about 10 miles of track is in need of reconstruction, but that otherwise the system is in good order.

Telegraph and Telephone Notes.

Canada.—Bell Telephone System.—According to a statement by Mr. C. F. Wise, president of the Bell Telephone Co. of Canada, made before the Railway Committee of the Canadian House of Commons in connection with the Bill before Parliament to authorise an increase in the capital stock of the company from $75,000,000 to $150,000,000, the company proposes to expend $126,239,000 during the next five years on extensions of its systems in the central provinces of Ontario and Quebec, where the company's lines are situated. The principal items, for some of which orders have already been placed, are as follows:—Montreal, $29,853,000; Toronto, $28,464,000; other cities and towns of more than 2,000 telephones, $30,539,000; places of less than 2,000 telephones, $12,003,000; toll lines and repeater equipment, $25,380,000. Extensions for 1929 alone will amount to $27,165,000; the chief items are: Montreal, $7,667,000; Toronto, $5,441,000; other cities and towns of more than 2,000 telephones, $6,973,000; places of less than 2,000 telephones, $2,190,000; toll lines and repeater equipment, $4,894,000. The Bell Company's Bill received the approval of the Railway Committee in amended form, the amendment, which was moved by the Minister of Railways and Canals, providing that the company shall not have the power to make any issue of stock without obtaining the approval of the Board of Railway Commissioners to the amount, terms, and disposition of the stock issue. The amendment applies only to the new stock of the company.

China.—Wireless Station.—A party of engineers left Lisbon on April 9th to establish a short-wave wireless-telegraph station at Macau, the Portuguese settlement in Southern China.—*Reuter* (Lisbon).

Germany.—Ship-shore Telephony.—At a meeting of representatives of Hamburg shipping companies it was stated that technical difficulties in the way of wireless telephone communication with ships at sea had been removed, but one of the obstacles in the way of fitting out all passenger vessels with the necessary telephone apparatus was the expense. Experiments are to be made with fishing vessels, and it is asserted that, as the telephone can be used by anybody, it will render superfluous the carrying of a wireless expert.

Greece.—Strike Threat.—The telegraph and telephone services were interrupted all over Greece on April 10th from 10 o'clock in the morning till 1 o'clock in the afternoon while the employés held meetings to discuss their grievances against the Government, which refused their application for increased wages. In the afternoon a meeting of employés in Athens passed a resolution asking the Government to satisfy their demands, and threatened that if their demands were not met the strike would not be limited to a few hours.—*Reuter* (Athens).

It was reported later that the dispute had been settled.

Guernsey.—Telephone Service.—The revenue statement and statistics for the year ended December 31st, 1928, of the Guernsey States Telephone Department (manager and engineer: Mr. E. H. Bennett) show a gross revenue of £19,219 and a net profit of £718. The number of lines increased by 172 to a total of 4,226, and the junction lines by 7 to 103. The mileage of overhead wire increased by 14 to 2,428 miles and underground circuits grew by 161 to 4,886 miles. The calls increased by 103,848 to a total of 2,607,855; trunk calls between the islands numbered 14,993. Telegrams and letters telephoned reached 26,371.

Hull.—Telephone Kiosks.—The manager of the municipal telephone system has reported to the Corporation Telephone Committee that the approximate cost of fitting multi-coin boxes in kiosks will be £15 per kiosk. He was asked to obtain information from other cities on the subject.

The Telephone Service.—An Emergency Device.—A scarlet disk is being placed in all multi-coin telephone boxes connected with manual exchanges whereby emergency calls will be speeded up. In the disk is a button which, on being pressed, operates a flashing signal in the exchange, and to this immediate priority will be given. The installation of the disks is due to complaints that delays have occurred through having to place coins in the slot to make connections in such cases of emergency as the calling of fire brigades and ambulances.

Radio Notes.

Receiving Licences.—Portable Sets.—The Postmaster-General draws attention to the following arrangements with regard to receiving licences:—

(1) A licence covers the use in the premises occupied by the licensee of any number of sets of receiving apparatus of any character by the householder, his family, and his domestic staff.

(2) A licence covers the temporary use (for example, during holidays) of receiving apparatus at another residence provided that no receiving apparatus is being worked at the home address.

(3) A separate licence is necessary for a separate building, such as a lodge or gardener's house, or for a portion of the same address under a separate tenancy.

In view of the increasing popularity of portable sets, the Postmaster-General has decided that in future a licence will cover, not only the use of sets at the address shown on the licence, but also the use of one portable set at any place in Great Britain and Northern Ireland by the licensee, or any member of his household. When a portable set is used away from the home address, the person using it must carry the licence with him and produce it if asked to do so by an authorised officer of the Post Office.

Licences.—European Progress.—The official returns for 1928, when compared with those for 1927, show generally a most gratifying state of affairs. The number of actual licence-holders in Europe (Russia not included) rose during 1928 from 5,897,000 to 7,163,000 says *World-Radio*, an increase of about 21.4 per cent., representing in persons, as distinct from homes, an increase of about five millions. The percentage increase is lower than in 1927, which is traceable to a slight slowing-up in the Swedish rate of increase and to a somewhat stationary state of affairs in Czecho-Slovakia, the Irish Free State, Italy,

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and Norway. The new high-power stations projected for all these countries should bring them into line once again with the progress being made elsewhere.

Common Wavelength.—Stoke Station.—On April 11th the Stoke-on-Trent station of the B.B.C. was included among those transmitting on the national common wave-length of 288.5 metres.

Cuba.—Short-wave Agreement.—The Government of Cuba has formally notified the Canadian Government that it accepts the agreement concluded at Ottawa in January relative to the division of short radio waves in the North American area. All the countries represented at the January conference have now, according to *World-Radio*, formally accepted the agreement, which became effective on March 1st, 1929.

New Station.—A powerful wireless broadcasting station capable of direct communication with Europe and South America is being built at Tiscornia, across the bay from Havana. It is expected to be completed next month.—*Reuter* (Havana).

European Conference.—Wave-lengths.—A new plan for the repartition of wave-lengths among the broadcasting stations of Europe, to be known as the Plan of Prague, received the approval at Prague on April 13th of the official delegates of 27 European telegraph administrations, including those of Russia, and is to be put into operation on June 30th. A protocol accompanying the plan contains recommendations concerning the construction and operation of broadcasting and other wireless stations which are considered to be essential for the successful future of the broadcasting services, says *The Times*. To the Czecho-Slovak telegraph administration belongs the credit of having convoked this first official European conference on broadcasting. National sacrifices have been made with the common object of securing unanimity, and the British delegation, notably its chief, Mr. F. W. Phillips, assistant secretary of the General Post Office, who was chairman of one of the sub-commissions engaged upon the problem, made most valuable contributions to the success of the meeting, as did also General Ferrié and Ministerialrat Arendt, chief delegates of France and Germany, respectively. The Prague Plan is based on the work of the Union Internationale de Radiophonie and extends the principle of nine kilo-cycles separation between stations to all medium wave-lengths down to 216 metres.

Italy.—Short-wave Transmitter.—The Italian Broadcasting Company has authorised the Marconi Company to proceed with the manufacture of a short-wave broadcasting transmitter. It will to a large extent follow the design of 5SW, and will enable the Italian Broadcasting Company to carry on a service for the Italian colonies.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 15th. Victorian Railways. One geared 3-phase electric winding engine. (A.X. 7650.)*

May 15th. Melbourne Tramways Board. One 500-kW sub-station rectifier unit for automatic control, with switchgear. (B.X. 5206.)* Two rotary convertor units of 1,000 kW and one 500-kW for automatic control. (B.X. 5210.)*

June 4th. State Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 5216.)*

June 18th. Posts and Telegraphs Department. Switchboard cable. (B.X. 5228.)*

Sydney.—May 13th. Public Works Department. One synchronous condenser. (B.X. 5205.)*

June 22nd. Transformers and spares for Burrinjuck hydro-electric development sub-stations. (B.X. 5230.)*

May 28th. Posts and Telegraphs Department. Telephone jacks and number plates. (B.X. 5202.)*

Carlisle.—Electricity Department. L.c. and l.c.a. paper-insulated cables for 12 months. (April 12th.)

Chertsey.—May 18th. Board of Guardians. Installation of electric lighting at the Institution at Ottershaw. (See this issue.)

Devizes.—May 1st. Rural District Council. Complete electrical installation for cottages situated in the parishes of Market Lavington, Potterne, and Rowde. Specifications and schedule from Mr. P. R. Trapp, clerk, Maryport Chambers, Devizes.

Dundee.—April 24th. Transport Department. Stores, including armature and field coils, castings, &c., for a year. Specifications, &c., from general manager.

April 27th. Harbour Trustees. Two 3-ton electric travelling jib cranes of portal type. Specifications, &c., from office of the General Manager and Engineer, Harbour Trust.

Dunfermline.—April 26th. Town Council. Electric lighting installation for housing scheme. Schedules, &c. (£1 1s. deposit) from Mr. D. H. Shaw, burgh engineer, City Chambers.

Edinburgh.—April 22nd. Education Authority. Electric lighting and heating installation at the new school at Saughton. Plans, &c., from Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

May 6th. Installation of electric lighting at the Gorgie new special school and annexe to Trinity Academy. Schedules from the Education Offices.

Egypt.—Cairo.—May 15th. Ministry of Public Works. 120-kW d.c. Diesel-engine generating set and a small electrically-driven cooling water pump. Forms of tender from the Chief Inspecting Engineer, 41, Tothill Street, S.W.

May 25th. Prison Administration. Stores (including lamps and electrical articles). (C. 3022.)*

Epping.—May 2nd. Board of Guardians. Installation of electric light at the Institution, Epping. (April 12th.)

Glasgow.—April 22nd. Lighting Department. Materials, including electrical fittings and accessories, for one year. Specifications from office of department, 20, Trongate.

Grimsby.—May 3rd. Electricity Department. 10 miles 33,000-V overhead line. (See this issue.)

India.—May 8th. Assam-Bengal Railway Co., Ltd. Turbo-generator set for Pahartali. (See this issue.)

Irish Free State.—Dublin.—April 29th. Electricity Supply Board. Supply and laying of 40,000-V cables in the County and City of Dublin. (April 5th.)

April 23rd. Dublin Port and Docks Board. Three electric overhead travelling cranes and gantries at new tobacco warehouse, Custom House Docks. Specifications from engineer to the Board, East Wall, Dublin.

London.—Central Electricity Board.—May 4th. Supply, delivery and erection of 33,000-V and lower-voltage cables in connection with the South-East England Electricity Scheme. (April 12th.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (March 15th.)

Islington.—May 6th. Cleansing Committee. Two new lead batteries for Edison electric vehicles. (April 5th.)

London County Council.—April 22nd. Reconstruction of conduit tramways in Whitechapel High Street. Specification (£5) from the Chief Engineer, Old County Hall, Spring Gardens, S.W.

H.M. Office of Works.—April 22nd. Supply of incandescent electric lamps. (April 12th.)

May 1st. Electrical accessories. (See this issue.)

Lourenço Marques.—April 22nd. Port and Railways Board. Electric hanging and ordinary lamps. (B.X. 5238.)*

Electric motors, &c. (A.X. 7765.)*

Manchester.—April 24th. Electricity Committee. Stores for 12 months, including dry batteries, conduit and wiring accessories, fuse boxes, auto-transformers, &c. Particulars from Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall.

May 3rd. Electricity Department. 12 months' supply of electric kettles, electricity meters, circuit breakers, star delta switch starters, a.c. motors, potential and current transformers, cables and time switches. (See this issue.)

April 30th. One 33,000-V, 11,500-kVA self-cooled outdoor auto-transformer, one 6,600-V switch, &c., and a neutral earthing resistance. (See this issue.)

Salford.—April 26th. Electricity Department. E.h.p. and l.p. paper-insulated lead-covered cable. Particulars from City Electrical Engineer, Electricity Department, Frederick Road.

South Africa.—Johannesburg.—May 16th. South African Railways and Harbours. Electric signalling apparatus. (B.X. 5165.)*

Cape Town.—May 1st. Electricity Department. 30-ft. steel tubular poles, cross arms, insulators, &c. (A.X. 7697.)*

Bloemfontein.—May 18th. Electric Supply Department. Turbine and generator, condensing plant and auxiliaries; switchgear and cables; cooling spray pond equipment, or alternatively cooling tower complete. (B.X. 5192.)*

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Pretoria.—May 23rd. Posts and Telegraph Department. Rubber-covered wire and telephone cables. (B.X. 5229.)*
May 30th. Telegraph materials, &c. (A.X. 7767.)

Southampton.—April 30th. Electricity Department. Steel-framed building, steelwork for firing floor, platform carrying induced draught fans, overhead bunkers, &c.; two water-tube boilers with superheaters, economisers, air heaters, mountings, chain-grate stokers, water walls, induced and forced draught fans, sootblowers, steel flues and chimneys, grit arrestors and collectors, &c.; steam, feed-water and other piping, covering, &c.; water softener. (March 29th.)

Stafford.—April 30th. County Education Committee. Installation of electric lighting and power at the New High School for Girls, Wellington Road, Bilston. Installation of electric light at the Girls' High School, Stafford. (April 12th.)

Uruguay. — Montevideo. — May 6th. State Electricity Works. Electric cables and accessories. (B.X. 5178.)*

Walthamstow.—May 3rd. Education Committee. Electrical installation for the Billet Road school. (April 12th.)
May 8th. Electricity Department. L.p. distributor and service cables; e.h.p. and l.p. feeder cables. (See this issue.)

Wolverhampton.—May 10th. West Midlands Joint Electricity Authority. One 50,000-kW turbo-alternator with step-up transformers, &c., condensing plant, boiler feed pumps, evaporators, circulating water pumps, &c., main and auxiliary 33,000-V switchgear with circuit breaker. (March 29th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Belfast.—City Electricity Department.
Twelve months' supply of electric lamps.—Siemens Electric Lamps & Supplies, Ltd.

Bradford.—Tramways Committee. Accepted:—
Equipment of railless vehicles under construction with air brakes (£1,583); six double-deck railless electric trolley vehicles and certain spare parts (£12,769); and one single deck demonstration railless vehicle (£990). —English Electric Co., Ltd.
Electricity Committee. Recommended:—
Circulating water valves and atmospheric exhaust valve for turbo-alternator; and steam valves for boiler and high-pressure plant.—J. Blakeborough & Sons, Ltd.
Reinforced steelwork for new cooling pond at Valley Road power station.—Indented Bar & Concrete Engineering Co., Ltd.
Two feed pumps for Valley Road power station.—Mather and Platt, Ltd.

Burton-on-Trent.—Town Hall Committee. Accepted:—
Electric organ-blowing installation at Town Hall (£96).—A. Talbot.

Chesterfield.—Electricity Committee. Accepted:—
New overhead feeders to supply the New Whittington trolley 'bus extension (£661).—Macintosh Cable Co., Ltd.
Miscellaneous cables (£683).—Greenwich Cable Works, Ltd.

Douglas (I. of M.).—Electricity Committee. Accepted:—
High-pressure panel at Tromode Road sub-station (£96).—New Switchgear Construction Co., Ltd.

East Ham.—Electricity Committee. Recommended:—
L.p. switchgear (£309).—Bertram Thomas.
H.p. switchgear (£1,438) (revised quotation).—A. Reyrolle and Co.

Gravesend.—Electricity Committee. Accepted:—
Overhead lines (£1,273).—W. T. Henley's Telegraph Works Co., Ltd.
Internal telephone installation at offices (£94).—Dictograph Telephones, Ltd.

Hastings.—Town Council. Accepted:—
Electrically-driven pumping plant for the Kent Street water well (£2,000).—Mirrlees Watson Co., Ltd.

Hull.—Telephones Committee. Recommended:—
Cable (£279).—Siemens-Schuckert (Great Britain), Ltd.
Electricity Committee. Accepted:—
Circulating water pump (£3,363).—Drysdale & Co., Ltd.
Three 1,500-kW motor convertors:—

Ateliers de Constructions Electriques de Charleroi	£10,500
Crompton Parkinson, Ltd.	10,650
Metropolitan-Vickers Electrical Co., Ltd.	13,115
British Thomson-Houston Co., Ltd.	13,115
Bruce Peebles & Co., Ltd. (Accepted.)	13,115
English Electric Co., Ltd.	13,115
Mather & Platt, Ltd.	13,116
Brush Electrical Engineering Co., Ltd.	13,620
Hewittic Electric Co., Ltd.	19,719

Holbeach.—Board of Guardians. Accepted:—
Installing electricity at the Institution (£138).—Bratley and Sons.

Leeds.—Baths Committee. Accepted:—
Electric light fittings for 12 months.—Sun Electrical Co., Ltd., and G. Casperson.
Health Committee. Accepted:—
Electric light installation at Gateforth Sanatorium (£103). —Squires & Sons, Ltd.
Electricity Committee. Accepted:—
Meters for 12 months (about 2,500) (schedule prices).—Measurement, Ltd.
Four 1,000-kVA transformers (£777 per set; additional transformers for a period of two years at special terms).—British Electric Transformer Co., Ltd.
Three 10,500-kVA transformers, spare transformer, &c. (£11,680).—Hackbridge Electric Construction Co., Ltd.
Cables (£1,194).—W. T. Henley's Telegraph Works Co., Ltd. (£2,565).—Enfield Cable Works, Ltd.; and (£3,110).—Macintosh Cable Co., Ltd.
Tramways Committee. Accepted:—
1,250 tons tram rails (£9 10s. 3d. per ton); fishplates (£13 10s. 3d. per ton).—Cargo Fleet Iron Co., Ltd.
Lay-outs, points, crossings, &c.—(£3,355), Edgar Allen and Co.; (£1,058), Hadfields, Ltd.; and (£1,039), Titan Trackwork Co., Ltd.
500 tram tires (£24 per ton).—Monkbridge Iron & Steel Co., Ltd.
Electrodes.—Premier Electric Welding Co., Ltd.

Liverpool.—Watch Committee.
Five additional telephone boxes (£105).—Standard Telephones & Cables, Ltd. (Recommended.)
Electrically-driven pumping machinery for Aubrey Street Station (£2,840).—Mather & Platt, Ltd. (Accepted.)

London.—
Electric wiring contract for the new Bank of England.—Drake & Gorham, Ltd.

Luton.—Town Council. Accepted:—
Steel construction work (£10,960).—Braithwaite & Co.
Travelling crane (£1,530).—Herbert Morris, Ltd.
Coal tipper, elevator, and conveyor (£4,550).—Henry Lees.

Malvern.—Urban Council. Accepted:—
1,000 yd. of h.p. concentric cable, approx. (£550).—Pirelli-General Cable Works, Ltd.

Manchester.—Waterworks Committee. Accepted:—
Additional converting and pumping plant for Lostock booster station.
Transformer.—Metropolitan-Vickers Electrical Co., Ltd.
A.c. and d.c. switchgear.—Ferguson, Pailin, Ltd.
D.c. circuit breakers and field regulator.—Whipp & Bourne, Ltd.
C.i. pipes.—Sheepbridge Coal & Iron Co., Ltd.
Valves.—Glenfield & Kennedy, Ltd.
Motor starting and control gear.—Brookhirst Switchgear, Ltd.
Tramways Committee. Accepted:—
Maximum traction trucks.—Electro-Mechanical Brake Co., Ltd.
5-cwt. pneumatic power hammer with motor and starter.—B. & S. Massey, Ltd.
Shearing machine with motor and starter.—Scott Bros. (Halifax), Ltd.
Electricity Committee. Accepted:—
Conversion of automatic rotary convertor plant.—Harland Engineering Co., Ltd.
Tramways Committee. Accepted:—
Supplies for 12 months:—
Grid resistances.—Rheostatic Co., Ltd.
Ampere-hour meters.—Chamberlain & Hookham, Ltd.
Cables.—St. Helens Cable & Rubber Co., Ltd.
Galvanised mild steel wire cable.—Rd. Johnson and Nephew, Ltd.
Controller spares.—British Thomson-Houston Co., Ltd.; English Electric Co., Ltd.
Electro-mechanical brake spares, &c.—Metropolitan-Vickers Electrical Co., Ltd.
Controller fingers, &c.—Fairless Engineering Supplies Co., Ltd.; Forest City Electric Co., Ltd.

Northern Ireland.—Belfast.—County Borough Education Committee. Accepted:—
Electric lighting installation at the Riddel Memorial P.E. School (£128).—G. McCartney.
—*Irish Builder and Engineer.*

Plymouth.—Electricity Committee. Recommended:—
Switchgear.—A. Reyrolle & Co.
Cables.—British Insulated Cables, Ltd., and Metropolitan Electric Cable and Construction Co., Ltd.
Meters (a.c. and d.c.).—Ferranti, Ltd.
Transformers.—British Electric Transformer Co., Ltd.

Torquay.—Electricity Committee. Accepted:—
Switchgear (£431).—British Thomson-Houston Co., Ltd

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Watford.—Electricity Committee.
House wiring for 12 months (schedule rates).—J. W. Russell. (Recommended.)
Cable.—W. T. Henley's Telegraph Works Co., Ltd. (Accepted.)

Weymouth.—Electricity Committee. Accepted:—
Earthing equipment for one 1,500-kW and one 3,500-kW turbo-alternators (£325).—English Electric Co., Ltd.
One 50-amp. rotating standard meter-testing set (£90).—Ferranti, Ltd.
E.h.p. and l.p. equipment for supply to Weymouth Bay estate (£1,643).—Johnson & Phillips, Ltd.

Forthcoming Events.

Physical Society.—Friday, April 19th. Imperial College of Science, South Kensington, S.W. 5 p.m. Guthrie Lecture. "The Properties of the Elements under High Pressure." Prof. P. W. Bridgman.

Institution of Municipal and County Engineers (Southern District).—Saturday, April 20th Council House, Corn Street, Bristol. 10.30 a.m. "Description of the New Power Station, Portishead." Mr. H. Faraday Proctor.

Association of Mining Electrical Engineers.—Saturday, April 20th. South Wales Institute of Engineers, Park Place, Cardiff. 6 p.m. "Three-phase Induction Motors and their Control Systems." Mr. H. T. Gregory.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, April 23rd. Victoria Mansions Restaurant, Victoria Street, S.W. 7.15 p.m. General meeting of Group members, interspersed with social items.

Institution of Civil Engineers.—Tuesday, April 23rd. Institution, Great George Street, S.W. 6 p.m. "The Arapuni (New Zealand) Hydro-Electric Development." Mr. F. W. A. Handman. "The Tata Power Co.'s Hydro-Electric Project." Mr. N. J. M. Cursetjee.

Chadwick Public Lecture, 1929.—Tuesday, April 23rd. Institution of Mechanical Engineers, Storey's Gate, S.W. 8 p.m. "What Health and Civilisation Owe to Engineering." Mr. C. E. Stromeyer.

Royal Society of Arts.—Wednesday, April 24th. John Street, Adelphi, W.C.2. 8 p.m. "The Educational Value of Broadcasting," by Mr. H. L. Fletcher.

Overhead Lines Association.—Wednesday, April 24th. Institution of Electrical Engineers, Savoy Place, W.C. 5.30 p.m. "Practical Uses and Tests of Concrete Poles in the U.S.A." Mr. W. Fennell.

Institution of Electrical Engineers.—Thursday, April 25th. Institution, Savoy Place, W.C.2. 6 p.m. Twentieth Kelvin Lecture. "Lightning." Dr. G. C. Simpson, F.R.S.

(Scottish Centre).—Friday, April 26th. Technical College, Dundee. 7.30 p.m. "Load Levelling Relays and their Application in Connection with Future Metering Problems." Mr. W. Holmes. "The Lothian Protective Gear for Distribution." Mr. H. C. Babb.
Saturday, April 27th. Excursion from Dundee to Elie by road.

(South Midland Students' Section).—Tuesday, April 23rd. Joint meeting with the Rugby Engineering Society.

(London Students' Section).—Friday, April 26th. Institution, Savoy Place. 6.15 p.m. Annual general meeting. "The Manufacture and Testing of Submarine Cables." Mr. V. E. Connor.

Chemical Society.—Thursday, April 25th. Burlington House, W. 5.30 p.m. "T. W. Richards" Memorial Lecture by Sir Harold Hartley, F.R.S.

Birmingham Electric Club.—Friday, April 26th. Grand Hotel. 7 p.m. "Electric Cables—Installation and Maintenance." Mr. H. Blades.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Red Light lighting sets (spare parts required).

Notes.

Institution of Engineers-in-Charge.

About 250 members and guests enjoyed the 29th annual dinner of the Institution of Engineers-in-Charge at the Holborn Restaurant on April 12th. Mr. H. G. Burford, president of the Institution, took the chair. After the loyal toasts, Sir Brodie H. Henderson, K.C.M.G., president of the Institution of Civil Engineers, proposed "The Institution." His Institution and that of the Engineers-in-Charge worked in the belief that theory was no good without practice, and he thought that before long all the leading Institutions would adopt that policy. The entrance examinations to Institutions were getting more and more difficult; he was not sure that that was altogether a good thing. The time had come when engineers could not be strictly divided into sections; they could only exist by co-operation. The more practical knowledge the designer had the greater was the simplicity of his designs, and the engineer's ideal should be simplicity. He congratulated the "Engineers-in-Charge" on their membership (between 500 and 600); to seat half their members at the annual dinner indicated the vitality of the Institution. In addition to spreading knowledge, an important function of the engineering organisations was to promote good fellowship, which led to efficiency. The Institution of Engineers-in-Charge was one of the most useful in the engineering profession—its papers were of a high standard, and the discussions were excellent. When the membership was scattered it paid to keep up a high standard of literature; in the "Civils" the members abroad were just as keen as those at home, for that reason.

In his reply, Mr. Burford said that the engineering Institutions should put before the public the serious national question of the great shortage of skilled labour, and he suggested that a conference of the leading Institutions might be held to consider ways and means of doing so. There was no incentive nowadays for young people to enter the skilled trades. If the great Institutions took the lead they would get Parliamentary and national support. The success of this country had been built up on the work of its skilled men. Lord Eustace Percy was very keen on the question, and with the support of the great Institutions he would be able to do a great deal.

Mr. J. Wardlaw Milne, M.P., proposed "Transport and Industry." He said that the immense impetus given to communications in recent years would probably result in the peace of the world, in addition to ensuring the safety of the world's supplies. He emphasised the need for vision with regard to transport. One of the difficulties of the trained man was that he saw little in the future; the remedy was not to reduce the wages of the sheltered trades, but to level up the others. To do this co-operation between the great industries was necessary. In spite of the shortage of skilled labour, there was never a time when there was a better nucleus of engineers in this country.

Dr. W. R. Ormandy, F.I.C., in reply, speaking of the fuel of the future, said that the time of oil had come, and oil was going to remain. There was no doubt that a great German concern had succeeded in producing oil from brown coal commercially. He had every reason to believe that the day was not far distant when English coal would be the source of fuel for automobiles, &c., so keeping a great amount of money in this country. He had recently visited Jugo-Slavia, where there was vast wealth in minerals, &c., lying idle because of lack of transport; he had reason to believe that the dormant areas would soon be developed and that the work would be given to this country.

Mr. G. A. Hughes, vice-chairman of the Institution, warmly welcomed the visitors, on whose behalf Mr. J. Roger Preston, president of the Institution of Heating and Ventilating Engineers, replied.

Mr. S. Carter, chairman of the "Engineers-in-Charge," proposed "Our President," and Mr. Burford suitably replied.

Electrical Association for Women.

Following upon the Council meeting and general meeting of members, the luncheon of the Electrical Association for Women took place at the Hotel Cecil on Tuesday last and was well attended by members from all parts of the country. The gathering included distinguished representatives of almost every branch of the industry, Mrs. Wilfrid Ashley, president of the Association, being in the chair. The speeches were opened by Sir John Snell, Chairman of the Electricity Commission, his subject being "The Economy of Electricity." In the course of his address he gave particular instances of the use of electricity, one case being that of an eight-roomed house occupied by six persons for whom the consumption per head over a three-years' average had been 1,324 units, the total cost being 0.88d. per unit. He suggested that his original estimate made in 1926 of 500 units per head at the end of some ten years might need very considerable modification in the light of the facts brought forward. He wished and expected to see electricity brought to all outlying districts, particularly those in which no gas was available, as he appreciated that for some time to come there would be considerable competition with the gas interests in districts where gas was already firmly established. Electricity in outlying districts, however, meant very considerable outlay, and such expenditure

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would not be repaid unless an extensive scheme of education in the use of electricity could be adopted widespread. He felt that the Electrical Association for Women could and would do extraordinarily good work in such directions.

Lady Emmott, J.P., president of the National Council of Women of Great Britain, in reply, said that women had feared, and still feaeed, that electricity was extremely costly, but she felt sure from what Sir John Snell had said that that fear would be speedily overcome. Electricity would obviously play an extremely important part in improving the health of the movement to spread the gospel of electricity abroad.

Lt.-Col. K. Edgcumbe, president of the Institution of Electrical Engineers, proposed the toast of the "Electrical Association for Women." He opened in his best humorous vein and, turning to the work of the Association, said that everything done by it was for the benefit, not only of its members, but for the country as a whole. He believed that the best way to reduce costs would be to increase the intensity of demand, and he hoped that all members would induce their friends to use electricity on every possible occasion, and also to see that their appliances were made by British manufacturers. He pointed out the fact, which is not always appreciated, that electricity is now cheaper than it was in 1914, whereas gas is some 50 per cent. dearer and coal about twice as costly as it was before the war.

Mrs. Wilfrid Ashley, replying, said that the E.A.W. was one of the surest direction-posts towards progress. It was for women to create the demand for electricity and, no doubt, the Central Board would see that adequate steps were taken to cope with the demand so created.

After the luncheon members of the Association visited the works of M.K. Electric, Ltd. The various processes in the manufacture of M.K. products having been inspected, the party was taken to Messrs. Belling & Co.'s factory at Enfield, and, after being entertained to tea, they were shown round the works.

Mr. Belling welcomed the members of the Association, and gave a brief *résumé* of the development of both M.K. Electric, Ltd., and Belling & Co. The latter, he said, commenced in 1912 at Enfield on a very small scale indeed. After a year, the works were moved to larger premises, about eight times the size, at Edmonton, and in the next two years the size of that factory was doubled. The present factory at Enfield was built four years ago, and is claimed to be probably the largest in the world devoted exclusively to the manufacture of electric fires, cookers, and water heaters. There are 24 bays, each 200 ft. by 20 ft.

Miss C. Haslett briefly replied, and the party, which numbered 150, left the works about 6 p.m. for London in motor coaches provided by Belling & Co.

The Association Ball followed at the Hotel Cecil, Mrs. Wilfrid Ashley receiving the guests at 9 p.m.

On March 20th members of the Birmingham and Midlands branch of the Association visited the works of the Electric Construction Co., Ltd., at Wolverhampton. On March 25th over 50 members of the same branch visited the printing works of Messrs. Kenrisk & Jefferson in West Bromwich.

On April 11th members of the Birmingham and Midlands Branch of the Association paid a visit to the Birchills power station.

The first meeting of the Bristol and District Branch of the Association was held on April 11th, and took the form of a lantern lectnre by Mr. G. S. Francis, of the British Electrical Development Association. The lecture dealt with modern architecture, and the important part played by electricity in its development.

Appointments Vacant.

Probationary assistant, telegraph engineers, for the Government of Nigeria. Technical officer (£361) for the Air Ministry. Junior assistant engineer (£200) for the Newport Corporation Electricity Department. Chief operation engineer (£1,200) for the River Shannon hydro-electric development. Lecturer in engineering for the Widnes Municipal Technical College. (See our advertisement pages to-day.)

Transient Voltages.

When subject to transient voltage excitation, local concentration of voltage takes place in an ordinary transformer in which the capacitance charging current of the coils to ground is supplied through the winding, or the ratio of inductance and capacitance of the various parts throughout the winding is not constant. In a recent paper, Mr. K. K. Palueff, of the American General Electric Company, explained various calculations and tests of voltage distribution in the winding, caused by the impact of (*a*) damped high-frequency oscillations, and (*b*) unidirectional-travelling waves. Transformers having one terminal grounded, such as are used in three-phase star connection, particularly in high-voltage systems, are frequently built with the insulation graded to other windings and ground, in the order of the normal frequency voltage stresss. The danger of such practice is shown in power transformers which are subject to transient over-voltage, since voltage oscillation in the winding may raise the voltage to ground of intermediate points above the terminal voltage, unless the design of the winding eliminates oscillation. According to the theoretical and experimental data given in his paper, the distribution and magnitude of voltage stresses existing during recognised standard insulation tests are essentially different from the stresses created by transient voltages. This permits the construction of transformers that would satisfactorily pass standard insulation tests, but at the same time would not be suitable for average service. Mr. Palueff described a new type of "non-resonating" transformer for use on grounded-neutral systems, in which type voltages at all frequencies distribute uniformly along the windings, as the possibility of internal voltage resonance is eliminated by a proper balance of distributed capacitance and inductance of the winding. This is accomplished principally by means of conducting surfaces (shields) placed outside the winding and connected to its line terminal. The action of the shields is similar to that of the shielding ring on an insulator string. It neutralises the effect of the capacitance current from the inside surface of the winding to ground, by supplying to every point of the winding a "charging current" equal to the "discharging current" of that point to ground. The application of the shield in some cases reduces the local stresses to one-eightieth. Up to the present time the total capacity of the new type of transformer exceeds half-a-million kVA.

Iron Losses in Turbo-generators.

This subject was recently dealt with in a paper read by Messrs. C. M. Laffoon and J. F. Calvert at a regional meeting of the American Institute of Electrical Engineers. There is no convenient method for determining the iron losses in large machines under load, and the authors outlined analytically the factors influencing the change of iron loss under load. While very definite results can be obtained for a simplified machine, it is not recommended at present that any change be made in the A.I.E.E. Standards for computing load loss, because there is much to be done before the work can be considered complete. This particular problem is typical of many which are entirely suitable for purely analytical study, and should furnish very desirable work for investigators who do not have access to large machines for extensive tests, but who desire to carry on studies relating to this type of apparatus. This, as well as similar loss problems, can be studied much more readily by theoretical work and model tests than by measuring the total losses of an entire machine, because the value sought is never a predominant proportion of the total value measured; even if satisfactory results be obtained on a particular machine, they are not generally applicable to all such apparatus. The authors demonstrated that on the basis of flux distributions the machines can be most conveniently divided into end zones, which present three dimensional problems, and a large central zone, which presents only two dimensional problems. The losses in each part were discussed qualitatively, and those in the central zone were obtained quantitatively for an ideal machine in which only the fundamentals of the flux waves are present. It was shown that, contrary to the usual view, these losses do not vary as the square of the generated voltage, but are predominantly affected by the ratio of the slot to total leakage reactance. The results were shown by curves, and the complications in the problem introduced by the usual commercial designs by non-sinusoidal field forms, phase bands, &c., were discussed qualitatively.

Noises in Electrical Apparatus.

In a study of noises in electrical apparatus, such as motors, generators, vacuum sweepers, induction regulators, gears, and radio loud-speakers, Messrs. T. Spooner and J. P. Foltz, of the Westinghouse Electrical and Manufacturing Co., have found the quantitative determination of noise to be very difficult, even with an analyser, owing to nodes and sound reflections. Noise often varies very greatly in different situations around a piece of apparatus, and it varies with the position of the objects in the room. For the accurate study of noise, the apparatus should be located in a sound-proof room with deadened walls, so that there will be little reflection. However, in a large number of instances when only one or two frequency components are important, qualitative results are quite sufficient. In other cases when tests must be made under shop conditions only, qualitative results can be obtained owing to a large amount of reflection as well as interference from the shop noises. In these cases results can be obtained very quickly by means of an analyser by using headphones in place of the meter usually employed to measure amplitude. Then, even though the surrounding noise level is very high, it is possible to obtain accurate frequency determinations of the noise being studied. Usually, if the frequencies of the principal components can be determined, the cause, or causes, of the noise can be assigned and means taken to eliminate, or reduce, it. Therefore a qualitative test is very often sufficient to enable the designer to avoid similar conditions in future apparatus.

Conservation of Wooden Poles.

Wooden poles are largely used in France for carrying electrical conductors, especially in connection with distribution systems in agricultural areas. At a recent meeting of the French Syndicat des Producteurs et Distributeurs d'Electricité, Mr. Dronin and Mr. Medan, of the Compagnie Générale d'Electricité, read a paper in which they dealt with the difficulties encountered with such supports, and with means of extending their useful life. The authors stated that in practice it was found, when wooden poles broke, that the fracture usually

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occurred at the ground level. In their opinion it was necessary to provide a coefficient of safety double that sufficient for indestructible masts. There were several methods of conserving wooden masts, such as treating them with sulphate of iron or copper, or with bichloride of mercury or zinc, creosote, &c., this being done either by immersion, injection, or the combined action of vacuum and pressure. The authors considered it specially necessary to protect the lower ends of wooden poles by embedding them in ferro-concrete. In recent years a movement had set in towards dispensing with the fixing of poles in the ground and of mounting them in steel or ferro-concrete sockets standing in and above the ground; a number of arrangements of this kind were described in the paper. The authors were in favour of the socket plan, and estimated that a well-injected wooden pole mounted in a socket should last for thirty years, at the end of which time, as the sockets were indestructible, it would only be necessary to put in a new pole.

Summer Time.

Summer time will be substituted for Greenwich mean time throughout Great Britain at 3 a.m. on April 21st. Accordingly all timepieces should be advanced by one hour during the night of Saturday-Sunday next.

I.E.E. Benevolent Fund Golf Competition.

The second annual golf tournament in aid of the Institution of Electrical Engineers benevolent fund and for the trophy presented by Messrs. W. L. Winning and Andrew Hutchison, will be held this summer on the various courses within the Scottish Centre. The competition will be open to members of all classes, and all members of the Institution should subscribe, whether players or non-players, in view of the object for which the competition is being promoted. The competition, in the first place, will be divided into districts, and the following have consented to undertake the duties of local secretaries:—Glasgow: Harold W. Bewsher, 147, St. Vincent Street, Glasgow, C.2. Edinburgh: J. Johnstone Foggo, 37, St. Patrick Square, Edinburgh. Dundee: P. Philip, Corporation Electricity Department, Dudhope Crescent Road, Dundee Aberdeen: J. Alex. Bell, Corporation Electricity Department, Millburn Street, Aberdeen. The entrance fee will be 2s. 6d.

Electrically-welded Ships.

The Treaty of Versailles allows Germany to replace obsolete vessels among her existing battleships, but the displacement of the craft she may build is limited to 10,000 tons. It is proposed to build four warships to comply with those conditions, their construction to be spread over a number of years, and by the use of "supergrade" light steel and electric welding, instead of riveting, it is hoped to save 550 tons in weight each. The speed of the ships will be from 26 to 28 knots, and the engines will be of the Diesel type, of very light weight.

B.S.S. for Photometric Integrators.

The British Engineering Standards Association has just issued B.S.S. No. 354-1929 for photometric integrators. The specification deals with photometric integrators of either spherical or cubical shape. The integrator may be used for the measurement of the light output of tungsten-filament electric lamps, or for ascertaining the efficiency of translucent or dispersive reflector fittings, particulars for these fittings being dealt with in B.S.S. Nos. 324 and 232, respectively. The specification gives the necessary constructional details for integrators of 24 inches and upwards in size, and it defines the requirements for the interior coating. Copies of the publication may be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

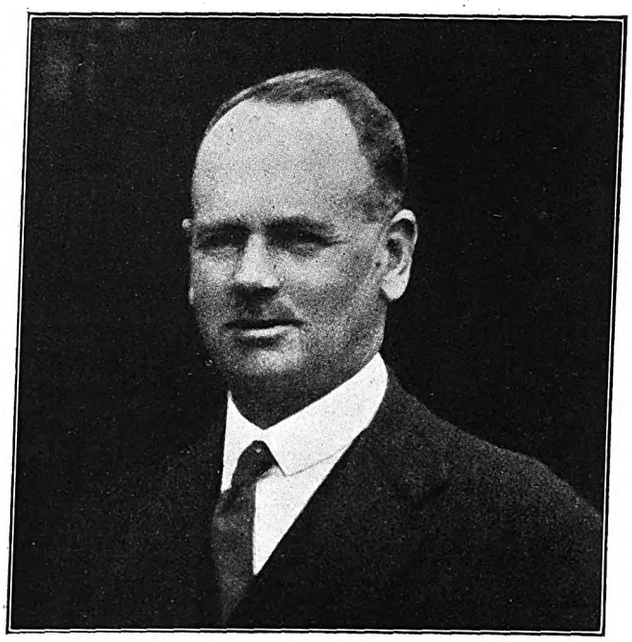
The most cordial good wishes of the Electrical Review and a host of other friends are offered to Mrs. Annie Mole and her husband on the celebration to-day of their golden wedding. Mrs. Mole, who is known in many parts of the country as one of the pioneers of electric cooking, the advantages of which she has been demonstrating for 25 years, wrote an interesting article on the subject in our last "Domestic Electrification Number" (October 19th, 1928, p. 650).

The Hull Corporation Electricity Committee has appointed Mr. G. A. Vowles as personal engineering assistant, at £569 per annum.

Mr. John Herbert Greenwood, of the Rotherham staff of the Yorkshire Electric Power Co., Ltd., who was married on March 30th to Miss J. U. Patrick, has been presented by his colleagues with a set of carvers.

Mr. J. Reed Wilkinson, B.Sc. Tech., A.M.I.E.E., has been appointed chief sales engineer and manager of the London office of Messrs. Ferguson, Pailin, Ltd., Bush House, London, W.C.2, in succession to the late Mr. Frank Thorp. Mr. Wilkinson has had many years' experience in the various departments of the company's head office, and for the last three years has been chief of the company's sales and estimating departments at the head office.

We reproduce herewith a photograph of Mr. S. E. Fedden, who, as we announced last week, has been appointed by the Central Electricity Board to the position of district engineer for the Mid-East England Electricity Scheme. Mr. Fedden was educated at Repton School, and received his early electrical training at the School of Electrical Engineering, London, and with the General Electrical Co., Schenectady, U.S.A. He also acquired knowledge of mechanical engineering with Messrs. Robey & Co., Lincoln. After further experience in Canada and the United States, he returned to England, and was appointed by the late Sir Alexander Kennedy to a position with the Westminster Electric Supply Corporation, ultimately becoming chief assistant engineer at the Davis Street station. He then went to the Edinburgh Corporation Electricity Department, where he was successively distributing engineer and chief assistant engineer. Later he was appointed consulting and chief engineer to the Burgh of Greenock and a number of electrical undertakings, including that of the Burgh of Broughty Ferry. Mr. Fedden's long association with Sheffield as chief engineer and manager of the Corporation Electricity Department dates from June, 1900, and he has been responsible for the undertaking during its tremendous growth over that period. In 1900 the plant capacity was 2,325 kW, the sales amounted to 1.3 million kWh, the number of consumers was 967, the capital expenditure £340,406, and the gross revenue £23,342. The figures for the year ended March 31st last were: Plant capacity, 106,000 kW; energy sold, 198.2 million kWh; number of consumers, 47,521; capital expended, £4,649,740; and gross revenue, £931,472. Mr. Fedden is a member of the three leading engineering institutions, and was president of the I.M.E.A. in 1907. He enters upon his new duties on May 1st.



Mr. S. E. Fedden, M.Inst.C.E., M.I.E.E., M.I.Mech.E.

Who has been appointed District Engineer for the Mid-East England Electricity Scheme.

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Mr. J. A. Bell, city electrical engineer, Aberdeen, has been granted a honorarium of £500 by the Electricity Committee for his special services for the past six or seven years during the extension of the undertaking. There was a counter-suggestion that the "recognition" should take the form of an increase in salary, but the honorarium was eventually approved.

Mr. Chas. P. Bramley, late works manager and director of the Lancashire Dynamo and Motor Company, Trafford Park, has joined the staff of the Igranic Electric Co. in the capacity of works manager at Bedford.

The Department of Overseas Trade announces that Mr. E. H. Mulock, lately Commercial Secretary for Egypt, has been appointed Commercial Secretary at Budapest in succession to Mr. H. N. Sturrock.

Mr. D. L. Thornton, M.A., has been appointed editor of the *Mechanical World and Engineering Record* in succession to Mr. C. N. Pickworth, Wh.Sch., who, as recently announced, retired last month after occupying the editorial chair for 40 years.

The Earl of Midleton has been elected chairman of the Globe Telegraph and Trust Co., Ltd. Mr. F. A. Johnston has joined the board to fill the vacancy created by the death of Sir John Denison-Pender.

Mr. Robert Lee, whose portrait is reproduced herewith, was recently appointed borough electrical engineer of Stockport at a commencing salary of £1,000 per annum. He was for many years assistant electrical engineer to the undertaking, but left Stockport about a year ago to take up the post of electrical engineer to the St. Helens Corporation. Sixty-two applications for the appointment were received by the Stockport Council, and at the meeting at which Mr. Lee's appointment was approved a letter was received from the Associated Municipal Electrical Engineers pointing out that the salary offered was below the minimum under the Association's scale and asking the Council to consider increasing it. It was resolved that the letter should "lie on the table."

Lafayette] [*Manchester.*

Mr. R. Lee, A.M.I.E.E.

The new Borough Electrical Engineer of Stockport.

Mr. B. S. Sarbutt, Carron Company's London representative, has resigned, and is about to take up a post on the staff of the British Electric Transformer Co., Ltd. He will represent it in the Southern counties for "Sunray Tricity" apparatus.

Mr. Henry Nimmo, M.I.E.E., M.I.M.E., electrical adviser and superintending electrical engineer to the Government of Burma, has proceeded on eight months' leave, and Mr. J. H. Eades is officiating in that post. Mr. Nimmo hopes to visit a number of electrical works, power stations, &c., during his stay in Great Britain and on the Continent. His address while in England will be: Wingates, Matching Green, Harlow, Essex.

In a note in our last issue we described Mr. J. A. Robertson as consulting engineer to the Salford Corporation. We find that we should have qualified this by adding that it was for the construction of the Agecroft power station as all extensions to the undertaking, including one of 20,000 kW at present in hand, are now carried out under the direction of Mr. L. Romero, the borough electrical engineer.

Mr. R. Vine Hall has been appointed assistant chief engineer of the Sydney Municipal Electricity Undertaking, at £1,500 per annum, says the *Australian Electrical Times*.

M. Voislav M. Popovitch has been appointed Director-General of the Jugo-Slavian Posts and Telegraphs in succession to M. M. Georgevitch, who has lately retired.

Mr. P. J. Underwood, of the staff of the West Midland Joint Electricity Authority at Wolverhampton, who was married on April 4th to Miss Elsie A. Mantle, was presented by the office staff with a canteen of cutlery.

The Southport Town Council has increased the salary of Mr. J. J. Young, station superintendent at the electricity works, from £468 to £510 per annum.

Obituary.—Mr. V. A. Fynn.—Our American contemporary, the *Electrical World*, announces the death, which occurred at St. Louis, Mo., on March 20th, at the age of 58 years, of Mr. Valère A. Fynn, who, until twenty years ago, was a well-known electrical engineer and inventor in this country. He was born in Russia, but his father was an Irishman. After receiving his technical education at the Swiss Federal Polytechnic in Zurich, he gained practical engineering experience with Brown, Boveri & Co., in Switzerland, and with Easton, Anderson & Goolden in London. In London he was in practice as a consulting engineer. He was the inventor of a single-phase motor, and these were manufactured by the Alioth Company in various European companies, and by the General Electric Co., Ltd., in England. Our contemporary states that it was in 1909 that Mr. Fynn transferred his interests to the United States, and from that year until 1921 he was retained by the Wagner Electric Manufacturing Company as consulting engineer. The Wagner Electric took out licences under almost all of his numerous patents, and during the twelve years this connection lasted Mr. Fynn gave his undivided attention to it. Since 1921 he has engaged in independent consulting engineering work with offices in St. Louis. Mr. Fynn was a Fellow of the American Institute of Electrical Engineers and a member of the Institution of Electrical Engineers.

Mr. W. Worby Beaumont.—We have to record with regret the death of Mr. William Worby Beaumont, M.Inst.C.E., M.I.E.E., M.I.M.E., the well-known consulting engineer and pioneering authority on motor traction of all kinds. He was the author of many publications on road vehicles, including industrial electric vehicles and trucks, electric motor boats and motor-cars, and on various other subjects, including rail corrugations, gas traction, &c. For some ten years he was joint editor of the *Engineer*, from which activity he returned to consulting engineering work. He was a member of the Advisory Committee of the Ministry of Transport. He was an enthusiast on road-making, and we well remember some of his speeches at British Association meetings between twenty and thirty years ago, in which he stressed the urgency of the expenditure of many millions upon the improvement of existing roads of Britain and the construction of many new ones.

Mr. C. E. Crocker.—The *Industrial Australian* reports the death, in March, as the result of an accident, of Mr. Claude Edward Crocker, general manager of Perth City Council's electricity and gas department. Mr. Crocker was born in Utah (U.S.A.) 53 years ago. He became an engineer of the Deep Leads Electric Power Transmission Company, Victoria, in 1900, but in the following year went to Western Australia, and remained there.

Herr G. Graf.—The sudden death at the early age of 46 years is reported from Leipzig of Herr Ing. George Graf, technical director of the Schiele and Bruchsaler Industriewerke Gesellschaft, of Baden-Baden. The deceased was a leading German authority on switch manufacture.

Mr. A. E. Angold.—We regret to learn of the death of Mr. Arthur E. Angold, M.I.E.E., of Sutton Coldfield, near Birmingham.

Mr. Angold, who was in his 57th year, developed serious symptoms while engaged in his usual duties on April 8th; an emergency operation was performed, and he passed away two days later. His health had not been robust for some time past, and last year he went for a visit to South Africa, but unfortunately he only derived temporary benefit. He was educated in London, and also received his engineering training here. He invented his first arc lamp in 1890, and, working in conjunction with Torr Todman, he showed the Todman-Arnold arc lamp for the first time at the second Crystal Palace Exhibition. The Todman arc lamp was taken over by the General Electric Co., Ltd., in 1892, and Angold then joined the company, to which he gave 37 years valuable service. Angold lamps were made for many kinds of service, and widely adopted, but Angold by no means confined himself to lamps. His patents covered rotary convertors, motor convertors, transformers, winches, hand lamps, condensers, amplifiers, and many other electrical products. Special mention should be made of his work in connection with automatic sub-stations.

Mr. W. N. Sievers.—The death is announced in *The Times* of Mr. W. N. Sievers, general sales manager of Electrolux, Ltd. Mr. Sievers passed away on April 12th "following the last of countless operations."

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Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Cables & Wireless, Ltd., and Imperial & International Communications, Ltd.—Particulars of these companies, formed to carry out the wireless-cable merger, appear on p. 720 of this issue.

C. H. Stave, Ltd.—Private company. Registered April 11th. Capital, £1,500 in 1,060 5½ per cent. cumulative preference shares of £1 each and 8,800 ordinary shares of 1s. each. Objects: To carry on business as electrical, wireless, scientific and general engineers, manufacturers of and dealers in gramophones, electric light, and other electrical apparatus, &c. The directors are:—C. H. Stave, 182, Church Street, Kensington, W.8, electrical engineer (managing director); May F. Stave, same address, secretary. Registered office: 182, Church Street, W.8.

Astorea, Ltd.—Private company. Registered April 9th. Capital, £100 in 1s. shares. Objects: To carry on the business of constructors of and dealers in gramophones, electric gramophones, radio and wireless apparatus, telephones, telegraphic apparatus, &c. The subscribers (each with one share) are:—F. C. Green, 29-31, Portugal Street, W.C.2, solicitor; E. F. Power Green, 151, Thornbury Road, Isleworth, Middlesex, solicitor's articled clerk. Solicitors: R. H. Tetley, 29, Portugal Street, W.C.2.

Venreco, Ltd.—Private company. Registered April 11th. Capital, £8,000 in 4,000 10 per cent. cumulative preference and 4,000 ordinary shares of £1 each. Objects: To adopt an agreement with Reandco, Ltd., and W. S. Veness, and to carry on the business of manufacturers of and wholesale and retail dealers in all electrical fittings, appliances and component parts. The directors are:—A. L. Rea, 10, Stratton Street, S.W.1 (director, Rea, Warren & McLennan, Ltd.); Ethel M. Rea, 10, Stratton Street, S.W.1 (director of Reandco, Ltd.); E. P. Clift, 7, Bedford Square, W.C.1 (director, Reandco, Ltd.); W. S. Veness, 23, Lupus Street, Victoria, S.W.1. Registered office: 55, Neal Street, Long Acre, W.C.

Victors (Cambridge), Ltd.—Private company. Registered April 12th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in radio and television sets and apparatus of all kinds, gramophones, &c. The subscribers (each with one share) are:—Ena Scott, 380, Monega Road, Manor Park, E.12, secretary; Eva G. Berryman, 28, Crown Road, St. Margarets, Twickenham, secretary. The first directors are to be appointed by the subscribers. Solicitors: Kenneth, Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.2.

Radio Parts, Ltd.—Private company. Registered April 12th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers, importers and exporters of, and dealers in all kinds of electrical and other instruments, supplies and components in connection with wireless telegraphy, &c. The directors are:—S. Kremner, "The Quest," Okeover Road, Broughton Park, Salford; D. McGregor, "Alpine," Davyhulme, Urmston (both directors of the Samdon Wireless Co., Ltd.). Registered office: 41, John Dalton Street, Manchester.

Edison Storage Batteries, Ltd.—Registered as a private company April 8th. Capital, £12,000 in £1 shares. Objects: To carry on business as electricians, electrical and mechanical engineers, and manufacturers of and dealers in electric batteries, to manufacture, put up and use telephones, telegraphs (wireless or otherwise), phonographs, dynamos, accumulators, lamps, and all apparatus connected with the generation, accumulation, distribution, supply and employment of electricity. Power is taken to carry on the business of motor carriage, omnibus and other conveyance proprietors, &c. The first directors are:—R. H. Allen, Orange, New Jersey, U.S.A. (vice-president, Thomas A. Edison, Inc.); C. Edison, Orange, New Jersey (chairman, Thomas A. Edison, Inc.); M. E. Fox, 5, Pembridge Gardens, W.2, engineer (director, Société Continentale de l'Accumulateur Edison S.A.); J. Millar, Orange, New Jersey (manager, export division, Thomas A. Edison, Inc.); A. F. Wagner, 42, Meadway, N.W.11 (director and manager, Thomas A. Edison, Ltd.). Secretary: M. E. Fox. Registered office: Victoria House, Southampton Row, W.C.1.

W. R. Bottomley & Co., Ltd.—Private company. Registered April 6th. Capital, £3,000 in £1 shares. Objects: To acquire the business of an electrical engineer carried on by W. R. Bottomley at Providence Electrical Works, Marsh, Huddersfield, as the "W. R. Bottomley Private Telephone Co.," and to carry on the business of wireless, mechanical and general engineers and engineering contractors, consulting wireless experts, manufacturers of and dealers in radio and telephone apparatus and supplies, wireless service agents, &c. The subscribers (each with one share) are:—W. R. Bottomley, Glynwood, Daisy Road, Brighouse, Yorkshire, electrical engineer; J. Magee, Byram Arcade, Huddersfield, incorporated accountant. The first directors are: W. R. Bottomley and Annie Bottomley (both permanent).

Official Returns of Electrical Companies.

Basil Marsh, Ltd.—Particulars filed of £700 debentures authorised March 4th, 1929, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Bower Electric (1926), Ltd.—P. J. Chaplin, C.A., 8, Staple Inn, W.C., was appointed receiver and manager on March 27th, 1929, under powers contained in debentures dated September 15th, 1926.

Laurie & Stuart, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital dated March 26th, 1929, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd

Cleartron (1927), Ltd.—Particulars filed of £10,000 debentures, authorised March 8th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £2,500.

Nelson Bros., Ltd.—Charge on 2, Regent Road, Blackpool, dated March 21st, 1929, to secure all moneys due or to become due from the company to Martin's Bank, Ltd.

London Electric Warehouse Co., Ltd.—Capital, £1,000 in £10 shares. Return dated December 31st, 1928. 8 shares taken up. £10 paid, £70 calls unpaid. Mortgages and charges, nil.

Bogota Telephone Co., Ltd.—Capital, £300,000 in £1 shares. Return dated January 14th, 1929. 258,493 shares taken up. £248,993 paid. £12,500 considered as paid. Mortgages and charges, nil.

W. G. Cannon & Sons, Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1928. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

Delagoa Bay Development Corporation, Ltd.—Capital, £166,300 in 267,400 ordinary shares of 10s. each and 133,400 preference shares of 5s. each. Return dated December 4th, 1928. 267,400 ordinary and 68,400 preference shares taken up. £105,800 paid on 177,400 ordinary and 68,400 preference shares. £45,000 considered as paid on 90,000 ordinary shares. Mortgages and charges, £209,350.

Grierson, Ltd.—Capital, £10,000 in 4,000 preference and 6,000 ordinary shares of £1 each. Return dated December 25th, 1928. 4,001 ordinary shares taken up. £4,001 paid. Mortgages and charges, nil.

City Notes.

Nigerian Electricity Supply Corporation, Ltd.

On Tuesday last this company offered the whole of its preferred ordinary shares of £1 each (450,000) for subscription at par. The balance of the capital is £200,000 in £1 ordinary shares. The preferred ordinary shares are entitled to a fixed non-cumulative dividend of 7½ per cent., and after the ordinary shares have received a similar amount, they participate to the extent of one-fourth in the surplus available for dividend. The Corporation was formed to acquire and complete a hydro-electric installation designed to provide power for the tin mines of the Bauchi Plateau, Nigeria. It has a 45-year concession and the right of a 20-year extension. The power of the Kurra Falls is being harnessed; the initial installation consists of three 2,000-h.p. sets, and additional plant is being installed to give 6,000 h.p. continuously and 10,000 h.p. maximum. The construction of a dam with a storage of 2,900 million gallons is well advanced. The company has contracted to supply 6,000 h.p.

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at a cost of 1½d. per h.p.-hour, and contracts for a further 2,300 h.p. are in hand. The chairman of the Corporation is the Hon. Lionel Holland, and the directors include Mr. M. A. Edwards, a director of the Derbyshire and Notts. Electric Power Co., and Maj.-Gen. A. C. J. de Lotbiniere, a director of the British Thomson-Houston Co., Ltd. The initial gross revenue is put at £120,000, rising to £180,000, and the net revenue at about £100,000, rising to £150,000.

Babcock & Wilcox, Ltd.

The net profit for the year ended December 31st last was £734,902, as compared with £743,820 for 1927. To this is added £125,362 brought forward, making £860,264. The final ordinary dividend is 8 per cent., free of tax, again making 15 per cent. for the year. The reserve fund receives £50,000 (against £100,000), and the staff pension fund £32,000 (against £20,000), leaving £118,363 to be carried forward. The report records the death of three directors—Mr. C. A. Knight, Mr. A. T. Simpson, and Sir Coles Child, Bt. Considerable extensions and additions to the works have been, and are being, made to meet the increasing demand for high-pressure boilers. These extensions include, it is claimed, the largest plate-bending press and corresponding riveter hitherto erected. The associated companies continue to show good results, the total income therefrom being satisfactory. The directors have decided to put the staff pension fund on a contributory basis, the company giving £1 for each £1 of the contributions of the members of the staff. Sir Robert B. Dixon, K.C.B., and Col. P. D. Ionides, D.S.O., have been appointed directors. Meeting: April 23rd.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Anode Wireless and Scientific Instruments, Ltd.
Associated Electric Traders, Ltd.
British Radio Sales Co., Ltd.
Coventry Wireless Supplies, Ltd.
Consolidated Diesel Engine Manufacturers, Ltd.
Diamond Wireless, Ltd.
Electric Lamp Regenerators, Ltd.
Electrolite, Ltd.
Holborn Electric Fires, Ltd.
Holborn Radio Co., Ltd.
Jenner Light and Power Co., Ltd.
Maywood Engineering and Electrical Manufacturing Co., Ltd.
Mitchell's Electrical and Wireless, Ltd.
Modern Electrical Supply Co., Ltd.
New Vacuum Cleaner Co., Ltd.
Park Royal Engineering Works, Ltd.
Prendergast Electrical Engineering Co., Ltd.
Re-Echo Electrical Manufacturing Co., Ltd.
Swift Electrical, Ltd.
Tele Dis Services (Founders Co.), Ltd.
Uni-Directional Apparatus Co., Ltd.
Wireless Installations, Ltd.

Direct Spanish Telegraph Co., Ltd.

After meeting all expenses and adding a balance of £1,083 brought forward, the profit for the year ended December 31st last was £3,638. In order to provide for the exceptional expenditure, £7,817 has been transferred from the contingencies fund, making a total available balance of £11,455. The preference dividend is paid, and 10 per cent., free of tax, is distributed on the ordinary shares, leaving £1,990 to be carried forward. Interruptions on the Bilbao-Porthcurnow and Marseilles-Barcelona cables were attended to during the year. The report records the death of Sir John Denison-Pender, the chairman, and the appointment of Mr. J. C. Denison-Pender in his place. Admiral H. W. Grant, C.B., has joined the board. The meeting was to be held on Wednesday last.

Brompton and Kensington Electricity Supply Co., Ltd.

The annual meeting was held on April 12th, Mr. H. R. Beeton (chairman) presiding. In moving the adoption of the report, the chairman said that a partial bulk supply from the London Power Co. was commenced in August last and a full supply in October, when the power station was closed down. The accomplishment of the new system necessitated the erection of a new transforming and bulk-distributing station, and the change of periodicity of the supply from 83 cycles to the standard 50 cycles. It involved an inventory being taken on the premises of approximately 11,000 consumers, the changing of 160 street transformers, and the replacement and adjustment of 12,000 meters, as well as the substitution, renewal, or adjustment of over 500 motors, lifts, and other apparatus. The cost of this work, with concurrent alterations, had involved a capital expenditure of nearly £70,000. Reduced charges had resulted in an increase of 14 per cent. in the sales of electricity. The report and accounts were adopted.

Kiesselbach Steam Accumulators, Ltd.

Speaking at the annual meeting on April 11th, the chairman (Sir Henry P. Maybury, G.B.E.) said that since the formation of the company a highly satisfactory number of requests for tenders had been received, and in dealing with those alone they would be working to more than capacity. Two tenders had already been accepted. Their consulting engineer (Mr. Rosencrants) reported that a very wide scope existed for the accumulators. They had decided to defer the question of the disposal of the American rights until they were further advanced in this country.

Notting Hill Electric Lighting Co., Ltd.

The report for 1928, which is to be presented at to-day's annual meeting, records a profit of £91,734 (including £27,744 brought forward). From this are deducted debenture interest, sinking fund contributions, &c., leaving £55,978. After the payment of the preference and standard deferred dividends, £1,891 is reserved for distribution as co-partnership bonus to the staff, and £28,978 is carried forward. The standard deferred dividend is raised from 13s. 7.636d. to 14s. 4.006d. per share owing to the fact that the company has been able to sell energy below the standard prices fixed in accordance with the provisions of the sliding scale under the 1925 Act. The connections rose from 16,329 to 18,017 kW, and the sale of energy from 6,975,960 to 7,640,091 kWh. The balance of the £25,000 of 7½ per cent. seven-year notes issued in 1921 was redeemed during the year.

Chelsea Electricity Supply Co., Ltd.

The annual meeting was held on April 11th. Mr. W. R. Davies (chairman), who presided, said that he hoped that by the end of this year it would be possible to reduce the charges for lighting from 5½d. to 4½d. per kWh, and for power from 1½d. to 1d. per kWh. The development of the company was not so rapid as that of some other concerns. This was due to the fact that it had a curiously constituted area. There was a very rich portion, where the demand for electricity was practically complete, and there was a large undeveloped area in which, as things were at present, very little could be done. Sir John Ellerman had bought a considerable amount of property, however, for the erection of better-class buildings, and as this property developed there should be considerable progress in the supply of electricity. The report and accounts were adopted.

South Wales Electrical Power Distribution Co.

The accounts for the year ended December 31st, 1928, show a credit balance of £89,060, as compared with £125,068 in 1927. After meeting debenture interest, there remains £24,990 (against £61,002). It is proposed to transfer £15,000 (against £44,220) to the depreciation reserve account, and to pay the dividend on the 5 per cent. preference shares, leaving a balance of £3,724 to be paid over to the South Wales Power Co., Ltd. The report records the death of Mr. W. A. Chamen, who was elected a director at the last annual meeting. Meeting: April 26th.

South Wales Power Co., Ltd.

After reviewing the accounts of the Distribution Co. (see above), the report for 1928 states that the total income from holdings in the Distribution Co., &c., amounted to £58,205, as compared with £66,496 for 1927. To this is added £20,706 brought forward, making £78,911. From this debenture interest and the dividend on the 6½ per cent. cumulative preference shares are paid, leaving a balance of £21,182, which it is proposed to carry forward. The directors consider that in view of the acute industrial depression which was even more pronounced last year than in 1927, the results obtained are as satisfactory as could be expected. Meeting: April 26th.

Gateshead and District Tramways Co.

The revenue for the year ended December 31st last fell by £6,691 to £121,405, while the expenses decreased by £385 to £703,116. The net profit thus fell from £24,595 to £18,289. To this is added £21,369 brought forward, making £39,658. The preference dividends are paid; the ordinary dividend is reduced from 10 to 6 per cent.; and £18,895 is carried forward. The traffics were adversely affected by the depressed state of trade in the district and by the closing to tramway traffic of a section of the Dunston route owing to the reconstruction of a road bridge.

Jarrow and District Electric Traction Co., Ltd.

The revenue for the past year amounted to £8,195 (against £9,806) and the available balance (which it is proposed to carry forward) to £427, including £1,202 brought in. The company has lodged a Bill in the present session of Parliament providing for the abandonment of the light railways, &c., and the substitution of omnibuses.

Wycombe (Borough) Electric Light and Power Co., Ltd.

The accounts for the year ended December 31st, 1928, show a profit of £13,852 (against £15,072) after providing for debenture interest, preference dividends, &c., and adding £1,272 brought forward. The final divided on the old ordinary shares is 6 per cent., free of tax, again making 10 per cent., free of tax, for the year. The 17,000 ordinary shares issued during the year receive a dividend of 5 per cent., free of tax. The general reserve account receives £750 and the staff benevolent fund £250, leaving £1,202 to be carried forward.

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London Electric Wire Co. & Smiths, Ltd.

The annual meeting took place on April 11th, Sir George H. Fisher-Smith (chairman) presiding. After reviewing the accounts (*vide* our last issue, p. 666), the chairman said that the general reserve now stood at £200,000, and the special reserve at £150,000. The increase of £14,662 in the profit did not accurately reflect the much larger turnover, as a considerable amount of business had had to be taken at very cut prices. The results, however, could be considered satisfactory; the company had been able to maintain its position in the trade in spite of exceptionally keen competition. The introduction of "rationalisation" had brought about many changes in industry during recent years; the board was giving serious attention to that problem with a view to taking such steps as were considered to be in the best interests of all parties concerned. During the latter part of 1928 up to the present time trade had been more stable and, unless anything unforeseen happened, the future could be regarded as distinctly hopeful.

Pinchin, Johnson & Co., Ltd.

At an extraordinary meeting on April 10th a resolution was passed providing for the sub-division of the £1 ordinary shares into 3,000,000 10s. ordinary shares. The chairman (Mr. E. Robson) explained that the alteration would tend to increase the number of shareholders and would thus lead to a wider and freer market for the company's products and shares.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The directors recommend the following dividends: "A" ordinary shares—Final dividend of 4 per cent. (actual), making 8 per cent. for the year. "B" ordinary shares—Dividend of 7½ per cent. for the year.

British Insulated Cables, Ltd.

At an extraordinary meeting on Tuesday this week the shareholders approved the directors' proposals to create 333,333 ordinary shares and 500,000 5½ per cent. cumulative preference shares of £1 each, and issue these *pro rata* to the ordinary shareholders as a bonus.

Lancashire Electric Light and Power Co., Ltd.

On Wednesday last this company offered for subscription 600,000 £1 ordinary shares at 27s. per share, raising the issued capital to £3,111,440. The proceeds are required to complete the first two 42,000-h.p. units in the new Kearsley station, for mains and for the general development of the area.

Clyde Valley Electrical Power Co., Ltd.

An extraordinary meeting is called for April 24th to consider resolutions providing for the cancellation of the 200,000 unissued cumulative second preference shares, and empowering the directors to create and issue 900,000 ordinary shares of £1 each to be offered at par to the ordinary shareholders in the proportion of one new share for each four held.

Cammell, Laird & Co., Ltd.

After providing for debenture interest and depreciation, the financial result for the year ended December 31st last was a loss of £80,694, against £112,046 in 1927. £75,000 (against £125,000) is transferred from the reserve, providing a credit balance of £5,921 to be carried forward. The dividend on the preference shares is in arrear as from June 30th, 1925.

Oxford Electric Co., Ltd.

The net revenue for the past year fell from £64,247 to £45,382, due mainly to reductions in charges and increased working expenses consequent upon the enlargement of the power station. The ordinary dividend is maintained at 8½ per cent., £25,000 is placed to reserve and renewal of plant account, and £6,448 is carried forward.

West London and Provincial Electric and General Trust, Ltd.

From the profits of the past year the directors propose to place £2,500 to general reserve, to pay a final ordinary dividend of 5½ per cent., making 10 per cent. for the year (as for 1927), and to carry forward £5,761.

Anglo-Portuguese Telephone Co., Ltd.

A final dividend of 5 per cent., making 8 per cent. for the year (as for 1927), has been declared. The dividend on the "A" ordinary shares is 8 per cent.

Indo-European Telegraph Co., Ltd.

The directors announce a final dividend of £1 2s. 6d. and a bonus of 15s. per share, making 10 per cent. (free of tax) for the year, as for 1927.

Brazilian Traction, Light and Power Co.

A quarterly dividend of 50 cents per share has been declared on the ordinary no-par-value shares.

Stocks and Shares.

Monday Evening.

The Budget effect upon Stock Exchange markets will not become manifest until the day after that on which these notes are being written. It would appear, from a preliminary study of the Chancellor's speech reported in the papers this—Monday—evening, that anticipation will be tolerably well satisfied by what Mr. Winston Churchill has done in the way of balancing his Budget. The market for gilt-edged stocks had been dull in advance of the statement, some little apprehension being felt as to a possibility that he might tamper with the Sinking Fund. It was generally agreed that the Chancellor had little chance, if any, of remitting income taxation.

Cable and Wireless, Ltd.

The outstanding feature of the week, so far as electrical markets are concerned, is found in the result of the publication of the Cable & Wireless, Limited, details, of which brief particulars were set out in these pages a week ago. The full scheme is published in the present number, but the salient features appeared on page 667 in last week's paper. The figures were in remarkably close accordance with what had been expected in the Stock Exchange, so far as the cable companies were concerned. We have said on many previous occasions that anticipation, regarded by some as a little optimistic, looked for the distribution of stock or shares that would give to Eastern ordinary stock a value of about £300 per £100 stock, and to the £10 shares of the Eastern Extension and the Western companies, the equivalent price of £30. The event shows that these values are likely to be reached, although for the moment Eastern ordinary is 282, and the shares of the other two companies stand at 28¼ or thereabouts. Globes have strengthened to 28. When a market starts in the new shares, it will be in the 5½ per cent. cumulative preference shares of £1 each in Cable & Wireless, Ltd., and 7½ per cent. "A" ordinary shares, also of £1 each, together with "B" £1 ordinary shares. Many people think that the preference will be worth more than their par value, and that the ordinary shares should stand nearer 22s. than £1.

Cable "B."

What the value of the "B" shares is likely to prove, it is difficult to say. The bullish way of looking at it is to assume that America will be a keen buyer of the "B" shares, and will be ready to pay up to 30s. or 40s. Dealings are said, indeed, to have taken place already at 30s. in the "B" shares. The value of the "B" is problematical, and at the present stage of the new company, 25s. seems to be a reasonable valuation to put upon them, in view of the possibility that they may receive no dividend for a year or two. They carry, however, the equity of the business, and it is this which gives the shares their speculative possibilities.

Marconis.

Speculative excitement has occurred in Marconis, which is only natural, in view of the lively gambling that had taken place in advance. This time last week, the price was standing at about 86s. 3d., from which there was a drop to 82s. 6d. on publication of terms that disturbed the optimism of the holders of Marconi £1 shares. It has been pointed out all along that, if there were any certainty of the £1 shares being treated as of value precisely double that of the 10s. shares, such discrepancy as existed between the quotations for the two would hardly obtain, and that this discrepancy indicated the scope which existed for possible disappointment when the terms became known. A chorus of protest promptly arose, and a committee of the dissentients is said to have been constituted. The price of the £1 shares ran up to 5⅜ on the eve of the announcement being made, from which it fell back to 4¾, recovering later to £5 a share. Until it becomes clear whether or not the dissentient holders of the £1 shares are going to take legal action in order to see if the status of their shares is higher than that assumed by the company, it is quite possible that the market for Marconis will remain in a jerky and, possibly, a dullish state.

But when everything has settled down, the promise is for better prices, and the speculative investor is likely to agree that there is a prospect of improved values as soon as the present dust of controversy has been brushed away.

Other cable stocks are good, a rise of £2 in Great Northern Telegraphs taking the price to 34. Anglo-American preferred at 102 is ex dividend. Marconi Marines are a better market at 3⅞ bid.

Telegraph Constructions.

Telegraph Construction & Maintenance shares, quoted ex dividend last week, and now standing at 24¼, become interesting by reason of the merger. The company for years past has been paying dividends of 10 per cent. free of tax, and the shares are of the unusual denomination of £12. The Tele-

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graph Construction & Maintenance among its other activities produces "loaded" cable, and it would seem as though the new merger is likely to provide the company with a good deal of business. There was some talk, a little while ago, of the American companies negotiating with the Telegraph Construction & Maintenance, but nothing has lately been heard of this, and the rumour may be merely gossip. The cable-wireless merger is likely, however, to lead to further developments in the future; and, humdrum though Telegraph Construction shares look as an industrial investment, holders will probably consider it worth while to retain their interest in the hope of future developments.

Electricity Supply.

Several of the deductions of dividends that were made last Thursday, the Stock Exchange pay-day, from prices in the Electricity Supply list, have been regained. Midland Electric Power, Clyde Valley, Newcastle-on-Tyne ordinary and 7 per cent. preference are amongst others which are quoted at the same prices ex dividend, as they were at the immediately-previous cum. dividend figures. Save for these gains, the list is unusually quiet. County of London ordinary hardened a few pence to 53s. Lancashire Light & Power ordinary remain at 30s. unaffected by the announcement of a new issue of shares at 27s. This would not include, of course, the dividend of 1s. 6d. per share dividend carried by the price of the existing issue. Atlas at 26s. 3d. are ex 4 4-5d. dividend. Egham & Staines are ex 1s. 6d. at 34s. 6d., and Isle of Thanet preference at 25s. 6d are ex 7 1/5d. all less tax.

"Approximate" Dividends.

It may have been observed that our price lists are brought as nearly as possible up-to-date by the addition of the dividends for 1928. The catalogue cannot be completed, it is obvious, until all the companies have published their accounts. In a certain number of the London electricity supply shares, the dividends are at rates which run into decimals to four places. We have taken the rates nearest to what might be termed round fractions, and this is the reason why the dividend columns in our tables are headed with the word "approximate." As mentioned on previous occasions, the yield on the money is calculated in most cases not upon the dividends at present being paid, but upon the 7 per cent. standard rate, to which the majority will decline after 1931. This system of working seems to be less liable to mislead the investor than that of working out the return on the basis of the distributions still being made by the companies.

The dividends on manufacturing companies' shares will be altered to the 1927-1928 figures when the table can be made more complete than is the case at present.

Manufacturing Companies.

Enfield Cable shares hold their last week's improvement to 4½. General Electrics developed spasmodic activity and gained 1/16 at 3 1/16. British Insulated ordinary at 4 9/16 are ex the dividend, allowing for which the price is practically unchanged. At 2⅜ British Aluminium also are ex dividend, thus being about 1s. harder on the week. English Electric weakened to 7s. There is a little speculation in the shares of the Telephone Manufacturing Company, on a hope that some modest distribution may be made, three months hence. The current price is 6s. 1½d. for the 10s. shares. Vickers six-and-eightpenny shares are dull at 10s. 10½d. ex the 8 per cent. dividend. A decline of 1/16 to 3⅜ in Babcock & Wilcox, reflects the mild disappointment at the dividend for the year, being left at 15 per cent. free of tax. This is the same rate as before: some people had hoped the dividend would be raised to 16 or 17 per cent., but the accounts show that an increase would have been hardly justifiable.

Railways and Traction.

Metropolitan Railway consolidated is up a point to 61½. Underground Electric Railway Incomes are 2 higher at 114, regaining the loss which, a week ago, was indicated here as being difficult to explain. Districts keep steady at 76½, the return at this price being 6½ per cent., a yield that makes the stock look moderately valued, in view of the company's hopeful prospects.

Brazilian Tractions firmed up to 62. Para Electric Railways preference have gone back to 18s. 9d. In the group of Mexican utilities, Mexican Light & Power common advanced 2½ to 82½. Amongst other foreign descriptions, Perak Hydro-Electrics turned dull, and lost 1s. at 17s. 6d., the debenture stock at 117 being put down a point. Hydro-Electrics recovered their previous week's loss, rallying to 37, though International Holdings, their stable companion, further declined to 8⅝. Shawinigan Water at 74½ shows a drop of 2, and has been still lower. "Dollar" stocks remain under the dominating influence of New York and Montreal, in both of which centres the effects of last month's sharp attack of financial indigestion have not wholly worn off.

Nigerian Electricity.

An interesting newcomer is the Nigerian Electricity Supply Corporation, which has been offering 450,000 perferred ordinary shares of £1 each. The company holds a 65 years' concession to utilise the Kurra Falls, in Northern Nigeria, for generation of hydro-electric power. The prospectus stated that the supply of electric power is expected to start next January.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Approx. Dividend. 1927,	1928.	Price April 15 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	—	£4/6	—	... ...
Brompton Ordinary	1	8½	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	49/3xd	+9d.	3 14 1
County of London	1	7½	10	53/-	+6d.	3 15 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	55/-	—	4 0 0
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	9	27/-	—	5 3 8
Metropolitan	1	9	9	2 1/16	—	4 7 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	36/3xd	+1/-	4 2 9
Newcastle on-Tyne Ordinary ...	1	6	6	1½xd	+6d.	4 16 0
do. 7% Pref.	1	7	7	26/-xd	+6d.	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/-	—	5 8 8
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	—	48/3	—	... ...
Westminster Ordinary	1	8⅝	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

Home Rails.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	8	8½	61½	+1	5 13 10
do. District	,,	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	23/6	—	5 13 10
do. do. Income ...	Bonds	6	6	114	+2	5 5 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102xd	—	5 17 8
do. Def.	,,	1½	1½	24	—	6 3 9
Automatic Telephone	1	10	12½	2 3/16	—	5 14 2
Eastern Extension	10	10	10	28xd	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	282xd	+4	*3 11 0
Globe Tel. and T. Ord.	10	10	10	28	+½	*3 11 5
do. do. Pref.	10	6	6	11¼	—¼	5 9 0
Great Northern Tel.	10	20	—	34	+2	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	10	—	4 5/16	—	... ...
Marconi-Marine	1	12½	15	3⅛	—	4 16 0
Oriental Telephone Ord.	1	12	—	2⅞	—	... ...
Western Telegraph	10	10	10	28¼xd	—	3 11 0

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3 11/16	—	7 9 3
do. do. 2nd Pref. ...	5	6	6	3⅞	—	7 14 10
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	—	850	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	62	+1	3 4 6
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	69½	—	7 4 0
Mexican Light Common	100	Nil	Nil	82½	+2½	... ...
do. 7% Pref.	100	7	7	75½	—	9 5 6
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		1926,	1927.			
Assoc. Elec. Ord.	1	—	—	38/3	—	... ...
Babcox & Wilcox	1	18	15	3⅜	—⅛	*4 8 9
British Aluminium Ord.	1	10	10	47/6	—	*4 4 3
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4 9/16	—	3 6 0
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	4⅜	—	3 9 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 3
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4½	—6d.	4 17 0
English Electric	1	Nil	Nil	7/-	—	... ...
do. do. Pref.	1	3	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	10	3 1/16	+1/16	3 5 8
Henley...	1	25	25	6	—	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	1 5/16	—	5 3 1
Siemens Ord.	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction	12	10	10	24¼xd	—¼	*4 19 3

* Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during March.

In examining the Board of Trade Returns for March it has to be remembered that the month not only included five Sundays, but also that the Easter Holidays occurred at the end of the month. So far as foreign trade generally was concerned, this led to decreases in both imports and exports during March, as compared with the corresponding month of last year. This, however, does not explain away the fact that while electrical exports decreased, imports of this class rose in value.

Dealing first with the exports it will be seen that there was a decrease of £89,674 as compared with the February figure. This decrease was general but most marked in the cases of telegraph and telephone apparatus (£59,208), non-submarine telegraph and telephone wires and cables (£38,969), batteries and accumulators (£36,366), and unenumerated electrical machinery (£30,651). The total decline in the telegraph and telephone section was £101,546. Against these were set four increases of which only two were of any magnitude, namely, unenumerated goods and apparatus (£68,741), and railway and tramway motors (£20,687). In comparison with March, 1928, there was a decrease of over 20 per cent., there being only three increases all of negligible proportions. The electrical machinery section showed a total decline of £158,177. The telegraph and telephone class recorded a total decrease of £160,773, including the largest fall in the list—£113,670 in the case of instruments and apparatus. In the goods and apparatus section the greatest decreases occurred in the cases of batteries and accumulators (£25,554), and insulated wires and cables (£24,534). The result of the fall in the total was to bring the exports for the first quarter of the year to £324,460 below the figure for the first three months of 1928.

The following table shows the distribution of our electrical machinery exports during March, and the figures are compared with those for March, 1928:—

Destination.	March, 1928. £	March, 1929. £	Inc. or dec. £
Europe	61,457	68,563	+ 7,106
Japan	26,109	7,911	−18,198
South America	84,895	48,160	−36,735
South Africa	49,949	29,619	−20,330
British India	133,339	162,466	+29,127
Australia	124,653	73,215	−51,438
New Zealand	39,531	20,430	−19,101
Canada	17,362	13,319	− 4,043
Other countries	107,137	62,572	−44,565
Totals	£644,432	£486,255	−£158,177

Having regard to the general decrease it is satisfactory to see the rises in the figures for British India and Europe. Conversely the falls in the cases of Australia, New Zealand and South Africa are not encouraging. The proportion between the amounts taken by foreign and Empire markets remained about the same.

The increase in imports as compared with February was fairly generally distributed over the items. Electrical machinery recorded the greatest rise (£29,023), and the only other outstanding advance was £28,179 in the case of glow lamps. There was a fall of £11,778 in the telegraph and telephone section. The increase upon the March, 1928, total was £56,527 and this was mainly due to larger imports of telegraph and telephone apparatus, this item showing a rise of £49,252. Apart from this there were no outstanding variations, with the possible exception of a fall of £7,891 in imports of non-submarine telegraph and telephone wires and cables. The total for the first quarter of the year is £110,160 above that for the corresponding period of 1928. The re-export section shows declines in both comparisons and only the decreases in the machinery section are of any note.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Mar., 1929.	Inc. or dec. as compared with Feb., 1929.	Inc. or dec. as compared with Mar., 1928.	Electrical imports for Mar., 1929.	Inc. or dec. as compared with Feb., 1929.	Inc. or dec. as compared with Mar., 1928.	Electrical re-exports for Mar., 1929.	Inc. or dec. as compared with Feb., 1929.	Inc. or dec. as compared with Mar., 1928.
Electrical goods and apparatus (unenumerated)	£246,948	+ £68,741	+ £7,407	£124,557	+ £4,017	+ £9,915	£7,411	+ £147	+ £331
Insulated wires and cables ...	228,442	+ 9,352	− 24,534	59,447	+ 2,966	− 2,258	734	+ 194	− 383
Glow lamps	39,648	− 4,345	+ 1,105	49,101	+ 28,179	+ 6,559	988	+ 123	− 41
Arc lamps and parts ...	631	− 1,941	− 439	831	− 189	− 1,633	2	− 151	− 86
Batteries and accumulators ...	77,190	− 36,366	− 25,554	44,788	+ 983	+ 2,071	102	− 105	− 369
Meters and instruments ...	26,049	− 738	− 12,370	22,927	+ 5,090	+ 439	772	+ 260	+ 368
Carbons	158	− 519	− 2,225	18,535	+ 5,592	+ 8,213	16	− 208	− 243
Switchboards (not telegraph or telephone)	5,631	+ 3,210	+ 3,327	157	− 665	− 171	—	—	− 100
Electrical Machinery—									
Electrical machinery (unenumerated)	293,597	− 30,651	− 53,811	149,803	+ 29,023	− 7,969	6,201	− 2,419	− 7,450
Railway and tramway motors	52,411	+ 20,687	− 18,223	—	—	—	—	—	—
Other motors and generators...	140,247	− 15,558	− 86,143	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	40,525	− 38,969	− 30,608	3,531	− 4,961	− 7,891	—	− 45	− —
Submarine telegraph and telephone cable	2,614	− 3,369	− 16,495	—	—	—	4	+ −4	+ 4
Telegraph and telephone instruments and apparatus ...	218,600	− 59,208	− 113,670	98,297	− 6,817	+ 49,252	2,540	− 426	+ 514
Totals	£1,372,691	− £89,674	−£372,233	£572,024	+ £63,208	+ £56,527	£18 774	− £2,626	− £7,455
Inc. or dec. for three months ...	Exports −£324,460			Imports +£110,160			Re-Exports −£9,439		

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Registered Electrical Contractors.

The Annual Meeting and Report of the Registration Board.

THE annual meeting of the board of the National Register of Electrical Installation Contractors was held at the Institution of Electrical Engineers on Monday last. Mr. P. V. Hunter (chairman) presided and presented the report of the Executive Committee which is reviewed below. Mr. R. A. Ure suggested that the Register was not sufficiently advertised in Scotland and that a Scottish Committee should be formed to put its objects before consultants, architects and others. Mr. F. W. Purse pointed out that the E.C.A. of Scotland was represented on the Executive. The chairman promised that the matter would be sympathetically considered by the Executive. Mr. W. R. Rawlings seconded the adoption of the report which was carried. The nominations to the Executive Committee were confirmed; Mr. P. V. Hunter was re-elected chairman and Mr. A. H. Dykes vice-chairman. The Committee asked for approval of a draft setting forth certain points of bad workmanship which rendered contractors liable to be struck off the Register. These were as follows:—

(1) Over-rating of mains, sub-mains or sub-circuits and all controlling apparatus connected therewith. (2) Inadequate methods of ensuring the electrical and mechanical continuity of metal-sheathed cables and conduit systems and lack of permanent earthing connections. (3) Leaving the ends of tubes at switch points, lighting points or distribution boards without suitable bushing by protective nipples or by a suitable outlet-box, or wood block. (4) On concealed tube systems failure to provide a suitable outlet which would protect the wire right up to the surface of the wall or ceiling; or alternatively failure to bring the tube through to the surface of wall or ceiling. (5) In the case of metal-sheathed, tough-rubber-sheathed and similar cables, failure to bring the whole of the protective covering through to the surface of wall or ceiling. (6) Failure to keep clear of used or disused gas pipes in such a manner that they could be brought into accidental contact with the wiring or its conduits. (7) The insertion of more wires in a conduit than would allow of at least one more wire of the same size as the largest already in the conduit, being easily pushed in for a distance of six inches. (8) The absence of reasonable precautions to safeguard against risks of fire and shock. (9) The employment of inadequately paid labour and the use of boys in unreasonable proportion to that of fully-qualified wiremen. A letter was read from Mr. J. J. Foggo (E.C.A. of Scotland) in which he considered that the proposals did not go far enough. He maintained that 15-A plugs and sockets, &c., should be insisted on for all power points; that screwed conduit and conduit boxes should be insisted upon, and the proposals made more rigid in other directions. Mr. H. J. Cash said that although he agreed with Mr. Foggo, the Register had to move slowly and cautiously. They had to carry with them supply authorities, manufacturers and others who were determined to push electricity at all costs, and they could not make the prices of installations prohibitive. Mr. Calvert pointed out that the Executive asked for approval to the principle behind the proposals; they could always be strengthened later on. In the course of a protracter discussion in which Messrs. W. H. Walton, W. R. Rawlings, H. J. Cash, R. A. Ure, P. V. Hunter, and A. H. Dykes took part, Mr. Purse suggested an addition providing for proper jointing and the protection of joints in cables and flexibles, and enjoining the use of mechanical connectors and suitable joint boxes. It was eventually decided to give the Executive Committee powers to circulate the document as put forward, with the certificate renewal notices. Messrs. Hunter, Dykes and Cash, the retiring members, were re-elected to the Executive Committee.

Mr. W. R. Rawlings mentioned that arrangements were being made to relieve Mr. Trimnell, the secretary, from some of his work, but said that the Register would continue to have the benefit of his advice and assistance. A number of members paid a tribute to Mr. Trimnell's work for the Register. Mr. W. A. Shaw asked the Executive to send copies of the approved draft regarding bad workmanship to all supply authorities, and the meeting concluded with a vote of thanks to the chairman.

The Annual Report.

In its report for the past year the Executive Committee of the Register draws attention to the increased expenditure upon advertising and publicity literature, &c. The item specified includes part of the sum of £400 allocated for the purpose which was spent on advertisements in the electrical, architectural, municipal and building journals, the printing and circulation of lists of registered contractors, pamphlets, &c. An item "legal expenses" in the accounts relates to costs incurred in connection with the obtaining of an injunction against a firm of contractors who had improperly used the device of the Register granted to their predecessor before their application had been adjudicated upon by the Executive Committee. A larger office has been taken in the same building.

During the year 257 applications for registration were received; of these 124 were accepted and 39 declined and withdrawn, while 94 were under consideration at the date of the report. The total number of applications received up to December 31st, 1928, was 1,584, and the net number of contractors on the Register at that date was 1,150, representing an increase of 101 during the year.

To those authorities who had already confined installation work under assisted wiring schemes to registered contractors, the following names were added during the year:—Birmingham, Leeds, Oldham and Plymouth. For some unexplained reason South Shields rescinded its previous decision to give such work only to registered contractors. The Committee considers that the grant for publicity has been well expended and made to go a long way. A reprint of an article by Mr. H. Moss on "The Need for Compulsory Registration" has been circulated to the number of 15,000, and contractors have applied for 100,000 copies of the pamphlet entitled "Hidden Risks." Advertisements have appeared at regular intervals in the electrical and other specialised Press, and many encouraging editorials and notices have appeared in those papers and in the daily Press, bringing the Register and its objects before the public. A large number of inquiries have resulted, coming not only from the United Kingdom but also India, Australia, the United States, &c.

At the last annual meeting it was stated that the representatives of the Electrical Contractors' Association on the local advisory committees were not always registered contractors, and it was resolved that the matter should be discussed with the E.C.A. to remedy this. As a result of a joint conference it was agreed that where the E.C.A. was unable to appoint a registered contractor member to a local advisory committee, the representative appointed should be required to become registered within twelve months or cease to be eligible as a member of the advisory committee. Discussions with the E.C.A. regarding certain of the rules and conditions of registration had led to the Association's agreeing to submit proposals in writing to the Register. To enable the Association to gain a better insight into the work of the Register, the President has been invited to attend the Committee's metings.

The Committee is still of opinion that the time has not yet arrived for making wiring regulations compulsory. Recent events, however, have proved the necessity for some provision for bringing under the ban of the National Register certain unsatisfactory features in installation work, and Mr. Cash, at the request of the Committee, has prepared a list of examples of faulty wiring work which it is recommended shall be the basis of a regulation or standing order, and the employment by a contractor of such methods shall be cogent reasons for the exercise by the Committee of the disciplinary powers conferred upon it. Recently a report upon an application for registration by a certain local advisory committee disclosed such a difference of opinion, that it was necessary for a member of the Committee to interview both the advisory committee and the applicants. Mr. Cash found that it appeared to be a practice in the locality to carry out wiring work in a manner that conflicted with the proposed regulation. The applicants were required as a condition precedent to the acceptance of their application to alter the installations in question and to undertake to avoid repetition of such methods in the future. The attention of the supply authority was also drawn to the matter, with the result that all contractors in the area, whether registered or not, have been forbidden to adopt the methods in question. The Executive Committee claims this as a considerable step in the direction of achieving one of the objects of the Register—the improvement and standardisation of electrical installation work. The seventeen London area advisory committees had now been practically filled and are now operating. With one or two exceptions the work of all local advisory committees has proceeded smoothly and with reasonable dispatch. The Committee expresses its appreciation of the activities of these bodies, and of Messrs. Cash and Purse, the Scrutinising Committee.

Complaints of bad workmanship against two firms were lodged during the year. In one case the report of a consulting engineer fully substantiated the complaint made, and in the absence of an adequate explanation the certificate of the contractors concerned was cancelled. In the other case, bad work was admitted but extenuating circumstances were pleaded. As a condition of remaining on the Register the contractor was required to make good the work in connection with which the complaint was made and any similar work carried out by him, and to give a satisfactory undertaking with regard to future work. Complaint was made against another registered contractor for employing an undue proportion of boy labour and paying inadequate wages. The contractor appeared before the Committee and promised to increase wages to a satisfactory rate. Subsequently he declined to carry out his undertaking, and accordingly his certificate was cancelled.

The only alterations in representation on the Registration Board are in the case of the I.M.E.A. which has nominated Mr. W. A. Walker in the place of Mr. C. H. Smyth; and the E.C.A. of Scotland whose president, Mr. J. J. Foggo, takes the place of the retiring president, Mr. Ure.

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Porcelain Insulator Tests.

A consideration of the design, or type, tests for determining the characteristics of the insulator and its suitability for the service specified.

By B. L. GOODLET, A.M.I.E.E.

(*Extracts from a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE general viewpoint of the various national specifications is much the same, the major tests differing from each other only in details of execution. All the specifications group the tests required under the following two heads:—(*a*) Design, or type, tests, the object of which is to determine the characteristics of the insulator and its suitability for the service specified; (*b*) routine or manufacturers' tests, the object of which is to detect manufacturing defects.

All the national insulator specifications have as their basis the following fundamental requirements:—

(1) The mechanical strength of the insulator must be sufficient for the purpose in hand.
(2) The puncture voltage of the insulator must exceed its spark-over voltage under all conditions of climate and load.
(3) The insulator must be completely non-porous.
(4) The insulator must withstand sudden fluctuations of temperature over a limited range.

Corresponding to these fundamental requirements are the following basic tests:—

Electrical.	*Mechanical.*
Dry spark-over voltage.	Puncture voltage.
Wet spark-over voltage.	Strength.
	Temperature cycle.
	Porosity.*

In addition, special tests are frequently included.

Minor alterations in the arrangement of all the details of the set-up are capable of producing appreciable results; successive tests even on the same insulator are never likely to be made under precisely the same conditions, and hence it is unreasonable to expect perfect coincidence of figures.

The barometric correction is important when insulators are to be used in mountainous regions; the temperature correction must be remembered when insulators are to be used in hot climates or situations. It does not appear to be known generally that an increase in humidity raises the spark-over voltage of most insulators, particularly large ones. A voltage increase of 15 per cent. is quite usual for a humidity increase of from 50 to 90 per cent. Above 90 per cent. relative humidity the spark-over voltage generally begins to fall; the actual precipitation of moisture on the insulator surface lowers the spark-over voltage. For this reason the spark-over voltage of an insulator should never be measured immediately the insulator has been brought in from outside or otherwise moved from a cold to a warm locality. In such cases sweating invariably occurs and the results, apart from being erratic, may be appreciably lower than would be obtained with the insulator clean and dry, which raises the question of the influence of surface films in general.

Frequently insulator hardware has a coating of soluble impurities remaining from the galvanising bath, and traces of crystalline salt are sometimes to be found (a relic of the water-bath test); as both these impurities are dissolved by rain water, its resistivity is lowered and low values are obtained until the coatings have been more or less removed. The presence of this kind of effect may often be detected by comparing the resistivity of the water falling on and flowing off the insulator, and the influence of the water resistivity on the results of wet spark-over tests is obviously much too great to disregard. It has sometimes been proposed that it should be permissible to test with water of any resistivity, the spark-over values being then reduced to a standard resistivity by multiplication by a correction factor. However, apart from the fact that these factors are not the same for different types of insulator, with water of various resistivities, there is a physical difference in the phenomena involved which cannot be adequately taken into account by a mere numerical ratio.

Consider now the electrical performance of fouled insulators. The experimental procedure best calculated to exhibit the effect of such deposits is to observe the discharge and spark-over voltages of the insulator as a function of the relative humidity of the air for various thicknesses of deposit.

Fig. 1 shows the influence of various intensities of salt deposit on the power-frequency spark-over voltage of a 3-unit chain of cap-and-pin type insulators, such as is frequently used on 33-kV lines; the relative intensity of the deposit is expressed by the weight (mg/cm²) of precipitate. The combined action of a heavy salt film and damp atmosphere is capable of reducing the actual spark-over voltage to less than 30 per cent. of its nominal value. The performance of an insulator in the fouled condition cannot be characterised solely on the basis of its spark-over voltage. Usually, luminous discharges are present at very much lower voltage and, with certain types of insulators, at the higher humidities these discharges assume the form of partial arcs between the sheds, developing considerable heat and noise, but without causing an actual arc-over. The action of such discharges, if prolonged, is very damaging to the surface and glaze of the insulator.

Another point of interest is that the spark-over voltage at 95 per cent. humidity is frequently lower than in actual fog or rain. The impulse spark-over is practically unaffected by fouling.

The phenomena observed with substances other than salt and soot are qualitatively very similar; of all the impurities tested,

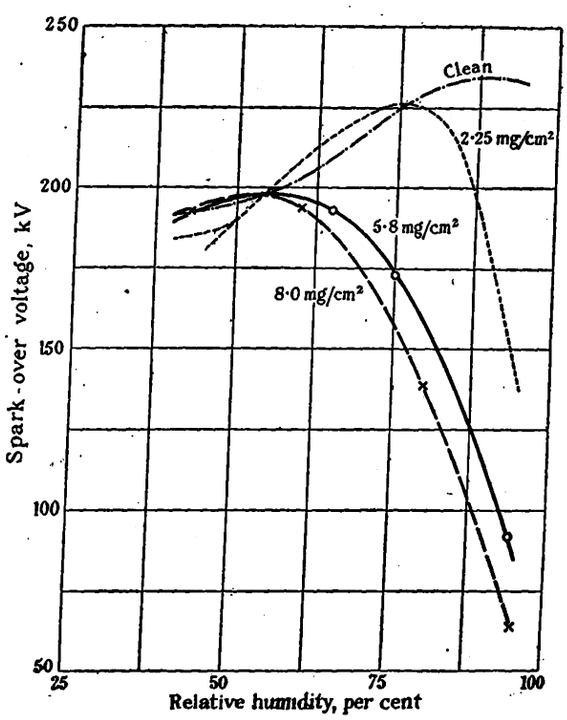

Fig. 1.—Spark-over Voltage as a Function of Salt Deposit.

those of a metallic nature, such as metallurgical fumes, had the most deleterious influence; cement dust is also extremely harmful, the spark-over voltage frequently being reduced to 10 per cent. or so of its nominal value.

The fouling trouble has given rise to a considerable amount of thought among insulator designers, and there are at present on the market several designs for which especially good performance in damp and polluted atmospheres is claimed. The majority depend for their effectiveness upon the presence of a long and protected leakage line obtained by the use of deep vertical surfaces. A rational criterion on which the probable performance of an insulator in the foul condition may be estimated is provided by the following consideration.

If a moist deposit is formed on the surface of a dielectric under stress, then the tangential component of intensity over that surface will tend to vanish to an extent dependent upon the conductivity of the surface film, and in the limit an equipotential surface will be established. *The minimum disturbance of the original field form will therefore occur with an insulator on which the deposits accumulate mainly on surfaces which are equipotential surfaces also in the clean condition.* Fig. 2 shows the field forms determined by experiment on the 3-unit suspension insulator chain previously mentioned, in the clean and foul conditions. The vanishing of the tangential component of intensity over fouled surfaces is well illustrated, the majority of the lines of force cutting the fouled surfaces strictly at right angles.

In studying the matter from this aspect, however, it must not be forgotten that the field form of an insulator is liable to

* Omitted from the American I.E.E. Specification.

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alter with voltage and other factors, so that conclusions on this basis can be drawn only with great caution. From the above remarks it will be apparent that the satisfactory execution of fog tests calls for great care and much knowledge of a nature not usually to be found in an engineering test room. For these reasons it may be doubted if a fog test can be developed which will give satisfactory results in commercial work.

In the selection of high-voltage insulators, engineers at the present time are guided mainly by the principles implicitly, or explicitly, laid down in the various national insulator specifications. Since innumerable networks equipped with insulators selected on this basis are giving fairly satisfactory service, it is obvious that the governing ideas of the specification cannot be unsound. It is, however, necessary to realise that the requirements of the national specifications are in general the absolute minimum which can be demanded from an insulator. An insulator which does not comply with these requirements is practically certain to be unsatisfactory in service, but the converse proposition is by no means the case; therefore, the present specifications are in general a little incomplete. To see the direction in which improvements could be effected it is necessary to examine briefly the origins of our present service troubles.

Insulator troubles in transmission systems are invariably due to one or other of the following causes:—

(1) Excessive voltages, which may be classified from their origin as (*a*) power-frequency surges due, say, to sudden dropping of load; (*b*) switching surges and arcing earths; (*c*) lightning surges.

Operating experience indicates that in systems insulated in accordance with modern practice (with earthed neutral) lightning is the only source of over-voltage requiring serious consideration. The voltages induced by lightning in the line itself are of an impulsive nature, but by reflection from terminal apparatus oscillatory voltages may be built up. We may therefore conclude that from the over-voltage standpoint the impulse and high-frequency characteristics of the insulator are of the first importance.

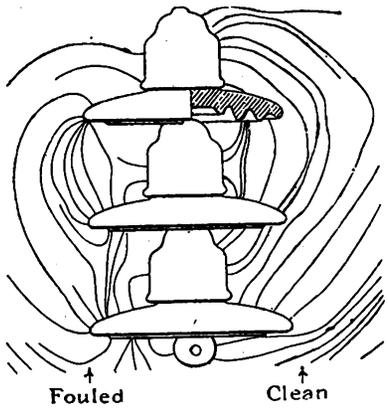

Fig. 2.—Insulator Field Form.

The over-voltage problem has given rise to a considerable amount of discussion as to the grading of the insulation strength in various parts of a transmission system. The generally accepted view seems to be that a short section of line immediately adjacent to a station should be more lightly insulated than any other portion of the system, with a view to localising troubles at a point convenient for repairs. The insulation of the station apparatus may either increase continuously from the incoming line to the main transformers, or the relative strength may be graded on a basis designed to attain minimum number of interruptions, minimum cost of repairs or some similar objective.

The advantages to be gained by the adoption of some such scheme undoubtedly appear to be very great, but the basis of classification to be adopted requires very careful consideration. The present tendency is to argue that as lightning trouble is the principal reason for any such system being desirable, the lightning, or impulse, spark-over and puncture voltages of the component parts should be made the basis of the grading. Classification on such a basis obviously requires the standardisation of methods of carrying out the impulse test, particularly with regard to the wave-form of the impulse adopted. To the question of what this standard wave-shape should be the obvious answer is that it should approach as closely as possible to that of the disturbances produced by actual lightning. This reasoning is certainly very plausible and convincing so far as it goes, but to the author it appears to neglect two most important facts.

In the first place, it seems to be tacitly assumed that a "standard" lightning surge does in fact exist, *i.e.*, that all lightning discharges are similar and give rise to impulses of similar wave-shape in the lines. In the second place, the distortion of the lightning impulse during its passage through the terminal apparatus is neglected. The wave-shape of an impulse arriving at the station from the line may be perfectly well known and simple. By the time, however, that it has traversed the various choke coils, isolators, oil switches, current transformers and other impedimenta which station engineers seem to find necessary, we may be quite certain that its form will be only remotely similar to that of the incident wave. Indeed, it seems to be fairly certain that the voltages developed at the main transformer terminals are frequently oscillatory and not impulsive in nature. Further investigation may certainly prove that the characteristics of the dangerous disturbances are sufficiently definite to enable imitative tests to be standardised. Until such evidence is to hand, however, it would be very unwise to make any far-reaching alteration in the specifications such as the classification and rating of insulators on the basis of impulse performance would involve.

(2) A reduction in the insulation strength of a system, which becomes manifest either as (*a*) a reduced spark-over voltage, or (*b*) a reduced puncture voltage. (*a*) Reduction may be caused either by adverse surface conditions (rain, fouling) or by damage of a mechanical nature such as fracture of the sheds. As the impulse and high-frequency spark-over voltages are unaltered by rain and fouling, surface conditions become important only when the magnitude of the reduction is so great that the normal operating voltage can start trouble. With systems insulated in accordance with present practice a reduction of such magnitude can be effected only by fouling. The study of the phenomena on fouled insulators has therefore considerable practical importance, particularly for engineers whose lines run through industrial or coastal districts. (*b*) Reduction almost invariably has its origin in some mechanical trouble, if we except the cumulative damage done by repeated impulses; such are excessive electro-mechanical loading, swelling of cement, growth of metal parts by corrosion, sudden temperature-changes and similar phenomena for which it is difficult to devise satisfactory tests. Impulse and electro-mechanical tests will probably be suggested as a cure for this trouble in the future, but it is by no means certain that this is the correct line of approach.

(3) Mechanical failures, which occasionally occur due to abnormal operating conditions, but are far more frequently to be traced to faulty design, or defective manufacture, of the insulators themselves. The more obvious constructional defects giving rise to a low ultimate strength are adequately looked after by the ordinary mechanical load test, but there are a number of other points, particularly relating to the transmission of load between the conductor clamp and the porcelain, which require serious consideration. In this connection it is probable that vibration and shock tests, and tests with fluctuating loads, will find an increasing application in the future.

Summarising the above remarks, it must be admitted that there are many phenomena affecting the service performance of insulators about which the tests called for in the various standard specifications provide us with little information. Some alteration in these specifications appears, therefore, very desirable. It must, however, be realised that it is neither possible nor desirable to devise tests which will cater for every possible source of trouble. Matters are seldom so simple that a crude test described in a 4-page specification will enable a casual inspector to determine facts which specialists may not be certain of. In particular the specification of "freak" tests by individual purchasers is to be deprecated. Such tests merely waste the time of precisely those individuals who are in the best position to effect advances in our knowledge of the subject.

It should be recognised that the best guarantee of a reasonably prolonged life for an insulator is the assurance that the manufacturers have themselves devoted intensive thought to their problems and run both their engineering and manufacturing departments under strict scientific control.

The foregoing paper is the result of experience gained in the research laboratories of the Metropolitan-Vickers Electrical Co., Ltd.

Discussion in London.

Mr. S. W. Melsom said the paper was timely, but it was unfortunate that the author had confined himself to tests, as an indication of how to design insulators was needed. The tests were not always made under practical conditions and they were therefore in a false position; that fact had been responsible for trouble in the past. Who could say what the resistivity of actual rain water was? However, the Research Association was working hard in collaboration with the author and his associates. The fouling conditions were not properly realised, and users had escaped trouble in the past because they had been using bigger insulators than the specifications called for. Exposure to rain did not keep insulators clean: observation in South Wales had shown that salt floated in the wind in a dry state, was deposited on insulators, and after being moistened by dew would adhere tenaciously in crystal form even after much rain. He could not appreciate the suggestion to provide "weak links," as lightning was not so obliging as to go to earth where one would like it to. What was wrong with spark-gaps? He would prefer them with hard insulation all along the line. When they were able to plot the voltage distribution over an insulator surface satisfactorily they would solve many of their problems.

Mr. C. W. Marshall explained that in the national specifications an attempt had been made to simulate practical conditions. Britain had been very much behind in providing suitable testing apparatus anywhere. The power-arc test was very informative, but was not yet available in England. Most people favoured the provision of guard rings, but opinion in America was somewhat contrary.

Mr. N. E. P. Harris thought those who had been responsible for insulator design must have been very slow, for it was remarkable to recall how long ago statements had been made which foretold that which was happening to-day. He endorsed the author's remarks on resistivity relative to the correction of the water rather than of the test results. The

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I.E.E. rules were based on variation and that factor only, because variation was considered to be worse than anything else. Manufacturers' greatest enemy was the man who did the work and the process through which the materials went, not heating and cooling in the fire as the author seemed to think. Regarding the author's remarks on equipotential surfaces, the most critical condition was when the surfaces were wet and the criterion was the length and efficiency of those surfaces.

Mr. W. A. Coates remarked that if the paper resulted in the establishment of standard methods of testing, then it would be the most important they had had for many years. He mentioned tests which were undesirable at present because methods of reproducing them were undefined. By using guard rings on the "grid" the Central Board was leading the way; horns were practical, but the author's lantern slides might be misunderstood, for in practice they would not guarantee that the arc would keep away from the porcelain. The author's work on fouled insulators had been of extraordinary value and might lead to a demand for insulators that would stand up to foul conditions, though their design was not practicable yet. He suggested that the B.E.S.A. should form a committee of the three or four men who were really skilled in the technique of the high-voltage laboratory to frame agreed conditions of test; by the time it had done that it might be in a position to classify atmospheres and specify insulators for each of them.

Mr. R. W. Todd pointed out that large contracts called for from 5 to 10 per cent. to be type tested; that was too large and a saving could be made without sacrificing efficiency. Did it matter if the dry flash-over figures fluctuated, so long as they did not exceed the wet test figures, which were the lowest and on which the safety factor was based? In addition to the duties suggested by the previous speaker, his proposed committee should consider all the tests now considered necessary and put them on a definite basis.

Mr. W. A. Erlebach, in referring to the inaccuracy of various tests, thought that too many string tests were made; one should suffice for the whole order, and more attention should be concentrated on making individual units alike. He recommended the over-potential test, the third of the American tests, as being quite conclusive.

Mr. W. Wilson thought the author dismissed porosity too lightly. He knew of a 70-mile 66-kV line on which pin insulators made by a number of experienced manufacturers were used, on which over 40 break downs per year had been experienced. Investigation traced the trouble to porosity, which could not be detected except by the long application of a h.p. test, say 2,000 lb. for 100 hours.

Mr. J. F. Shirley contended that manufacturers thought they knew how to pack insulators for export, but they did not. He knew of many cases of insulators which had passed tests in England having to be replaced when they reached the other end of the world.

Mr. W. Holttum suggested painting insulators to simulate deposit on them for test purposes. It was insufficient to assume that porcelain was not porous, and a test should be applied to prove it. Greater use might be made of arc rings to drain off stress at the end.

Mr. B. L. Goodlet, in reply, said that they only attempted to simulate in the laboratory what happened in service; they could not reproduce the same conditions. He exhibited a sample of porcelain which he claimed to be not porous in any way.

A Conference on Chromium Plating.

A Report of a Recent Provincial Meeting of the Electroplaters' and Depositors' Technical Society.

A RECENT meeting of the Electroplaters' and Depositors' Technical Society at Birmingham took the form of a conference on chromium plating. Mr. S. Field, president, occupied the chair, and there was a very good attendance of both London and provincial members.

Mr. G. E. Gardam, B.Sc., A.R.C.S., opened the conference with an appropriate paper entitled "A Survey of the Published Information on Chromium Plating," and a very animated discussion followed the reading of the paper, which is reported below.

Survey of Chromium Plating.

Although a certain amount of information on chromium plating was previously available, development of the commercial deposition of chromium on the present scale was principally due to the work of Sargent, published in 1920. The two chemicals forming the essential basis of a chromium depositing solution were shown by him to be chromic acid (CrO_3) and chromic sulphate. Subsequent investigations, however, demonstrated that, whereas the addition of some second substance to the chromic acid is imperative, it is not necessary to employ chromic sulphate, and that sulphuric acid, or certain other acids, or their salts, will give satisfactory results; owing to the fact that sulphuric acid may be readily obtained in a state of high purity, coupled with the fact that sulphates are a common impurity in chromic acid, it is commonly found convenient to use this acid as the second essential chemical in chromium-plating solutions.

The concentration of sulphuric acid in the solution is of considerable importance, and it must bear a fixed relationship to the chromic-acid content. For average working conditions one part by weight of sulphuric acid should be added for every hundred parts of chromic acid present in the solution. If the proportion of sulphuric acid is lower or higher than the above values, there will be a tendency for the cathode efficiency to be reduced, so much so that in the absence of sulphuric acid from the solution, or in the presence of a considerably greater proportion than that stated above, little or no deposit will be obtained. A further detrimental effect caused by too-low a concentration of sulphuric acid is the production of deposits covered with a brownish film.

It has been found possible to produce deposits of chromium from solutions containing as little as 100 gm. and as much as 300 gm. of chromic acid per litre, but for general purposes most workers prefer a bath of moderate concentration, of which the following composition is typical:—

	Gm. per litre.	Oz. per Imperial gallon.
Chromic acid (CrO_3)	250	40
Sulphuric acid	2.5	0.4

No other added substances are essential for satisfactory working, but it is evident from the change of colour of the solution which takes place, and also from chemical analysis, that certain chemical changes occur during electrolysis. The most important of them is the reduction of a portion of the hexavalent chromium to the trivalent state. Some workers have, therefore, favoured the deliberate initial reduction of part of the hexavalent chromium to the trivalent state by chemical, or electro-chemical means, or the addition of compounds of trivalent chromium, such as the hydroxide or carbonate. The presence of trivalent chromium in a chromium-plating solution is probably essential if good results are to be obtained, and baths which are working satisfactorily usually contain up to 2 per cent. of this substance. It is, however, important for a number of reasons that the concentration of trivalent chromium in the solution should be limited. It has been shown, for example, by Haring and Barrows and Schneidewind and his co-workers that the presence of considerable quantities of trivalent chromium greatly reduces the range of current densities in which satisfactory deposits can be obtained.

In spite of the fact that excellent results may be obtained from a solution made up from chromic acid and sulphuric acid alone, a large number of other substances have been patented as offering advantage when added to chromium depositing solutions. Such additions fall into two classes: (*a*) additions of such substances as chlorides, fluorides, borates, phosphates in place of, or auxiliary to, the usual sulphate additions, and (*b*) additions of salts, usually hydroxides or carbonates, of such metals as nickel, zinc, copper, the heavy and alkaline earth metals, as well as chromium. From a critical examination of chromium-plating patents, Schneidewind has drawn the conclusion that no fundamental improvement is obtained by such additions as those referred to above.

Operating Conditions.

The most striking features in which chromium plating differs from most other metal-deposition processes are the high current density necessary, the low current efficiency obtained, and the pronounced differences in the character of the deposit that result from variations of the current density, temperature, and composition of the solution. In general, with increasing current density, or decreasing temperature, the efficiency increases, and the appearance of the deposit changes from a bluish coloured deposit having a bright matte surface to one with a bright lustrous appearance, and finally to a dark-coloured iridescent deposit often described as "burnt." The bluish deposit with a bright matte surface is usually extremely thin and of no commercial value. The bright lustrous deposit is extremely hard and decorative, and needs little or no subsequent polishing. The dark matte deposit is obtained at much higher efficiency than the bright lustrous coating and, though still extremely hard, can be polished by the usual methods. The resulting plate is somewhat darker than the coating deposited in the bright condition.

The balance of current density and temperature necessary in a given solution to obtain the bright lustrous deposit is very sharply defined and, moreover, varies with the nature of the cathode metal. A considerable amount of data has been empirically accumulated on the optimum average current-density range in which a bright deposit may be produced. It is desirable that the range should be as wide as possible

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for at least three reasons: first, because it is often difficult to estimate the area of objects to be plated, and in such cases the current density cannot be calculated with any exactitude; and, secondly, because in the case of the large majority of articles that are chromium plated the current density cannot be calculated with any exactitude; thirdly, because in the case of the large majority of articles that are chromium plated, the current density varies from one part of the surface to another, being relatively high on projecting parts and low on recessed portions. The desired end is best achieved if:

(1) A solution of chromic and sulphuric acid in the ratio, and approximately in the concentration already suggested, is used.
(2) The bath is kept as free as possible of trivalent chromium.
(3) The current density is moderately high (*i.e.*, from 100 to 300 amps. per sq. ft.).
(4) The surface of the cathode is formed of a metal of high hydrogen over-voltage (such as copper).

Influence of the Cathode Metal.

The nature of the cathode material, in particular its hydrogen over-voltage, is an important factor in determining, not only the character of the initial deposit of chromium, but also the ease with which the cathode may be covered with the deposit. In the case of metals of low hydrogen over-voltage, such as iron and steel, the minimum current density at which chromium can be deposited is higher than, and the range of current densities in which bright deposits may be produced is both different from and more restricted than in the case of metals of high hydrogen over-voltage, such as copper. Once the cathode is completely covered with a coating of chromium, by virtue of its own hydrogen over-voltage, it demands its own particular range of current densities for the continuance of a bright deposit. The over-voltage of chromium being fairly high, the current-density range will only be the same as the "striking" range if the over-voltage of the basis metal is fairly high. It is often desirable, therefore, to coat a metal of low hydrogen over-voltage, such as steel, with a metal of higher hydrogen over-voltage, such as copper, before proceeding to deposit chromium upon it. As nickel has a lower hydrogen over-voltage than copper, it is thus not so satisfactory in this respect, but an undercoat of nickel has much to recommend it from the corrosion standpoint, and it is now common practice to deposit a layer of this metal on steel articles prior to chromium plating.

Anodes.

Lead anodes are very satisfactory, though they are slowly attacked by chromic-acid solutions, forming insoluble lead chromate, which, however, has no detrimental action on the bath. Lead of high purity is necessary, impurities, particularly antimony, greatly increasing the rate of attack. If sufficiently large, lead anodes tend to cause reoxidation of trivalent chromium by virtue of their high oxygen over-voltage, and for this reason it is recommended that the area of lead anodes should be at least twice that of the cathode. One disadvantage of lead anodes, however, is that in course of time an adherent coating of high resistance tends to form upon them, causing, if complete, a high bath voltage. If the coating is not complete, but occurs in patches, its presence is not so easily detectable and it may cause uneven current distribution and patchy deposits. A method of removing this non-conducting coating of lead chromate that involves less labour than scouring consists in submitting the anodes to the action of a saturated solution of sodium chloride acidulated with hydrochloric acid, which readily dissolves it.

Properties and Applications.

Electrodeposited chromium is especially distinguished from other metals by (i) its resistance to atmospheric and other corrosion, (ii) its resistance to oxidation and corrosion at elevated temperature, and (iii) its extreme hardness and low coefficient of friction. As deposited in the bright condition, chromium has a bright, lustrous metallic surface with a slightly blue colour. The reflectivity is only 65 per cent., but, in contrast with other metals, this figure is permanently maintained as the chromium is apparently quite unattacked by the atmosphere, even at temperatures as high as 300 deg. C., and also by salt water salt spray, ammonia, nitric acid and hydrogen sulphide. Dilute sulphuric acid and hydrochloric acid vigorously attack the metal only if it is first rendered "active" by cathodic polarisation, *e.g.*, by contact with a piece of zinc also immersed in the acid.

The commercial applications of chromium plating are, of course, too numerous for each to be mentioned. Among the more important applications of the thinner types of deposits, however, are the plating of plumbing fixtures, cheap jewellery and motor-car fittings. The latter in some cases have not apparently given such good service as was hoped, probably owing to the fact that the chromium was deposited directly on to brass. Nevertheless, the standardisation of chromium plating on certain makes of car forecast considerable popularity in the future. Some firms have installed completely automatic chromium-plating plant.

Advantage has been taken of the high resistance to wear possessed by chromium deposits in such applications as the facing of gramophone-record matrices, steel plug gauges, and printing plates, and it has been found that such parts are serviceable for from four to ten times as long when they are faced with a thin deposit of chromium. Chromium-plated valves for steam and internal-combustion engines withstand the action of hot gases better than similar unplated parts. Reflectors have been successfully plated with chromium, the untarnishable and unscratchable nature of the surface compensating to a large extent for the low reflecting power.

The low coefficient of friction which chromium possesses makes it a suitable metal with which to coat bearings, machine parts, and cams Rolls for paper finishing and glass-sheet manufacture have a longer life when chromium plated; plating has also been successfully applied in the case of moulds used for the manufacture of glass bottles, synthetic resin and vulcanised-rubber articles, as it provides a surface to which the material shows no tendency to adhere. Chromium-plated die-casting and ingot moulds also withstand the solvent action of the molten metal to a considerable extent. Certain parts of chemical plant used in paper making and petroleum refining plants have been plated with chromium, and the treatment has proved very successful.

Discussion.

Opening the discussion, the president (Mr. S. Field) said there was still a considerable amount of doubt regarding the nature of the trivalent chromium present in the solution, and the extent to which it was combined with the chromic acid. The latter was also combined with iron which entered the solution. In one case of a poorly working solution, it was found that the trivalent chromium and iron content accounted for the whole of the chromic acid in the solution!

Mr. E. A. Ollard said failure in the early days was due to non-attention to details, *e.g.*, solutions with as much as 20 per cent. sulphate were used. Solutions containing fluorides were easier to control. Adding sulphate to allow for "drag" was not to be recommended, since it might be difficult to get rid of later. The amount of sulphate present should depend on the dichromate content. Satisfactory results were not obtained by analysing for hexavalent and trivalent chromium. The solution could be readily controlled by periodic determination of the specific gravity and the conductivity.

Mr. L. Wright said the deposit usually aimed at was the bright one, but he had obtained the matte deposit on both laboratory and commercial scale, and these could be highly polished subsequently. These deposits were obtained from a bath having a chromic dichromate content which was deemed to be unworkable by the Americans, Haring and Barrow. The working range of a bath was determined by the ratio of chromium to hydrogen, not chromic acid to sulphuric acid.

Mr. A. E. Boulter asked if chromium could be deposited in a more or less ductile form to withstand vibration, as required when deposited, for example, on gramophone needles. Also, would the deposit retain a cutting edge or fine point indefinitely?

Mr. J. W. Perring asked for an approximate estimate of the overall efficiency of a chromic-acid plant in B.O.T. units per gram of metal deposited, taking into account the electrode efficiency, motor-generator efficiency and power required for the fan.

Mr. L. G. Roberts said he had found it possible to obtain very satisfactory results without having to remove the anodes periodically. He used a large anode surface, about half the side of the vat in area. He urged the younger platers desirous of making a success of chromium plating to spend a part of their time in studying the theoretical aspects of the problem.

Mr. S. Wernick said that the big problem of throwing power had been largely overcome in the last two years, but still chromium-plating practice was very much ahead of theory. There was uncertainty in regard to the effect of constituents other than those which were essential, thus, iron was said to be beneficial in producing a brighter deposit, but was detrimental since it decreased the conductivity and throwing power. Since ferrous containers were used to a large extent, it was important to know what limit was allowable. For theoretical reasons, nickel was better than copper as an underlay, resulting in a higher throwing power.

Mr. E. J. Dobbs said his experience was that determination of chromate content was a difficult matter—he could get within one gram per litre, but sulphate content could be obtained within 0.01 gram per litre. In analysing, he added alcohol to the chromic-acid solution until no further action occurred, then sufficient hydrochloric acid for all the chromium present, leaving a slight excess. The solution was then boiled to remove aldehydes present, and precipitated with barium chloride, allowing it to simmer for some hours before filtering. This avoided carrying down any green chromic acid with the precipitate.

Mr. D. J. Macnaughtan, in an eloquent address, urged that there should be the closest co-operation possible between the practical plater and the plating chemist, this being one of the foremost aims of the Society. He was supported by Mr. R. A. F. Hammond, who said that platers could best co-operate by using their powers of observation and communicating their findings to the scientific investigators, since often the most apparently irrelevant phenomena provided clues which were of the utmost value to the chemist in solving difficulties.

The Author replied to the discussion, and it was suggested that the next provincial conference of the Society be held in Glasgow.

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KVA-Demand Measurement.

Technical considerations concerning the definition and calculation of power factor in relation to tariffs.

By E. W. HILL.

(*Abstract of a paper read before the* METER AND INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

SPECIAL tariffs have been devised, and in many cases accepted, with a view to encouraging consumers to adopt power-factor improvement methods, and various kinds of instruments have been invented for the purpose of measuring the fundamental quantities (power factor, kVA and kVA-hours) upon which these special tariffs are based. Under certain conditions the use of these terms involves ambiguity, unless the terms are explicitly defined, since more than one definition of them is possible. The measuring instrument employed is chosen, apparently, not in order to conform to a predetermined definition of the quantities, but, on the contrary, the definition is allowed to depend on the choice of instrument, and in that respect the definition is a matter of hazard rather than of conscious selection. Such a condition of things is hardly defensible, since it will be seen that it is possible for large sums to be at stake on the choice, for example, of kVA definition.

The first ambiguity centres round the definition of power factor in a 3-phase system. Two definitions stand out as being reasonably acceptable to engineers, both of which are based upon analogy from the definition of power factor in single-phase systems, in that they state 3-phase power factor under steady conditions to be the ratio between the total 3-phase watts and the total 3-phase volt-amperes. The total 3-phase watts is a definite physical quantity, without ambiguity, but the total 3-phase volt-amperes is not; and the two definitions of the 3-phase power factor depend upon two corresponding definitions of 3-phase volt-amperes, which are usually known as: (i) the vector-sum definition, and (ii) the arithmetic-sum definition.

The results of the two definitions can only agree if the phase-displacement angles are all equal and are all lagging or all leading. It is claimed that (i) is by far the better definition, upon the grounds that it is free from ambiguity; that it gives results dependent only upon the character of the load, and not upon the way it is applied to the lines; and that the results are the same however and wherever in the system the measurement is made. Although the arithmetic-sum definition on the other hand lacks the support of almost every one of these attributes, yet it has points to commend it to the clear disadvantage of definition (i) in relation to its suitability as a basis for a tariff. The arithmetic-sum definition is not susceptible of completely general application in a scientific sense to all polyphase systems; in order to be quite definite it depends upon the employment of the three star-leg voltages; and its results depend also upon the way in which a set of loads are applied to the 3-phase lines, as well as upon the character of the loads. The last, however, far from being a defect, is a positive virtue in relation to tariffs.

To be of any use, a "power-factor taiff" should be founded upon a technical basis which gives effect to the principle that a consumer should be penalised for demanding more than the minimum current necessary for a given power consumption.

The discrepancy between the two definitions may have an important practical bearing in relation to such instruments as power-factor indicators. There are many of these constructed for 3-phase unbalanced loads, and it is very doubtful indeed whether any one of them bears an explicit indication as to the particular definition of unbalanced 3-phase power factor to which it is supposed to conform. It appears that the definition of apparent power in a 3-phase system is involved with the question of unbalanced loads. This question also leads to another matter requiring consideration. With unbalanced loading it may happen that the maximum volt-ampere demands on the individual lines are not coincident. On the contrary, there may be a diversity of incidence, such, for example, as would be illustrated by loads of 2, 1 and 1 amperes, respectively, in lines R, W and B at a certain time; while later the loads may have altered to 1, 1 and 2 A, respectively, and again still later to 1, 2 and 1. The conclusion to be drawn from this is that where there is serious unbalance of loading it might be advisable to base a tariff, not upon the simultaneous combined demand on the three lines, but upon the highest one of the three demands on the individual lines, multiplied by three. Even without diversity of incidence this might still be advisable, because 3-phase cables and other apparatus must necessarily be constructed with three conductors of *equal* capacity, the capacity being that of the highest demand on any one conductor.

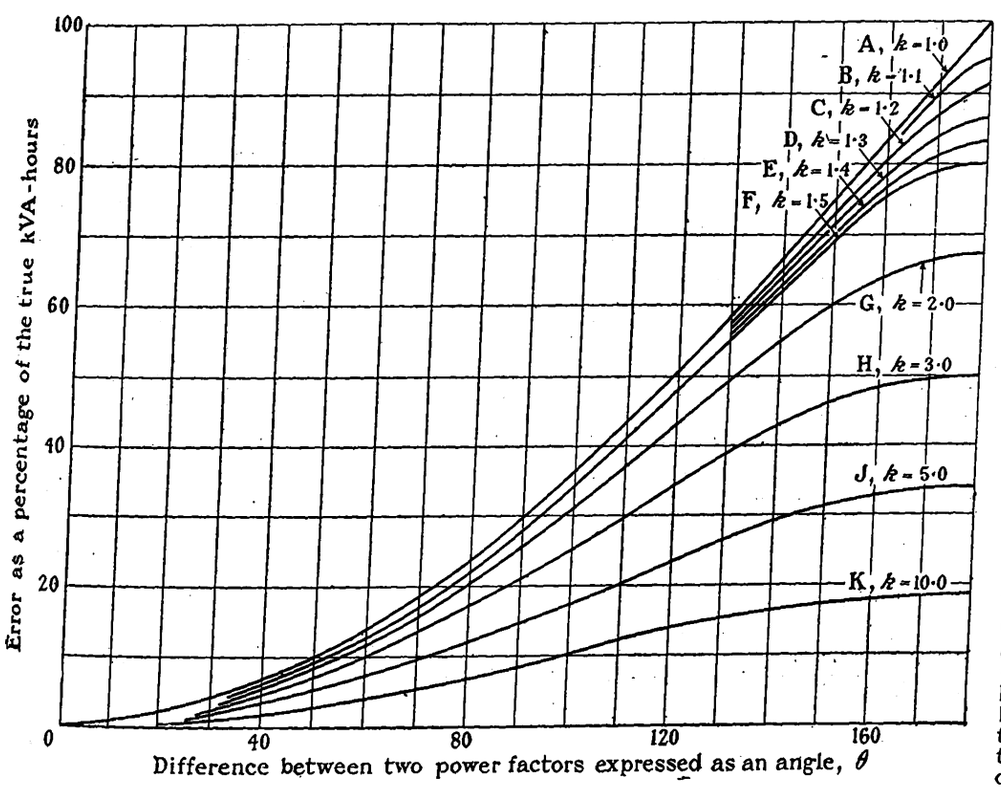

Fig. 1.—KVA-error-Angle Difference Curves.

There are also ambiguities possible in relation to systems in which the power factor does vary, and under such conditions it is frequently desirable to adopt a definition of "average power factor." An obvious one is "the time average of all the values assumed by the power factor over a given period, such as could be obtained from a graph drawn by a graphic recording power-factor indicator." But this is inadmissible in practice for tariff purposes, because it is necessary to weight the average according to the magnitude of the loads at which the various values of the power factor occur. The most logical method of obtaining a "weighted mean power factor" is one derived from the definition of invariable power factor as the ratio watts/volt-amperes. A simple extension of the idea involved in this ratio leads to the definition of average power factor which is usually adopted, *viz.*, watt-hours/volt-ampere-hours. The numerator and denominator of this ratio are the time integrals, respectively, of the true power and the apparent power over the interval of time for which the weighted mean power factor is required.

If a true kVA-hour meter is not employed, it is necessary to have recourse to some other expedient for the evaluation of the volt-ampere-hours. Two such expedients are at present more or less widely used, *viz.*, the use of a watt-hour meter

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(cosine meter) in combination with a reactive component meter (sine meter) which is applicable to single-phase or polyphase systems; and the use of two single-phase watt-hour meters on the "two-wattmeter principle," applicable only to 3-phase balanced-load systems.

The value of the kVA-hours is then assumed to be that given by the following formulæ:—

$$\sqrt{(A^2+B^2)} \quad \ldots\ldots \quad (1)$$

where A=registration on the cosine meter, and B=registration on the sine meter.

$$(L+R)\sqrt{\left\{1+3\left(\frac{R-L}{R+L}\right)^2\right\}} \quad . \quad . \quad . \quad (2)$$

where L=registration on one meter, and R=registration on the other meter.

Now formula (1), when applied to 3-phase systems, involves the vector-sum definition of apparent power, which has been contended to be inequitable for tariff purposes. In addition, formula (1), both for single-phase and polyphase systems, and formula (2) are open to the grave objection that they always give some quantity which is less than the true kVA-hours, except in the one particular case in which the power factor remains absolutely invariable throughout the period of time under consideration.

Whether the error will be large or small depends on the amount of variation of the power factor. It may be contended that the possibility of error does not necessarily condemn the sine-cosine meter combination, for two reasons: first, in cases where the power-factor variation is small the error will not be appreciable; and second, in spite of the admitted departure from complete theoretical accuracy, the sine-cosine meter system may still be useful for a special tariff based upon some sort of indefinite "average power factor." These considerations apply with exactly equal force to two single-phase meters in combination on a 3-phase balanced load. The question of accepting or rejecting these methods of metering must remain a matter for the judgment of each supply authority, according to the circumstances governing the conditions of its supply.

In the curves shown in fig. 1 the excess of the true kVA-hours over the values calculated from formulæ (1) and (2) is expressed as a percentage of the true value, and the values of this percentage error are the ordinates of the curves, the abscissæ being the angular differences which express the difference between the values of the power factor for two periods of time. The errors depend solely upon the angular difference and not upon the absolute values of the two power factors. Thus the error would be precisely the same for two periods with power factors 1.0 and 0.5, respectively, as for two periods with power factors 0.866 and zero, since the angular difference is in each case 60 deg. In general, for intervals of time split into two part-periods, if the true kVA-hours for the first part-period at a constant power factor $\cos\phi_1$ are x, and for the second part-period at a constant power factor $\cos\phi_2$ are kx, and if the difference between the two power factors is expressed by $(\phi_2-\phi_1)$, and called θ, the kVA-hours for the whole period calculated from the formula $\sqrt{(A^2+B^2)}$ can be expressed also in terms of x, k, and θ by the formula

$$x\sqrt{(1+2k\cos\theta+k^2)} \quad \ldots\ldots \quad (3)$$

the true kVA-hours being

$$x(1+k) \quad \ldots\ldots \quad (4)$$

For all values of k, when θ is zero, the error is zero; and for any value of θ, when $k=1$, the error is maximum. The curves are set out for such two part-periods and for various values of k, over the whole range of power-factor variation from zero (lagging) to zero (leading). The maximum possible error, 100 per cent., is that given by curve A for which $k=1$, at the point where $\theta=180$ deg. As an example of the determination of the error from the curves for any particular case, suppose a period of time divided into two parts, the first, two hours with a load of 100 kVA (*i.e.*, 200 kVA-hours) at power factor 0.95 (lagging); and the second, 40 hours with a load of 10 kVA (*i.e.*, 400 kVA-hours) at power factor 0.4 (lagging). The value of k is 400/200=2.0. The value of θ is (66 deg. 25′−18 deg. 11′)=48 deg. 14′.

From curve G, for an angular difference of 48 deg. 14′ the magnitude of the error is found to be 7.7 per cent. Inspection of the curves shows that under all conditions the error is negligible (being under 2 per cent.) for power factors having angular differences less than 20 deg, *i.e.*, for power factors whose values, for example, do not vary outsidee the limits 0.985 lagging and 0.985 leading, or 0.34 and 0 both lagging or both leading, the former giving the smallest and the latter the largest numerical difference in the values of the power factor for the angle chosen, *viz.*, 20 deg. In the neighbourhood of unity power factor, merely small differences in the power factor correspond to relatively large angular differences and consequently give rise to the possibility of large errors.

An examination of current practice in the measurement of kVA demand in polyphase circuits shows that the following classification may be adopted for the various kinds of instruments chiefly in use.

Group I (Vector-sum type).

(*a*) Watt-hour meters with "over-lagged" shunt circuit fluxes, or energised from special potential transformers with "lagged" pressures.

(*b*) Combination of cosine and sine component meters linked by rotating sphere to obtain the hypotenuse of the energy triangle.

(*c*) Cosine and sine component meters compounded by selective differentials leading to an integrator which is advanced by the fastest combination of the two components.

Group II (Arithmetic-sum type).

(*d*) Thermal ampere-demand type.

(*e*) Induction ampere-demand type—shaded-pole motor pattern.

(*f*) Induction volt-ampere demand type—shaded-pole motor pattern with voltage compensator.

The author would not advocate the use of Group I instruments except under conditions of approximately balanced power factors.

The Cable-Wireless Merger.

Particulars of the Two New Companies.

THE following supplements the brief information regarding the merging of the wireless and cable systems which appeared in our last issue. The holding company—"Cables and Wireless, Ltd."—although its nominal capital is only £100, is empowered to raise it to £53,700,000 by ordinary resolution. This enlarged capital will be divided into £1 shares as follows: 23,500,000 5½ per cent. cumulative preference shares; 21,200,000 7½ per cent. non-cumulative "A" ordinary shares; and 9,000,000 "B" ordinary shares. The company is to acquire the present or future stocks, shares, debentures, and other securities of the Eastern Telegraph Co., Ltd., the Eastern Extension, Australasia and China Telegraph Co., Ltd., the Western Telegraph Co., Ltd., and Marconi's Wireless Telegraph Co., Ltd., and of any other present or future companies whose objects include the owning and operation of communication systems (including television and broadcasting), the generation, supply, &c., of electricity, or carrying on the business of transport. It is also to guarantee the performance of all or any of the obligations or engagements of such bodies to H.M. Government or other authority and to recoup the constituent companies the costs of the negotiations which have led up to the merger, &c. The articles stipulate that the control shall remain in British hands, not more than 25 per cent. of the capital being allowed to be held by foreigners; only British subjects can be directors of the company. Compensation to a maximum of £25,000 can be paid to directors of the constituent companies who are adversely affected by the merger. The first directors are Sir Charles A. Addis, Mr. F. R. S. Balfour, Sir Charles C. Barrie, Sir Frederick J. Barthorpe, the Earl of Bessborough, Sir Basil P. Blackett, Col. the Hon. A. G. Broderick, the Earl of Clarendon, Mr. J. C. Denison-Pender, Admiral H. W. Grant, Mr. H. C. Hambo, Viscount Inchcape, Lord Inverforth, Mr. F. A. Johnston, Mr. F. G. Kellaway, Major H. Lefroy, Senatore G. Marconi, the Earl of Middleton, Mr. J. F. O'Malley, the Hon. G. Peel, Dr. L. G. Sherlock, and Lord Wester Wemyss. Lord Clarendon and Sir Basil Blackett are directors approved by the Government.

The objects of the other company—"Imperial and International Communications, Ltd."—are to acquire the whole or parts of the companies mentioned or companies owned by them, and to take over the assets and obligations of the Pacific Cable Board (including those relating to the West Indian cable and wireless system), the Imperial Transatlantic Cables and the "Beam" system. The directors are the same as those of Cables and Wireless, Ltd., and similar provisions are made for the retention of control in British hands.

Mr. Edward Wilshaw is manager and secretary of both companies, and the registered offices are at Electra House, Moorgate, E.C.2.

At the first courts of directors held last week it decided to offer the stock and shareholders of the constituent companies, shares in Cables and Wireless, Ltd., in exchange for their holdings on the following basis:—

As regards the three cable companies:—Each £100 of ordinary stock in the Eastern Telegraph Co., or each £100 of ordinary shares of £10 each in the Eastern Extension Co., or each £100 of ordinary shares of £10 each in the Western Telegraph Co.: £165 of 5½ per cent. cumulative preference shares of £1 each; £108 18s. of 7½ per cent. non-cumulative "A" ordinary shares of £1 each; and £26 of "B" ordinary shares of £1 each.

As regards Marconi's Wireless Telegraph Co., Ltd.:—Each

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£100 (nominal value) of 7 per cent. cumulative participating preference shares of £1 each (*i.e.*, 100 shares), or each £100 of ordinary shares of £1 each (*i.e.*, 100 shares): £131 10s. of 5½ per cent. cumulative preference shares; £205 8s. of 7½ per cent. non-cumulative "A" ordinary shares; and £150 5s. of "B" ordinary shares. Each £50 of ordinary shares of 10s. each (*i.e.*, 100 shares): £81 10s. of 5½ per cent. cumulative preference shares; £205 8s. of 7½ per cent. non-cumulative "A" ordinary shares; and £150 5s. of "B" ordinary shares.

Where the exchange of the total amount of the stock or shares would involve the issue of a fraction of a share, a cash payment calculated at the par value of such fraction will be substituted for the fraction. It is hoped to make the definitive offer to the stockholders and shareholders about the end of April. The offer when made will be conditional on its acceptance within a stated time by the holders of a specified majority of the stock or shares in each of the four companies. The directors warn intending purchasers of stock or shares that not more than 25 per cent. of the issued shares of any class may be held by, or in trust for, or in any way under the control of, foreigners, foreign corporations, or corporations under foreign control, and that if it is at any time found that this limit is exceeded the directors may bring the foreign holdings down to the limit by selecting any shares which come within the foregoing category and requiring the holders thereof to transfer them to properly qualified persons.

Following upon the announcement, the holders of the Marconi Company's preference and £1 ordinary shares formed protective committees to deal with what they consider an injustice. Their contention is that they should receive exactly double the value of merger shares received by the holders of the company's 10s. ordinary shares. They claim that this is what would have happened if the normal method had been adopted of selling the assets of the Marconi Company for shares in the merger company and distributing those shares in a winding-up among the Marconi shareholders according to their legal rights. They consider that the only disadvantage to the shareholders who do not accept the offer would be a restricted market for their shares.

"Arrangements are, however, under consideration, by which £1 ordinary and £1 preference shares may be deposited under a trust agreement with the Prudential Assurance Company, as depositories. The depositories would issue to the depositors of £1 shares of both classes their own certificates, all ranking *pari passu*. These certificates would entitle the holders (subject to deduction of nominal expenses) to receive proportionately all revenue and all capital that may be received by the depositories in respect of the Marconi shares deposited. As the £1 ordinary shares and the preference shares stand at a price considerably in excess of their nominal value, it is proposed that four units shall be issued for each £1 share deposited. By this arrangement the non-assenting £1 ordinary and preference shares would, in effect, be amalgamated and split into four shares each, and the number of units represented by the certificates should be so large as to ensure a free market."

Meetings of the two classes of shareholders were to be held on Wednesday last to consider the position.

It should be noted that the £1 ordinary shares are the results of the exercise of conversion rights by debenture-holders who were thus not affected by the writing down of the existing ordinary shares from £1 to 10s. in 1927.

In the course of a statement issued from Electra House on Monday last it was stated that Cables and Wireless, Ltd., would hold all or nearly all the shares in the old cable companies and the Marconi Company. All the communication assets held by the cable and Marconi companies would be transferred to the Communications Company in exchange for shares in that company. Although the preference shares of the Eastern Company and the debenture stock of all three cable companies would continue to be held directly by the public, both the old cable companies and the Marconi Company would, in fact, have little more than formal existence under the new *régime*.

High-voltage D.C. Generators.

Notes on the manufacture of high-pressure direct-current machinery in Germany for use in wireless transmission stations and laboratories.

THE increasing importance of high-voltage direct-current machines in recent years for use as valve anode-current generators and in wireless transmission work has induced a number of makers at home and abroad to take up their manufacture, and amongst the earliest of such firms in Germany was the Bayerische Elektricitäts Werke, of Munich. Fig. 1 shows one of its h.p. generators as used at the Kaiserslautern transmission station. It is a 16-kW, 4,500-volt, 1,440-r.p.m. machine, and is shown with the protective end covers removed. In spite of the comparatively large output, the machine is a 2-pole one. The armature contains two distinct windings, the coils are former wound, and the whole insulation, to withstand a test pressure to earth of 10,000 volts, is placed in the slots. The commutators are small and solidly built, and, owing to the 2-pole construction, have a comparatively small voltage between segments (under 50 volts). The mica separators are only 0.025 inch thick. Special care is taken to avoid breakages of the commutator connections. The complete weight of the machine is 1,575 lb., showing that the 2-pole construction does not, necessarily, involve excessive weight. At the same time it ensures ample clearance between the brushes of opposite polarity. Commutating poles are provided, and the windings on these are connected in front of the two armature windings so as to act as protection for the latter against voltage surges.

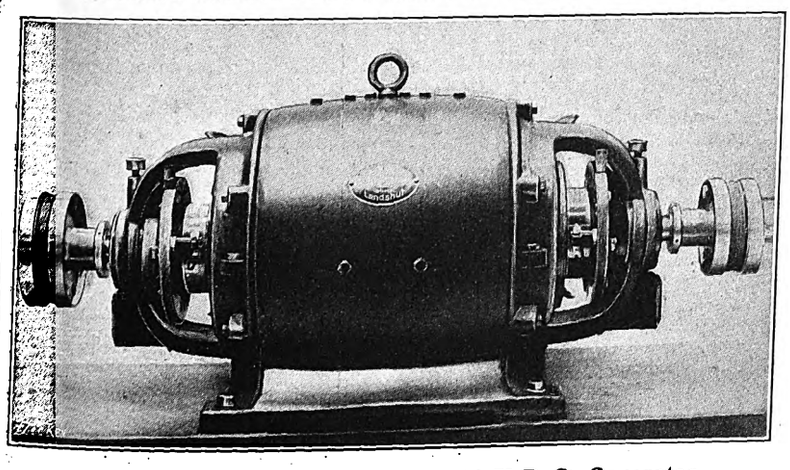

Fig. 1.—A Two-pole 16-kW, 4,500-V D.C. Generator.

The end covers are hinged in such a manner that, when open, they break the exciting circuit and so make it impossible to touch the working parts when they are alive. The field winding is protected against high voltage rises on switching off by suitable condenser-resistance by-pass circuits. Sometimes the two armatures are in entirely separate machines, and double generators of this type have been built for 10,000 volts in sizes as small as 3 kW.

Another interesting arrangement is shown in fig. 2; it consists of a drip-proof induction motor driving a drip-proof h.p. generator of 3 kW at 3,000 volts and 2,940 r.p.m. A fan, seen on the right of the photograph, is arranged to draw cooling air through both motor and generator and to discharge it through the grid shown in the side of the bedplate.

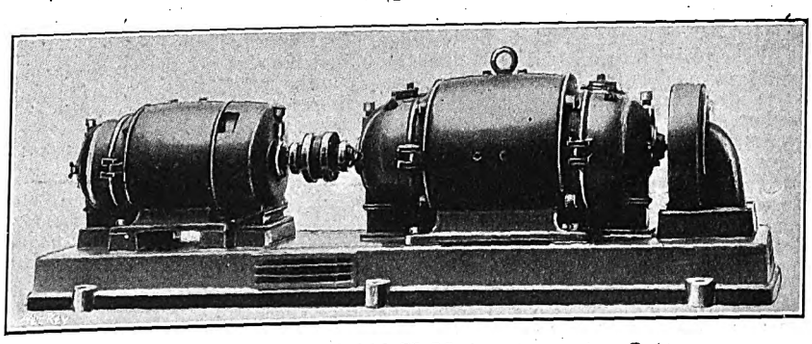

Fig. 2.—A 3-kW, 3,000-V Motor-generator Set.

Combinations of all kinds of high- and low-pressure generators can be arranged, either as a number of separate machines

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coupled together on a bedplate or in the form of single multi-commutator machines. One of the latter is shown in fig. 3. This gives three distinct direct-current voltages—high, medium and low—and also has a pair of slip rings to deliver 50-cycle

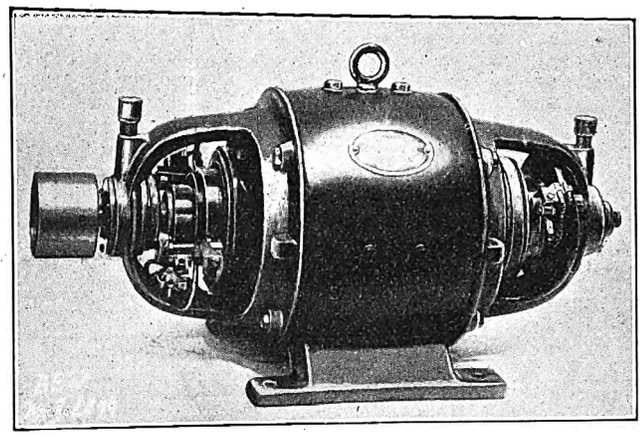

Fig. 3.—A Multi-Commutator D.C. & A.C. Generator.

alternating current. There is, further, a separate stator winding giving an a.c. output at 800 cycles. The machine is intended for engine driving in this case.

Legal.

The Gasfilled Lamp Patent.

In the Chancery Division on April 9th, on the application of the British Thomson-Houston Co., Ltd., Mr. Justice Luxmoore fixed May 1st for the hearing of the company's application for an extension of the period of its patent for the gasfilled electric lamp. Mr. Whitehead, K.C., for the applicants, said that notice of opposition had been given by eight parties.

Cooper Roller Bearings Co., Ltd., v. Power Plant Co., Ltd.

The proceedings in this action, the hearing of which occupied over three weeks, were briefly reported in our issue of April 5th (p. 636). On April 12th Mr. Justice Talbot delivered his reserved judgment. The plaintiffs claimed £833 for the price of goods sold and delivered and work and labour done. The question in dispute was whether certain friction clutches supplied by the plaintiffs for use in connection with machinery at tinplate rolling mills and other works were in accordance with contract or not. The contention of the defendants was that the clutches supplied by the plaintiffs were unsuitable, and that plaintiffs had committed breaches of contract and warranty. The plaintiffs maintained that the clutches were not able to perform their functions properly because of lack of adequate electric power supply.

Mr. Justice Talbot said the action was brought in connection with various contracts made between plaintiffs and defendants for the supply of clutches to be used with plant supplied by defendants to customers of theirs. In one case it was some rolling mills belonging to the Grovesend Tinplate Co.; in another to tube mills of the Eastwood Cement Company, Cambridgeshire; in another case to the rolling mills of the Elba Tinplate Company in South Wales; and there was a fourth contract in respect of which defendants had admitted liability and paid a sum into court. The first question was whether the goods were supplied and the work done by defendants' order and request. Plaintiffs alleged verbal orders and alternatively relied on the correspondence. The Grovesend clutches were delivered in January, 1926. Plaintiffs did not know for what mills they were required, or where they were in fact to be installed. On January 1st, 1927, the plaintiff firm heard from defendants that the clutches had broken down. Thereafter for many months plaintiffs were supplying appliances, chiefly plates, to replace those broken, and paying repeated visits to the Grovesend works in order to get at what was wrong. The Grovesend company had fixed the rated horse-power of the motors ultimately at 150. Defendants contracted to supply the driving and starting gear, including the motors and clutches. The clutches being part of the plant supplied by the defendants, when difficulty arose the Grovesend company applied to the defendants, and it was their business to deal with the matter. He was clearly of opinion that it was in giving such help and endeavouring to overcome the difficulties at defendants' request that the goods were supplied and the work done. The question of liability did not appear to have been raised till May, 1927, and it was only when it became evident that the sum involved had become considerable that it occurred to anyone that an understanding was necessary. After correspondence it was decided to let matters remain as before, and that the question of liability should be settled later. The burden of proving that there was a breach of contract was on the defendants, and therefore it had to be ascertained what was the contract under which the clutches were supplied. Previous orders for clutches had been on the basis that they should transmit 150 per cent. above the normal horse-power. It was obvious on this basis that the efficiency of the clutch depended on whether the horse-power was sufficient, a matter of which plaintiffs had no knowledge, and which was uncontrolled by them. It was evident that the defendants were thoroughly satisfied with the plaintiffs' clutches, and relied on their experience. It seemed plain that the defendants ordered on their own responsibility clutches of a capacity substantially greater than the horse-power of the motor. He was satisfied that this routine or practice was derived from and based on an earlier contract at Bryngwyn, which was thoroughly discussed, and that defendants impliedly represented to the plaintiffs that the conditions at the rolling mills in each case were not more severe in proportion to the power of the motor than those at Bryngwyn. When it was alleged by the defendants that plaintiffs had supplied clutches with plates which were too small a sharp difference of opinion arose between the parties. The defendants said they had given the plaintiffs all necessary information on which to quote for adequate clutches, but there was no question that plaintiffs were not in fact informed for what particular mills the clutches were required, and it was clear from the evidence that it would have been quite contrary to commercial practice, and also defendants' own practice, to give any such information. Having regard to the previous history of transactions between the parties, it seemed to him there was an overwhelming probability that the plaintiffs had fulfilled what was required of them. There was a strong presumption that either the motors adopted at the Grovesend works were not powerful enough, or there was something in the conditions, whether as to supply of power or pressure of the current or in the character of the duty itself which accounted for the difficulties experienced, and not anything in the design or construction of the clutches.

As to the size of the clutches defendants had entirely failed to prove they were too small. He thought it most improbable that the plates originally supplied were defective. With regard to the suggestion that plaintiffs should have ascertained the particular purpose for which the clutches were required, he did not know of any authority which laid that burden on them. So far as the Grovesend contract was concerned, in his opinion, the counter-claim failed.

It remained to consider both as to the claim and counter-claim the contracts relating to the Eastwood Company's mills and the Elba mills. Taking the latter first, the circumstances connected with the Elba works were practically the same as those of the Gravesend contract. In this case the plaintiffs were asked to supply transmission clutches capable of transmitting 150 h.p. above the rated h.p. of the motor specified. There was no evidence that plaintiffs failed to do that, and therefore plaintiffs were entitled to recover for goods supplied and work done in connection with those clutches, and were also entitled to judgment on the counter-claim so far as it related to this contract.

With regard to the Eastwood contract the complaint was that the clutch, soon after it was put in, "froze up" solid, and had been in that condition ever since. It appeared, however, that someone at the Eastwood Company's works locked up the clutch so that it could not be used as a clutch. It was difficult to ascertain what the real facts were owing to the lack of evidence from the Eastwood Company. The main complaint seemed to be that too much power was used by the clutch in accelerating the plant. It appeared to be established that there was great irregularity of voltage, but whether that accounted for all the complaints of the Eastwood Company it was impossible to say, and was not necessary to decide. It was enough to say that it had not been proved that plaintiffs broke the contract in the particulars alleged or in any other way. He thought plaintiffs had established a *primâ facie* case, subject to questions of amount, for the recovery of their whole bill. The onus of proving that any item was irrecoverable was on the defendants.

There would be no formal judgment entered now, but ultimately plaintiffs would be entitled to judgment on the claim and counter-claim with costs. He left the parties to move for judgment when the actual amount to which it was found after the reference they were entitled had been ascertained.

Mr. Pitt said he was instructed to apply for a stay of execution, but Mr. Justice Talbot said that that was not necessary.

Mr. Cyril Atkinson, K.C., said he should, in due course, after the amount had been determined by the Official Referee, apply for judgment for the plaintiffs on the claim and counter-claim with costs.

Johannesburg Compensation Claim Settled.

The *Cape Argus* states that two claims for compensation, each to the extent of £10,000, have been made against the Johannesburg City Council by dependents of two European electricians, Messrs. R. G. Urwin and J. Cleaves, who were killed in an accident at the switchboard in the municipal power station

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last year. The dependents in each case are a widow and two children. Negotiations have, however, recently taken place between the solicitors for the plaintiffs, and the Council has agreed to a recommendation "that without prejudice a sum of £2,650 be offered in each case in full and final settlement."

False Pretences Charge.

At the Birmingham Police Court on April 9th, Arthur Ward, labourer, of Small Heath, was charged with being on enclosed premises for an unlawful purpose, and with attempting to obtain money by false pretences from two householders.

Mr. Pugh, prosecuting solicitor, said that on March 28th Ward called at several houses in Somerville Road, representing himself to be chief inspector of the Electricity Department.

Lord Ilkeston (Stipendiary) found Ward guilty of the two attempts to obtain money, and fined him 60s. and 10s. costs. On the first count he was discharged.

North Wales Power Co.'s Capital Reduction.

In the Chancery Division, on April 15th, Mr. Justice Maugham sanctioned a petition by the North Wales Power Co., Ltd., asking for a reduction of its capital.

Mr. Lionel Cohen, K.C., for the company, said the proposal was to cancel 10s. of each of the 383,883 issued ordinary £1 shares. The reduction was part of a scheme to reorganise the company with a view to raising fresh capital to enable it to carry out its duties under the new regional power arrangements. The company's capital was £1,000,000, divided into 500,000 each of ordinary and preference shares. Resolutions had been passed to sub-divide both classes of shares into 10s. shares, and converting the preference into ordinary shares. The capital would then be increased to the original amount by the creation of new ordinary shares of 10s. each. Among the terms involved in the reorganisation was one that the company should buy the hydro-electric undertaking of the Aluminium Corporation.

Zone Wireless Co., Ltd.

Mr Justice Maugham, in the Winding-up Court, on April 15th, made an order for the compulsory liquidation of the Zone Wireless Co., Ltd., on the petition of Marconi's Wireless and Telegraph Co., Ltd.

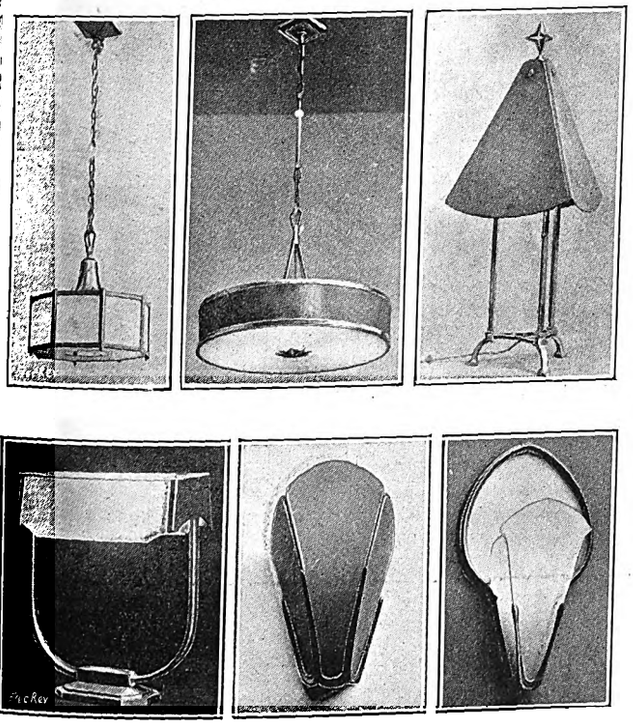
It was stated that the petitioners were creditors of the company for £162 under a contract.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

New Lighting Fittings.

The accompanying illustrations, figs. 1 to 6, are of selections from a range of lighting fittings recently marketed by Messrs. Best & Lloyd, Ltd., Handsworth, Birmingham. Many of these fittings are constructed with "Firelight" glass, which is coloured (standard) with a delicate orange merging into pale yellow, giving a very pleasant and becoming lighting effect. Various metal finishes can be supplied in oxidised brass, bronze, silver, and so on. Fig. 1 shows a one-lamp pendant fitting with obscured rimpled panes; the overall dimensions are 4 ft. long and 12 in. in diameter. The pendant fittings in fig. 2 is intended for three lamps



Figs. 1 to 6.—Selections from B. & L. Fittings.

and has a tinted vellum band, opal top glass and sandblast rimpled glass at the bottom. The fitting is 3 ft. 6 in. long and 20 in. in diameter. The table fittings shown in figs. 3 and 4 are each designed for one lamp, and are, respectively, 21½ in. and 12 in. high. The former is fitted with "Erinoid" panes and the latter with obscured rimpled panes. The wall fittings shown in figs. 5 and 6 are designed for one lamp each, having a projection of 4 in. and 4¾ in., respectively. The former is fitted with "Firelight" panes and the latter with obscured rimpled panes.

An Explosion-proof Lighting Fitting.

The continued demand for the more efficient illumination of situations in which explosive mixtures are prevalent has resulted in the development of the "Wigan" 100-W explosion-proof lighting fitting shown in fig. 8. The feature embodied to ensure safety are: (*a*) ample mechanical strength (to withstand the destructive effects of any internal explosion); and (*b*) a pressure-release device (so that there is no possibility of the ignition of external gases). The pressure developed is dependent upon the nature of the gases, and the fitting has successfully passed tests in methane-air, pentane-air, and acetone-air mixtures. The tests were carried out at the Sheffield University, forming the subject of certificates Nos. 227 and 243. The total number of explosions carried out on the sample fitting submitted was twenty-three,

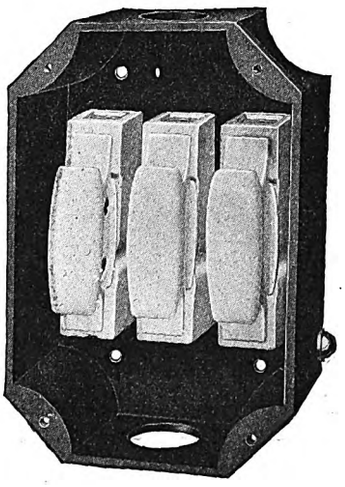


Fig. 7.—"Donovan" Isolating-link Box.

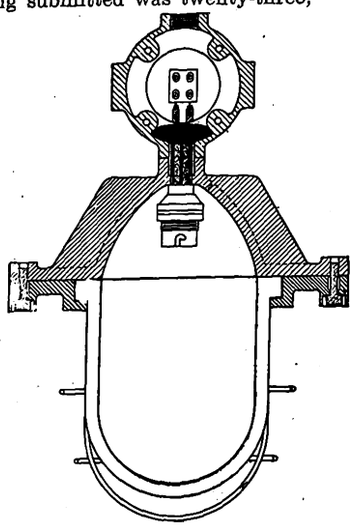


Fig. 8.—"Wigan" Explosion-proof Fitting.

without damage. The tests prove, it is claimed, the safety of these fittings when used in petrol depôts, cellulose works, mines, &c. The manufacturers, Messrs. Heyes & Co., Ltd., Water-Heyes Electrical Works, Wigan, will be pleased to forward full particulars to interested persons.

An Isolating-link Box.

An isolating-link box has recently been introduced by Messrs. Donovan & Co., 47, Cornwall Street, Birmingham, which, it is claimed, enables H.O. Regulation No. 11 to be fully complied with, in that efficient means of isolation can

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be fitted within easy reach of the motor starter. The standard link box consists of a cast-iron case arranged to connect to 1¼-in. conduit at one end, and to conduit or to a starter or switch at the other end. Other types of cable entry can also be supplied.

Inside the case are fitted two or three porcelain-clad bases arranged to take cable up to 19/.064, fitted with hand-shield porcelain-clad removable links. The contacts are self-aligning. The electrical resistance of the links is so small that it approximates to 6 in. only of 19/.052 cable, and the power dissipation per link at 60 A is under ½ watt. One size only is manufactured, up to 60 A, so that contractors and engineers can standardise this No. 1 size for all ordinary duty. Fig. 7 shows a 3-way box with the cover removed.

A Special Push Switch.

The "Klaxon Multum" push, fig. 9, a recent production of Klaxon, Ltd., 36, Blandford Street, W.1, has been specially designed for controlling alarm bells, hooters, and other electrical apparatus in mines, factories and other places where constant use calls for great strength and efficiency. It can

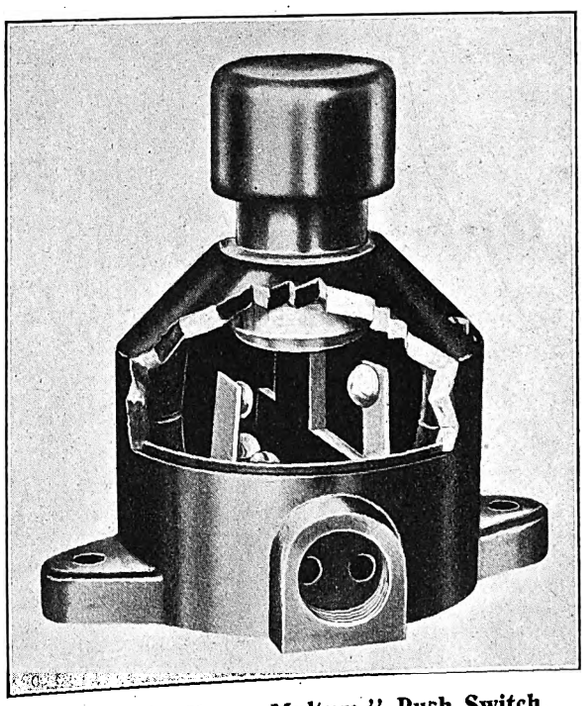

Fig. 9.—"Klaxon Multum" Push Switch.

be installed either permanently or for use in emergency only, and it will operate frequently and continuously, it is claimed, on circuits up to 500 volts, breaking 10 A at 110 volts. The capacity is high, and the contacts have sufficient mass to withstand considerable arcing while still maintaining good contact.

Indian Electrical Notes.

[By An Indian Correspondent.]

Ceylon.

TWELVE sub-stations in Colombo and the necessary machinery and equipment have been completed. Extra-high-pressure cables about 70 miles in length conveying power from the Kolonnawa power station have been laid in two rings serving practically the whole area of Colombo, each ring being supplied directly by two feeders. The steam plant at Kolonnawa was expected to be in full operation in February.

Calcutta.

Negotiations are proceeding between the Calcutta Municipality and the Calcutta Electric Supply Corporation, Ltd., regarding the prices charged for electricity in the city. The Supply Corporation is prepared to enter into a five-year agreement to charge 2.1 annas (2.36d.) per kWh for general lighting and 1.5 annas (1.68d.) per kWh for street lighting, with retrospective effect from January 1st, 1928. The Municipality, however, requires that the rate for general lighting shall be reduced to 2 annas (2¼d.) per kWh for a consumption of over one million kWh.

Madras.

After prolonged discussion the Corporation of Madras has decided upon the feasibility of the municipalisation of the electricity supply, instead of renewing the agreement with the Madras Electric Supply Corporation. Though it was pointed out that on a rough estimate it would require Rs.11 lakhs (£82,500) for the erection of suitable plant, and that the present finances of the Corporation would not permit of such a venture, it was thought by the majority necessary that municipalisation should be brought about.

The Mettur Project.

An agreement has been entered into between the Mysore and Madras Governments for the supply of electrical energy to the Mettur Project headworks now under construction by the Mysore Government. It is estimated that by purchasing power from Mysore instead of generating at the site as originally intended there will be a reduction of not less than Rs. 14 lakhs (£105,000) in capital expenditure and a further saving in the cost of power during the period of construction of about Rs. 10 lakhs (£75,000). The transmission line from Sivasamudram, the generating centre, to Mettur has been completed and the supply of energy has commenced. The line runs over 63 miles, mostly through thick forests and hilly tracts. The average demand is expected to be about 2,040 kW, available normally for about twelve hours a day.

Punjab.

Electricity is making great headway in the Punjab, and according to the latest report a number of towns are now electrically lighted. The Lahore Electric Supply Co. has been granted a licence for the supply of energy to Sialkot, and the new Lahore City sub-station of the company has been passed for operation. The company has also ordered a 300-kW set with boiler equipment for Amritsar. At Lyallpur considerable progress has been made in the installation of Diesel engines and the installation of distribution mains. At Gujranwalla two generating sets installed by the local electricity supply company have been augmented by a third set of 200 kW.

Mysore State.

Mysore leads the way among Indian States in the matter of electrification. During the past year there has been considerable activity in the extension of electric lighting schemes in the district areas of the State, and measures for instituting a chain of electrical installations in the remoter centres are being proceeded with. The power generated during the year at Mysore was 161,894,410 kWh. The maximum loads recorded were 17,860 h.p. for mining companies, 11,680 h.p. for industrial concerns, and 4,470 h.p. for street and house lighting.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Cleaning Machinery.

There have been a number of advertisements of late for electric blowers, the purpose of which is to clean generators, &c., by means of compressed air. I have always been very much against this method of cleaning generator and motor windings, my reason being that while blowing quite a large amount of dust out of the machine one is also blowing dust into places from which one will not be able to get it again; in other words, one is blowing dust from one part of the machine to another. To my mind it is much better to use a strong type of vacuum cleaner, because with this type of cleaning one *does* know where the dust goes to. If proper fittings are used, it is no trouble to clean a machine much better than by blowing the dust about.

Charge Engineer.

April 13th, 1929.

Proposed Technical Society for Meter Engineers.

With reference to the formation of a new technical society on the lines of, and similar to, the old Meter Engineers' Technical Association, it has been suggested to me by several meter engineers that there is still room for a technical association as distinct from the Meter Section of the I.E.E.

It appears to be realised by meter engineers in general, as well as those of us who were transferred to the Meter Section of the I.E.E. on the fusion of the M.E.T.A. with the I.E.E., that the needs of the majority of the meter fraternity are not being catered for from a technical engineering standpoint. A review of the I.E.E. papers of the past four months supports this view, as little of interest to the meter engineer is contained therein, the proceedings being of a general electrical engineering character. A further point is that when meetings and discussions are held, many engineers who would attend are prevented from so doing on account of the distance.

I would suggest, therefore, that a new technical society be formed on the lines of the old M.E.T.A., but incorporating the group system, whereby meetings could be held by different sections of the Society throughout the country.

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I shall be pleased to have the names of all meter engineers who would be willing to co-operate in the proposed schemes. Letters may be forwarded to me at the address below.

H. F. Hudson,
Graduate I.E.E.

Electricity Works, Hylton Road, Worcester.
April 13th, 1929.

Advertising Municipal Vacancies.

I should like the aid of your journal to call attention to the revivification of that one-time rampant disease, *viz.*, the advertising of vacant positions for which individuals are already earmarked.

A rather brazen sample of this procedure has recently been enacted by a municipality when two vacancies occurred.

It is doubtful if anyone really cares a straw about this give-preference-to-my-late-colleague, brotherly-love kind of stuff; in fact, the majority would no doubt be full of sympathy for those concerned who possibly may not be able to obtain a move on their merits.

I think, however, that I am reiterating the opinion of the multitude when I say that this hypocritical bunk which causes applicants to waste their time and money should cease.

The usual excuse that advertising is compulsory is too lame to toddle.

Fueleco.

April 15th, 1929.

[If it were not compulsory to advertise, might not the ground for grievance be thought to exist more extensively?—Eds. Elec. Rev.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

24,877. "Negative secondary battery plates." D.P. Battery Co., Ltd., and J. Waddell. September 21st, 1927. (308,283.)

30,705. "Rotary electric switches." C. A. Turner. November 15th, 1927. (308,183.)

33,200. "Means for regulating the supply of current from dynamos having a third brush for use in power-driven vehicles." A. Muriel (legal representative of G. Fornaca (deceased)). December 8th, 1927. (308,286.)

34,182. "Circuit arrangements for embodying discharge tubes." S. G. S. Dicker Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 16th, 1927. (308,288.)

34,281. "Means for controlling electric hoists and elevators." P. McDermid and P. S. McDermid. December 19th, 1927. (308,184.)

34,297. "Junction boxes for metal-sheathed electric cables." Walsall Hardware Manufacturing Co., Ltd., and A. E. Read. December 19th, 1927. (308,185.)

34,322. "Electric switchgear." A. Reyrolle & Co., Ltd., and J. Mirrey. December 19th, 1927. (308,186.)

34,341. "Apparatus for rectifying alternating electric currents." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. December 19th, 1927. (308,188.)

34,342. "Apparatus for rectifying alternating electric currents." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. December 19th, 1927. (308,189.)

34,343. "Apparatus for rectifying alternating electric currents." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd December 19th, 1927. (308,190.)

34,362. "Regulating devices." International General Electric Co., Inc. December 24th, 1926. (282,676.)

34,534. "Electric contact-making and breaking devices and associated controlling and controlled means." Creed & Co., Ltd., F. G. Creed, and A. Orling. December 20th, 1927. (308,239.)

34,715. "Alternating-current electric machines." English Electric Co., Ltd., and R. D. Ball. December 22nd, 1927. (Cognate application, 23,883/28.) (308,335.)

34,737. "Two-way telephone and the like systems." W. S. Smith and N. W. McLachlan. December 22nd, 1927. (308,336.)

34,738. "Thermionic and the like amplifiers." W. S. Smith and N. W. McLachlan. December 22nd, 1927. (308,337.)

35,088. "Electric protective arrangements." A. Reyrolle & Co., Ltd., and B. H. Leeson. December 28th, 1927. (308,334.)

35,089. "Electric protective arrangements." A. Reyrolle & Co., Ltd., B. H. Leeson, and E. W. M. Scott. December 28th, 1927. (308,378.)

35,166. "Driving mechanism of electrically-driven paper machines and the like." Harland Engineering Co., Ltd., and F. G. Warburton. December 28th, 1927. (308,380.)

35,232. "Electric cable joint." T. Yamanouchi. December 29th, 1927. (308,381.)

35,260. "Means for generating electricity by evaporating liquids." F Von Brunner. December 29th, 1927. (308,382.)

35,376. "Electric time relays." Akt. Ges. Brown, Boveri et Cie. December 30th, 1926. (282,831.)

35,427. "Alternating-current dynamo-electric machines." Sachsenwerk Licht-und- Kraft Akt. Ges. and T. Schmitz. December 31st, 1927. (308,384.)

1928.

16. "Dialling apparatus for automatic telephone instruments." C. A. Schierwater. January 2nd, 1928. (308,385.)

501. "Electric fuses." W. J. John and H. Wright, Junr. January 6th, 1928. (308,388.)

573. "Apparatus for the ultra-violet ray treatment of flour." S. Bonsor. January 7th, 1928. (308,390.)

880. "Electrical insulators." J. E. Pollak (Hermsdorf Schomburg Isolatoren Ges.). January 10th, 1928. (308,393.)

1,588. "Electric-current interrupters." Siemens Bros. & Co., Ltd., E. A. Petithorey, and E. R. Garrod. January 18th, 1928. (308,398.)

1,824. "Signalling devices for traffic-controlling purposes." Brighton Lighting and Electrical Engineering Co., Ltd., and E. Heaps. January 19th, 1928. (308,400.)

1,826. "Coin-freed prepayment mechanism for electricity meters." Smith Meters, Ltd., E. W. Smith, H. E. Angold, and A. W. Angold. January 19th, 1928. (308,401.)

2,688. "Electric transformers." British Thomson-Houston Co., Ltd., and J. G. Wellings. January 27th, 1928. (308,406.)

3,153. "Apparatus for illuminating the interiors of closed compartments." Walker, Hunter & Co., Ltd., and J. Walker. October 27th, 1928. (308,409.)

3,185. "Safety devices for electrical apparatus." British Thomson-Houston Co., Ltd. February 1st, 1927. (284,630.)

3,417. "Lead-sheathed electric cables." J. McCallum. February 3rd, 1928. (308,413.)

3,560. "Electric motors.' British Thomson-Houston Co., Ltd., A. A. Pollock, J. Hutt, and A. G. Salisbury. February 4th, 1928. (308,416.)

4,637. "Electrical plug-and-socket coupling with longitudinally-divided sockets." M. Bing. February 14th, 1928. (308,425.)

5,446. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and L. Griffiths. February 21st, 1928. (308,432.)

5,714. "Sparking plugs." B. Hopps and A. M. Lodge. February 23rd, 1928. (308,435.)

6,243. "Electrical signalling systems." General Electric Co., Ltd., and N. C. Smart. February 28th, 1928. (308,440.)

6,621. "Systems of protection and control for electrical distribution systems." British Thomson-Houston Co., Ltd. March 9th, 1927. (286,693.)

7,274. "Telephone instruments." Mullard Radio Valve Co., Ltd., and C. F. M. Hayes. March 8th, 1928. (308,448.)

7,275. "Telephone instruments." Mullard Radio Valve Co., Ltd., and C. F. M. Hayes. March 8th, 1928. (308,449.)

8,453. "Piezo-electric devices." Marconi's Wireless Telegraph Co., Ltd. March 21st, 1927. (287,484.)

8,693. "Sparking plug." F. Bolton. March 22nd, 1928. (308,472.)

9,235. "Electrodes for use in electric arc welding." Quasi-Arc Co., Ltd., and A. P. Strohmenger. March 27th, 1928. (308,475.)

9,277. "Electric switches." Harben's (Viscose Silk Manufacturers), Ltd., and W. E. Sharples. March 27th, 1928. (308,476.)

9,477. "Ram and connecting rod fitting particularly for electro-hydraulic steering gears." Brown Bros. & Co., Ltd., and W. Wallace. March 29th, 1928. (308,478.)

9,529. "Direction indicators for use on vehicles." Ceskomoravska-Kolben-Danek Akciova Spolecnost. April 1st, 1927. (288,150.)

10,152. "Hand magnifying glass with electric illumination between the lenses." J. Catwin (Merano Ges. Optik-Feinmechanik). April 4th, 1928. (Convention date not granted.) (288,302.)

11,086. "Wireless telegraphy and/or telephony." P. E. McIver. April 14th, 1928. (308,493.)

11,118. "Electric incandescent lamp fittings." R. P. A. Anderson. April 14th, 1928. (308,494.)

11,486. "Cases for electric condensers and other electrical components." Sterling Telephone & Electric Co., Ltd., and R. E. Miles. April 18th, 1928. (308,497.)

12,278. "Circuit arrangement for intermediate amplifiers in two-wire lines." Siemens & Halske Akt. Ges. June 18th, 1927. (292,461.)

12,973. "Device for directing or guiding tramway or other cars at rail junctions." I. Litvinshev. May 2nd, 1928. (308,505.)

13,310. "Methods of, and apparatus for, making electric incandescent lamps and similar articles." British Thomson-Houston Co., Ltd. May 7th, 1927. (290,165.)

13,516. "Electric call apparatus." C. Dupuis. June 3rd, 1927. (291,436.)

13,640. "Insulation and securing of coil windings of lacquered wire." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). May 9th, 1926. (308,508.)

16,179. "Lead covering of electric cables and the like by extrusion." W. T. Henley's Telegraph Works Co., Ltd., and E. E. Judge. June 2nd, 1928. (308,521.)

16,876. "Thermionic apparatus." British Thomson-Houston Co., Ltd. July 19th, 1927. (294,168.)

17,841. "Holders for electric lamps." C. Baty. July 18th, 1927. (294,145.)

19,406. "Testing arrangements for electric networks." Ateliers de Constructions Electriques de Charleroi. July 13th, 1927. (293,831.)

21,866. "Impregnation material for use in electrical condensers." Telephon-Apparat-Fabrik E. Zwietusch & Co., Ges. October 29th, 1927. (299,697.)

28,024. "Directive aerials." N. Koomans. October 3rd, 1927. (298,131.)

29,105. "Railway and tramway rail joints." W. C. Fairweather (Ges. für Wirtschaftlichen-Bahnoberbau). October 10th, 1928. (308,555.)

29,689. "Piezo-electric devices." E. W. C. Russell. October 14th, 1927. (298,904.)

29,703. "Coin-freed prepayment mechanism for electricity meters." Smith Meters, Ltd., E. W. Smith H. E. Angold, and A. W. Angold. January 19th, 1928. (Divided application on 308,401.) (308,557.)

29,704. "Coin-freed prepayment mechanism for electricity meters." Smith Meters, Ltd., E. W. Smith, H. E. Angold, and A. W. Angold. January 19th, 1928. (Divided application on 308,401.) (308,558.)

30,957. "Voltage balancing for systems of electrical distribution." British Thomson-Houston Co., Ltd. October 27th, 1927. (299,465.)

34,782. "Radio transmitters." Telefunken Ges. für Drahtlose Telegraphie. November 24th, 1927. (301,326.)

35,085. "High-frequency circuit arrangements, thermionic-valve transmitters and the like." Telefunken Ges. für Drahtlose Telegraphie. December 29th, 1927. (303,150.)

1929.

4,435. "Rotary electric switches." C. A. Turner. November 15th, 1927. (Divided application on 308,183.) (308,241.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 10th :—

Allscott (lettering and design). No. 495,953. Class 8. Radio-telephonic apparatus and parts thereof.—J. Scott, trading as James Scott & Co., 56, Inglis Street, Dunfermline.

Univisaphon. No. 496,376. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—J. Good, 173-174, Finsbury Pavement House, Moorgate, E.C.2.

U.H. (lettering and design). No. 498,480. Class 8. Electrical batteries (not for medical purposes) and electrical transformers.—C. R. F. Hanson, trading as Hanson & Co., Building 191, Trading Estate, Slough.

Fairylite (lettering and design). No. 499,928. Class 8. Apparatus for displaying signs by means of light reflective surfaces.—Fairylites, Ltd., 32, Victoria Street, S.W.1.

Microficient. No. 500,220. All goods in Class 8.—Graham Farish, Ltd., 17, Masons Hill, Bromley, Kent.

Lathol. No. 500,070. Class 13. Portable electric torches.—Ever-Ready Co (Great Britain), Ltd., Hercules Place, Holloway, N.7.

Electrorad. No. 498,000. Class 18. Electric heating apparatus for buildings. —H. P. Barker, trading as the Electro-Gas Co., 100, Victoria Street, S.W.1.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ADDLESTONE.—50 houses for Chertsey U.D.C.; E. J. Castle, clerk, Council Offices, Chertsey.

ANNAN.—Re-erection (after fire) of Blackyett (mansion) for Col. Frederick M'Connel.

BARKING.—40 subsidy houses, Faircross Estate; E. Glenny and Son.

BEXLEY.—Additional 50 houses, Brampton Estate, for the U.D.C.; surveyor.

BRISTOL.—Municipal buildings, College Green site; Corporation Municipal Buildings Committee.

BROADSTAIRS.—Church, Dumpton; vicar of St. Peter's.

BURNLEY.—Housing schemes, north and east areas; borough surveyor.

CANTERBURY.—Restaurant, The Parade, for J. Lyons and Co., Ltd., London.

CARLISLE.—Pathological institution, Cumberland Infirmary, for the governors; H. E. Scarborough, architect, 22, Lowther Street. Offices, Caldewgate, for Carr & Co., Ltd.

COLCHESTER.—Workshops, rest rooms, office and store, Hythe Bridge Ironworks; F. W. Brackett & Co., Ltd.

COULSDON.—Refuse destructor; U.D.C. surveyor.

DARTFORD.—Extensions, 20-bed ward and operating theatre, Livingstone Hospital; secretary.

DOUGLAS (I.O.M.).—Fire station; borough engineer.

EASTBOURNE.—Hospital, for the Leaf Homœopathic Cottage Hospital; secretary.

EDINBURGH.—Cinema, for Blue Halls (Edinburgh), Ltd.; the secretary. Extensions at Castle Mills Works, for North British Rubber Co., Ltd.; F. E. B. Blanc, architect. Extension of George Heriots School; G. Reid, architect.

ELLESMERE PORT AND WHITBY.—Housing scheme (264), for the U.D.C.; T. W. Francis, clerk (returnable deposit of £5 5s.).

FIFESHIRE.—Church at Rosyth; the Rev. Arnold Boyd, Rosyth.

GLASGOW.—Warehouses at 227 to 233, Hope Street, for Watt Bros. (Glasgow and Edinburgh); the manager. Shops at Knightswood, for Anniesland Co-operative Society, Ltd.; the manager. School at King's Park, for Education Authority; clerk, Education Offices, Bath Street.

HESWALL (Cheshire).—Extension of branch Hospital; secretary, Royal Liverpool Children's Hospital.

HORNCHURCH.—Factory extensions, Ardleigh Green, for Stafford Allen & Sons, Ltd., Cowper Street, E.C.

HULL.—Heating and extensions, Mental Hospital; J. R. Preston, consulting engineer. Estate development, Bricknell Avenue; A. L. Windross & Partners.

ILKESTON.—Drill hall, Albert Street; Territorial Force Association.

INCE-IN-MAKERFIELD.—Housing scheme (44), for the U.D.C.; W. Thornley, architect, 46, Wallgate, Wigan (returnable deposit of £1 1s.).

IRISH FREE STATE (Lurgan, Co. Rosscommon).—Conversion of Workhouse into hospital for the Board of Guardians (£28,000); Ferguson & McIlveen, architects, Belfast.

IRLAM AND CADISHEAD.—Houses (50), for the U.D.C.; Brew Bros., builders, Cadishead.

KNUTSFORD (Cheshire).—Housing scheme (140), for the U.D.C.; surveyor.

LEEDS.—Cinema, lock-up shops, stores, &c., Wellington Road, New Wortley; West Leeds Amusements Co., Ltd. Warehouse, offices, &c., Bridge Road, Kirkstall; Thrift Stores, Ltd. Housing scheme (64), Meanwood Estate; J. E. Acfield, city engineer, Municipal Buildings.

LONDON (East Ham, E.).—Elementary school, Flanders Road; Education Committee. Depôt for London Co-operative Society, Ltd., Little Ilford Lane; A. Hulbert. 218 houses, Roman Road and Saxon Road; J. Stokes and Sons.

(Finchley, N.).—Cinema and dance hall, Ballards Lane; Ritz Cinemas & Entertainments Co., Ltd. Extensions, New Oak Road; Simm's Motor Units, Ltd.

(Fulham, S.W.).—Isolation accommodation, Western Hospital (£32,590); Metropolitan Asylums Board.

(S.W.17).—Extensions, Fountain Mental Hospital (£3,500); Metropolitan Asylums Board.

LYMINGTON.—Housing scheme (30), for the R.D.C.; R. O. L. Lovell, surveyor (returnable deposit of £2 2s.).

MACCLESFIELD.—Additional 100 houses, for the T.C.; borough surveyor.

MANCHESTER.—Baths and wash-houses, Hulme (£23,000); city engineer. Aerodrome, Chat Moss (£14,800); city engineer. Chapel, shelters and nursing accommodation, Baguley Sanatorium; Hospital Committee. Central laundry, Moss Side (£7,865); city engineer.

MATLOCK BATH.—Re-erection (after fire), of Royal Hotel; for R. J. Bray.

MITCHAM.—Church (£10,000), for the Congregational trustees; secretary.

MOTHERWELL.—Extensions, silk factory, for Anderson and Robertson.

NEWMILNS AND GREENHOLM.—Housing scheme (17), with electric wiring work, for the T.C.; J. H. Gilmour, burgh surveyor (tenders by April 22nd).

NORTHAMPTON.—Additional 40 houses, for the T.C.; borough surveyor. Estate development, Headlands Estate, Weston Favell; D. P. Taylor.

OLDHAM.—Sewage works, Foxdenton Lane, Chadderton (deposit £2 2s.); borough engineer, Town Hall.

OXFORD.—Church (£6,000), Headington, for the Wesleyan trustees; secretary.

PLYMOUTH.—Public school; Torneley & Rooke, architects. Extensions, confectionery works, Bucknell Street; Lear Bros. Secondary school for girls, Montpelier site; city architect. Development of Central Park (£130,000); city engineer.

PURLEY.—Secondary school (400 places), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

RICHMOND (Yorks.).—Business stores, Catterick, for the Co-operative Wholesale Society, Ltd., Manchester. Church, Catterick Camp, for the Presbyterian trustees.

ROTHERHAM.—Works extensions, Grange Mill Lane; A. Shardlow & Co., Ltd.

SHEFFIELD.—Housing scheme (112), Wisewood Estate (Scheme No. 3) (deposit £2); W. G. Davies, city architect. Public baths and wash-houses, Wincobank and Upperthorpe (£19,000); W. G. Davies, city architect.

SOUTHEND-ON-SEA.—Hospital, with electrical block (£111,000), for the executive committee of the new General Hospital; secretary, 44, Alexandra Street.

STALYBRIDGE.—107 houses, Hague site; J. Gerrard & Sons, Swinton, Manchester. Housing scheme (19 acres) off Brishes Road; borough engineer.

STOCKTON HEATH (Warrington).—Cinema, Walton Road, for the Mersey Cinemas, Ltd.; secretary.

SUNBURY.—Housing scheme (32), for the U.D.C.; surveyor.

SUNDERLAND.—Central schools (deposit £2 2s.); C. A. Clayton Green, architect, Barclay's Bank Chambers, Fawcett Street.

TORQUAY.—Housing scheme (15 acres) at Combe Pafford; borough engineer. Development of Hilly Estate, St. Marychurch; Mr. Steer.

WALLASEY.—Housing scheme (228), Leasowe Road Estate; borough surveyor.

WALSALL.—Housing scheme (16 acres) at Leamore; borough engineer.

WATFORD.—Covering open-air market (£4,200); borough engineer.

WHITBY.—Bazaar premises, St. Anne's Staith, for F. W. Woolworth & Co., Ltd., Kingsway, London.

WILTON.—Houses (36), for the T.C.; J. Whatley, builder.

WREXHAM.—Houses (36), for the T.C.; J. Gerrard & Sons, Ltd., builders, Swinton, Lancs.

YORK.—Extensions, newspaper offices, Coney Street; *Yorkshire Herald*. Development, Clifton Estate; Clifton Estate, Ltd.

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The

Electrical Review

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Telephone Development.

IN the April issue of the *Telegraph and Telephone Journal*, Mr. W. H. Gunston states that the number of telephones in operation in Great Britain and Northern Ireland at the end of 1928 was 1,759,686, representing an increase of 125,864 during the year, which is the greatest advance made in this country in any one year so far. Over a third of the telephones (614,183) are in the London Telephone Area (which includes a number of large extra-Metropolitan districts, such as Croydon and Willesden) and in this area there are 8.3 telephones per 100 of population. In the London Administrative County the figure rises to 10.2. The next best developed area is not one of the large provincial cities, as might have been expected, but Bournemouth (7.6), which is principally a residential town. Then comes Cardiff (6.3), and the fourth is another seaside resort—Brighton (6.1). After the next, Edinburgh (5.9), come the principal industrial centres, Manchester (5.4) leading. It is surprising to observe that Newcastle-on-Tyne has only 3.7 telephones per 100 inhabitants, while such large industrial cities as Sheffield and Belfast have an even smaller number. It is not easy to draw conclusions from the figures, but it certainly seems strange that important commercial centres should be surpassed in telephone development by many residential and country towns. There seems to be scope for an intensification of the Telephone Development Association's activities at certain points.

There is no doubt that the work of that Association has already begun to bear fruit, but an enormous amount of work remains to be done. Sir Alexander Roger, the chairman, at the Association's recent annual meeting, maintained that there should be four million telephones in this country. If the Government was compelled to take a real interest in the telephone service the existing factories would be insufficient to meet the demands upon them. He deprecated the present attitude of the Treasury towards expenditure on this important and profitable business. The growing tendency of London to become the centre of international telephone communication rendered it all the more necessary that we should be highly developed in this direction.

A certain amount of political capital is now being

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made by means of promises of an intensified telephone development. This raises the question of how far the system can be developed in advance of the demand, a subject upon which there may be room for considerable difference of opinion. At present little seems to be done in advance of immediate requirements, and the Post Office, though willing enough to serve, too often waits until it is asked before it does anything. We must agree that once an application is made, or a telephone installed, the G.P.O. does a great deal to stimulate its use and encourage extensions.

What is wanted is more foresight at the Post Office and the Treasury and more activity of the kind mentioned in the Chancellor's Budget speech to which we refer below. The G.P.O. should co-operate wholeheartedly with the T.D.A., realising that their aim is a common one, bringing benefits to both as well as to the public.

It should also be considered whether the service given to existing customers is as good as it ought to be. Defects in this direction are a bad advertisement for the telephone. It should not be possible for so many complaints to appear at once, as has been the case lately. There may be perfectly good reasons for a great many wrong numbers and delays, but the public always looks on reasons as excuses, which is bad for the service. Maybe the automatisation of the system will diminish the causes of complaint by eliminating the erratic human element. If so, the work of conversion should be proceeded with as quickly as possible. The manufacturers are willing and able to produce far more plant than they are being asked for at present.

Practical steps in the development of the use of the telephone were announced by Mr. Winston Churchill in his Budget speech last week. Rural post offices and railway stations which hitherto have had no telephones are to be equipped, and the radius from the nearest exchange in which there is no "mileage charge" is to be extended from 1½ to 2 miles. The latter should make a real difference, for in most cases the added area will be well-populated and a good field for cultivation of extra business.

The Sale of the Shanghai Undertaking.

The decision of the Shanghai Municipality to accept the offer of the American & Foreign Power Co. to purchase the electricity undertaking is an outstanding event, not only in view of the amount involved (£10,000,000) but also as an indication of the changing state of affairs in the International Settlement. The undertaking is a most important one, embracing installed plant of about 150,000 kW and serving over 47,000 consumers, many of them being large industrial concerns. The output during 1927, the latest figure available, was in excess of 400 million kWh.

Although "international," the undertaking is predominantly British. The "nationality" of the generating plant installed (including a 20,000-kW set in course of erection) at the end of 1927 was as follows:—British, 81,000 kW; American, 56,000 kW; and German, 4,000 kW. In addition to this, a further 20,000-kW Metropolitan-Vickers set was on order. The boiler plant is practically wholly British and so is the main switchgear.

Mr. T. H. U. Aldridge, the engineer-in-chief and manager, has occupied this position for many years and has been responsible for the undertaking's progressive policy and striking advance, in conjunction with Messrs. Preece, Cardew & Rider as consulting engineers.

Moderate Wiring Rules.

It is the policy of many new institutions to allow people with scant qualifications to become members to swell the numbers. Then at a later date the conditions of entry are made stricter and often (though certainly not always) the institution eventually becomes properly representative and powerful in its particular sphere.

With the National Register of Electrical Installation Contractors, however, this was not the case. From the very first a high standard was fixed and applicants for registration had to conform to it. Moreover, registration does not entitle a contractor to recede from that high standard, and it is a sign of the growing strength of the Registration Board that certain cases of bad workmanship have been severely dealt with. At the annual meeting of the Board last week the Executive Committee put forward a list of the nine deadly sins in electrical contracting work, commission of which would render a registered contractor liable to have his certificate cancelled. (Bad contractors are so much worse than ordinary mortals that they are not content with seven.) It is possible that many registered contractors will be given furiously to think by this list, for one or two of the items may be thought to be only minor faults. Some, for instance, may look upon the tight packing of wires in conduit as reasonable economy, while others may not realise that cheap labour very seldom means good workmanship.

All contractors who wish to see their important industry placed upon a sound and trustworthy basis will be grateful to the Executive of the Register for dealing so ably with the matter. In the absence of compulsory wiring regulations this moderate measure of control should certainly bring those responsible for placing installation contracts to a realisation of the fact that it pays to employ a man or firm possessing the certificate of the Register.

Rural Electrification.

Last week the Electricity Commission granted a Special Order to Mr. R. Borlase Matthews, whose rural electrification and electro-farming work is well known, for the supply of electricity to an area of 1,281 square miles in Lincolnshire, that is, the whole of the County, less those parts wherein electricity supply undertakings already operate, or in respect of which powers have just been granted. The district represents 2.5 per cent. of the whole area of England, and the Order affects a population of 140,590 persons. The scheme planned will be the first serious attempt to be made in this country to supply electricity everywhere (including towns, villages, hamlets, and farms) and hence its development will be watched with the keenest interest. For the County of Lincolnshire itself the scheme should contribute materially towards improving the prospects of reviving farming prosperity and promoting rural industry, while from the point of view of the rest of the country it will serve to demonstrate what can be done elsewhere. Incidentally, the promoter's plans contemplate an effort to brighten the popular seaside holiday resorts. It is gratifying to learn that most of the material required for the electrical development of Lincolnshire will be made in other parts of England.

Lead Cable Sheaths.

It had been hoped that the recent article on "The Physical Behaviour of Lead Sheaths in Relation to Failures of High-voltage Cables," in which Mr. C. J. Beaver suggests that the alleged creation of voids in normal cables as a result of the permanent distension of their lead sheaths is a view which distinctly lacks foundation, would stimulate discussion, but the criticism of the author's contention has been limited and disappointing. Accordingly, elsewhere in this issue, Mr. Beaver exercises an author's privilege and replies to his critics in no less definite terms than those in which he originally submitted his thesis.

The importance of the subject cannot be denied; moreover, most students of high-voltage cable technique hold by no means uncertain ideas of the reasons of cable failures, but it is not easy to induce them to express their opinions publicly, more especially when to do so would involve finding fault with commonly-accepted theories.

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The Central Argentine Railway.

Some details of important Buenos Aires suburban-line electrification extensions, of which little information has been available hitherto.

ARRANGEMENTS have now been made to complete the electrification of the Buenos Aires suburban lines of the Central Argentine Railway, and important contracts have been placed with the Metropolitan-Vickers Electrical Co., Ltd., for the additional electrical apparatus required for the power station, sub-stations, and multiple-unit trains. The contracts cover the supply and erection of large-capacity transformers and 20,000-volt switchgear for the power station, complete equipment for five new sub-stations and for the extension of four existing sub-stations; and the supply of electrical equipment for seventy-one motor coaches and sixty-four trailer coaches.

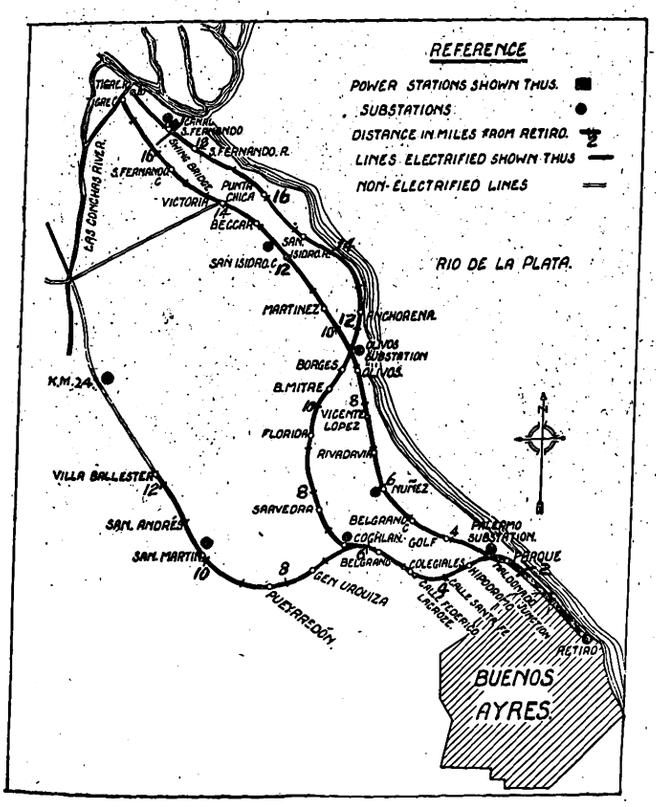

Fig. 1.—Suburban System of the Central Argentine Railway.

The work is to be carried out to the specification of Messrs. Merz and McLellan, who are the consulting engineers for the electrification scheme, an interesting feature of which is the fact that the new sub-stations, totalling 20,000 kW in capacity, together with two new track-sectioning cabins, are to be arranged for unattended operation with supervisory control.

The Central Argentine Railway is the second largest British-owned railway in South America and was the first in that country to apply heavy electric traction to its system. The suburban system, shown in fig. 1, consists of three separate routes serving a large residential area to the north-west of Buenos Aires. The three routes run together for a distance of three miles from the Retiro station, which is the terminal station of the Company, one line then branching off to Tigre West, which is 17½ route miles from Buenos Aires. The other two routes run together for a further three miles, after which one line branches to Tigre East, 20 route miles from Buenos Aires, the other running on the Company's main line to the north, the suburban service terminating at Villa Ballester, 12½ route miles from Buenos Aires.

The present electrified section is the route from the Retiro station to Tigre West, on which a full electric service has been in operation since 1916 with very satisfactory results. In a paper read before the Argentine Centre of the Institute of Transport last year by Mr. K. M. Eckhard, superintendent of electrification to the Central Argentine Railway, it is stated that the total number of passengers carried per year on that section increased from about 5½ millions in 1915, the last year of steam operation, to about 17½ millions in 1927. Mr. Eckhard remarks that, while it cannot of course be said that the whole of that increase is due to the electrification of the line, the electrification has enabled the Company to deal effectively and economically with the heavy traffic which now exists, without necessitating track lay-out modifications, or other works.

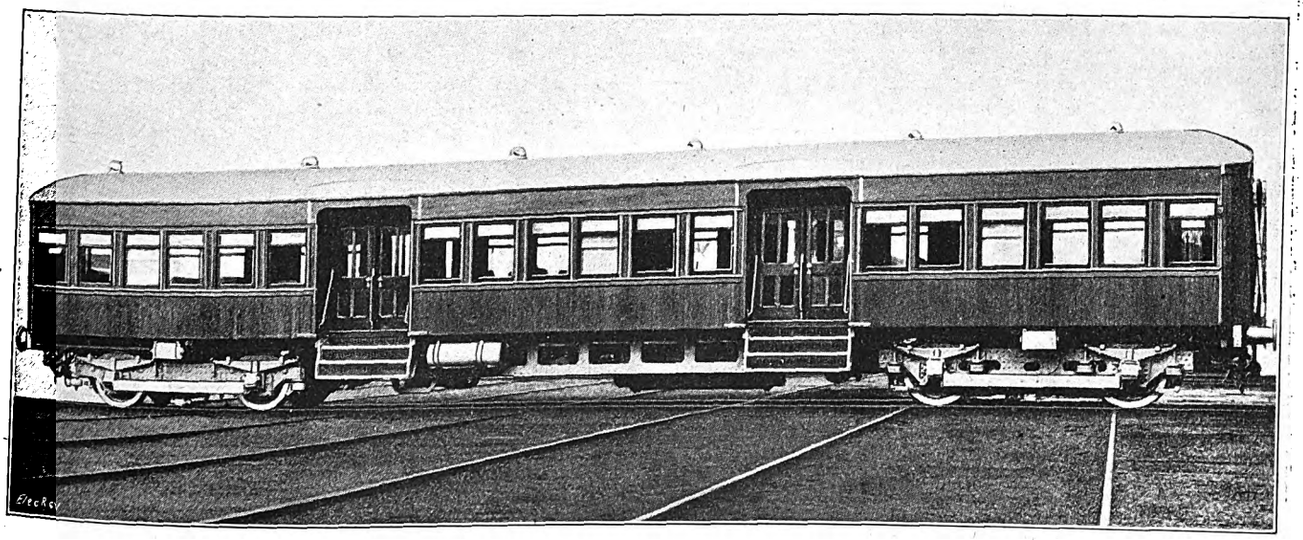

Fig. 2.—Exterior of New First-class Electric Railway Motor Coach.

The extensions now to be undertaken are to electrify the service on the remaining two steam-operated

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suburban routes. The system of operation will be the same as that on the Tigre West route, *viz.*, by direct current at 800 volts supplied by third rail from rotary-convertor sub-stations. The supply to the sub-stations is at 20,000 volts, 3 phase, 25 cycles, from the Company's power station at Canal San Fernando, the equipment of which is at present being increased by the addition of three 6,000-kW turbo-alternator sets, raising the total generating capacity to 30,000 kW. The high-voltage transmission system has been linked since 1924 with that of the Buenos Aires Western Railway Company, the two power stations operating in parallel on an agreed programme to the mutual economic benefit of both companies.

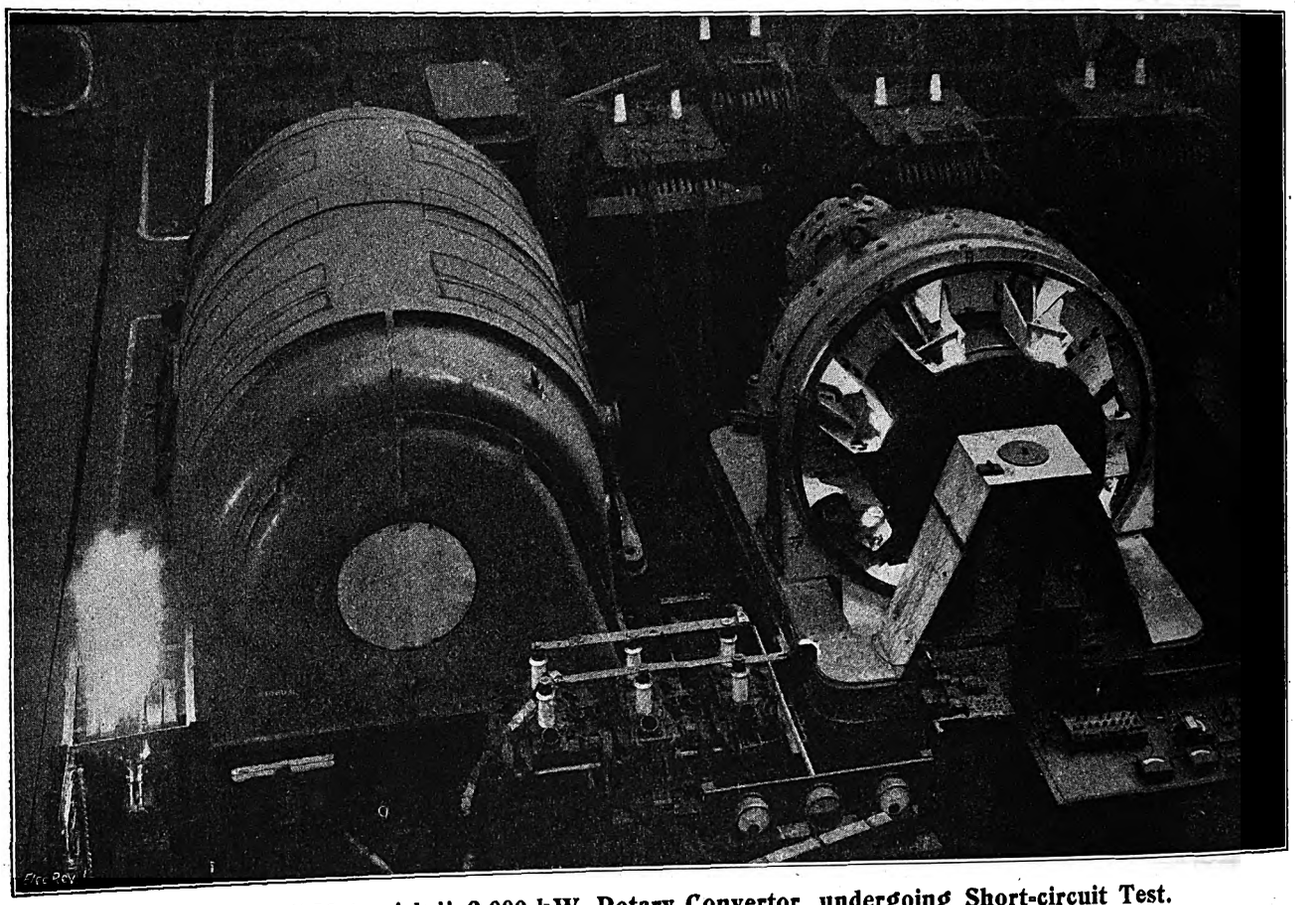

Fig. 3.—A "Metrovick" 2,000-kW Rotary Convertor undergoing Short-circuit Test.

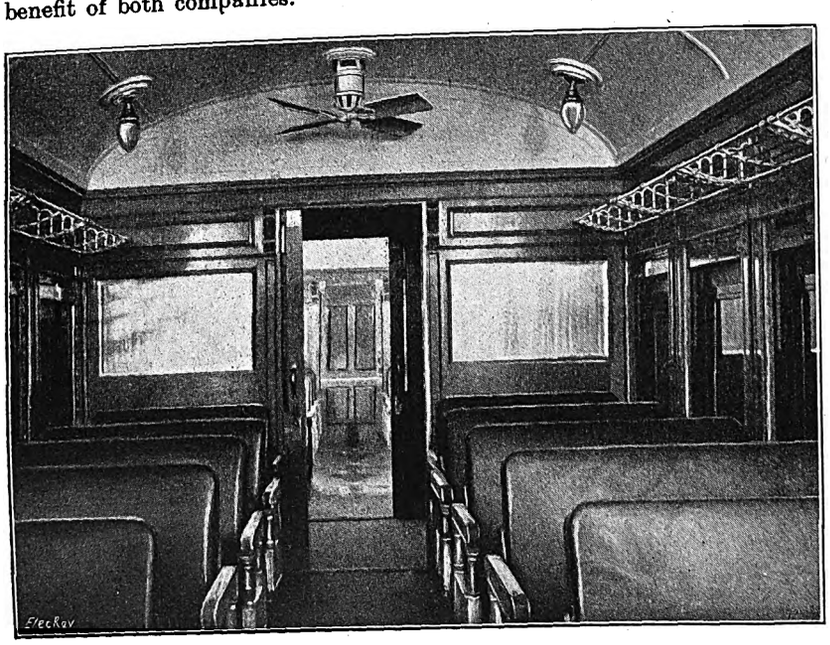

Fig. 4.—Interior of New First-class Motor Coach.

For the San Fernando power station the Metropolitan-Vickers Company is to supply three transformer groups, each of 9,000 kVA capacity, for the step-up connection between the alternators (generating at 5,000 volts) and the 20,000-volt transmission system. The contracts also include 20,000-volt metal-clad switchgear, transformers for the 440-volt auxiliary supply, and switchgear and starting gear for pumps, coal- and ash-handling plant and other station auxiliaries.

The new sub-stations that are to be constructed and the rotary-convertor sets to be installed in them are as follows:—

Location.	Route.	Rotary Convertors.
San Isidro C.	Tigre West	3–2,000-kW sets.
Nunez	,, ,,	2–2,000-kW ,,
Coghlan	Tigre East	2–2,000-kW ,,
San Martin	Villa Ballester	2–2,000-kW ,,
Kilometre 24	,, ,,	1–2,000-kW ,,

The incoming high-voltage lines in each sub-station will be protected by metal-clad switchgear similar to that for the power-station. All the circuit breakers for the 20,000-volt circuits are to be of large breaking capacity in view of the large amount of power which will be connected to the line and would have to be dealt with under fault conditions. The starting gear for the rotary convertors will be arranged on marble panels, and the outgoing 800-volt d.c. feeders will be controlled by truck-type switchgear.

The whole of the equipment of the five new sub-stations, and also that of two new track-sectioning cabins which are to be provided at Florida and San Isidro on the Tigre East line, are to be arranged for unattended operation with supervisory control from the existing attended sub-station at Olivos. The system of supervisory control will be that which has been developed by the Metropolitan-Vickers Electrical Company in conjunction with the Automatic Telephone Company.

For the existing sub-stations of the Tigre West route, *viz.*, Retiro, Palermo, Olivos, and San Fernanda, are to be supplied four 2,000-kW manually-operated rotary-convertor sets, one for each sub-station, together with truck-type switchgear for the rotary convertors and feeder circuits. Fig. 3 shows one of the rotary convertors, the supply of which was arranged on a

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preliminary order, undergoing a short-circuit test in the maker's works. The tests were very severe, the total external resistance in the machine circuit being reduced to 0.0036 ohm, and the peak short-circuit current, as measured by an oscillograph, being over 15,000 amperes. As will be noted from the illustration, there was no tendency to flash over, and the machine was fit for commercial service immediately on the conclusion of the series of tests. In the tests, as in service, the short circuit was cleared by a "Metrovick" high-speed circuit breaker, the flash from which can be seen in fig. 3 on the left of a 44,000-kVA turbo-alternator.

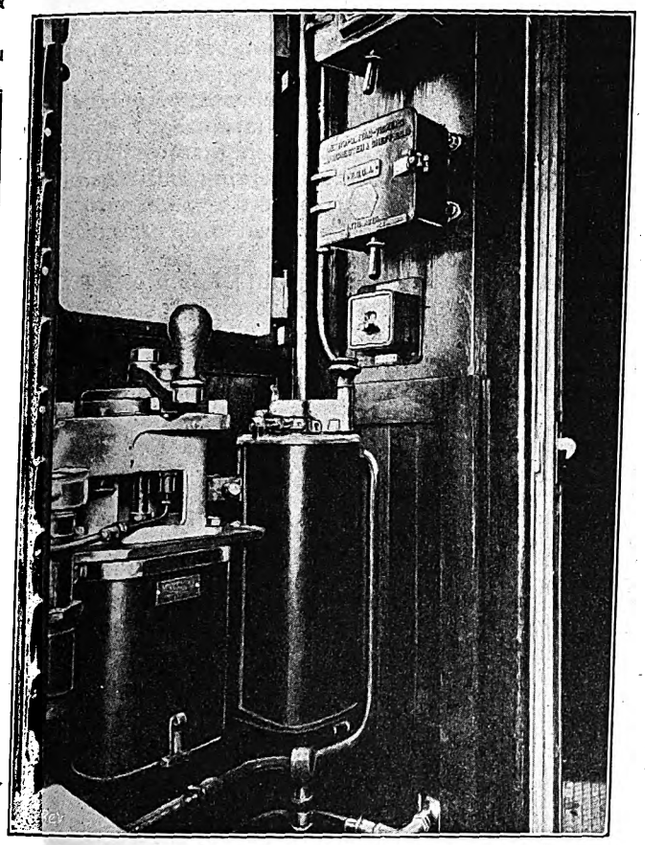


Fig. 5.—Driver's Cab, showing the Master Controller.

Some new rolling stock for the extension of the electrified service has already been supplied on preliminary contracts: figs. 2 and 4 show the exterior and interior, respectively, of new first-class coaches built by the Birmingham Railway Carriage and Wagon Company and equipped by the Metropolitan-Vickers Electrical Company. The coaches of this type are 65 feet in length and have body work of wood. The further coaches required, however, are to be mainly, if not entirely, of the steel-body type and 70 feet in length. All the new coaches will be comfortably equipped with transverse seating. The equipment of each first-class coach includes four 39-inch "Metrovick" ceiling fans, operated in series on the 800-volt d.c. supply.

The electrical equipment ordered from the Metropolitan-Vickers Company on the preliminary and main contracts includes motors, control gear, and motor-driven vacuum exhausters for seventy-one motor coaches, fifteen driving trailer coaches, and fifty-one non-driving trailer coaches. The motors are 310-h.p. machines, two motors being fitted on each motor coach. The control gear is of the electro-magnetic type, with the switch groups under-slung from the frame of the coach. Fig. 5 is a view of the driver's cab equipment, showing the master controller. The collector shoes are arranged for contact on the under side of the third rail.

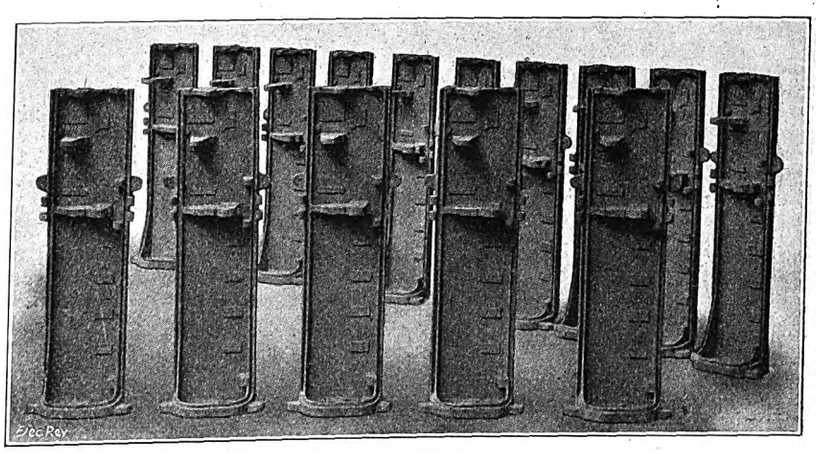
Aluminium Castings.

This article is principally addressed to that section of the electrical industry which is concerned with machine construction, for which aluminium in the form of castings is a possible constructional material.

By EDGAR T. PAINTON, A.M.I.E.E.

While aluminium is now firmly established as the metal *par excellence* of which to make many component parts of automobiles and their engines, and indeed the attainment of the modern standard of excellence is coincident with the increasing use of aluminium and its alloys, manufacturers of electrical plant do not, as a whole, fully appreciate that many of the reasons which justify the use of aluminium in the automobile trade apply similarly to their own industry. Aluminium as an electrical conductor is, of course, well established, but at the moment we are not concerned with its use for overhead lines, or for bus-bars.

The main advantages of aluminium are, first, its lightness, and, secondly, its cheapness. As regards lightness, the advantage of reducing the dead weight of all transport vehicles, such as tram-cars and railway stock, can be expressed in definite figures of energy economy and, though the figures vary in every instance, the general order of their magnitude will be gathered from the fact that in the case of one particular electric railway a reduction of 1 ton in the dead weight of any car provides an annual economy of £80 in energy consumption in respect of that car. In the case of portable tools the advantage of weight reduction is equally apparent, though it cannot be expressed so



Cast by Wm. Mills, Ltd., Birmingham.

Fig. 1.—Cast-aluminium Controller Backs for use on Railway Rolling Stock.

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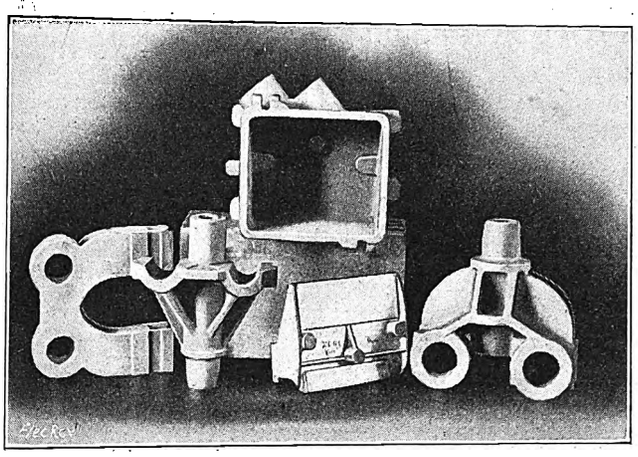
definitely, and for moving mechanism of all kinds, such as the moving parts of oil-switches, reduction of inertia will often mean quicker operation and more sensitive control.

As regards cheapness, it must be remembered that though the cost per ton of aluminium is high, yet



Oil-switch Crossheads for the State Electricity Commission of Victoria.

Fig. 2.—Miscellaneous Electrical Parts.

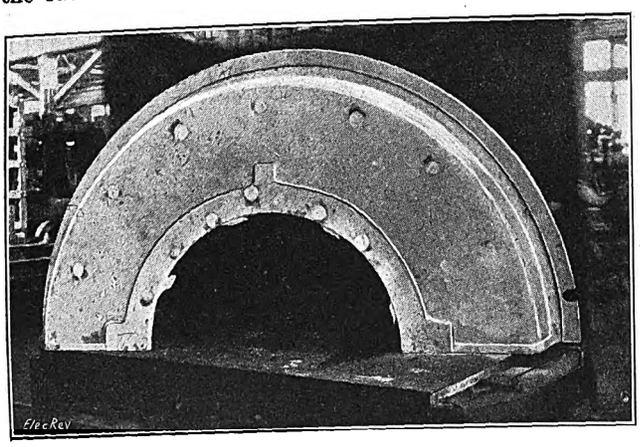
one ton of aluminium goes three times as far as an equal weight of brass, bronze, or iron. As a result a component can be made of aluminium at about one half the cost of brass. As compared with iron, the cost of aluminium is generally greater, but here again if much machining has to be done, the

TABLE I.—Physical Properties of Chill-Cast Aluminium Alloys.

Designation.	Composition. per cent.	Specific gravity.	Ultimate strength, tons per sq. in. Guaranteed minimum.	Ultimate strength, tons per sq. in. Normal value.	Elongation % on 2 in. Guaranteed minimum.	Elongation % on 2 in. Normal value.
2L5	13 Zn 2½ Cu	2.95 to 3.05	11	13	3	6
3L11	7 Cu (with or without 1 Sn)	2.87 to 2.93	9	12	3	4
"Y" alloy	4 Cu 2 Ni 1½ Mg	2.85 (max)	11	13	—	2
"Y" alloy (heat-treated)	4 Cu 2 Ni 1½ Mg	2.85 (max)	18	20	3	4
Silicon alloy	12 Si	2.65	11	14	7	12

excellent machining qualities of aluminium may so reduce manufacturing costs that the finished part in aluminium costs less than in iron.

A further point, often of very great importance, is the fact that aluminium may be cast in metal moulds,



Manufactured by the General Electric Co. of America.

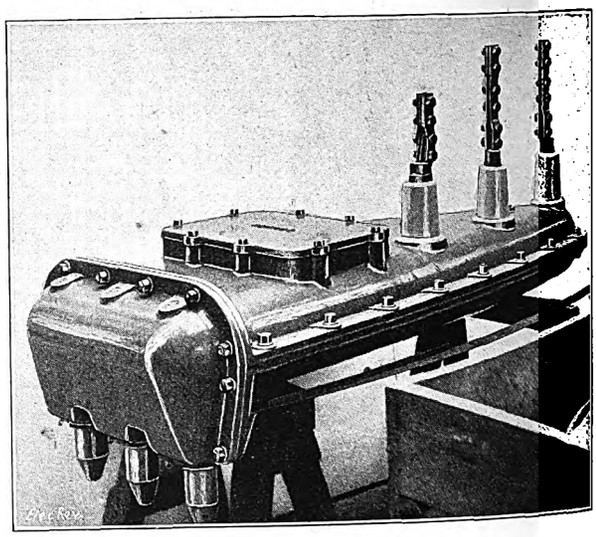
Fig. 3.—Turbo-alternator Aluminium End-Shield.

and a casting so produced has smooth flat surfaces equal to a machined surface, with dimensions exact to fine limits. Sections can be cast much thinner than in sand moulds, and the practical elimination of the necessity for subsequent machining means a decided price advantage. Other properties of aluminium, such as its non-magnetic qualities, its good heat conductivity, and its casting ability, sometimes justify its choice for special purposes.

Aluminium Alloys.—Castings are normally made of an alloy of aluminium with copper, zinc, or other metals, a casting of pure aluminium being too soft for general construction. The alloys usually contain not less than 85 per cent. of aluminium, so that the specific gravity is not very different from that of pure aluminium. The presence of the hardening constituent has, however, a profound effect upon the mechanical properties and various alloys are available, of which the chief are summarised in Table I.

Of these alloys, the 2L5 and 3L11 mixtures are most used. Both are excellent for general purposes, and the first is particularly good for screw-cutting and other forms of machining. The Y-alloy is used when exceptionally great strength is desired, and particularly when strength at elevated temperature is necessary. The silicon alloy is especially interesting: it is the lightest of the alloys and has good strength values with an exceptionally large elongation. Perhaps its chief advantage, however, is its excellent foundry characteristics, which enable castings to be produced with very thin sections, or with large insets of other metals cast in place, or for other work exhibiting difficult foundry problems.

The specific gravity figures in the table show that an



Constructed by Reyrolle & Co., Ltd.

Fig. 4.—Terminal Joint Box for Alternator.

aluminium casting will have about one-third the weight of a similar casting of brass or iron. The strength in tension of a casting of, say, the 2L5 alloy, would be a little greater than that of an iron casting, but a little

TABLE II.—Comparative Properties of Aluminium, Brass and Iron.

	Cast aluminium (2L5 alloy).	Cast brass (60% Cu, 33% Zn).	Cast iron (3.5% C, 0.2% Si).
Tensile strength, tons per sq. in.	11 — 13	12 — 14	8 — 9
Elongation, % in 2 in.	3 — 6	35 — 40	nil
Specific gravity ...	3.0	8.4	7.2
Weight per cu. ft., lb.	187	524	450
Modulus of elasticity, lb. per sq. in. ...	10×10^6	10×10^6	17×10^6
Coefficient of linear expansion, per °C ..	22×10^{-6}	19×10^{-6}	11×10^{-6}
Thermal conductivity (Silver = 100) ...	35%	23%	10%
Specific heat, cals/gm/°C	.19	.09	.12
Melting point, °C ...	615	910	1,375
Shrinkage in casting, in. per ft.	.15	.17	.13

less than that of a brass casting. There is, however, little difference between the strengths of the three different metals as shown by the comparative figures in Table II, and in most cases the use of aluminium would not involve alterations in dimensions.

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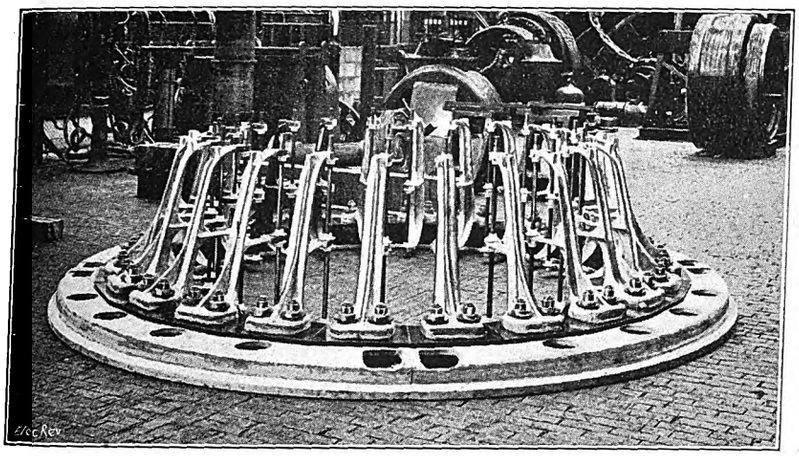
Some Particular Applications.—A typical example of the direct substitution of aluminium is illustrated by the controller backs shown in fig. 1, which have dimensions but little different from those of castings of other metals for the same purpose, the chief requirement in this case being rigidity against distortion or fracture under accidental blows.

In other applications considerable strength is required, and in such cases it is possible to employ "heat-treated" aluminium alloys of very much greater strength. An important point to be borne in mind, however, is that the forces to be resisted often depend upon the weight of the object, and the superiority of aluminium in this respect may permit a highly stressed part, for which a particularly high grade of brass or iron would otherwise be employed, to be made quite satisfactorily in an ordinary standard aluminium alloy. An outstanding example of the interdependence of both weight and strength on the suitability of aluminium for certain purposes is the use of cast aluminium, instead of cast steel, for the road wheels of heavy commercial vehicles. In spite of the great difference in strength between cast aluminium and cast steel, aluminium wheels have proved surprisingly efficient for this purpose, and have run for over 100,000 miles over rough roads without developing cracks or other defects. The reason is that, owing to the lighter weight, the aluminium wheels are not subjected to the same shocks due to road irregularities as are cast-steel wheels.



Messrs. Siemens-Schuckertwerke.

Fig. 5.—Brush-holder Arms and Supporting Ring.

Similar cases arise in the electrical industry, in which the required sectional area of an aluminium part may be considerably smaller than that determined from consideration of the tensile strength alone. A particular case is provided by the oil switch parts shown in fig. 2.

The non-magnetic quality of aluminium is of value in the case of heavy-current busbar chambers, and for certain kinds of switch casing where the use of iron would be prohibited by heavy losses and overheating resulting from induced currents. A particular example is the box illustrated in fig. 4, which is designed for the purpose of connecting three single-core insulated cables to the terminals of an 11,000-volt, 50-cycle, 16,500-kVA generator. It is unnecessary in such cases to use aluminium entirely and cost is saved if one half is made of aluminium and the other of iron; this system is depicted in fig. 4. It is of interest to note that when, for the purpose of weight reduction, the end shields of a motor are made of aluminium instead of iron, the reduction in flux leakage is sometimes marked. Fig. 3 shows a casting for the end cover of a large machine built by the General Electric Co. of America; each of these castings weighs 777 lb. and has a diameter of 9½ ft.; in iron, such a casting would weigh over a ton, and the difficulty and cost of erection and transport in aluminium are proportionally less. Cooling fans cast in aluminium, or built up of aluminium sheet, are quite commonly employed on all classes of rotating machinery, and need little discussion. A comparatively new application is indicated in fig. 5, which shows brush-holder brackets and their supporting ring for a 4,000-kW, 500-V, rotary convertor. These parts have been cast in aluminium and one reason for its choice in this case was that, in spite of all kinds of protective measures, the machines are subject to bad short-circuits, and it was therefore desirable that the removable parts should be easy of manipulation, so that they can be inspected and cleaned. The high specific heat and thermal conductivity of aluminium enables the castings to withstand very well the effects of flashover. An interesting point is that, in spite of their light weight, the brackets are exceptionally rigid and free from vibration, due to the fact that because of the good casting properties of aluminium it was possible to design brackets of quite thin section, but with metal so disposed as to provide very great stiffness.

Fig. 6 shows a further interesting application in which the high electrical conductivity of aluminium is of importance. It represents a squirrel-cage rotor from which a section has been cut away to show its construction. The rotor bars and end rings are of aluminium and are cast in one, so that the jointing between rotor bars and end rings, which is the weakest part of the design of a squirrel-cage rotor, is eliminated. The adoption of such a construction with copper would be practically impossible owing to the extreme difficulty of casting pure copper without blow holes, or other unsoundness on the one hand, while on the other hand, if brass or other copper alloy is used the electrical resistance is too high.

Some Points of Design.—While the design of an aluminium component need not, in general, be greatly different from that of a similar article made of brass or iron, there are a few special points to be taken into account with the lighter metal, and before finally completing their plans designers not familiar with aluminium would be advised to discuss their proposals with the technicians of the aluminium foundry.

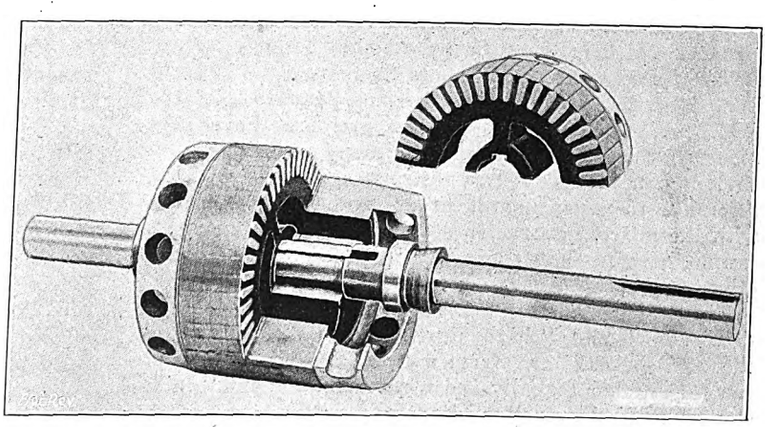


Fig. 6.—Cast Aluminium Rotor, showing Uniformity of Bars and End Rings.

For instance, the majority of the aluminium alloys are not good bearing metals, and are susceptible to rapid wear if under rubbing. Hence, when an aluminium part has to work upon a spindle it is usually necessary to employ a bushing of brass or bronze. Such a bushing can readily be inserted during the founding, the usual method being to place the bushes in the mould before pouring the aluminium, so that when the casting has cooled the insets are held by the contraction forces. It

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may be remarked that heat-treated alloys are quite satisfactory without bushing with a hardened-steel spindle; as a point of interest, duralumin connecting rods in automobile engines operate directly on the case-hardened gudgeon pin without any bushes.

A second point is the desirability of using coarse threads of large diameter when aluminium has to be screwed. Although very fine threads can be cut in the metal quite readily, there is a tendency for them to be stripped with constant screwing in and out. Iron screws cut with Whitworth threads are very satisfactory for use in a tapped hole in aluminium.

Permanent joints are best made by oxy-acetylene welding. This process, as applied to aluminium, is simple and economical, although a beginner in oxy-acetylene welding will require practice before being entrusted with an important piece of work. A welded joint can be made in metal of any thickness and is fully as strong as the unwelded portions.

Soldering, on the other hand, is apt to be a disappointing process unless the right type of solder is selected. Silicon-alloy solders melting at about 580 deg. C. are, however, very satisfactory and can be recommended.

The Physical Behaviour of Lead Sheaths in Relation to Failures of High-voltage Cables.

A reply to various criticisms that purport to challenge the conclusions the author reached in his recent article on this important subject.

By C. J. BEAVER, M.I.E.E.

FRANKLY, the criticism of my original article on the above subject[1], which purported to challenge my conclusions, have been disappointing, but I feel constrained to reply from a sense of duty to those who may have followed the matter closely.

With regard to Messrs. T. N. Riley and T. R. Scott's opening remarks[2] on the statement concerning permanent distension of lead cable sheaths in normal service which my experiments appear to controvert, the "considerable amount of published evidence" which they mention is apparently identical with the published matter which I referred to as reiterated statements without experimental evidence of a quantitative character in support. If not, why do they not give reference to it?

Private search and public challenge have alike failed to produce the evidence to which I referred, the only evidence which is scientifically acceptable.

The passage which they quote later from the 1927-28 Report of the Underground Systems Committee of the N.E.L.A., to show that greater pressures have been observed than those determined in my experiments, is obviously a more or less abstract statement with no reference to experimental proof, and, being familiar with the general character of those valuable Reports, I cannot imagine that it was ever intended to be regarded otherwise.

The statements that "high pressures . . . . *can be* developed" and "high pressures cause stretching of the lead sheath," are, from my point of view, reminiscent of another (equally incontrovertible) anent "milestones on the Dover Road."

The variations of internal pressure from place to place under uniform heating conditions mentioned in the quoted passage can only indicate internal inequalities which should never exist in a well-made cable, or arise in use, the latter being the more probable explanation. The chain of circumstances is probably (*a*) the use of comparatively thin mineral oil with its high coefficient of expansion, (*b*) the inequalities above referred to, probably resulting from (*a*), and possibly (*c*) the recording of a peak-pressure value.

Incidentally, it may be noted with regard to the pressure of 60 lb. per sq. in. observed in the American cable that normal working temperatures are considerably higher in America than in Europe. In any case, I have not said that such a pressure cannot be attained, but I have pointed out that at higher pressures than I observed in my experiments permanent distension can be avoided by thickening and/or alloying the sheath.

With regard to the statement that the passage in their paper on "Insulating Oils for High Voltage Cables"[3] which prompted my first comments on the subject was based on experience and a special test of their own, it struck me as strange that this was not stated in the paper, or even in their reply to the discussion thereon, published six months later[4]; as they stated that this test would be included in their forthcoming paper, I possessed my soul in patience and awaited something erudite and impeccable.

The paper ("Electrical Insulating Papers for the Manufacture of Power Cables")[5] has since been presented to the I.E.E., and again I am disappointed, for the only reference to lead distension (their figs. 5A and 5B) occurs in connection with an experiment described to illustrate "the part played by capillarity in cable structure." It purports to show by capacity measurements that a permanent distension of the lead sheath had occurred when the cable sample which was the subject of the experiment was heated to 85 degs. C. in an oil bath. I have no doubt it had. That temperature exceeds any mentioned in my article, and is from 30 deg. to 35 deg. C. higher than the maximum working temperature usually permitted in present-day high-voltage cable practice. No determination was apparently made of the temperature *below* which the lead would *not suffer* permanent distension, and no quantitative measurement of the distension was determined directly or indirectly (if space permitted, it could be shown from the data given, using normal coefficients of expansion, that permanent distension would not occur below 70 deg. C., which confirms my direct experiments).

For these reasons (not the only ones) this experiment has no value whatever for the purpose under review, and certainly could not have been designed with direct reference thereto, as Messrs. Riley and Scott's letter

[1] Electrical Review, January 18th, 1929, p. 96 *et seq.*
[2] Electrical Review, February 15th, 1929, p. 310.
[3] *I.E.E. Journal*, Vol. 66, No. 380, p. 809.
[4] *Ibid*, p. 837.
[5] Electrical Review, March 22nd, 1929, p. 540.

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would seem to infer, or to give direct and quantitative results on the subject, as were those described in my article.

If I may crystallise the remaining points of Messrs. Riley and Scott's criticism, they apparently seek to show that experimental error must have existed in my tests, and they propound two alternatives, one based on calculations of excess expansion of the interior components over that of the sheath, and the other (based on imagination) assuming abnormal air content. Regarding the former, it will be seen by reference to the statement of the case in their letter that they have equated the thermal expansion of the lead sheath to that of the impregnating compound, thus utterly neglecting the dielectric compressibility, which was heavily stressed in the original article as one of the factors which precluded the accurate forecasting of results by calculation, and determined the line of demonstration by simple and direct experiment which I took. This unscientific treatment of the physical behaviour clearly invalidates their deduction. As to their estimate erring in my favour, they apparently did not read the article with sufficient care to notice that I actually quoted Mr. Riley (ref. 14) to the opposite effect.

Coming to the alternative conclusion, *viz.*, "that there is occluded air in the highly viscous dielectric of his experimental cable, which cannot be removed by the methods he employed," it would, first, be interesting to know why attention is concentrated on cable A (fig. 4) and no reference made to cable B (fig. 5). The conditions of test are similar and the results obtained are closely corroborative, in spite of a large difference in viscosity; in fact, from the broad point of view the results from the latter are more interesting and informative. Secondly, with regard to the sentence which Messrs. Riley and Scott have partially quoted to indicate that I "admit" the presence of residual air, reference to my article will show that the sentence was *preceded* by remarks on the irreducible minimum of air content, "so long as paper is used in its present form," and *followed* by a quotation from Emanueli bearing on the aggregation of gas occlusions. In a degree, therefore, their "conclusion" was a substantial part of my premises, and if, as I presume, those interested in Messrs. Riley and Scott's criticism have read in the original article the quoted sentence in its proper relation to the context, I am content.

Had I not expressly dismissed calculated data in favour of physical measurements (for reasons clearly set forth) I might have further quoted Emanueli as giving the normal gaseous content of impregnated paper dielectrics as from 0.5 to 1.5 per cent.,[6] or deduced from the experimental data of Junius a value of about 0.9 per cent., and shown that the air content of my experimental cables was well within those normal limits: or I might even now calculate the air content of Messrs. Riley and Scott's cable, the capacity of which varied by "under 2 per cent. between *vacuum* and 100 lb. per sq. in.," if only they had stated whether the vacuum was one inch or thirty inches of Hg. I should in any case point out that, presuming they refer to a three-core cable, their tests would be made on the core insulation alone, and not on the total substance inside the lead sheath, which is just as important and just as essential to the matter at issue in the one type of cable as in the other.

Messrs. Riley and Scott remark that I did not comment on the fact that a vacuum exists in cable A after cooling, and infer that it indicates a change in internal volume. Surely they must be aware of the slight absorption effects which follow the closing up and heating of a cable. They in turn make no comment on the fact that the degree of vacuum is constant in cable A until distension of the lead sheath occurs, whereas in cable B it is not only initially greater, but also tends to increase slightly without distension of the lead. It is fairly well known that this slowly increasing vacuum effect in cables made by the method of cable B show this behaviour, even when stored at ordinary temperatures, for many months after being sealed up.

Turning to Mr. H. Gurney Wood's article[7], I fail to read anything regarding his figs. 1 and 2, but that two lead tubes have permanently expanded by certain amounts when subjected to certain pressures at given temperatures.

No diameters or thicknesses are mentioned anywhere; although the former can be deduced from the scales of percentage increase in volume and increase in diameter, in the absence of thickness data the hoop stress is indeterminate, the elastic limit of the lead cannot be checked, and the curves are meaningless for the purpose for which they are employed in the article. Further, although diametral variations of the order of 0.0025 inch are recorded (not on polished steel, but on lead pipe) no indication of the method of measurement is given; this also applies to fig. 3. Surely the reader is entitled to such information, in view of the precise character of the method of measurement described in the original article which the later one purports to challenge.

Further consideration of fig. 3, which is the crux of Mr. Gurney Wood's article, shows that the permanent distension of the lead sheath at 104 deg. F. is 0.03 per cent., and at 140 deg. F. it is 0.16 per cent. Hence, the permanent distension caused by raising the temperature from 104 to 140 deg. F. is $0.16-0.03=0.13$ per cent. The thermal expansion of the lead sheath over this temperature range is $36\times0.000047=0.17$ per cent. and hence the dielectric expansion is $0.13+0.17=0.30$ per cent.

The cushioning effect of the air occlusion is negligible between these temperatures, since the author's figures show that the internal pressures will be roughly 60 and 70 lb. per sq. in., respectively. The elasticity of the lead sheath is also negligible (it is of the order of 0.01 per cent.) and hence the thermal coefficient of volumetric expansion of the dielectric must be "(must be)" $0.0030/36=0.000083$ per deg. F. The similarly deduced value for the 140 and 176 deg. F. readings is 0.000150 per deg. F. and that for the 176 and 202 deg. F. readings is 0.000265 per. deg. F. These deduced values should be approximately equal to fluid oils which do not exhibit change of state, which is presumably the type of oil used for impregnating the cable sample, and the lowest known value for a dielectric impregnated with such an oil is approximately 0.00012 per deg. F.

The curve in fig. 3 should, once the elastic limit of the lead sheath has been exceeded, be approximately a straight line to agree with the lineal expansion of the dielectric and lead with respect to temperature; and, from sight, the curve is obviously not a lead-sheath-expansion type of curve. The foregoing shows that large experimental errors must have occurred in the lead sheath distension measurement, and the results illustrated by fig. 3 must therefore be rejected as unreliable. Figs. 4 and 5 would have been more convincing if the cable (it is indicated by the expression "first run" in reference to them, that both figures relate to the same piece) had not been armoured, so that the lead sheath could have had free play.

My experiments on plain lead-covered cable were purposely simplified to the last degree, and it seems curious that in challenging them the issue should be clouded by considering armoured cable (we are not even told the type of armour employed) to show "typical" results. The effect of opposing an external resistance to expansion must be to increase the internal pressure, and as, to prove permanent expansion, the pressure is referred back to the data of figs. 1 and 3 (already impugned as scientifically unacceptable) the seriousness of the challenge would not appear to be enhanced by the declaration of the results as typical.

The sum total of Mr. Gurney Wood's contention therefore seems to amount to this: that if one proceeds by the devious route of measuring the temperature, referring temperature to calculated values of pressure, and

[6] *Electrical World*, September 24th, 1927, "Gas Films in High Pressure Cables."
[7] Electrical Review, March 1st, 1929, p. 370.

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thence to such diagrams as his figs. 1 and 3, the results obtained differ from those determined directly, simultaneously, and in an impeccably related manner. I agree, and have, I think, shown why.

Although I have already referred, both in the original article and earlier in this one, to my reasons for discarding calculated data in favour of quantitative measurements, I have, in fairness to other views, though with little success, tried to follow the figures given by Mr. Gurney Wood in the latter portion of his article. By way of an example, we may take his reference to the "simply calculated" air content of the prior impregnated cable (cable A in my article). Taking his figure of change in air volume due to a rise of 80°F. (0.021 cu. in.) this corresponds to a variation in pressure from 12 lb. to 24 lb. (absolute) per sq. in. By Boyle's Law (neglecting slight change due to temperature) the air-space volume of 0.021 cu. in. at 24 lb. (absolute) per sq. in. becomes 0.042 cu. in. at 12 lb. (absolute) per sq. in., thus giving an accommodation volume of 0.021 cu. in. for dielectric expansion. Mr. Wood's calculated figure of 0.064 cu. in. is inexplicable.

In line therewith, the method he describes for experimentally verifying his calculations of air content will not inspire confidence, and the statement that it, *inter alia*, checks the slackness, or otherwise, of the lead casing will cause wonderment in the minds of cable users, although they will hardly believe that air content is dependent on the fit of the lead sheath in a super-voltage cable.

Trade and Preferential Discounts.

The author justifies the granting of special terms where specific services are rendered and points to the need for careful discrimination.

By I.S.A.

THE question of trade and preferential discounts is rapidly becoming a very important item in the trade of this country, and one which will soon demand more than casual attention. Trade discount, and by this I mean, a reduction from a manufacturer's listed price to a purchaser engaged in trading in that particular product, as some inducement for him to buy, is as important from the manufacturer's point of view as it is from the purchaser's. On the one hand, it is a clear indication that the manufacturer recognises that legitimate traders should be given some advantage over the casual buyer or consumer when purchasing their product. It gives a trader or retailer a definite status as a dealer in a particular product, he becomes known amongst the purchasing public as such, and it is recognised that for his services he receives some preference from the manufacturer.

Manufacturers have recognised that in order to maintain a market for their goods, a preference must be given to the traders who retail them, or merchants who purchase the goods for the use of others, and consequently a given percentage is included in every price list to allow of that discount; trade discount therefore becomes an integral part of our whole business system.

What amount of discount should be given must necessarily vary with the various trades, and to a large extent on the economic demand for the article. In such trades as engineering, furniture making, electrical engineering, agricultural implements, boot and shoe manufacturing, &c., where there is a steady demand for the product, the rate of discount can be kept fairly stable, but in trades that are subject to seasonal demands, such as the motor-car industry, the cotton and woollen trades, &c., the discount must, to a large extent, vary with the demand, and becomes more of an economic problem.

Trade discount should ensure that the trader gets a fair return for selling the article, and that it is not possible for his customer to be able to buy at the same price. It should also be such as to encourage business retailing trades to ensure for themselves a fair living and return for their labours.

Trade discount also protects the public very largely from being "fleeced." The manufacturer having fixed the selling price, the retailer usually abides by it, and the public are thereby enabled to buy the same article at a reasonable figure from any retailer dealing with it. If there were no trade discount and traders fixed their own profit, it would be very unsatisfactory for the purchasing public, the probability being that prices would vary enormously.

It cannot, however, be overlooked that the granting of trade discount to-day needs considerable tightening up. In a great many instances, so loosely is trade discount granted, that a great many firms and persons obtain the reduction in price, who could not, by any stretch of imagination, be regarded as entitled to it. There will, no doubt, always be some manufacturers who for perhaps several sound reasons applicable only to themselves, will not, or cannot, take a firm stand in this direction; also no doubt some, with less scruple than others, see in the indiscriminate granting of trade discount, an easy outlet for more of their products. It would undoubtedly be a difficult matter to tighten up the indiscriminate granting of trade discount, but it is not insuperable, and no doubt means could be devised for dealing with firms who do not wish to co-operate with their fellows to the betterment of industry as a whole.

On the other hand, of course, there are manufacturers, especially of articles for domestic use, who have had to create their own market by selling direct to the public, and would not feel disposed, at any rate for a time, to grant trade discount at all. It usually follows, however, except in such instances as multiple-shop firms, that when a trader is willing to stock and sell an article, the manufacturer will grant a trade discount to make it worth while. After all it is undoubtedly much more economical for him to grant a trade discount than have to maintain large stocks of his own, as well as a much larger staff.

Preferential discount is not quite the same as trade discount, but is generally an extra discount granted as an added inducement for the purchaser of quantities of a particular product, or for some extra service that the trader or retailer is able to give to the manufacturer in the selling of his goods.

In these days of traders' and retailers' associations this question of preferential discount, particularly in some trades, is fast becoming an added burden to the manufacturer. In a great many trades, prices are already cut so fine, owing to increasing competition and consequent limited demand, that no margin exists for a further preferential discount, unless the goods are standardised and bought in larger quantities, or the price to the user is raised.

It is not the intention of the writer to go into the matter fully in this article, but simply to point out that there must be a limit to the granting of "preferential" discounts, over and above trade dis-

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count. Many well-meaning trading associations ask for their members a preferential discount over their fellow traders, but in return for this preferential discount the extra service or purchases which they are able to give or make do not always materialise, and the manufacturer has to suffer. Again, some purely "discount snatching" associations have been formed from time to time, but happily their activities have been short-lived, though occasionally they still come along even to-day.

Undoubtedly, when a trader or retailer is able to offer extra service to the manufacturer such as carrying a stock of his goods, and giving demonstrations where necessary, or purchasing in large quantities, an extra discount should be given, but even then there is a limit unless the gross price is to be unduly inflated. The purpose of this article is simply to draw attention to the importance that should be attached to trade and preferential discounts, and the need for discriminate granting of both.

Domestic Electrification.

Comments and Impressions of a Satisfied User of Electricity for Varied Domestic Purposes.

By W. N. Y. KING, A.C.G.I., A.M.I.EE.

As the experience of one who has for the past three or four years had the whole of his domestic requirements in respect of lighting, heating, and cooking, with the exception of general hot-water supply and occasional sitting-room fires, well satisfied by electricity, the following notes may be of interest to others.

The installation referred to is in what is usually described as an eight-roomed house, *i.e.*, on the ground floor are two sitting rooms, the kitchen, pantry and scullery, and on the first floor four bedrooms, a bathroom, and the usual offices. The occupants during the period covered by these notes were, on the average, four adults.

The equipment comprises: in the kitchen, a "Falco" cooker, controlled by a double-pole iron-clad switch and fuses, with an oven and two hot-plates, each with three heats, "full," "medium" and "low," and a griller and toaster arranged for "on" and "off" control only. Each separate circuit had its own fuse, placed at the sides of the cooker in readily accessible positions, and the board on which the main switch was mounted also carried two batten-type lampholders and switches and fuses for attaching leads for a kettle, an iron and similar appliances.

Provision for heating was limited to a plug and switch in one sitting-room, and in each of the two larger bedrooms. The two sitting-rooms open into one another by sliding doors, so that the one plug was considered sufficient, though in a modern layout a plug in each room would be provided. Also a small water-filled type enclosed heater and switch are provided in the bathroom.

The lighting is done by plain pendants throughout, with shades suitable to the environment, one in each room, with double switching for the stairs, and two lamps in each of the two larger bedrooms. There are eleven points in all.

The supply of direct current at 240 volts is obtained through one meter, the price being based on a quarterly standing charge (£1 4s.) and 1d. per kWh for all energy used. During the summer quarters of 1928 this latter charge was reduced to ½d. per kWh.

During the whole of the period with which we are concerned there was no failure of supply from the mains that the household was aware of, and on one or two occasions only were the main fuses blown, and then it was due to an appliance being tried which was not suited to the supply system: the fuses were replaced at once and caused no further inconvenience. Occasionally the local fuses of the cooker, *e.g.*, hot-plate, were blown, owing to the short circuiting of the heating elements due to boiling over: however, the original open-type elements have been replaced by the closed-in type with a solid iron top, and since then no trouble has been experienced.

For house heating two radiators have been used, one of 1.8 kW, with three bars, each of 0.6 kW, and one with three 1-kW bars. Both of them are arranged so that the middle element is heated when the plug and switch are "on," and two switches on the radiator itself control the other two elements. The two radiators have proved to be ample for the requirements of the house, because in the severest spells of weather the sitting-room coal fires were lit; but during about nine months of the year the coal fires were not used at all.

A kettle and an iron were, of course, used regularly, and with little trouble. The kettle was left once or twice to boil dry, but the safety device in the base came into action, and the results were easily remedied by the replacement of the fuse provided for the purpose. The system was in the charge of various persons, none of whom had had previous experience of electric cooking, and they did not experience any trouble in obtaining satisfactory results from the operations. The most noticeable features of electricity in the home are the readiness with which the energy can be switched on, without groping round for matches, also cleanliness and absence of unpleasant odours. There is the certainty of getting the same temperatures every time, heating at the same rate, according to the position of the regulating switch, for as long as may be required.

To those accustomed to other means of illumination and warming, the state of the house paint and decorations is an eye-opener. No discoloured patches in the neighbourhood of the source of light or heat, and no smell of any kind can be detected.

The cost of electricity supply, including repairs, during the past three years has been as follows, per quarter:—

Year.	March.	June.	Sept.	Dec.	Total.
1926	£5 11 5	£1 8 0	£2 1 3	£5 8 9	£14 9 5
1927	£5 2 5	£2 9 0	£2 8 10	£2 5 1	£12 5 4
1928	£4 11 8	£2 9 4	£1 9 6	£5 14 0	£14 14 6

The lower cost in the December, 1927, quarter's account is due a smaller number of residents during the period covered.

With regard to the radiators, it is found that they emit rather a fierce heat close up to the heating elements, and one of them is fitted with a wire-mesh screen which is most useful in preventing the accidental contact of clothing and other objects which may be brought into close proximity to the radiator. The other radiator is not fitted with a screen and is usually protected by means of a screen arranged in front of it, but the most satisfactory plan is a screen fitted as part of the radiator. Also the heat is so great that it is somewhat painful to switch off the separate elements when the switches are in front. A preferable arrangement would be to locate the switches at the back, or sides, of the radiator.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Sale of the Shanghai Electricity Undertaking.

What is believed to be one of the biggest, if not the biggest, cash deals ever made east of Suez was completed on April 17th by the ratepayers of the Shanghai International Settlement agreeing to accept the offer of the American and Foreign Power Company of £10,000,000 for the Shanghai Municipal Electricity Department with plant and assets as a going concern. The buying company is a subsidiary of the Electric Bond and Share Company which operates in the United States and 17 foreign countries, and whose assets are officially stated to be 1,075,000,000 gold dollars. Associated in the deal is a British group, including Mr. F. Dudley Docker, director of the Midland Bank, Ltd.; Sir Harry Cassie Holden; Messrs. Lazard Bros. & Co., Ltd.; Whitehall Electric Investments, Ltd.; and the Whitehall Trust, Ltd. The deal was negotiated by Mr. Samuel W. Murphy (representing the purchasing company), with whom was associated Mr. William Meyer, of Messrs. Anderson, Meyer & Co., and Mr. F. R. Davey, of the firm of Messrs. E. D. Sassoon & Co., Ltd.—*Reuter* (Shanghai).

The Shanghai correspondent of *The Times* states that the principal consideration of the ratepayers was, in view of the uncertainty of the political future of Shanghai, to make provision for the security both of the electricity undertaking and the outstanding municipal debentures, amounting to 53,000,000 taels (£6,625,000), against the possibility of Chinese control in Shanghai, which would be alike fatal to the security of the one and the value of the other. The chairman of the Municipal Council pointed out that the Provisional Court had been heralded as the destined model Court to inspire foreigners with the confidence that there was nothing to fear from the abolition of consular jurisdiction. So far from this, the Court had only created widespread dismay and distrust, and presented one of the most forcible arguments against the premature abolition of extraterritoriality.

Cable Manufacturing in Holland.

The Hollandsche Draad en Kabelfabriek, reporting on the year 1928, states that the balance of working was about the same as in the previous year, although the undertaking was subject to keener competition. The company's subsidiary—the Reinshagen company—in 1927 withdrew from the German cable syndicate, which had since collapsed, with the result that extremely sharp competition broke out in the German market. By withdrawing earlier than the other firms, the Reinshagen works had found it possible for the most part to neutralise the prejudicial consequences of the price contest by an early extension of the sales organisation. Nevertheless, negotiations are said to be proceeding for a renewal of the syndicate. The accounts of the company show net profits of 322,000 fl., as compared with 293,000 fl. in 1927, and the dividend remains at 7 per cent.

The Nederlandsche Kabelfabriek reports that 1928 was a satisfactory year and the turnover considerably increased, partly in consequence of the largely growing exports. Apart from the increase in the cost of raw materials the prices of cables in the home market were about on the same level as in the previous year, but the difference between costs and sale prices taken as a whole was small. The production of the copper rolling mill with its connected wire-drawing mill, largely exceeded that in 1927. The profits amounted to 1,717,000 fl., as compared with 1,345,000 fl. in the preceding year, and besides the statutory dividend of 6 per cent., it is proposed to pay a "super-dividend" of 15 per cent. (24 per cent. in 1927) and to carry forward 159,000 fl.

Mumbles Railway Commemoration Luncheon.

The South Wales Transport Company, Ltd., gave a luncheon on April 18th to commemorate the opening of the Mumbles Electric Railway.

Proposing the toast of the Borough of Swansea, the Chairman (Mr. G. C. Tegetmeier) acknowledged the assistance which the company had received from the Corporation in the electrification of the railway, and on behalf of the Transport Company presented the Mayor of Swansea with a canteen of cutlery as a memento of the occasion. Acknowledging the gift and replying to the toast, the Mayor said the railway was first constructed for transporting stone and minerals, but afterwards was used for passenger traffic. Steam traction was introduced in 1879, and now the line was further modernised as an electric railway, the power being supplied from the Swansea Corporation electricity generating station. Sir Percy Molyneux, proposing the health of the chairman, recalled the fact that it was Mr. E. Garcke in 1895 who brought about the electrification of the Swansea tramways, whilst the Transport Co. was to be congratulated for having spent over £125,000 in order to electrify the line, and bring it right up-to-date. The company, he thought, was entitled for its enterprise to a measure of protection. The Town Clerk in speaking of the importance of the transport and tramway undertakings to Swansea, observed that the Corporation received £9,000 a year in rent from them, £10,000 in rates and about another £10,000 for electrical energy, whilst those undertakings gave employment to about a thousand men. Replying, the chairman said that Mr. Garcke had laid the foundations for the whole of the development of the Mumbles through its railway. Mr. David James pointed out that the electric service gave sixty car journeys per day as compared with eighteen by the old steam trains. The supply is a.c. at 6,600 V, and in order to convert it into d.c. at 650 V for the line, a sub-station has been provided by the Swansea Corporation at Blackpill, which is about the mid point of the route. The sub-station is arranged for fully automatic control. Its equipment includes two 500-kW rotary convertors which, together with the a.c. and d.c. switchgear, a negative booster set, and the automatic control gear for the whole of this equipment, have been supplied by the Metropolitan-Vickers Electrical Co., Ltd. Other contractors for the scheme were:—Equipments for rolling stock, British Thomson Houston Co., Ltd.; car bodies, Brush Electrical Engineering Co.; underground cables, Callender's Cable & Construction Co., Ltd.; overhead fittings, Brecknell, Munro & Rogers; trolley wire, Richard Johnson & Nephew, Ltd.; signals, W. R. Sykes and Interlocking Signal Co.

Madagascar Customs Exemptions.

The administrative Council of Madagascar recently passed a resolution having as its object the total or partial exemption from Customs duty on importation into Madagascar of the following:—(1) Material destined for radio-telegraphic stations imported for the account of the State or the colony; (2) Labour-saving machinery and articles for the development of the colony. In the second category are included various machines and apparatus for the textile industry, for mining, agriculture, horticulture, road-making, treating rice and coffee, and road-making material.

Household Appliance Exhibition Proposal.

Under the auspices of the Household Appliances Section of the London Chamber of Commerce a conference was held on April 16th to discuss a proposal that a periodical exhibition should be held to further the interests of the electrical, ironmongery and household appliances trades. Mr. L. J. Hydleman, presided, and there were present representatives of the hardware trade, Major T. G. Leith (General Electric Co., Ltd.) and Mr. V. W. Dale (business manager, British Electrical Development Association). The chairman said that it would be unfair of ironmongers to judge the proposed exhibition on the basis of previous efforts which were run by organisers having no interests in the trades concerned. He felt that the ironmongery and allied trades were of more than sufficient importance both numerically and otherwise to organise an exhibition of their own. Major Leith stated that one of the reasons why he felt disposed to support such an exhibition was that his company was of opinion that much useful co-operation could exist between manufacturers and ironmongers in the sale and display of electrical appliances, a co-operation which at present seemed to be lacking. It was resolved that the Ironmongers' Federated Association should be asked to approve the proposal, to encourage manufacturers to support such an exhibition, and the conference was adjourned.

Price Increases.

In our last issue we mentioned that a number of manufacturers had announced that owing to the increased cost of raw materials, they had been compelled to raise the prices of electric lighting fittings. Statements to this effect have been received from Siemens Electric Lamps and Supplies, Ltd., and Messrs. Frederick Thomas & Co., Ltd.

The Sun Electrical Co., Ltd., announces a number of increases in the prices of cables and flexibles, &c.

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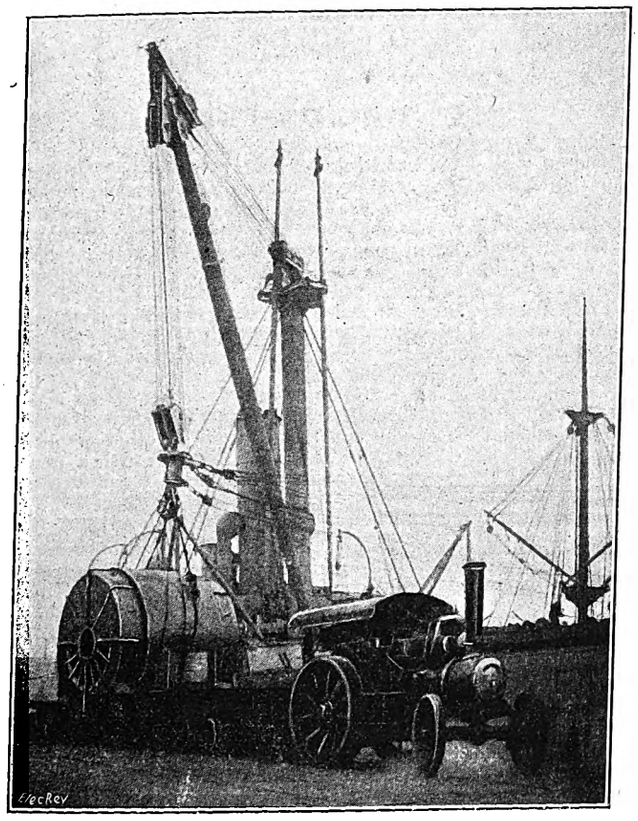
Transporting a Large Stator.

The illustration herewith shows the 25-cycle stator of the 30,000-kW frequency changer which the Metropolitan-Vickers Electrical Co., Ltd., has supplied to the London Power Co., Ltd., for its Deptford West station, being loaded at Manchester Docks by a steam tractor fitted with a 100-ton derrick. The stator was lifted and swung over to a steamer for conveyance to London. The Ship Canal Company had no crane



Handling a Large Frequency-Changer Stator.

capable of dealing with such a large piece, which weighed 85½ tons, and as it was entirely out of gauge, the railway companies were unable to deal with it. The measurements were 14 ft. 6 in. high by 14 ft. 6 in. wide, by 17 ft. 6 in. long. Arrangements were made with regard to discharge by the Port of London Authority's 200-ton mammoth crane, which lifted the stator out of the steamer on to a special trolley, by means of which it was conveyed from the wharf to site.

American Enterprise in Poland.

It is reported that preliminary studies are in progress at the Polish Ministry for Public Works with the object of granting an electricity supply concession to the American Harriman group. The concession will be for sixty years, and the area of supply will be composed of the so-called strategic triangle (Radom-Kielce-Czenstochau). The concessionnaire will have the right of supply to the communal unions in this area. During the first five years after the grant of the concession the communal unions will be deprived of the right of installing their own supply networks, this being said practically to mean that it will be possible for the American group to establish itself in the most profitable districts. On the other hand, the Americans will have the right of refusing to afford a supply unless a certain minimum demand is guaranteed.

Electricity Meter Approved.

The Electricity Commissioners have approved of the construction and pattern of the "Korting and Mathiesen" Type WZ5°, single-phase watt-hour meter rated sizes 1.5, 3, 5, 10, 15, 20 and 30 A, 100, 110, 200, 210, 220, 230, 240 and 250 V, at 50 cycles per second.

The North-East Coast Lighting Service Bureau.

The Lighting Service Bureau, Newcastle, will be closed on April 30th, after which the activities will be transferred to the stand of the Electric Lamp Manufacturers' Association, at the North-East Coast Exhibition, which opens on May 14th. It is hoped that during the six months run of the Exhibition, it will be possible to make great strides in the development of architectural, lighting, facia lighting, &c.

Patents and Trade Marks Commission.

The international commission of experts composed of representatives from Offices of Patents and Trade Marks in England, Germany, Holland and Switzerland, who recently met to draw up a draft agreement regarding the international division into categories of goods for which trade marks have been registered, have approved a draft which will be recommended for the acceptance of the different states which are members of the Union for Industrial Protection. To the draft will be annexed a list of goods which will shortly be designated by the Commission.—*Reuter* (Berne).

Great Britain's Radio Exports.

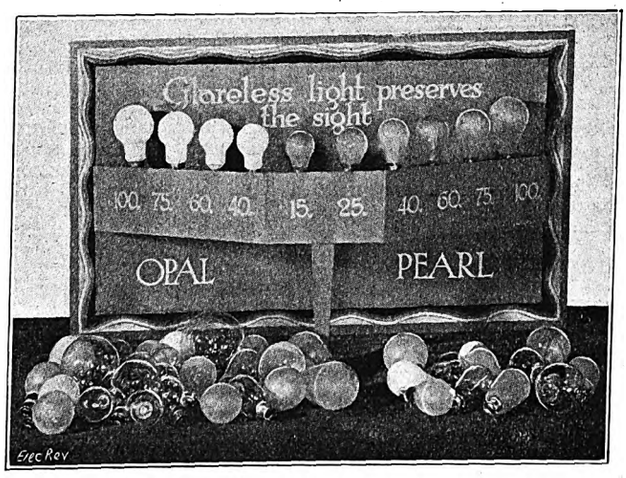
During January last, according to the *Wireless Trader*, the exports of radio apparatus from this country were valued at £123,190, including valves, £17,365. The Netherlands was the principal customer, taking goods to the value of £18,048, including valves £201. Japan was next with £17,185 (valves £1,367) and Australia third with £10,460 (valves £1,439). Other important customers were the Irish Free State, £7,947 (valves £1,890); Rumania, £7,491 (valves £1,379); and France, £5,746 (valves £476).

Education in Advertising.

An excellent scheme for training men in the many subjects which enter into modern advertising has been prepared by the Advertising Association, Inc., as the result of a report by a special committee which it set up for the purpose in 1927. The plan provides for preliminary, intermediate and final examinations. The preliminary examination is merely to ensure that the student has a good general education, and the possession of one of many school leaving certificates or four years' advertising work (if over 24 years of age) will secure exemption for the student. The intermediate examination will cover: (*a*) English and psychology (both compulsory) and principles of accounts or advertising administration (optional); (*b*) reproduction, media, and layout and commercial art (compulsory), and direct mail advertising or market research (optional). The subjects of the final examination are as follows: (*c*) English (copy, sales letters, &c.), applied psychology and economics (compulsory); (*d*) advanced reproduction, media, and layout and commercial art (compulsory), and advanced direct mail advertising or market research (optional). In each case a comprehensive syllabus has been drawn up and it is evident that those who succeed in passing the final examination will have a very thorough knowledge of business generally, quite apart from the advertising aspect. Particulars of the scheme can be obtained from the general secretary of the Association, 56-57, Fleet Street, E.C.4.

Glareless Lamps.

Under the auspices of the Electric Lamp Manufacturers' Association Messrs. W. J. Jones and H. E. Hughes delivered a lecture in various provincial centres last week, in the course of which it was pointed out that lamp manufacturers in this country are embarking on a definite effort to popularise the glareless lamp, aiming at the complete replacement of all clear lamps in the 15-100-W range with internally-frosted lamps. This policy is important, for with the reduction in glare from artificial lighting, the intensities of illumination which can be installed with comfort are considerably increased. In this way the sale of glareless lamps will automatically widen existing markets, and the work of the trade will be made easier, less costly, and more profitable as the result of this measure of standardisation. The electrical trade, particularly the lamp industry, has suffered in the past on account of the multiplicity of stocks and variations in practice. Standardisation means that the cost of manufacture is reduced and works output increased, resulting in lower cost to the consumer and increased facility for obtaining supplies. The reduction of 72 per cent. in the price of the 100-W gasfilled lamp since 1915 is almost entirely due to improved sales which have enabled mass production to be effected. This is the reason



A Few New Lamps for Many Old.

why, in anticipation of the great demand for glareless lamps, the "pearl" lamp is being offered at a lower price than the clear lamp, in spite of the fact that it involves more works operations and processes. Pearl lamps of 15 and 25 W and opal or pearl lamps of 40, 60, 75 and 100 watts can completely replace 60 or 70 types and sizes of lamps. This point was demonstrated by the display used in conjunction with the lecture, which is illustrated herewith.

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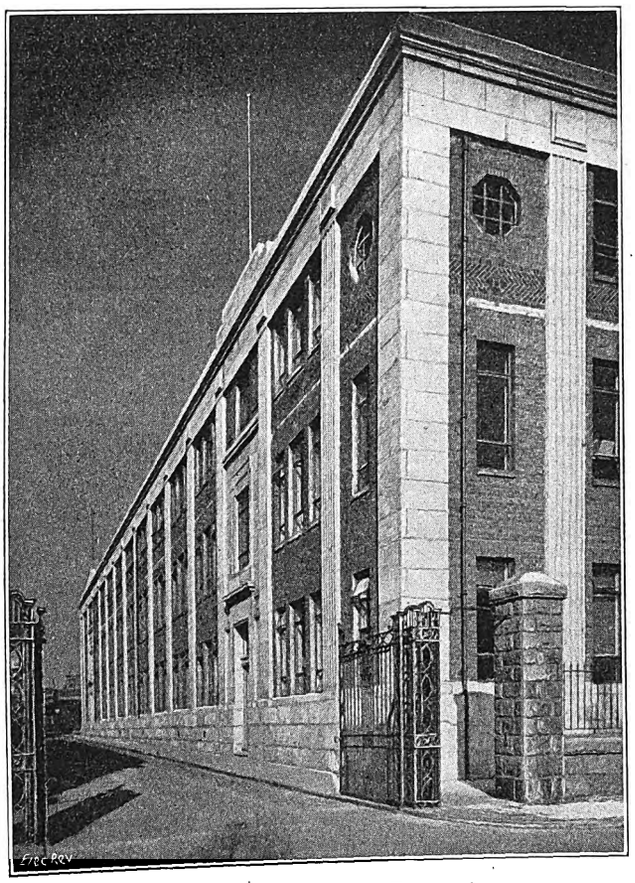
New B.I. Offices at Prescot.

British Insulated Cables, Ltd., has recently completed, at a cost of £35,000, the fine block of offices shown in the accompanying illustration to house its staff, which has been growing steadily for many years. The new building, designed by Messrs. Bailey & Nisbett, of Liverpool, is at the corner of the Prescot factory. It is rectangular in shape, 256 ft. long by 42 ft. wide, and consists of a steel framed structure encased in a rich sand faced red brick with artificial stone plinth, pilasters, and cornice. The floors are of reinforced concrete covered with Granwood block flooring with coloured borders. Ample daylight is provided by 252 steel windows. The main entrance is at the north end of the building, where a spacious hall, provided with main staircase and a passenger lift, gives access to all three floors. The main hall and corridors are floored with black and white rubber tiling. A second entrance with a smaller hall is provided at the south end of the building. On the ground and second floors a central corridor runs lengthwise from end to end with rooms opening right and left. On



New B.I. Offices at Prescot.

the first floor the centre of the building is thrown into one large office, 5,100 sq. ft. in area, occupied by the General Office staff. There are in all 95 radiators connected to a low-pressure central heating ring system with two steam calorifiers. The domestic hot water is also heated by a steam calorifier through which passes the condensate from the central heating calorifiers. The ground and first floor are ventilated by means of ducts running along the ceilings of the ground floor corridor and the General Office and connected to extractor fans in the roof ventilators. The wiring was carried out by the company's own staff with the "Prescot" wiring system. The decoration of the interior is simple and effective and has been treated with due regard for lighting. Electric clocks controlled by a master clock, on the "Pulsynetic" system, are installed throughout.

Gold Coast Electrical Imports.

During 1928 electrical and telegraphic apparatus valued at £72,963 was imported into the Gold Coast Colony.

Canadian Imperial Preference Conditions.

As we reported at the time, the Canadian Government recently decided that in order to qualify for the British preferential tariff, imported goods should represent Empire labour and materials to the extent of 50 per cent. In the course of communications upon the subject it was pointed out by Sir William Clark, British High Commissioner in Canada, that certain classes of goods, including manufactures of copper and its alloys and electric cables, raw materials which were unobtainable in the United Kingdom in commercial quantities exceeded 50 per cent. of the total value of the manufactured article. In the meantime, *Reuter* reports, the regulation is in abeyance to a considerable extent as the Canadian Government is desirous of meeting the wishes of the British Government with regard to details.

Electricity in the Chemical Industry.

In addressing the shareholders of Imperial Chemical Industries, Ltd., last week, the chairman (Lord Melchett) said that at the Billingham works of Synthetic Ammonia Nitrates, Ltd., they were erecting one of the largest and cheapest electrical power plants in this country. None of the "superpower" stations would be able to supply electricity so cheaply. Later he said that the Winnington alkali works had been remodelled, and in the course of the work twenty-five engines had been replaced by one "small and apparently insignificant electric blower" which for a very small part of the capital and working cost did the work which those great and impressive machines used to do.

Bankruptcy Proceedings.

George Cohen, electrical engineer, 49, Newman Street, W.—This debtor attended last week before Mr. Registrar Warmington at the London Bankruptcy Court, for public examination. He failed last July with total liabilities of £4,445 (unsecured £3,282) and net assets valued at £296. According to the observations of the Official Receiver the debtor states that for about nine years prior to 1910 he carried on business as an electrical engineer and, after incurring losses through bad debts, he paid a composition to his creditors. He continued the business, and in 1917, when he joined the army, he sold it for about £300. In April, 1919, he commenced an electrical engineer's business at 31, King Street, Cheapside, E.C., under the style of the "Reliance Electric & Maintenance Co.," in which he had a partner until May, 1920. After buying out his partner for £50 he continued the business alone and moved to other premises. The debtor attributes his failure and insolvency to bad trade; to heavy overhead expenses; to loss on the transfer of assets to the partnership; to bad debts and to law costs.

The debtor was questioned upon cash and goods accounts filed by direction of the Court and the examination was concluded.

L. J. Smith, electrical, radio and cycle engineer, 3, Lower King's Road, Berkhamstead.—First meeting, April 26th, at 37, Cornmarket Street, Oxford. Public examination, May 7th, at the County Hall, Aylesbury.

H. Holmes, sanitary plumber and electrical contractor, 60, Ward's End, Loughborough. Trustee, Mr. G. L. Foulds, Federation Chambers, Wheeler Gate, Nottingham, appointed April 13th.

H. C. Sharpe, wireless engineer, 4, Gordon Terrace, Dorchester.—First and final dividend of 3 3/16d. in the £, payable at the Official Receiver's office, City Chambers, Catherine Street, Salisbury.

S. E. Jones and G. W. A. E. Short (S. E. Jones & Co.), dry battery manufacturers, Elsecar, near Barnsley.—Trustee, Mr. B. S. Briggs, Official Receiver, County Chambers, King Street, Wakefield, released April 8th.

R. H. Nicholson (W. Nicholson), electrician, &c., 8a, High Street, Mexborough.—Trustee, Mr. L. G. Clegg, Official Receiver, 14, Figtree Lane, Sheffield, released April 5th.

H. Osborn, wireless dealer, 3, High Street, Normanton.—Trustee, Mr. B. S. Briggs, Official Receiver, County Chambers, Wakefield, released April 8th.

Company Liquidations.

Ashworth & Smith (Electrical Supplies), Ltd., wholesale electrical dealers, 27, Blackfriars Street, Manchester.—The statutory meeting of creditors was held on April 16th in Manchester. Mr. B. H. B. Eldridge, 52, Brown Street, Manchester, the liquidator, submitted a statement of affairs which disclosed liabilities of £3,130, all due to unsecured creditors, and net assets of £2,399, leaving a deficiency, so far as the creditors were concerned, of £731. The company was registered in 1927, when it took over an existing business, the purchase price being £2,325. Shares to the value of £1,500 were issued to the vendors, and the balance of £825 was left on loan by Messrs. Ashworth & Smith, Ltd. With the issued capital of £1,500, there was a deficiency as regarded the shareholders of £2,231. A resolution was passed confirming the voluntary liquidation of the company with Mr. Eldridge as liquidator, and an advisory committee of the principal creditors was appointed. The following are creditors:—

	£		£
Ashworth & Smith, Ltd.	905	Electric Accessories Mfg. Co.	58
Schlothaver, C. F. ...	296	Metro - Vick Supplies, Ltd.	56
Siemens-Schuckert, Ltd.	185	Ashley Cables, Ltd. ...	55
Beardsall, W. E., Ltd. ...	119	Blackwell, T. & C., Ltd.	53
Armorduct Cable Co. ...	102	Stockwell, Williamson and Co.	47
Credenda Conduits Co., Ltd.	101	Baxendale & Co., Ltd. ...	45
Nathan, F. J., & Co. ...	87	L'Appareillage Elec. de la Seine	43
General Accessories Co.	86	Stella Conduit Co., Ltd.	42
Midland Mfg. Co. ...	79		
Helzel Bros.	61		
Scandinavian Cable Co.	40		

Western Electric Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. A. Fryer, 38, Gresham Street, E.C., who is authorised to consent to the registration of a new company, to be named the Western Electric Co., Ltd. (See our "New Companies" section to-day.) Meeting of creditors was called for April 23rd, at Bush House, Aldwych, W.C. Particulars of claims by May 16th. (This notice is purely

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formal. The company has gone into liquidation solely for purposes of reconstruction; all debts will be paid in full.)

Oscilectron, Ltd.—Winding up voluntarily. Liquidator, Mr. H. J. M. Gregory, 513, Salisbury House, E.C.2. Meeting of creditors was called for April 25th at the liquidator's offices. Particulars of claims by May 31st.

Zone Wireless Co., Ltd.—Winding up order made by the High Court on April 15th.

W. J. Ferguson (Redditch), Ltd.—A meeting of members is called for May 25th at Central Chambers, Redditch, to hear an account of the winding up from the liquidator, Mr. W. J. Ferguson.

Private Arrangements.

H. J. Gill, 33, Carn Street, Pentre, electrical and wireless contractor.—A meeting of the creditors was held recently, when a statement of affairs was presented which disclosed liabilities of £289 and net assets of £77. The debtor started business three or four years ago with a capital of £30 lent to him by his mother. Up to Christmas, 1927, his turnover was about £15 weekly, but since then had gradually decreased, and was practically nothing at the present time. The debtor attributed his present position to depression in trade, keen competition, and lack of capital. It was decided to confirm a deed of assignment already executed in favour of Mr. S. E. Clutterbuck (Messrs. Clarke, Dovey & Co.), Cardiff, as trustee, on the understanding that the debtor's mother's claim of £50 should be withdrawn. A committee of inspection was also appointed. The following are creditors:—

	£		£
Edison Swan Electric Co., Ltd.	28	General Electric Co., Ltd.	98
		Hobday Bros., Ltd. ...	27

A. H. Wilcox and H. D. Sparrow, trading as Wilcox, Sparrow & Co., Wolverhampton, wireless dealers.—A meeting of creditors was held recently at Wolverhampton, when it was reported that the liabilities amounted to £1,290 and the net assets to £602, leaving a deficiency of £688. It was decided that the debtors should be given 14 days in which to find a cash composition of 10s. in the £, security to be found to the satisfaction of a committee of inspection. Failing this arrangement being made, steps were to be taken for administering the case in bankruptcy. The following are creditors:—

	£		
Doran & Price	23	Sheargold, W.	182
C. Walsh Graham, Ltd.	25	Carver (Wolverhampton), Ltd.	140
Parker, Winder and Achurch, Ltd.	20	Hobday Bros.	174
Cooke Wireless Co., Ltd.	79	Bankers	139

Mico Ltd., accumulator manufacturers, &c., Newcastle-on-Tyne.—A meeting of creditors was held recently, when a statement of affairs was submitted which showed gross liabilities of £2,141 and assets comprising book debts £153, stock £683, and cash in hand £40, leaving a deficiency of £1,265. The company was registered in 1904, and for many years was able to carry on successfully, but for two or three years past there had been losses. Recently, a creditor issued a writ, and on March 28th, a receiver for the debenture holders was appointed. It was pointed out that the business had been badly affected in the last year or two through the extension of "after sales service" by certain manufacturers. First debentures were issued in 1924 for cash, and second debentures in November, 1928. It was decided to leave the matter in the hands of a firm of chartered accountants who were acting for the trade creditors.

New Catalogues and Lists.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—Price list No. 181, giving details and revised prices of Philips "Argenta" lamps.

Metro-Vick Supplies, Ltd., Trafford Park, Manchester.—A substantially-bound and well-arranged catalogue of wiring accessories (No. 131/1, 172 pp.). A thumb index to the various sections is provided, as well as complete alphabetical and numerical indexes. The sections comprise wiring accessories, insulators, bells and accessories, wires and cables, ironclad switch- and fuse-gear, conduit and fittings, reflectors, and fans and starters. The list is fully illustrated and priced.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive List No. 2420 C, illustrating and dealing in great detail with B.T.H. rotary convertors, with views of actual installations of these machines; and Descriptive List No. 5281, describing the company's auto-transformer starting equipments for large squirrel-cage induction motors, &c.

The Fuller Accumulator Co. (1926), Ltd., Woodland Works, Chadwell Heath, Essex.—A wall chart containing particulars of the "Fuller" batteries appropriate to all makes of automobile—British and foreign.

The Electro-Dynamic Construction Co., Ltd., 733b, Old Kent Road, S.E.15.—An illustrated descriptive pamphlet dealing with the company's polyphase variable speed motors, including performance curves.

Messrs. W. Christie & Grey, Ltd., 4, Lloyd's Avenue, E.C.3.—A pamphlet dealing with the elimination of vibration and noise in machinery installations, and giving particulars of the company's methods.

Messrs. James Scott & Co., Inglis Street, Dunfermline.—A well-illustrated and priced folder describing "Allscott" radio sets and radio-gramophones.

The Electrical Equipment & Carbon Co., Ltd., 107-111, New Oxford Street, W.C.1.—April stock list of dynamos, motors, testing sets, bell transformers, carbons, &c.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram G.E.C. Bulletin" for April containing, among other things, illustrated articles on the lighting of the new Bournemouth Pavilion and other important buildings, the manufacture of tungsten filaments, and the "Osram" photo-electric cell in picture-telegraphy.

The Enfield Cable Works, Ltd., 296-302, High Holborn, W.C.1.—Trade price lists of "Enfield" v.i.r. wires and cables and v.i.r. and pure rubber flexible wires, &c.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester. Book 5, Section 4, illustrating and describing "Pulsynetic" clocks controlled by observatory time signals.

A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—A leaflet illustrating examples of the company's small automatic circuit breakers to replace fuses.

Omega Lampworks, Ltd., Rodney Place, S.W.19.—An illustrated pamphlet announcing prices of various types of "Omega" lamps.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—Publication No. Wc405, dealing with Ferranti output transformers, condensers and chokes; and Wc412, describing in detail the company's push-pull transformers and their applications. In both cases performance curves are included, with diagrams of connections, &c.

British Insulated Cables, Ltd., Prescot, Lancs.—Pamphlets advertising "Helsby" rust-proof rubber-insulated wires and cables, and "Prescot" demand indicators.

Les Etablissements Skoda, Prague, Czecho-Slovakia.—The "Revue Skoda" for March, containing illustrations of the concern's works and products, with titles in Czech, German, English, French, and Spanish.

Messrs. Rd. Johnson, Clapham & Morris, Ltd., Jacem House, Trafford Park, Manchester.—A catalogue of hardware and domestic appliances of all kinds, including electric vacuum cleaners, &c. The list also includes gramophones and radio sets. Illustrated and priced.

Messrs. J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham.—A series of illustrated and priced leaflets covering tumbler switches, bell pushes and boxes, insulated lampholders, switch-plugs, and ironclad switches and fuses.

Brook Motors, Ltd., Empress Works, Huddersfield.—Publication No. 240, dealing with the conversion of motors from 25-cycle to 50-cycle operation.

The Wholesale Fittings Co., Ltd., 23, Commercial Street, E.1.—Catalogue No. W.195, a very comprehensive list (140 pp.) of radio component parts and accessories. Fully illustrated and priced.

Book Notices.

"Operational Circuit Analysis," by V. Bush. Pp. x+392; figs. 102. Price 22s. 6d. net. London: Chapman & Hall, Ltd.

"The Profession of Engineering." Essays edited by D. C. Jackson and W. P. Jones. Pp. ix+124. Price 7s. 6d. net. London: Chapman & Hall, Ltd.

"The Engineer's Guide to Success." (108 pp.). London: The Technological Institute of Great Britain.—A prospectus of the various courses conducted by correspondence by the Institute.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. April, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Electrical Transmission and Distribution." Vols. V and VI. Sub-station Work, Parts 1 and 2. By R. O. Kapp. Vol. V, pp. viii+278; Vol. VI, pp. vii+287; both vols. fully illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. each net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVIII. April, 1929. New York: The Institute. $1.

"Electricity Supply Contracts," by H. E. Dance, B.Eng., A.M.I.E.E. Pp. 48; figs. 24. Liverpool: George Reed & Co.—A reprint of a paper read in January last before the Liverpool Engineering Society.

Unemployed.

The returns of unemployment issued last week gave the following totals: March 18th, 1,182,454; March 25th, 1,132,856; April 8th, 1,178,100. On April 2nd, 1928, the total was 1,041,900.

Recent Contracts.

Among the orders recently received by the Birmingham Electric Furnaces, Ltd., is one from the Moss Gears Co., Ltd., Birmingham, for an electric re-heating furnace; one for a box-type electric furnace for carburising and an electric re-heating furnace for the Alvis Car & Engineering Co., Ltd., Coventry; and one for three electric re-heating furnaces for Messrs. David Brown & Sons, Ltd., Huddersfield.

The Bastian Meter Co., Ltd., is manufacturing and installing off-peak water-heating apparatus for the new offices of the Candy Filter Co., Ltd.

The New South Wales Government Railways and Tramways have ordered from the Brown-Boveri organisation three further h.p. rectifier equipments, each for an output of 1,500 kW at 1,500 volts d.c. These will be arranged for completely automatic control. When the three new sets are at work, the undertaking will have a total of 15 1,500-kW plants in operation.

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Trade Announcements.

The Mullard Wireless Service Co., Ltd., has removed to Mullard House, Charing Cross Road, W.C.2 (telephone: Gerrard 0767; telegrams: "Radiovalve, Westcent, London"). The Birmingham offices of the company have been removed to 36-37, Dale End, Birmingham. The telephone number and telegraphic address are unaltered.

The London Fan & Motor Co., Ltd., 81, Charlotte Street, W.1, has opened a branch at 277, High Street, Acton, W.3 (telephone: Chiswick 5273).

The Sterling Varnish Co. has removed to Fraser Road, Trafford Park. Manchester, where it has acquired premises and land for extension.

Alloy Welding Processes, Ltd., has removed to new and larger offices and works—Ferry Lane Works, Forest Road, E.17. Telephone: Walthamstow 2366-7-8; telegrams: "Alweprol, Waltstreet, London."

Mr. Alan Williams, representative in Great Britain of Moffats, Ltd., Weston, Ont., has opened a new office and showroom at 15, Victoria Street, S.W.1, where a selection of "Moffats" ranges is on view. (Telephone: Victoria 3788.)

For Sale.

Salford Corporation invite offers for two 5,000-kW turbo-alternators, two 28,000-32,000 lb. boilers, one 5,000-kW turbo-alternator, eight 10,000-lb. boilers, one 20,000-lb. boiler, and four cooling towers. (See our advertisement pages to-day.)

London Electricians' Wages Increased.

The National Federated Electrical Association announces that the rate for a journeyman in the London Area is to be increased by 5 per cent., the increase being based on the rate fixed in accordance with the National Standardised Wages Agreement and remaining in operation for a period of six months. The new rate will therefore be 1s. 10¾d. per hour against the existing rate of 1s. 9¾d., and the increase will take effect on the first pay day in May for the period covered by that pay day. The rate for mates will be increased proportionately, *i.e.*, from 1s. 5½d. per hour to 1s. 6¼d. per hour.

Cable Manufacturing in Switzerland.

The Bratislava Kabelfabrik Gesellschaft, of Bratislava, Czecho-Slovakia, has lately acquired works at St. Gall in order to establish a branch factory in Switzerland for the manufacture of electric cables.

E.D.A. Area Sales Conference.

Arrangements have been made by the North Midland Area Committee, E.D.A., for the second area sales conference to be held at the Royal Victoria Station Hotel, Sheffield, on April 30th. Mr. R. A. S. Thwaites, B.Sc., of the Yorkshire Electric Power Co., Ltd., will speak on the subject of "Selling Electricity for Industrial Purposes," and the chairman will be Mr. S. E. Fedden, city electrical engineer, Sheffield.

The Timber Trade.

Our Timber Trade Correspondent reports that business in the wood trade has been steady of recent weeks, following the poor trade of February, when ice and snow prevented much outdoor work and hampered transport. Stocks of general utility woods in the country are fairly large, and prices reasonable, all things considered, with good supplies to come forward to meet the late spring and early summer demand. Hardwoods, on the other hand, are of moderate supply and rather quiet in demand with price steady, teak, as well as satinwood, rosewood and other fancy woods being very firm in value.

Wages in the Cable-making Industry.

The Joint Industrial Council for the Electrical Cable-Making Industry announces that there will be no cost-of-living alteration in wages on the third pay day in May.

Local Exhibition.

Guildford.—An electrical exhibition arranged by the Corporation was held at the Village Hall, Bramley, last week. Apart from the general exhibits of the Corporation, there were displays of domestic appliances by the General Electric Co., Ltd., Electric Installations, Ltd., Messrs. Bowden and Higlett, and Messrs. Groves.

C.M.A. Football Cup Final.

The final tie for the Cable Makers' Association Football Cup was played at Woolwich Stadium on Saturday last between teams representing the Anchor Cable Co., Ltd., and Standard Telephones and Cables, Ltd., and a large crowd witnessed a victory for the London team by three goals to nil. The match was keenly contested and victory undoubtedly went to the better side on the day's play. A high wind and a lively ball made accurate football difficult, and it was mainly due to the London team's ability to overcome these difficulties which gave it the victory. At the conclusion of the match the cup was presented to Mr. J. Torrance, captain of the winning team, by the Mayor of Woolwich. The fifth annual dinner in connection with the competition was held in the evening at the "Welcome Inn," Well Hall Road, S.E.9

Lundberg Switch in Speed Test.

Major Segrave's motor boat *Miss England*, which recently set up a speed record, was equipped with Lundberg's dual-control switch in conjunction with the magnetos.

Prices of Materials.

Messrs. F. Smith & Co. report, April 23rd: Copper (electrolytic) bars, £84, £5 dec.; ditto ditto sheets, no change; ditto ditto wire rods, £94, £5 dec.; ditto ditto h.c. wire, 11 5/8d., 9/16d. dec.

Messrs. James & Shakespeare report, April 23rd: Copper bars (best selected), sheet and rod, £117, £7 dec.; English pig lead, £26 5s., 10s. inc.

Messrs. Edward Till & Co. report, April 23rd: India-rubber, Para fine, 11½d., ½d. dec.

In the course of their letter, dated April 20th, Messrs. James Forster & Co. state that the backwardation in lead prices has increased further, more due to influential support for the April position than to any revival in demand from consumers. In fact, the demand last week was poor, while in some cases consumers postponed delivery of purchases previously made to a later month. Although supplies have been fairly full so far this month, it is anticipated that arrivals will be short during the next six weeks, owing to the interruption of shipments from Mexico and smaller shipments from Australia, so that, should consumers' demand revive, a firmer tone might easily develop. The Board of Trade returns for March show: Imports, 21,579 tons; exports, 2,864 tons; leaving for home consumption 18,715 tons.

Lighting and Power Notes.

Barking.—Year's Working.—In his annual report, the chairman of the Urban District Council states that the electricity department has again had a successful year, 504 additional consumers having been connected. The maximum demand reached 1,944 kW and the electrical energy purchased under the bulk supply agreement totalled 5,158,199 kWh, as compared with 4,378,299 kWh in the previous year. It is not yet possible to give any information as to the amount of electricity sold, but it was considerably greater than in 1927-28, and he forecasts a satisfactory financial result of the year's working. It is hoped that arrangements will shortly be made for supplying the houses to be erected on the portion of the Becontree Estate situate in the Council's district with electricity.

Barnsley.—Loan.—The Corporation Electricity Committee is applying for sanction to the borrowing of £6,693, for the extension of h.p. and l.p. mains.

Brierfield.—Loan Sanctioned.—It was reported at a recent meeting of the Urban District Council that sanction had been received to a loan of £10,000 for the electricity conversion scheme.

Bromley (Kent).—Loan.—The Town Council has applied for sanction to a loan of £15,000 for mains and services for the ensuing two years. Electricity is to be supplied to 71 houses to be erected on the Bromley Palace Estate, at an estimated cost for mains extensions of £562.

Carlisle.—Extension of Supply Area.—The Electricity Committee has recommended that application be made for a Special Order to supply electricity in rural districts a distance of two miles from the Cathedral, and to part of the rural districts of Brampton and Longtown. The estimated cost of the scheme is £35,513, and as a result of a canvass the income for the first year is estimated at £2,242.

Continental.—Russia.—A recent meeting of the Electricity Planning Committee was devoted to the question of new power stations at Leningrad. The representative of the Elektrotok said that owing to the concentration of industrial enterprises in various parts of the city there were 13 or 14 suitable points for a power station at Leningrad, but that the outstanding district was that of the Red Triangle rubber works, which consumed a large amount of electricity, and that it was proposed to erect a first station of from 30,000 to 40,000 kW in this district. The Committee agreed, and decided that the construction of power stations at Leningrad must be pushed forward with all possible speed.—*Reuter's Trade Service* (Moscow).

Italy.—The Società Elettrica Emiliana has recently completed a new hydro-electric power station at Farneta to utilise the water power of the rivers Dolo and Dragone. The plant comprises four Pelton-type turbines direct coupled to Italian Brown-Boveri 12,000-kVA alternators generating electricity at 6,500 V at 420-500 r.p.m. The installation also includes a 6,500/60,000-V transformer.

Belgium.—The Société d'Electricité de la Region de Malmedy has completed and put in operation a new hydro-electric

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power station at Beverce. The power generated is being transmitted at 70,000 V to the Liége district. Work has commenced on the construction of a second dam at Butgenbach.

France.—As a result of the dry summer of last year, which interfered with the output of the hydro-electric station of the Société des Forces Motrices de la Vallée d'Aspe, in the Pyrenees, it has been decided to establish a stand-by steam-operated plant, which will eventually have a capacity of 20,000 kW. At first, however, only one set of 10,000 kW is to be installed.

Croydon.—Supply to Epsom.—The Corporation Electricity Committee has been approached by the Central Electricity Board with regard to a supply of electricity to Epsom. The Board is anxious to avoid an extension of plant at the electricity works at Epsom and desires to take a supply from Croydon, and to give it to the Epsom Council until such time as the grid system is in operation. The Board is prepared to enter into a temporary arrangement with the Corporation under Section 5 of the South-East England Electricity Scheme, 1927, on the following terms: The supply to be delivered to the Board at a pressure of about 6,600 V at the Croydon generating station, to transformers and lines which will be constructed by the Board, the price to be paid for a supply to be a standing charge of 25s. per kW of maximum demand with a running charge equal to the actual cost of fuel per kWh delivered to the h.p. feeders at the Croydon generating station, plus 10 per cent., provided that the addition of 10 per cent. shall not be greater than .05d. per kWh. The Committee has recommended that the supply be provided.

Ealing.—Electricity Extensions.—The Electricity Supply Committee is to install a 1,500-kW Scott-connected 3-phase transformer set, together with a booster regulator. It has also been decided to install a spare set of the same capacity by September next. High-pressure mains between the transformer cubicle, the operating chamber, and the coupler switches are also to be provided.

Glasgow.—Progress during March.—Under the Corporation Electricity Department's scheme 667 houses were wired in March, making the total to date 12,828, while 83 applications for the hire of appliances were dealt with, bringing the total to 18,567.

Distribution Mains.—The Electricity Committee has recommended that distributing mains be laid at an estimated cost of £9,000.

Hull.—Loans.—The Corporation Electricity Committee has decided to apply for sanction to loans of £100,000 for maintenance and service, and £50,000 for new sub-stations.

Street Lighting.—A sub-committee has been appointed to investigate the question of lighting the streets by electricity.

Inverness.—Electricity Supply Progress.—The burgh electrical engineer (Mr. C. A. Grut) reports that extensions to the generating station at Waterloo Place are now under way, the Bught hydro-electric station is nearing completion, and the work on the refuse destructor is proceeding satisfactorily.

Kirkintilloch.—Electricity Supply.—The Town Council having approached the Clyde Valley Electrical Power Co. for an extension of its cable to Lenzie, has been informed that this will involve a capital outlay of £11,000. The proposal is being considered.

Luton.—New Plant.—The Town Council has applied for sanction to a loan of £163,267 for extensions to the power station, including a 12,500-kW turbo-alternator, with condensing plant, &c., a 6,600-V switch panel, with cables, and two boilers, evaporator, pipework, feed pumps, &c.

Inquiry.—Sir W. F. Marwood held a Ministry of Transport inquiry on April 8th relative to an application by the Town Council for compulsory wayleaves for an overhead line required to supply electricity to the country Zoo being established at Whipsnade, with a possible later extension to Studham and Whipsnade village. There was opposition on the part of the National Trust, landowners and farmers. It was stated that an electricity supply was urgently needed at the new Zoo, and work was being held up owing to the absence of a supply.

Marlborough.—Electricity Supply.—With reference to the application to the Town Council for sanction to extend the generating station, the Electricity Commissioners suggested that the Corporation should ascertain from the Swindon Town Council whether it could furnish a satisfactory alternative to the proposed extension. A conference was held, but there was reluctance on the part of Swindon and Marlborough to accept responsibility for the capital expenditure which would be incurred by establishing a transmission line between the two towns. It was suggested that the only solution would be a bulk supply through a line forming part of the grid. The Commissioners replied that they were of the opinion that the proper course would be for the Wessex Electricity Co. to erect a line from Swindon to Marlborough, and the company was preparing a scheme, but was unable to proceed with it in the vicinity of Swindon until the Swindon Corporation came to a decision with regard to its rights under Section 80 of the Wessex Electricity Act, 1927. It was intimated at the last meeting of the Town Council that the Wessex Co. held out no hope of a bulk supply in the future. The maximum load at Marlborough last winter was 160 kW, and the capacity of the present generating plant is 240 kW.

Merthyr.—Hydro-Electric Scheme.—The new hydro-electric plant which has been erected on the river Taff at Pont-y-cafnau was put into operation by Mr. C. G. Tegetmeier, chairman of the Merthyr Electric Traction and Lighting Co., Ltd., on April 17th. The electrical energy generated will be transmitted to the company's main generating station and distributed from there.

Paignton.—Change-Over.—The Urban District Council has raised no objection to the proposals of the Paignton Electric Light and Power Co., Ltd., to spend approximately £10,000 for various extensions in connection with the change-over of the system of electricity supply from d.c. to a.c.

Paisley.—Loan Sanctioned.—The Corporation has received sanction to a loan of £16,590 for electricity purposes.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Llandrindod Wells.—Lighting: From 8d. to 7½d. per kWh. Power: From 5d. to 4d. per kWh. Heating: From 2d. to 1¾d. per kWh.

Conway.—Lighting: From 6d. to 5d. per kWh. Power: From 2d. to 1½d. per kWh.

Blyth.—*Northern Counties Electricity Supply Co., Ltd.*—Shop lighting: From 6½d. to 6d. per kWh, with a secondary charge of 2½d. per kWh. Domestic premises: Lighting from 6½d. to 6d. per kWh. It is also proposed to introduce a sliding scale varying from 6d. to ¾d. per kWh, based on the number of rooms.

Bredbury and Romiley.—Lighting: A reduction of ½d. per kWh. Domestic power and small power users: From 2d. to 1¾d. per kWh.

Bromley.—"All-in" tariff: Private residences from 12½ per cent. of the ratable value and 1¼d. per kWh to 10 per cent. and 1d. per kWh. Business premises, &c., the "unit" charge from 1¼d. to 1d. per kWh.

South-East Lancashire Electricity Advisory Board.—Transmission Lines.—The Engineering Advisory Committee has recommended the Board to approve the construction of a 33,000-V transmission line by Salford Corporation between Frederick Road generating station and Trafford sub-station, at an estimated cost of £6,600, and the construction of transmission lines by Manchester Corporation from Barton power station to High Street and Oldham Road sub-stations.

Fringe Order.—The Committee has recommended the Board to support the application of Oldham Corporation for a Fringe Order to supply certain premises in the rural district of Limehurst.

Mid-Cheshire Electricity Extension Order.—The Committee has considered an application by the Mid-Cheshire Electricity Supply Co., Ltd., for approval of a proposed extension of the Mid-Cheshire Special Order, 1924, so as to include certain parishes in the rural district of Bucklow and the South-East Lancashire Electricity District, and has decided that it cannot recommend any scheme whereby any part of the area in question would be developed on a non-standard frequency. Consideration of the matter, however, has been adjourned, and in the meantime the Altrincham Electric Supply, Ltd., has been requested to submit details of any scheme which it desires to propose for developing the parishes which it suggests should be added to its area of supply.

Special Order.—The Board has been recommended to support the application of Wigan Corporation for a Special Order authorising it to supply electricity in the urban districts of Standish and Upholland and the rural district of Wigan.

The minutes of the proceedings of the Engineering Advisory Committee have been approved and adopted by the Board.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Newcastle-upon-Tyne Electric Supply Co., Ltd., authorising it to supply electricity in the rural district of Haltwhistle, and part of the rural districts of Hexham and Bellingham; and Mr. J. J. Martin, to supply in the parish and township of Sedburgh.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Cleveland and Durham County Electric Power Co. to supply electricity in the urban districts of Stanhope and Tow Law, and part of the rural district of Weardale.

The following Special Orders made by the Commissioners have been confirmed by the Minister of Transport:—West Cornwall; Midland Electricity Power Distribution and Lighting (Extension); Marple; Henley-in-Arden and District; Epping Rural (Nazeing to Sheering); Blackburn Electricity (Extension); Warrington Electricity (Extension, &c.); and Stokesley District.

Stretford.—Electricity Supply.—At a recent meeting of the Urban District Council Electricity Committee it was reported that a detailed financial report had been prepared and submitted to the Joint Electricity Committee. It showed that the expenditure on the Barton-Urmston scheme on December 31st last was £73,849, and that a further expenditure of about £11 000 would be incurred from December 31st to March 31st next, when the Barton-Urmston undertaking would be merged in the Stretford Electricity Board. The number of services laid and connected up to date was approximately 972, while

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the estimate in the original scheme was 500 during the first three years. Applications were still being received, and it was recommended that application be made for sanction to borrow a further sum of £25,000, to meet the cost of mains and services.

"All-in" Tariff.—The Committee has decided that the following "all-in" charge for the supply of electricity for lighting and domestic power, for private residences only, be adopted as an alternative charge to the flat rate:—An annual fixed charge of 15 per cent. on the net ratable value of the house, plus ½d. per kWh for electricity used for all purposes. Combined houses and shops, or houses divided into flats, will be suitably assessed, and where the net ratable value exceeds £50, the annual fixed charge will be 15 per cent. on the ratable value up to £50 and 7½ per cent. on the remainder; the minimum net ratable value will be £100. The adoption of this rate will be contingent upon the installation of domestic appliances.

Walsall.—Mains Extensions.—The Corporation Electricity Committee is to carry out mains extensions at an estimated cost of £7,000.

Wellington (Somerset).—Electricity in Bulk.—The Urban Council has received from the Electricity Commissioners a notification to the effect that the Whitehall Securities Corporation, which has acquired the whole of the shares in the Wellington District Electricity Co., Ltd., proposes to provide a bulk supply of electricity for the town from Exeter. A supply will be available in about a year's time, and the proposed charges are 9d. per kWh for lighting, and 2½d. per kWh for domestic heating and small power users.

Tramway and Railway Notes.

Brighton.—Revised Tramway Agreement.—The *Sussex Daily News* reports that the Town Council on April 18th decided to revise the terms of the proposed agreement with Messrs. Tilling for the merging of the tramway and 'bus transport services of the town. The original terms of the merger were that a new company was to be formed to work the amalgamated undertaking with a capital of £750,000, of which £300,000 represented the interest of the Corporation and the balance that of Messrs. Tilling. This unequal holding gave rise to strong criticism, as did the further provision that the board of six directors should have a chairman permanently representing Tillings, with the power to give a casting vote. The agreement approved meets both these objections. It provides that in the company, to be known as the Brighton and District Transport Board, the Corporation and Messrs. Tilling are to hold equal proportions of capital, and that the board of directors shall consist of three representatives of the Corporation and three representatives of Messrs. Tilling, who shall appoint their own chairman. Provision is also made for the Corporation to have the option of taking over the combined undertaking within a certain number of years. As in the old agreement, provision is made for the gradual replacement of tramways by motor-'buses, and there are clauses safeguarding the interests of the tramway employés. The agreement must not be looked upon as finally settled: it is really a basis for further negotiation with Messrs. Tilling.

Continental.—France.—Application has been made by the Cie. des Chemins de Fer du Midi to the French Ministry of Public Works for authority to convert the railway extending from Beziers (Hérault) to Neussargues (Cantal) from steam to electric traction. According to details published in *La Chronique des Transports*, the power will be supplied at 1,500 V d.c. from the stations in the Pyrenees and the Massif Central, connected by a 150,000-V line from Toulouse to St. Victor. At St. Victor the power will be transformed to 60,000 V. The station at Pinet, on the river Tarn, belonging to the Sté. d'Energie Electrique de Rouergue will also be brought into use on its completion next year. When the power from the Pyrenees is insufficient during winter the station at Pinet will supply the deficit, and in summer any shortage caused by drought in the neighbourhood of the Tarn will be made up from the Pyrenees. From Pinet a transmission line at 60,000 V will be constructed to Aguessac, where it will have two branches, one going to Neussargues and the other to Beziers. Power will be supplied thus to 14 sub-stations, where the pressure will be reduced to 1,500 V. The locomotives will, at 2,250 h.p., have a maximum speed of 130 km., while the equipment of the line will be identical with that already in existence elsewhere on the company's lines. The cost is estimated at a total of 150 million fr., and it is anticipated that the work will be completed early in 1931.

Croydon.—Doubling of Track.—The Corporation is to double the tramway track at North End at a cost of £1,160.

London.—New Tube Trains.—Nine new trains of the most modern type have just been put into service on the Piccadilly Railway. The whole of the original rolling stock of this line is being replaced, and 27 new trains of six cars each are being supplied for this purpose. The old cars which have been in service since the line opened in December, 1906, are being sold as scrap, and the last will have been replaced by the beginning of July. The new rolling stock is identical with the new cars already in service on the Hampstead Line. As soon as the Piccadilly line has its full complement of these new trains, the old rolling stock on the Bakerloo line will also be replaced. It is expected that all the new cars for the Bakerloo line will be in service by the end of this year or early in 1930.

M.E.T. Tramcars.—Twenty more re-equipped cars have now been placed in service on the northern and western routes of the Metropolitan Electric Tramway Co. This marks a further stage in the scheme for modernising the rolling stock on the tramway systems associated with the Underground. The full programme involves the re-equipment of nearly 160 cars, and work is now in hand on the remainder.

Traction Motors.—Coil Insulation.—The Metropolitan-Vickers Electrical Co., Ltd., has received a letter from Mr. R. F. Dixon, engineer and manager of the Mansfield and District Tramways, Ltd., drawing attention to a remarkable example of good service under the difficult conditions of tramway operation. We quote from the letter: "It might interest you to know that we were overhauling one of our tramcars this week, and, taking down the field coils for re-insulation, we discovered the original shop ticket. This car has been running continuously for 24 years, and it rather appears to us that the insulation used on these coils must have been of excellent quality. We may add that they appear to be in quite good condition, and we are putting them back for further service."

Telegraph and Telephone Notes.

Belgium.—Communication with Colonies.—Another instance of the importance attached by European countries to direct wireless communication with their colonies is the order just placed with the Marconi Company by the Société Belge Radioelectrique, on behalf of the Belgian Government, for a short-wave telegraph-telephone transmitter which will be used for communication between Belgium and the Belgian Congo and Belgium and South America. Two short-wave receivers, similar to those used in the Marconi "beam" stations, have also been ordered.

Irish Free State.—Telegraph Service.—In Dail Eireann last week, Mr. M. R. Heffernan, Parliamentary Secretary to the Minister for Posts and Telegraphs, said that the loss on the telegraph branch of the postal service for the year ended March 31st, 1928, was £142,212. Complete returns for the last financial year would not be available for some months. He proposed, in connection with the current year's estimates, to indicate in a general statement the effect of the increased telegraph charges upon traffic and revenue in the Irish Free State.

International Telephony. — England-Finland. — A public telephone service was established last week between all parts of this country and the south-western parts of Finland.

Portuguese India. — Radio-Telegraphy.—The Portuguese Radio Marconi Company has sent a proposal to the Minister for the Colonies for the establishment of wireless stations in Portuguese India, Macao, and Timos, of sufficient strength to communicate with Lisbon.—*Reuter's* (Lisbon).

Radio-telegraphy.—New "Beam" Station?—It is reported by the local Press that Marconi's Wireless Telegraph Co., Ltd., is to erect a "beam" wireless station near Hastings. A piece of land near the Fairlight coastguard station was recently inspected, and arrangements are being made to obtain electric power from the Corporation.

United States.—Long-distance Telephony.—The sum of 82,000,000 dollars (about £16,500,000) is to be spent by the American Telephone and Telegraph Co. during the present year on new long-distance telephone facilities in the United States, an increase of 67 per cent. over 1928. During 1928 the public use of the long-distance telephone service increased by more than 18 per cent. over 1927. Rather more than half of the allotted sum will be spent on extending the existing cable system. The programme also includes the supply of a million loading coils, and about 24,000 repeaters, as well as the stringing of 74,000 miles of new aerial wire.

Transatlantic Circuits.—Of special interest is the contemplated construction of three additional short-wave transoceanic telephone systems, supplementary to the present telephone facilities to Europe, to meet the increasing volume of overseas telephone calls. Speaking in the Newfoundland Legislative Assembly on April 17th, Sir R. A. Squires, the Premier, announced his intention of introducing a Bill during

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the present session to empower the American Telephone and Telegraph Co. to lay new transatlantic cables, *via* Newfoundland, for telephone purposes between the two hemispheres. The cable, it is understood by *Reuter's*, will be laid from America into Placent Bay, carried across the isthmus to Conception Bay, and thence to Europe.

Venezuela.—Communication Services.—According to a recent return, Venezuela has now 12,732 telephone instruments in use, or 4.1 for each 1,000 of the population. The length of telegraph wires in the Republic is 6,281 miles, or 2.6 miles for each 1,000 inhabitants.

Radio Notes.

Greece.—Concession.—An agreement has been signed in Athens in connection with a broadcasting concession granted to a Greek group and supported by the Marconi Co.

Spain.—High-Power Transmitters.—For the opening of the exhibition in May this year the two companies operating in Barcelona, the Union Radio and Radio Catalana, both intend to put high-power transmitters into operation. Radio-Catalana, with a transmitter situated not far from the exhibition grounds, will use 10 kW, and Radio-Barcelona will be "on the air" with a 7-kW transmitter situated 1,500 ft. above the town on the famous Tibidabo.

Switzerland.—Geneva.—Radio-Genève has suspended its afternoon transmissions, as the transmitter is required for commercial air-service telephony until 8 p.m. daily. This station will be limited to evening transmissions until next winter, if the Swiss administration does not grant permission for the new transmitter proposed and already financially ensured for Geneva. The administration is still withholding its authorisation, says *World-Radio*, in view of the reorganisation of Swiss broadcasting which is to take place some time this year.

Finance.—The third annual report on Swiss broadcasting shows an improvement in the financial position of the Basle station. Three factors are said to have contributed: the raising of the licence fee from 12 to 15 francs, a new method of distribution of the income from licences among the various stations, by which Basle receives the fees paid in its local telephone district, together with a tenth of the amount collected for all the Swiss territory, and, finally, the subsidy of 15,000 francs granted by the Basle municipality. Increased revenue has resulted in the provision of better programmes.

Television.—B.B.C. Announcement.—Following upon the published letter from the secretary of the General Post Office to the Baird Television Development Co., Ltd., dated March 27th, negotiations between the technical officers of the British Broadcasting Corporation and the Baird Company were initiated on April 18th. There was a general technical discussion as a preliminary to the submission of definite proposals by the Baird Company.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—June 4th. State Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 5216.)*

June 18th. Posts and Telegraphs Department. Switchboard cable. (B.X. 5228.)*

June 25th. Telephone cable terminal boxes of the protected type. (B.X. 5231.)*

Sydney.—June 22nd. Public Works Department. Transformers and spares for Burrinjuck hydro-electric development sub-stations. (B.X. 5230.)*

June 4th. 18 electrically-operated water level indicators. (B.X. 5233.)*

Canada.—Winnipeg. — May 6th. Municipal Council. Switching equipment for Slave Falls. (B.X. 5250.)*

Chertsey.—May 18th. Board of Guardians. Installation of electric lighting at the Institution at Ottershaw. (April 19th.)

Devizes.—May 1st. Rural District Council. Complete electrical installation for cottages situated in the parishes of Market Lavington, Potterne, and Rowde. Specifications and schedule from Mr. P. R. Trapp, clerk, Maryport Chambers, Devizes.

Edinburgh.—May 6th. Education Authority. Installation of electric lighting at the Gorgie new special school and annexe to Trinity Academy. Schedules from the Education Offices.

Egypt.—Cairo.—May 15th. Ministry of Public Works. 120-kW d.c. Diesel-engine generating set and a small electrically-driven cooling water pump. Forms of tender from the Chief Inspecting Engineer, 41, Tothill Street, S.W.

May 15th. Diesel engine-driven electric generating set with accessories, for the Government Press Power Station at Bulaq. (B.X. 5246.)*

May 25th. Prison Administration. Stores (including lamps and electrical articles). (C. 3022.)*

Epping.—May 2nd. Board of Guardians. Installation of electric light at the Institution, Epping. (April 12th.)

Grimsby.—May 3rd. Electricity Department. 10 miles 33,000-V overhead line. (April 19th.)

May 8th. Supply of 8,000 yd. each of paper-insulated lead-covered, 6,600-V, and l.p. cable. (See this issue.)

Hull.—May 16th. Electricity Department. Supply and laying of underground cables. (See this issue.)

India.—May 8th. Assam-Bengal Railway Co., Ltd. Turbo-generator set for Pahartali. (April 19th.)

May 21st. India Stores Department. One 400 kW, 6-phase rotary convertor set and accessories for H.M. Mint, Calcutta. (B.X. 5255.)*

Irish Free State.—Dublin.—April 29th. Electricity Supply Board. Supply and laying of 40,000-V cables in the County and City of Dublin. (April 5th.)

Leeds.—May 2nd. Board of Guardians. Electric lamps required during period ending September 30th, 1929. Form of tender, &c., from Mr. J. H. Ford, clerk to the Guardians, Poor Law Offices, South Parade.

London.—Central Electricity Board.—May 4th. Supply, delivery and erection of 33,000-V and lower-voltage cables in connection with the South-East England Electricity Scheme. (April 12th.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. March 15th.)

H.M. Office of Works.—May 1st. Electrical accessories. (April 19th.)

Stepney.—May 2nd. Board of Guardians. Installation of an automatic intercommunicating telephone system at the Mile End Hospital and at premises situate in Bancroft Road, Mile End, E. (See this issue.)

St. Marylebone.—May 6th. Electricity Department. L.p. and e.h.p. underground cables for 12 months. (See this issue.)

Lourenco Marques.—May 6th. Port and Railways Board. Electric motors, &c. (A.X. 7765.)*

Manchester.—May 3rd. Electricity Department. 12 months' supply of electric kettles, electricity meters, circuit breakers, star-delta switch starters, a.c. motors, potential and current transformers, cables and time switches. (April 19th.)

April 30th. One 33,000-V, 11,500-kVA self-cooled outdoor auto-transformer, one 6,600-V switch, &c., and a neutral earthing resistance. (April 19th.)

May 6th. Supply, delivery, and erection of three 1,000-kVA static transformers. (See this issue.)

New Zealand.—Auckland.—June 3rd. Auckland Electric Power Board. Pilot cable and accessories. (B.X. 5244.)*

Wellington.—Posts and Telegraph Department. June 18th. Telephone cords. (B.X. 5251.)*

April 30th. Telephone cable. (B.X. 5240.)*

South Africa.—Johannesburg.—May 16th. South African Railways and Harbours. Electric signalling apparatus. (B.X. 5165.)*

Bloemfontein.—May 18th. Electric Supply Department. Turbine and generator, condensing plant and auxiliaries; switchgear and cables; cooling spray pond equipment, or alternatively cooling tower complete. (B.X. 5192.)*

Pretoria.—May 23rd. Posts and Telegraph Department. Rubber-covered wire and telephone cables. (B.X. 5229.)*

May 30th. Telegraph materials, &c. (A.X. 7767.)

May 20th. Town Council. Cables, switchgear, and transformers. (B.X. 5245.)*

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Southampton.—April 30th. Electricity Department. Steel-framed building, steelwork for firing floor, platform carrying induced draught fans, overhead bunkers, &c.; two water-tube boilers with superheaters, economisers, air heaters, mountings, chain-grate stokers, water walls, induced and forced draught fans, sootblowers, steel flues and chimneys, grit arrestors and collectors, &c.; steam, feed-water and other piping, covering, &c.; water softener. (March 29th.)

Stafford.—April 30th. County Education Committee. Installation of electric lighting and power at the New High School for Girls, Wellington Road, Bilston. Installation of electric light at the Girls' High School, Stafford. (April 12th.)

Stockport.—Electricity Department. Supply of electric lamps for 12 months. (See this issue.)

Uruguay. — Montevideo. — May 6th. State Electricity Works. Electric cables and accessories. (B.X. 5178.)*
May 22nd. National Administration of the Ports. Four electric cranes (to lift 3 metric tons) mounted on trucks. (A.X. 7814.)*

Walthamstow.—May 3rd. Education Committee. Electrical installation for the Billet Road school. (April 12th.)
May 8th. Electricity Department. L.p. distributor and service cables; e.h.p. and l.p. feeder cables. (April 19th.)

Wolverhampton.—May 10th. West Midlands Joint Electricity Authority. One 50,000-kW turbo-alternator with step-up transformers, &c., condensing plant, boiler feed pumps, evaporators, circulating water pumps, &c., main and auxiliary 33,000-V switchgear with circuit breaker. (March 29th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Ashford (Kent).—Urban Council. Accepted:—
Wiring 60 houses for electric light (£372).—Mr. Dowling.

Bexhill.—Electricity Committee. Recommended:—
Balancer, regulator and mechanical starter for Ashdown Road works (£292).—Crompton Parkinson, Ltd.
Feeder panel and balancer panel (£144).—Bertram Thomas
Cable for six months.—Enfield Cable Works, Ltd.

Croydon.—Electricity Committee. Recommended:—
Sub-station switchgear (£1,547).—A. Reyrolle & Co., Ltd.
Cooling tower repairs (£345).—Davenport Engineering Co., Ltd.
Two 400-kVA transformers (£674), and a 1,000-kVA transformer for Craven Road sub-station (£570).—British Electric Transformer Co., Ltd.
Extension of main switchboard at power station and supply of two new switches (£2,331).—Metropolitan-Vickers Electrical Co., Ltd.

Government Contracts.—The following Government contracts were placed during March, 1928:—

Admiralty Contract and Purchase Department.

Fan units.—Bull Motors, Ltd.
Telemotor-operated hoists.—McTaggart, Scott & Co., Ltd.
Incandescent electric lamps.—General Electric Co., Ltd.
Batteries, cells, &c.—D.P. Battery Co., Ltd.; Edison Swan Electric Co., Ltd.; Tudor Accumulator Co., Ltd.
Terminal blocks, &c.—Player & Mitchell, Ltd.; Pinnacle Switchgear & Fuse Co.; Edison Swan Electric Co., Ltd.
Distribution and junction boxes, &c.—General Electric Co., Ltd.; Telford, Grier & Mackay, Ltd.; Hawkers, Ltd.; Pinnacle Switchgear & Fuse Co.; Engineering and Lighting Equipment Co., Ltd.; Edison Swan Electric Co., Ltd.
Electric cable.—W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.
W./t. coils.—H. W. Sullivan, Ltd.; Johnson & Phillips, Ltd.
W./t. condenser units.—W. H. Dorman & Co., Ltd.
Conduit accessories.—Electrical Conduits Ltd.; Stella Conduit Co., Ltd.
Electric overhead travelling crane.—Clyde Crane & Engineering Co., Ltd.
Electric wharf crane.—Cowans, Sheldon & Co., Ltd.
Lightning conductor fittings.—G. Clark & Sons (Hull), Ltd.; Gabriel & Co., Ltd.; Hawkers, Ltd.; Player and Mitchell, Ltd.
Distribution fuse panels.—Engineering & Lighting Equipment, Ltd.
Automatic starters and resistances.—Watford Electric and Mfg. Co., Ltd.
Main controlling switchboard.—Whipp & Bourne, Ltd.
Fuse release switches.—Whipp & Bourne, Ltd.

War Office.

Electric cable and wire.—Macintosh Cable Co., Ltd.
Dynamos.—General Electric Co., Ltd.
Electric wire.—General Electric Co., Ltd.

Air Ministry.

Motor generator (Cranwell).—Electric Construction Co., Ltd.
Cable.—London Electric Wire Co. & Smiths, Ltd.
Airship electrical apparatus.—Haslam & Newton, Ltd.
Generators.—Haslam & Newton, Ltd.
Generator set spares.—Norman Engineering Co., Ltd.
Petrol-electric pack sets.—Stuart Turner, Ltd.

Post Office.

Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones Ltd.; International Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Terminal blocks.—T. De La Rue & Co., Ltd.; Ebonestos Insulators, Ltd.
Distributing boards.—Edison Swan Electric Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.
Joint-box castings.—Bradley & Turton, Ltd.; United Steel Companies, Ltd. (Thos. Butlin & Co.).
Loading coils.—Standard Telephones & Cables, Ltd.
Cords for telephones.—British Insulated Cables, Ltd.; L.P.S. Electrical Co, Ltd.; Phœnix Telephone and Electric Works, Ltd.
Telegraphic iron work.—Bullers, Ltd.; Guest, Keen and Nettlefold, Ltd.; Chas. Richards & Sons, Ltd.
Enamelled copper wire.—Concordia Electric Wire Co., Ltd.; Connollys (Blackley), Ltd.
Zinc rods.—Eyre Smelting Co., Ltd.
Battery replacement (Grimsby telephone exchange).—Hart Accumulator Co., Ltd.
Manufacture, supply, drawing-in and jointing cable Anglo-Irish (Ballyhornan-Belfast section).—Standard Telephones & Cables, Ltd.
Short-wave telephony power supply cabling (Rugby radio station).—Edmundson's Electricity Corporation, Ltd.
Telephone exchange equipment: Beeston and Bulwell (Nottingham area).—Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Electric Construction Co., Ltd., for charging machines; Alton Battery Co., Ltd., for batteries. Arnold, Sherwood, Manchester (Central), Langham, Brixton, Manchester (City), Holborn and Tandem, Epsom, Maida Vale and Speedwell: Automatic Telephone Mfg. Co., Ltd. Hazell, Watson and Viney, Ltd. (Aylesbury): Relay Automatic Telephone Co., Ltd. Gladstone: Ericsson Telephones, Ltd. Leytonstone: General Electric Co., Ltd. Hastings: Standard Telephones & Cables, Ltd. Sub-contractors for Gladstone, Leytonstone and Hastings: Crompton, Parkinson, Ltd., for charging and ringing machines; D.P. Battery Co., Ltd., for batteries. Pollards (London, S.W.): Siemens Bros. & Co., Ltd. Sub-contractors: Haslam & Newton, Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries.
Four-wire repeater equipment extension for Fenny Stratford repeater station.—Standard Telephones & Cables, Ltd.

Crown Agents for the Colonies.

Cables.—Callender's Cable & Construction Co., Ltd.; Brown, Lennox & Co., Ltd.; Macintosh Cable Co., Ltd.; Johnson & Phillips, Ltd.
Electric cookers.—Revo Electric Co., Ltd.
Generating sets.—Petters, Ltd.
Meters.—Ferranti, Ltd.; G. Kent, Ltd.; W. & S. Tylors, Ltd.
Switchgear extension.—British Thomson-Houston Co., Ltd.
Telephone materials.—Standard Telephones & Cables, Ltd.
Telephone switchboards.—Ericsson Telephones, Ltd.
Train-lighting spares.—Chloride Electrical Storage Co., Ltd.
Transmitting set.—Marconi's Wireless Telegraph Co., Ltd.
Wire.—British Insulated Cables, Ltd.; Whitecross Co., Ltd.

H.M. Office of Works.

Cable.—Callender's Cable & Construction Co., Ltd.

Glasgow.—Tramway Committee. Recommended:—
Special track work.—Titan Trackwork Co., Ltd.
Steel tubing.—Scottish Tube Co., Ltd.; and Stewarts and Lloyds, Ltd.

Electricity Committee.—
One 4-panel switchboard for Messrs. Campbell, Achnach and Co.'s premises (£672).—A. Reyrolle & Co., Ltd.

India.—Assam-Bengal Railway.
Train-lighting lamps.—Omega Lampworks, Ltd.

Irish Free State.—Dublin.—Posts and Telegraph contracts placed during March, 1929.
Battery-charging sets.—Metropolitan-Vickers Electrical Co., Ltd.
Bell sets.—Irish Telephone (New System) Co., Ltd.

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Cables.—W. T. Henley's Telegraph Works Co., Ltd.; Victor Zorn.
Cells.—Alton Battery Co., Ltd.; Le Carbone.
Repair of bridge Meggers.—Evershed & Vignoles, Ltd.
Microphone amplifiers.—Marconi (Ireland), Ltd.
Protectors (telephone).—Phœnix Telephone and Electric Works, Ltd.

—*Irish Electrician.*

Lichfield.—Town Council. Accepted:—
L.p. cable (£1,001).—W. T. Henley's Telegraph Works Co., Ltd.

Liverpool.—Mersey Docks and Harbour Board. Accepted:—
Electric cables.—Callender's Cable & Construction Co., Ltd.

London. — Islington. — Cleansing Committee. Recommended:—
Battery for electric vehicle, less allowance for old battery (£154).—D.P. Battery Co., Ltd.
St. Pancras.—Contract and Stores Committee.
L.p. cable:—

Siemens Bros. & Co., Ltd. (Recommended.)	£1,209
Hackbridge Cable Co., Ltd.	1,211
British Insulated Cables, Ltd.	1,231
Pirelli-General Cable Works, Ltd.	1,232
Standard Telephones & Cables, Ltd.	1,249
Greenwich Cable Works, Ltd.	1,395

London County Council.—Accepted:—
Control battery.—Edison Swan Electric Co., Ltd.
Public Control Committee. Accepted:—
Wiring and fittings for electric lighting at Bethnal Green coroner's court (£189).—Eons Electrical Co.
Education Committee. Accepted:—
Electrical installation at Beaufoy Institute extension (£390).—Stegman & Co.
Highways Committee. Accepted:—
Electrodes.—Premier Electric Welding Co., Ltd.; Quasi-Arc Co., Ltd.
Copper bonds.—British Insulated Cables, Ltd.
Commutators.—Dyer & Young, Ltd.
Stepney.—Electricity Supply Committee. Recommended:—
12 sub-feeder and 35 two-way and 36 single-way disconnecting boxes (£285).—Universal Electrical Mfg. Co.
Three steel chimneys, fans, flues, &c., for the Limehouse generating station (£4,445).—J. Keith & Blackman Co., Ltd.
Marylebone.—L. & N.E. Railway.
12 months' supply of vacuum and gasfilled lamps.—Siemens Electric Lamps & Supplies, Ltd.; Metro-Vick Supplies, Ltd.
Admiralty.
Radiators.—Edison Swan Electric Co., Ltd.

Peebles.—Town Council. Accepted:—
Electric lighting installation for the Municipal Buildings.—R. B. Scott.

South Africa.—Cape Town.—Electricity Committee. Recommended:—
Switchgear of A. Reyrolle & Co., Ltd.'s manufacture, 13-panel switchboard for Salt River sub-station (£5,004), 6-panel switchboard for Darling Street sub-station (£1,939), 7-panel switchboard for Roeland Street sub-station (£2,067), 3-panel switchboard for city consumers (£488), three 3-panel switchboards for private sub-stations (£1,159), 4-panel switchboard for Alhambra sub-station (£732).—A. Vaux, Ltd.
Cables in connection with the lighting of a new pavilion at Muizenberg (£340).—Paul Gregson, Urquhart & Co. (Craigpark Electric Cable Co., Ltd.).
30 tons .1 stranded bare copper wire (£3,315), 10 tons .075 stranded bare copper wire (£1,100).—Albert Vaux, Ltd.
50 miles indestructible type insulated wire (£1,167).—British Insulated Cables, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
H.p. switchgear and transformers (£5,220).—General Electric Co., Ltd.
L.p. cable (£9,501).—Union Cable Co., Ltd.

Forthcoming Events.

Institution of Electrical Engineers (Scottish Centre).—Friday, April 26th. Technical College, Dundee. 7.30 p.m. "Load Levelling Relays and their application in connection with Future Metering Problems." Mr. W. Holmes. "The Lothian Protective Gear for Distribution." Mr. H. C. Babb.
Saturday, April 27th. Excursion from Dundee to Elie by road.
(Western Centre).—Monday, April 29th. South Wales Institute of Engineers, Cardiff. 6 p.m. Kelvin Lecture. "Lightning." Dr. G. C. Simpson, F.R.S.

Institution of Electrical Engineers—*continued.*
(London Students' Section).—Friday, April 26th. Institution, London, W.C. 6.15 p.m. Annual general meeting. "The Manufacture and Testing of Submarine Cables." Mr. V. E. Connor.
(Meter and Instrument Section).—Friday, May 3rd. Institution, Savoy Place, W.C. 7 p.m. Address by the Chairman, Mr. G. D. Malcolm.
(Wireless Section).—Wednesday, May 1st. Institution, Savoy Place, W.C. 6 p.m. "A Portable Radio Intensity-Measuring Apparatus for High Frequencies." Dr. J. Hollingworth and Mr. R. Naismith.

Birmingham Electric Club.—Friday. April 26th. Grand Hotel. 7 p.m. "Electric Cables—Installation and Maintenance." Mr. H. Blades.

Electrical Trades Benevolent Institution.—Monday, April 29th. Institution of Electrical Engineers, Savoy Place, W.C.2. 2.30 p.m. Annual general meeting.

British Electrical Development Association (North-Midland Area).—Tuesday, April 30th. Royal Victoria Station Hotel, Sheffield. 7.30 p.m. Second Area Sales Conference. "Selling Electricity for Industrial Purposes." Mr. R. A. S. Thwaites.

Illuminating Engineering Society.—Tuesday, April 30th. Holophane, Ltd., Elverton Street, Westminster, S.W. 6.30 p.m. "Some Further Properties of Glass and their Application to Illuminating Engineering." Mr. S. English.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Holden recording chronograph.
Owen electric lighting plants (American).
Duroid insulation.

Notes.

Electrification in Lincolnshire.

Following the inquiry held at Lincoln in November last, the Electricity Commissioners are reported to have come to a decision with regard to the various applications for Special Orders in respect of the electrically unoccupied parts of the County of Lincoln. It is stated that the Commissioners have decided to grant the applications of the Yorkshire Electric Power Co. for the Isle of Axholme and District Electricity Special Order, the Yorkshire Electric Power (Eastern Extension) Electricity Special Order, and for a further area for which formal application is yet to be made. The area covered amounts to 750 square miles, and includes the rural districts of Howden and Riccall and part of the rural district of Escrick in the East Riding, the unoccupied part of the rural district of Tadcaster in the West Riding, and the whole of the unoccupied part of the administrative county of Lindsey (Lincoln) as far south as the existing southern boundaries of the Gainsborough and Caistor rural districts. The remainder of the unoccupied area in the administrative county of Lindsey, and the whole of the unoccupied area in the administrative county of Kesteven (Lincoln), is to be granted to Mr. R. Borlase Matthews, whose application under the Lincolnshire Electricity Special Order covered the whole of the unoccupied area in the administrative counties of Lindsey and Kesteven, partly overlapping the applications of the Power Company. Work is to commence so soon as the necessary Parliamentary confirmation has been obtained.

Diesel Engine Users' Association.

At a well-attended meeting of the Association on April 12th, Mr. H. O. Farmer, B.Sc., read "Some Notes on High-speed Oil Engines." He said that there appeared to be an increasing demand for a high-speed compression-ignition oil engine to take the place of the low-compression carburettor engine. The author confined discussion to the four-stroke-cycle engine, as it was with that type that most progress had been made.

Overhead Lines Association.

The date of the May meeting of the Overhead Lines Association has been altered from May 8th to May 15th. It will be held at 5.30 p.m. at the I.E.E. Building and Lt.-Col. Vignoles, D.S.O., M.I.E.E., will deal with the subject, "Getting Consumers in Rural Areas."

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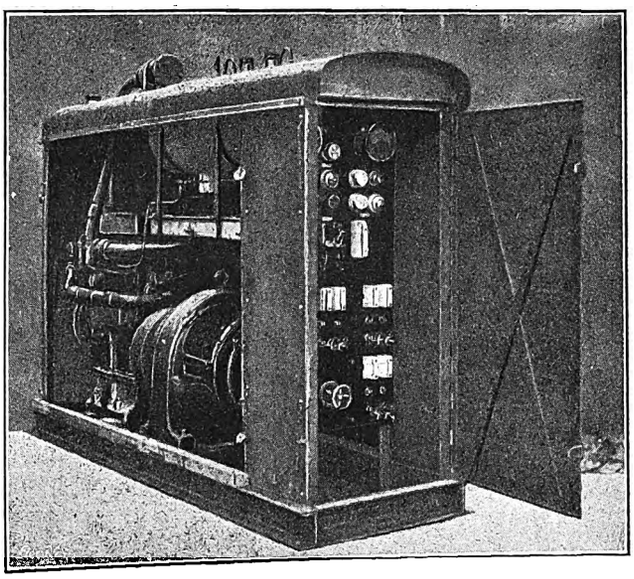
An Electric Furnace Installation.

In a recent issue of "Le Journal du Four Electrique," M. R. Sevin gives a description of the electric iron and steel furnaces which have recently been completed at the works at Saint Chely, France, of the Société des Acieries de Firminy. The plant comprises ten 1,000-kW single-phase furnaces, a three-phase one of 1,500 kW, a 12-ton electric molten-metal mixer, and a cupola for the smelting of foundry pig iron. The necessary electricity—about 50 million kWh per year—is being supplied from the hydro-electric stations at Albaret-le-Comtal and Malzieu.

An Emergency Ship-lighting Set.

The accompanying illustration depicts an interesting emergency ship-lighting set which has been produced by Aster, Ltd. The chief point of interest is in the arrangement of the plant, which is enclosed in a housing permanently attached to the bedplate of the set. This is of considerable advantage in the case of ships where space cannot be afforded in any of the existing structures. The arrangement is quite compact without in any way sacrificing accessibility. The switchboard is housed in a separate cubicle to which access is



Emergency Ship-lighting Set.

gained by means of a hinged door. The set has an output of 3 kW at 110 volts, 800 r.p.m. The engine is of the standard "Aster" 4-cylinder, vertical, 4-stroke-cycle, stationary, water-cooled, paraffin type of 6 b.h.p. It starts on petrol and is equipped with high-tension magneto ignition, a sensitive adjustable governor, and a heavy-type flywheel, with a pin-type flexible coupling. The dynamo is of the "Crompton" protected type, compound wound, with two end-shield bearings. The switchgear is mounted on a slate panel, with spring-controlled instruments, pilot lamp and bracket, earth-detecting set, &c.

Appointments Vacant.

Sub-station attendant (72s.) for the Brighton Corporation Electricity Department. Meter mechanic for the Rotherham Corporation Electricity Supply Department. Test-room assistant (£3) for the Leatherhead and District Electricity Co., Ltd. Engineer and manager (£800) for St. Helens Borough Council electricity undertaking. Borough electrical engineer and manager (£1,200) for the Hammersmith Borough Council Electricity Department. Workshop superintendent for the Telegraph Department of the Government of Ceylon. Junior scientific officer in the Admiralty Scientific Pool. Superintendent of posts and telegraphs workshops for the Sudan Government. Teacher of electrical engineering for Barnsley Education Committee. Assistant power superintendent (£471) for Stoke-on-Trent Corporation Electricity Department. Junior mains assistant, for Hull Corporation. Chief engineer and commercial manager, for Bridport Corporation. General manager and engineer, for Sheffield Corporation Electricity Department. (See our advertisement pages to-day.)

London Chamber of Commerce.

The Household Appliances Section of the London Chamber of Commerce, Inc., gave a luncheon at the Holborn Restaurant on April 23rd, the chief guest being Mr. H. Gordon Selfridge, Junr. After the loyal toast, Mr. Selfridge said that manufacturers must devote more of their activities and thoughts on how to sell what they manufactured. The factory superintendent must take second place to the selling organisation, and the sales department must think of new ideas to sell the product or the factory would go under. To persuade customers to buy, the sales manager must make what he had to sell as near a necessity as he could. He should be a psychologist and able to feel what the customer required. Salesmen needed a peg on which to hang the story of their products. A peg not used sufficiently was novelty and newness, as the desire for something which was novel and new was always with the customer.

Dublin Students at G.E.C. Works.

A party of students from the Mechanical Engineering Department of University College, Dublin, were the guests of the General Electric Co., Ltd., at the Osram Lamp Works, Hammersmith, recently. They were accompanied by Professor J. Taylor, M.A., M.Inst.C.E., and after a tour of these works were taken to the Glass Works and the Research Laboratories of the company at Wembley, where much interest was evinced in the various processes incidental to the manufacture of the newest forms of projector, lighthouse, and other types of "Osram" lamps and thermionic valves. The visit formed part of a week's itinerary arranged by the University and the Irish Free State Education Department.

Dry Recovery of Dust and Fume.

In a paper on this subject recently delivered before the Junior Institution of Engineers, Mr. B. V. Lambert gave the following reasons for the growing attention that is being given to dust recovery in various branches of the engineering industry: (1) The dust may be of value; (2) it may be obnoxious if allowed to settle in the neighbourhood of the plant; (3) it may be an undesirable constituent of a gaseous product; (4) it many constitute an explosion or fire hazard; and (5), in many respects the most important, it might be injurious to workers.

The methods of dust collection, or elimination, varied in accordance with the nature, size, and other qualities of the substance to be dealt with; generally, apparatus employing centrifugal action, such as cyclonic separators and centrifuges, and settling chambers and friction plates were most useful when the particles of dust were relatively coarse, but settling chambers should, in general, only be used as part of a multi-stage recovery process and where it is desired to cool hot gases preparatory to further treatment. Whilst those methods could account for a large proportion by weight of the dust they dealt with, smaller particles of the coarser dusts would escape collection, and those methods would be of little value when the particles formed clouds, *i.e.*, those whose diameter ranged from 10^{-3} to 10^{-5} cm, and practically useless for dealing with smoke whose particles ranged from 10^{-5} to 10^{-7} cm. in diameter. For very fine particles some form of bag filter, or recovery by electrostatic precipitation, was essential.

The latter was based on the principle that if a suitable electrostatic discharge took place within a vessel containing smoke, the smoke particles were almost instantly deposited upon the walls of the vessel. Plant on this principle utilised from 50,000 to 60,000 volts, which was maintained between two electrodes, the discharge electrode being in the form of a straight wire either hanging vertically within a metal cylinder or pipe, or between flat plates, on to which the dust was deposited, and from which it was removed by automatic, or manually-operated, rapping gear. The gases to be cleaned passed through the tube, or between the flat plates suspended in a flue. The collection efficiency of the apparatus might approach that of a good bag filter and was well adapted to the handling of gases at high temperatures and acid-forming gases, being in fact much used for the precipitation of sulphuric-acid mist.

Fatality.

An inquest was held recently into the cause of the death of John H. Lavers, who died from burns received when an explosion occurred in a switch cubicle in an underground chamber of the Charing Cross Electricity Supply Co. Evidence was given to show that the explosion was due to a faulty contact and vaporisation of the oil, which ignited. A formal verdict was returned, the jury adding a rider that the machinery should be inspected more frequently.

Improved Braking on the District Railway.

The London Underground electric railways have recently been experimenting on the District line with an improved form of high-speed electro-pneumatic brake so successfully that an order has been placed with a British firm for similar equipment for use on 100 of the 1920 steel-stock coaches, which cars are the heaviest in service on the line. Tests have shown that the deceleration of trains, long trains in particular, is both quicker and smoother with the new system of braking, it having been proved that an eight-car train can approach a station at 40 m.p.h. and accurately stop within two or three inches of a given mark in 20 seconds. The extra smoothness in stopping is achieved by simultaneous braking on all eight cars, which holds the train in uniform deceleration, and thus almost entirely does away with roughness and jerking at the rear end of the train when it is being pulled up. With the existing braking system, the brakes cannot be fully applied to the wheels of the last coach for at least four seconds after they have been applied to the front coach. Corresponding advantages are obtainable from the new form of braking in the act of releasing, which can be done simultaneously throughout the train, and the immediate release of brakes means that the train can get away much more quickly than formerly. The value of this feature is apparent when a close interval is being worked, and trains are consequently liable to occasional check by signals. In consequence of the greater flexibility of control, the time for which a train will occupy a

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station can be reduced by some four seconds, and where a close service is being maintained the total saving of time will accumulate sufficiently to make possible an increase in the number of trains operated per hour. The new braking system has, therefore, an important bearing upon the passenger-carrying capacity of an electrically-operated railway. It must be mentioned that the electrical apparatus is auxiliary to the ordinary braking apparatus; the latter is held in reserve in case of necessity.

Educational.

The Polytechnic, Regent Street, W., School of Engineering, Wireless and High-frequency Section.—A course of six lectures on thermionic valves and their uses in wireless and electrical engineering will be delivered by Mr. W. H. Date, B.Sc., on Wednesdays, commencing May 8th, at 6.30 p.m. Fee for the course, 7s. 6d. Particulars and syllabus can be obtained from the Director of Education. (See our advertisement pages to-day.)

A Diesel-electric Ship.

A recent inspection of the Diesel-electric oil tanker *Brunswick* revealed that the electrical machinery was in as good a condition to-day as when it was installed. The vessel is owned by the Atlantic Refining Co., of Philadelphia, U.S.A., and during the last seven months has covered 48,000 miles on the high seas separating California from South Africa, Australia, and New Zealand, with satisfaction to the owners and crew. The inspection of the machinery was made at Thameshaven a short time after the vessel had been on a voyage from California to Australia, where many persons of note in the shipping world had visited her at the various ports. It may be recalled that the *Brunswick* is the largest Diesel-electric ship so far built in this country, having a dead weight of 12,500 tons and a maximum displacement of 17,680 tons. Scotts' Shipbuilding and Engineering Co., Ltd., Greenock, built her and the British Thomson-Houston Co., Ltd., Rugby, manufactured the electrical propulsion equipment, auxiliary motors, and control gear for all services (see Electrical Review, September 21st, 1928, p. 467).

The Electrical Association for Women.

At the general meeting of the members of the Electrical Association for Women included in the recent one-day conference, Miss C. Haslett, director, outlined the activities of the Association. The following points are taken from her address:

Since the last annual meeting of the Association new branches have been formed at North Wales, Rugby, Hampshire, Swansea, Mid-Gloucestershire, North Staffordshire and Bristol. Many other branches are in process of formation throughout the country, and it is expected that the number of branches will be doubled during the coming year. The headquarters at Kensington Court continue to attract many visitors, including architects, educational authorities and oversea visitors. The Provincial Electric Supply Association presented a set of electric clocks for the club room and offices, which are very much appreciated. The Association is increasingly acting as a link for the placing of women as demonstrators and saleswomen in the electrical industry. A number of very interesting and important posts have been filled, apparently to the mutual satisfaction of the women concerned and the industry.

Requests have come from headmistresses of schools for a simple syllabus which can be used for a basis for electrical training in schools, and we are gratified to learn that the syllabus has already been brought into operation in one or two schools. The Association discovered, however, that very few schools are equipped with up-to-date electrical appliances on which instruction can be given. The Association is calling a conference of educational representatives and representatives of the electrical industry toward the end of April, to discuss this matter.

Evidence continues to come in that the report on the cooker enquiry prepared by the E.A.W. has been of some considerable use to the electrical industry. The journal of the Association, "The Electrical Age," is entirely self-supporting and brings in a small revenue. Evidence has been received that the journal is widely read in Germany and many other European countries, and also in America.

In their work they have been fortunate in securing the support of many university and educational authorities throughout the country. Well-known scientific bodies and engineers have co-operated in loaning the use of their various lecture halls and giving lecturing services. Invitations to attend important national conferences have been received from many of the electrical and agricultural associations, and similar bodies.

The rapid extension of their work would have been quite impossible without the financial assistance received from various sections of the electrical industry, and in this respect they especially thank the British Electrical Development Association for a generous donation and also Lieut.-Col. Vignoles, the director, and members of his staff, for service and help throughout the year.

The electrical outlet campaign has undoubtedly been a success. While the Association will continue to press forward its own campaign, it has become evident that a more comprehensive campaign, which should be run and financed by the electrical industry, is necessary. The suggestion has been made to the Electrical Development Association that it should conduct a supplemental campaign, thus bringing this all-important question of more outlets to the notice of the whole of the electrical industry and the public at large. The idea has been adopted, and next autumn an important National Campaign will be launched by the E.D.A., based on the preliminary work done by the E.A.W.

On April 11th, Mr. J. W. H. Cooper, of the E.L.M.A. Lighting Service Bureau, gave a particularly interesting talk to the Rugby Branch of the Electrical Association for Women on "Colour Lighting in the Home."

Dr. A. Bryce, M.D., gave an interesting lecture to members of the Birmingham and Midlands Branch of the Electrical Association for Women on April 17th on "Health."

Forced-draught Stokers on Marine Boilers.

An interesting development is announced by Messrs. Edward Bennis and Co., Ltd., in connection with their forced-draught stokers for marine boilers. As in the stokers for Lancashire boilers, the furnace grates of the new arrangement are composed of a number of hollow trough bars, with self-cleaning action, and fitted with sections of grid bars at the top which carry the fuel bed, but the air for combustion is introduced under pressure into the front tubular end of each trough by separate nozzles which penetrate the tubes a certain distance and are of maximum size consistent with the free movement of the enclosing tubes. The air nozzles are arranged upon a common air duct, fixed immediately in front of the grate, their centres corresponding with those of the firebar troughs, and the pressure of air in the duct is maintained by a fan. There is a separate duct to each furnace flue, proportioned to the volume of air required for the bars at the pressure used, each duct being connected to the fan delivery. This arrangement can be used either for air at atmospheric temperature, or with preheated air. In the latter case it is found advisable to prevent overheating of the bar grids by an interior cold-air circulation throughout the length of the grids, as these show a tendency to grow under the continual high temperature of the preheated air and fuel combustion combined. The cold air is obtained from the fan delivery, on the cold side, by a separate small duct or pipe and directed through the individual grids, which are of special hollow section, by tubular connections. It is finally guided through the fuel bed, on emerging from the rear end of the grids, having become heated in transit through them. The arrangement is applicable to boilers with 2, 3 or more flues. The ashes are withdrawn at intervals from below the rear ends of the grates by a long-handled shovel along the flue bottom, without disturbing the fires. Experiments have been carried out with a similar arrangement on a Lancashire boiler, but using air at atmospheric temperature, and the results have been compared with those on an adjacent boiler with air injection by means of steam jets; from the preliminary tests taken, the indications are that the air draught stoker has increased the evaporative capacity of the boiler by about 20 per cent., with an increased fuel efficiency of about 5 per cent., the overall efficiency of the plant being approximately 76 per cent.

Institution Notes.

Institution of Electrical Engineers.

Informal Meeting.—The final informal meeting of a session notable for excellent attendances and discussions upon a very wide range of subjects was held on April 15th (Mr. E. S. Ritter in the chair), when Mr. M. G. Tweedie opened a discussion upon "Power Supply and Railway Electrical Signalling." He confined his remarks to the control of the movements of steam trains on the main lines, in connection with which the problems were peculiar and formidable, and exhibited a number of lantern slides of diagrams of connections of the elaborate relays, signal locks, and lamps which have the responsibility of directing or holding trains. This vital apparatus must be of the finest quality and reliability, and it was the cost of that apparatus, together with that of the connections and transmission wiring, which retarded the abolition of manual signalling. The current required for signalling services was very small, and the cost of transmitting it to the site was often much more than the cost of wet cells, though they occasionally must be capable of providing 1,000 ampere-hours at 6 volts. The first and last requirement of the signal engineer was reliability; cheapness, too, was desirable, but it was a secondary matter.

Mr. G. H. Crook said the principle and practice of electric signalling was established, and he looked forward to the time when supplies of electricity would be more general, so that its use, where wanted, would be less expensive.

Mr. W. E. Lang observed that the signalling load was inconsiderable, while the cost of the apparatus was high. That railways had adopted electric signalling must have the justification of efficiency or ease of maintenance.

Mr. A. Morgan pointed out that the fundamental principle of railway signalling was that a failure of the controls produced a stop warning and meant safety. With industrial apparatus the push button and ordinary control gear were on the opposing principle, which was surely wrong. He felt that the relative immunity of Britain from accidents had retarded the adoption of electric signalling, because the cost factor operated.

Messrs. J. Coxon, W. A. Erlebach, H. W. Gregory, S. B.

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Jackson, E. S. Ritter, J. F. Shipley, and W. L. Wreford also spoke.

Mersey and North Wales (Liverpool) Centre.—At the annual general meeting on April 15th the undermentioned officers and new members of Committee were elected for the 1929-30 session. *Chairman:* Prof. W. E. Marchant; *vice-chairmen:* Messrs. T. B. Morgan and A. J. Pratt; *hon. treasurer:* Mr. L. Breach; *hon. secretary:* Mr. O. C. Waygood; *committee:* Messrs. R. G. Devey, J. Hamilton, H. H. Harrison, and F. B. Mercer.

Western Centre.—The following officers and new members of Committee have been nominated for the 1929-30 session. *Chairman:* Mr. S. B. Haslam; *second vice-chairman:* Mr. W. A. Scott; *committee:* (north of Bristol Channel, four vacancies) Messrs. J. M. Bowman, R. Illingworth, J. B. G. Lewis, T. E. Lewis, L. A. Snow, and S. Thomas; (south of Bristol Channel, one vacancy) Mr. A. M. Willis. The new Swansea sub-committee is represented on the Western Centre Committee by Messrs. R. G. Isaacs and H. O. Davies (hon. secretary).

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. J. H. Thomas, M.C., M.I.E.E., has relinquished his position as assistant manager of the Manchester branch of the General Electric Co., Ltd., and has taken up the position of general sales manager of A. C. Cossor, Ltd., valve and wireless manufacturers, of Highbury.

Mr. P. E. Johnson, constructional engineer at the Aylesbury municipal electricity works, has resigned.

Herr Ing. Alfons Peucker, director of the Electrowerke Gesellschaft, of Berlin, has been awarded the title of Honorary Doctor Engineer of the Technical High School of Brunswick for his work in connection with large electric power stations in Germany.

Mr. M. H. Aylesworth, president of the National Broadcasting Company of the U.S.A., has recently been here studying British broadcasting methods. He broadcast from Savoy Hill last Friday.

The Tilbury Urban Council has decided to increase the salary of the electricity works superintendent to £485 per annum in accordance with the E.P.E.A. scale.

Presentations have been made by Mr. W. Moxon, borough electrical engineer, Southport, on behalf of the staff, to three employés who are about to leave the service: Mr. C. Almond, who is retiring after 34 years' service, a gold watch chain with seal, and pipe; Mr. A. W. N. Brown, who is taking up a position at Bury St. Edmunds, an attaché case and pocket wallet; and Mr. W. Lymath, who has obtained an appointment in the postal service, a case containing a fountain pen and pencil and a pocket wallet.

The *Times* reports that Professor E. V. Appleton, Professor of Physics at King's College, has been awarded the Morris Liebmann Memorial Prize for 1929 by the American Institute of Radio Engineers for the most important contribution to wireless progress during the last twelve months.

Mr. Robert Shaw, who for 35 years has represented British Insulated Cables, Ltd., in the Manchester district, has just retired on pension. After an early training in the textile and calico printing industry, Mr. Shaw entered the electrical business. He was for some years on the staff of the International Okonite Co., Ltd., and left them in 1894 to start a branch office in Manchester for the British Insulated Wire Co., now British Insulated Cables, Ltd. Mr. W. H. Clift, who has been his chief assistant for 33 years, has been appointed to succeed him.

The marriage took place at Oswestry, on April 16th, of Mr. H. G. Finchett, assistant engineer and manager of the Oswestry Electric Lighting & Power Co., Ltd., to Miss D. E. Charles. Mr. Finchett was presented with a canteen of cutlery and a case of fish knives and forks by the staff and employés of the company.

Mr. F. Rowlinson, at present publicity manager to Messrs. Mather & Platt, Ltd., Manchester, is shortly to take over the establishment of a publicity department for the United Steel Companies, Ltd., Sheffield the large "vertical" group controlling the merger of steel and allied industrial firms. We understand that it is intended to enter into a far more vigorous publicity policy.

Islington Electricity Committee recommends that Mr. T. A. Watson, who was promoted to the position of relief charge engineer in December last, be promoted to charge engineer at £386 per annum, and that Mr. P. Briggs, assistant charge engineer and draughtsman, be promoted to relief charge engineer at £358 per annum.

Mr. Reginald Patman, electrical engineer to the London and North-Eastern Railway Co. at Grimsby and Immingham Docks, has been appointed assistant engineer to the Yorkshire Electric Power Co. at the Thornhill station. He has received a testimonial from his late colleagues at Grimsby and Immingham.

The *South African Engineer* states that Mr. John Roberts, Borough Electrical Engineer, at Durban, recently left for England per R.M.S. *Saxon* on a brief business trip on behalf of the Electricity Supply Commission, of which he is the local manager. This is Mr. Roberts's first holiday since his severe illness two years ago. Mr. E. Poole, assistant borough electrical engineer, is in charge of the department during his absence, Mr. J. Fowler Brown has been appointed acting local manager for the Commission.

Our contemporary also says that the gradual closing down of the Alice Street power station, following on the commencement of bulk supply from the Commission's Congella undertaking, has entailed the removal from the establishment list of the Municipal Electrical Department of a considerable number of positions. Mr. J. H. Gyles has now been officially appointed chief distribution engineer, but will still exercise certain supervision at Alice Street as long as the station continues to generate. Mr. D. Burnie's designation of assistant superintendent (mechanical) has now been altered to that of engineer-in-charge. In addition to his responsibility for the operation of the turbines, boilers, &c., he has control of the dismantling of the various units of plant as these become available for disposal.

Captain A. G. D. West has resigned from the engineering staff of the B.B.C. in order to join the staff of the Gramophone Co., Ltd. During the greater part of his term of service with the B.B.C., Captain West has been engaged on research in acoustics.

The engagement is announced of Mr. Charles Furness, engineer and tramway manager, Blackpool, and Mrs. McCandlish.

The marriage took place at Northampton, on April 18th, of Mr. W. T. Gibson, who is engaged with the International Standard Electric Corporation of Paris, and Miss Kathleen Mary Griffin, of Northampton. Mr. Gibson was awarded the O.B.E. for research work at the Salisbury Experimental Station during the War.

The Electricity Committee having reviewed the state of his health, Mr. R. Birkett, borough electrical engineer at Southend-on-Sea, has been given two months' sick leave, to be extended to three months if necessary. Mr. A. C. Johnson has been appointed acting borough electrical engineer during his absence. The Town Council has increased the salary of Mr. G. H. Robinson, first engineering assistant, from approximately £351 to £377 per annum, and that of Mr. C. Hopgood, second engineering assistant, from approximately £318 to £377 per annum.

The Swindon Town Council has appointed Mr. P. M. Chivers as chemist to the electricity department at £300 per annum.

According to the *South African Mining and Engineering Journal*, Major Arthur Langton, until lately Secretary to the British Trade Commissioner's office in Cape Town and formerly resident in Johannesburg, was last month under orders to proceed to Trinidad to take up the work of deputy to his Majesty's Trade Commissioner in the West Indies.

—Sir James Devonshire, K.B.E., has been appointed chairman of Edmundson's Electricity Corporation, Ltd.

Obituary.—Mr. J. Dawson.—The death is announced, in his 84th year, of Mr. John Dawson, who was for over 24 years electrician on the Aske Estate, near Richmond, Yorkshire, for the late Marquis of Zetland. He retired only five weeks ago.

Mr. R. Sparling.—The death is announced in America of Mr. Rowland Sparling, who served his apprenticeship to electrical engineering at Burnley. He was then appointed manager for Messrs. Greenwood & Co., electrical engineers, of Halifax. He travelled extensively through the Eastern, Middle and Western States, California, British Columbia, and Mexico. In the war he was chief mechanic for Capt. Vernon Castle, the famous aviator. He subsequently gained the reputation of being a daring and successful flier in America. In 1919 he established a school of motoring in Manchester, but, losing his wife, *wanderlust* overcame him, and he went to Canada, and from there to the Southern States of America.

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Mr. E. Hudson.—The death took place, on April 16th, of Mr. E. Hudson, Gobowen, secretary of the Oswestry Electric Lighting & Power Co., Ltd. Mr. Hudson had been associated with the company since its inception in 1894.

Mr. P. Bizet.—The death recently occurred at Montigny-les-Cormeilles, France, at the age of 61 years, of M. Paul Bizet, the managing director of the Compagnie Générale d'Electricité, of Paris. The deceased took a prominent part in the development of electricity supply in France and was a strong advocate of the linking-up of generating stations and distribution systems in all large districts.

Wills.—The late Mr. W. R. Spaven, tramway manager at Portsmouth for many years, left £1,487.

Mr. John Harris, a director of Clayton & Shuttleworth, Ltd., left £14,071 net and £16,264 gross personalty.

Mr. A. W. Seth, of Hayes, and Victoria Street, S.W., electrical engineer, left £9,615 net and £11,156 gross personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Electric Supplies and Repairs, Ltd.—Private company. Registered April 18th. Capital, £500 in £1 shares. Objects:—To carry on the business of electrical, manufacturing, and mechanical engineers, radio engineers, automobile engineers, &c. The directors are:—C. V. Stead, 46, Cavendish Road, West Didsbury, Manchester; G. C. Smith, "Caldy," St. Werburgh's Road North, Chorlton-cum-Hardy, Manchester.

Southend and District Electric Supply Co., Ltd.—Private company. Registered April 17th. Capital, £100 in 1s. shares. Objects:—To acquire the business formerly carried on at 17, Commercial Street, E.1, as "H. Goldman," and to carry on the business of dealers in and factors and suppliers of electrical, gas and radio appliances, fittings and apparatus, dealers in lamps, &c. The first directors are:—H. Goldman and B. Goldman, 29, Old Montague Street, Aldgate, E.1. Secretary: B. Goldman. Solicitors: Applebe & Morrison, 17, Commercial Street, E.1.

Western Heating and Stove Co., Ltd.—Private company. Registered April 13th. Capital, £2,000 in £1 shares. Objects:—To acquire the business carried on by E. M. Watts and L. W. Malcolm as the Western Heating and Stove Co., at 140b, Victoria Street, Bristol, and to carry on the business of heating and stove engineers, manufacturers of, and dealers in gas, electric, fuel, oil and other heating plants and installations, &c. The directors are:—Major E. M. Watts, Mudgedown, Iron Acton, Gloucestershire, L. Wentworth-Malcolm, The Haven, Weston Road, Failand, Somerset, manufacturers' agent. Registered office: 140, Victoria Street, Bristol.

Laing Electricity Supply Co., Ltd.—Public company. Registered April 16th in Edinburgh. Capital, £10,000 in 5,000 "A" and 5,000 "B" shares of £1 each. Objects:—To carry on the business indicated by the title. The directors are:—W. G. Davidson, Golspie, Sutherland, solicitor; H. Davidson, Laing, Sutherland, merchant; A. C. Macauley, Golspie, Sutherland, W.S. Registered office: 4, Duke Street, Golspie, Sutherland.

Electrode Welding Co., Ltd.—Private company. Registered April 15th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers and suppliers of and dealers in all raw materials for the electric valve and lamp-making industry, including the supply of electrodes, &c. The subscribers (each with one share) are:—W. H. Phillips and E. A. Froud, 35, Craven Street, W.C.2. Secretary: H. E. Wiltshire. Registered office: 8, Regent Street, S.W.1.

Western Electric Co., Ltd.—Registered as a private company April 15th. Capital: £20,000 in £1 shares. Objects: To carry on the business of manufacturers and sellers of equipment and apparatus for the reproduction, transmission, amplification or recording of sound by electrical or other means, independent of, or in connection or synchronism with, or as incidental to the exhibition of motion pictures, or for the transmission of pictures or images, whether moving or not, &c. The subscribers are:—H. G. Knox, St. Ermins, Westminster, S.W.1, electrical engineer; E. P. L. Pelly, Gonder, Penn, Bucks., engineer. The first directors are to be appointed by the subscribers. Solicitors: Johnson, Jecks & Colclough, 24, Austin Friars, E.C.

Eastnor Electric Co., Ltd.—Registered April 13th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, manufacturing, mechanical, radio and automobile engineers, specialists in tramway equipment, switchgear, and patent trolley bushes, &c. The directors are:—E. C. Johnson and Mrs. M. Johnson, 4, Rowsley Road, St. Annes-on-the-Sea. Secretary: E. C. Johnson. Registered office: 11b, Eastnor Street, Old Trafford, Manchester.

Belco (London), Ltd.—Private company. Registered April 19th. Capital, £2,000 in £1 shares. Objects:—To adopt an agreement between Belco, Ltd. (by its liquidator) of the first part, E. May of the second part, and this company of the third part, and to carry on the business of electrical merchants and wholesale dealers, dealers in electric lamps, electrical fittings, hardware, &c. The first directors are:—E. May, "Hadlow," Woodlands Road, Bickley, Kent, engineer; Dorothy M. Arnall, 21, Wallerton Gardens, East Sheen. Secretary: W. F. Bond. Registered office: 2, Castle Street, W.C.2.

Arnolds (Staines), Ltd.—Private company. Registered April 19th. Capital, £100 in 1s. shares. Objects:—To carry on operations in relation to radio-telegraphy and telephony in all branches. The subscribers (each with one share) are:—H. H. Matthews, 37, Oxford Street, Weston-super-Mare, manager; H. Stuckey, 26, Clarendon Road, Weston-super-Mare, master baker. Secretary: Mrs. I. G. Evans, 44, East Road, Wimborne, Dorset.

Gramo-Radio Amplifiers, Ltd.—Private company. Registered April 19th. Capital, £4,000 in 2,500 cumulative 10 per cent. preference shares of £1 each and 30,000 ordinary shares of 1s. each. Objects:—To acquire from G. E. Ward his interest in a certain invention for improvements relating to inter-valve couplings, and to carry on the business of electrical and motor engineers and contractors, manufacturers of and dealers in telegraphic, telephonic, and radio apparatus, &c. The subscribers (each with one share) are:—C. H. Francke, 5, Lucerne Road, Highbury Park, N.5, solicitor's clerk; Margaret Gray, 3, Robert Street, Holborn, W.C.1, shorthand-typist. Secretary (*pro tem.*): C. H. Francke. Registered office: 1a, New London Street, E.C.3.

British Portable Radio, Ltd.—Private company. Registered April 19th. Capital, £1,000 in 1s. shares. Objects:—To carry on the business of manufacturers, assemblers, maintainers and repairers of, and dealers in gramophones, phonographs, autoscopes, biographs, radio, telegraphic and telephonic apparatus, &c. The subscribers (each with one share) are:—Gladys I. Key, 43, Clarence Avenue, Ilford, Essex, solicitor's clerk; A. Ward, 77, Halley Road, Forest Gate, E.7, solicitor's clerk. Solicitors: Chatterton & Co., 231, Strand, W.C.2.

Official Returns of Electrical Companies.

Italian Asbestos Co., Ltd.—C. Latham, 78, New Oxford Street, W.C.1, ceased to act as receiver or manager on April 2nd, 1929.

Midland Valves, Ltd.—W. E. Withnall, 19, Temple Street, Birmingham, ceased to act as receiver or manager on April 5th, 1929.

Erith Electrical Company (Barber & White), Ltd.—L. G. Darling, Albion House, 87-89, Aldgate, E.C.1, ceased to act as receiver or manager on March 28th, 1929.

Phantestra (Renn's Gramophone & Wireless), Ltd.—Particulars filed of £35,000 debentures and premium of 5 per cent. authorised March 14th, 1929, charged on premises in London and Poole and the company's undertaking and other property, including uncalled capital, the whole amount being now issued.

Electric Construction Co., Ltd.—Satisfaction to the further extent of £5,850 on March 31st, 1929, of 4 per cent. perpetual 1st mortgage debenture stock secured by trust deed dated December 16th, 1897, securing £200,000.

Baxter & Caunter, Ltd.—Satisfaction (*a*) to the extent of £4,300 on March 6th, 1929, of debenture and mortgage dated June 23rd, 1924, securing £5,000, and (*b*) in full on same date of two charges dated July 8th, 1926, securing £3,066 13s. 4d., and £1,333 6s. 8d. respectively.

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B.S.A. Radio, Ltd.—Capital, £2,000 in £1 shares. Return dated February 8th, 1929. 2,000 shares taken up. £2,000 paid. Mortgages and charges, nil.

Barbados Electric Supply Corporation, Ltd.—Capital, £60,000 in £1 shares. Return dated January 14th, 1929. 56,621 shares taken up. £34,672 paid. £21,949 considered as paid. Mortgages and charges, £19,000.

Burma Electric Supply Co., Ltd.—Capital, £270,000 in 150,000 preference and 120,000 ordinary shares of £1 each. Return dated December 19th, 1928. 120,000 preference and 120,000 ordinary shares taken up. £100,000 paid on 100,000 preference shares. £140,000 considered as paid on 20,000 preference and 120,000 ordinary shares. Mortgages and charges, nil.

Rural Electricity Supply Co., Ltd.—Capital, £10,000 in 9,500 preference shares of £1 each and 10,000 deferred shares of 1s. each. Return dated August 7th, 1928 (filed March 5th, 1929). 5,512 preferred and 5,713 deferred shares taken up. £3,156 13s. paid on 2,871 preference and 5,713 deferred shares. £2,641 considered as paid on 2,641 preferred shares. Mortgages and charges, nil.

Pickvance, Ltd.—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated December 31st, 1928. 600 preference and 1,002 ordinary shares taken up. £650 paid on 450 preference and 200 ordinary shares. £952 considered as paid on the remainder. Mortgages and charges, £2,000.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated January 13th, 1929. 500 ordinary shares taken up. £500 considered as paid. Mortgages and charges, nil.

Power and Traction Finance Co., Ltd.—Capital, £250,000 in £1 shares. Return dated December 31st, 1928. 6,002 shares taken up. £6,002 paid. Mortgages and charges, nil.

Southern Brazil Electric Co., Ltd.—Capital, £507,800 in 650,000 ordinary shares of 10s. each and 182,800 10 per cent. cumulative preference shares of £1 each. Return dated December, 14th, 1928. All shares taken up. £3 10s. paid. £507,796 10s. considered as paid. Mortgages and charges, £861,550.

White, Jacoby & Co., Ltd.—Capital, £7,500 in £1 shares. Return dated January, 11th, 1929. 5,794 shares taken up. £3,437 paid. £2,357 considered as paid. Mortgages and charges, £1,500.

Norfolk Engineering Co., Ltd.—F. Heywood, 16, Cambridge Street, Sheffield, was appointed receiver and manager on March 30th, 1929, under powers contained in mortgage debentures dated July 12th, 1919, and October 25th, 1920.

Harris, Williams (Manufacturers), Ltd.—Debenture dated March 22nd, 1929, to secure £2,250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. Hall, 37, Groat Market, Newcastle-on-Tyne.

West Sussex Electrical Co., Ltd.—Issue on March 28th, 1929, of £200 debentures, part of a series already registered.

Mexican Hydro-Electric Development Syndicate, Ltd.—Issue on April 3rd, 1929, of £900 debentures, part of a series already registered.

Mico, Ltd.—A. F. Hawdon, 25, Sanderson Road, Newcastle-upon-Tyne, was appointed receiver and manager on March 28th, 1929, under powers contained in debenture dated March 28th, 1924.

Radio Experts, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1928 (filed February 1st, 1929). 200 shares taken up. £200 paid. Mortgages and charges, nil.

City Notes.

General Electric Co., Ltd.

As a result of the conferences between Sir Hugo Hirst, Bt., and Messrs. Chadbourne and Swope, representing the company's American shareholders, it has been decided to abandon the arrangement for the creation of 1,600,000 "British" ordinary shares with restrictions preventing them from falling into foreign hands. In a statement circulated to the shareholders last week Sir Hugo said: "These proposals were made with the sole object of increasing the prosperity of the company, of which I have been for many years the chairman and managing director, and were prompted by my view that a preponderating interest in our great industry should always be in British hands. I have always held the view that our scheme did not prejudice the property rights of or act unfairly towards any of our shareholders. Nothing was further from my mind or that of my colleagues, and we have no such intention. However, under all the circumstances of the case, with the assistance of the British, Foreign and Colonial Corporation, Ltd., it has been decided not to proceed with the proposals. We are certain that the general problem which such proposals has raised must receive consideration from eminent financial and economic authorities. This step, therefore, has been taken with a view to enabling that study to take place in a clear and calm atmosphere. I am sure that ultimately a way will be found to reconcile the needs of national industry with the requirements of any international obligations."

The American representatives, in expressing satisfaction at this decision, said that they had never questioned the sincerity of Sir Hugo's conviction that the scheme was for the best interests of the company, but they urged that it should not be such as to deprive existing shareholders of their rights to maintain their relative interests in the company. The American shareholders had no desire to control the General Electric Co.; that was proved by the fact that many of the shares had been purchased since the resolutions for the maintenance of British control were passed. They expressed their appreciation of the way in which they had been received, and of Sir Hugo Hirst's ability and integrity.

County of London Electric Supply Co., Ltd.

The annual meeting took place on April 16th. Sir Bernard E. Greenwell (vice-chairman) who presided in the unavoidable absence of the chairman (Sir Harry Renwick) read the chairman's speech. After referring with regret to the death of Sir James Hosker, a director, the chairman said that there was an increase in the electrical energy sold of 75,151,048 kWh. making a total of 323,462,367 kWh, an increase of 40,449 kW in the new business secured, making a total of 287,390 kW, and an addition of over 20,000 new consumers. Consumers had received benefits of over £200,000 during the past year as the result of reductions in electricity charges. Two part tariffs were introduced in January last and already a large number of consumers had taken advantage of them. The second half of the first section of Barking power station was now practically complete and in service, and the growth of business was so rapid that the Electricity Commissioners were being approached for their approval to the erection of a further section of the power station. The output of the station last year was about 363,000,000 kWh, an increase of about 72,000,000 kWh; that was apart from the Wandsworth station. Regarding the extension of the company's area of supply in the county of Essex, the Electricity Commissioners had approved a scheme for the development of the whole area and the necessary preliminaries for commencement of work on the scheme were now in hand. For the three months of the current year ended March 31st last there was an increase of 15 per cent. in the electricity sold over the corresponding period of last year, an increase in connections of 4,439 kW, and 2,748 new consumers. In addition, important negotiations were now pending with prospective large consumers. The company was now responsible for an area of nearly 1,000 sq. miles, and was the largest organisation of its kind in the country. Several undertakings had been purchased during the year and these additions involved areas amounting to 170 sq. miles. The general trade depression was reflected in the national consumption of electricity, and it was anticipated that the rate of increase over 1927 would not be more than 8 per cent. This increase, however, was favourable when compared with countries which had experienced a trade boom in 1928, the increases for which were as follows:—United States, 9 per cent.; Germany, 17 per cent.; Italy, 12 per cent.; Canada, 16 per cent.; and Switzerland, 10 per cent. The report and accounts were adopted and Sir Thomas Bethell and Mr. Robert Renwick were appointed to the Board.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The directors' report for the past year states that in order to provide capital for further development they have issued 300,000 6 per cent. cumulative preference and 255,000 "B" ordinary shares, and a premium of £54,125 on the issue has been transferred to a reserve appropriation account. The net receipts amounted to £303,950 (against £276,448 in 1927), and the addition of £45,629 brought forward makes available £349,579. After deducting expenses, rates and debenture and loan interest, there is a balance of £188,621. The 6 per cent. preference dividend is paid; a final dividend of 4 per cent. (making 8 per cent. for the year) is paid on the "A" ordinary shares; and the "B" ordinary shares receive 7½ per cent. The balance (£92,621) is placed to reserve appropriation account. From the latter account £18,937 is written off expenses; £2,392 is set aside for the inauguration of an endowment fund for weekly workers; £50,000 is placed to reserve; and a balance of £78,937 is carried forward. The capital expenditure during the year was £379,712, and approximately 100 miles of overhead and underground cables were brought into service, making the total about 500 miles. The installation of a further 20,000-kW set at the Stourport station is proceeding satisfactorily. The company has acquired a controlling interest in the Ledbury and Stratford-on-Avon undertakings, and the assets of the Church Stretton and Shipston-on-Stour undertakings; the purchases were made for cash. The whole of the issued capital of the Banbury and District Electric Supply Co., Ltd., was acquired, the consideration being £3,000 in cash and 50,000 "B" ordinary shares. The number of

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consumers rose by 27 per cent. during the year, and the sales of energy by 12 per cent., despite the industrial depression. In addition to the extensions of supply already mentioned, supplies of electricity have been made available in about 20 districts. The company's Bill increasing its capital and borrowing powers and extending the area of supply has received the Royal Assent. The Stourport and Smethwick stations have been "selected" under the Central England Electricity Scheme. Arrangements have been made for the interchange of supplies with the Wessex Electricity Company and the West Midland Joint Electricity Authority. After the ordinary meeting on April 30th, an extraordinary meeting will be held to consider resolutions authorising the creation of 350,000 6 per cent. cumulative preference shares to be issued at the directors' discretion.

Anglo-Portuguese Telephone Co., Ltd.

The report for the year ended December 31st last states that the capital expenditure during that period amounted to £117,097. The gross income was £170,019 and the gross profit £58,618. After adding bank interest and providing for debenture interest, &c., there was a net profit of £42,886, as compared with £31,412 for 1927. A balance of £74,299 brought forward is added, making £117,185. Of this, £25,000 is placed to general reserve, and it is proposed to pay a final dividend of 5 per cent. on the ordinary shares, again making 8 per cent. for the year, and to pay a dividend of 8 per cent. on the "A" ordinary shares, leaving a balance of £39,751 to be carried forward. In connection with the new concession granted in January last year covering a period of 40 years, with a possible extension for a further 25 years, a decree was published in August last authorising the company to put into force a new scale of tariffs, as from September 1st, 1928. The report records the death of Mr. John Lee, C.B.E., a director, and the appointment of Dr. Pinheiro Chagas and Mr. E. P. Basto to the Portugal board. Meeting: April 29th.

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Albert Electrical Co., Ltd.
Atelan Wireless Co., Ltd.
British Gramophone & Wireless Co., Ltd.
Compare Secret Radio Telegraph Co., Ltd.
Freshwater and District Electric Supply Co., Ltd.
Norton Electric, Ltd.
Princess Electrical Co., Ltd.
Radio Recorders, Ltd.
Reliance Electrical Supplies, Ltd.
Switchgear & Electrical Productions, Ltd.
Travelling Electric Night Signs, Ltd.
Trust Electrical Accessories Mfg. Co., Ltd.
Wavelengths, Ltd.
Westminster Battery Co., Ltd.
Wireless & General Engineers, Ltd.
Wireless Waves Co., Ltd.

Cork Electric Supply Co., Ltd.

The accounts for the year ended December 31st last show a total revenue of £136,328, as compared with £132,836 in 1927. The net revenue rose from £47,220 to £49,186. After meeting debenture interest, &c., transferring £15,000 to depreciation and renewals reserve and £7,500 to general reserve, and adding interest (£1,147) and £13,988 brought forward, there remains a balance of £35,147. The old ordinary shares are to receive a final dividend of 5 per cent. (again making 10 per cent. for the year), and the new ordinary shares a dividend at the rate of 5 per cent., leaving £15,758 to be carried forward. The number of passengers carried rose from 7,819,902 to 8,776,670 and the amount of energy sold from 7,293,702 to 7,732,325 kWh. Meeting: To-day (Friday).

Hydro-Electric Securities Corporation.

The report for 1928 shows that during the year $20,000,000 of 5 per cent. class "B" cumulative participating preferred stock was issued, and subscribers were given an option of taking up one share of common stock for each two preference shares at $25 per share. The total income was $1,296,438 and the net income $1,159,134. In addition the company received dividends payable in shares of a market value of $635,568; these were not treated as income. After meeting the dividend due on the "B" cumulative preferred stock, &c., there was a surplus of $1,021,837. The report states that about 89 per cent. of the company's investments are in the United States, the remainder being spread over companies operating in Spain, Italy, Belgium, Mexico and Brazil. The investments are said to have had a market value of $51,420,711 at December 31st last, since when a further $15,000,000 has been added.

Indo-European Telegraph Co., Ltd.

The report for 1928 states that an interruption occurred in the Crimea owing to bad weather, but working was maintained over lines placed at the company's disposal by the Soviet Government. Arrangements were made during the year for the installation of regenerators at various points on the line between London and Karachi in both directions. The revenue fell from £318,140 to £291,834, and the expenses from £212,562 to £207,459. The balance was thus £84,375, and after providing for income tax and adding £19,991 brought forward, there is an available balance of £87,367. The writing-down of various items absorbs £15,000, and it is proposed to pay a final dividend of £1 2s. 6d. per share (making 7 per cent. for the year) together with a bonus of 15s. per share, both free of tax, as in 1927. It is also proposed to hand over £15,000 to the trustees of the retirement trust fund, leaving £14,867 to be carried forward. The meeting was to be held yesterday (Thursday).

Electrical Finance and Securities Co., Ltd.

After meeting debenture interest, &c., the balance on the profit and loss account for the year ended December 31st last is £15,399 (against £12,877), and to this is added £3,474 brought forward, making £18,873. It is proposed to pay a final dividend of 6 per cent., making 10 per cent. for the year in the case of 98,000 shares. The ordinary capital has been raised to £150,000, and the ordinary shareholders have been offered 50,000 shares at 32s. 6d. per share. The premium received will be devoted to meeting the expenses of the issue and other capital expenses, the balance being transferred to reserve. Mention is made of the progress of the following companies in which the company is interested: The Northwood Electric Light & Power Co., Ltd., the Foots Cray Electricity Supply Co., Ltd., the Colne Valley Electric Supply Co., Ltd., the Boston and District Electric Supply Co., Ltd., and the Lothians Electric Power Co.

The Cable-Wireless Merger.

The committees representing the holders of the preference and £1 ordinary shares of Marconi's Wireless Telegraph Co., Ltd., convened a meeting of these shareholders on April 17th. The Hon. W. B. L. Barrington, who presided, said that they felt that an injustice was being done to them. Under the merger scheme they should have received twice as many shares as the holders of the 10s. ordinary shares, instead of which the merger company offered them what amounted to a capital sum of only 10s. more than the 10s. shares were to get. There was, however, nothing to compel the £1 shareholders to concur in the scheme and sell their shares.

A resolution was passed approving the Committee's action, and it was stated that nothing further would be done until it was ascertained whether the proposed scheme was to be proceeded with.

A committee representing the holders of the 10s. shares is already in existence in Ireland, and a similar body representing the English holders is suggested.

The directors of the Eastern Telegraph Co., Ltd., the Eastern Extension, Australasia and China Telegraph Co., Ltd., and the Western Telegraph Co., Ltd., announce that the shareholders' registers will be closed from April 30th to May 21st inclusive in connection with the forthcoming offer from Cables & Wireless, Ltd

It is stated by the directors of Cables & Wireless, Ltd., that the offer when made will be conditional on its acceptance by 60 per cent. (or such smaller percentage as may be approved by the Government) of the ordinary shareholders of the cable companies and each of the three classes of shareholders in the Marconi Company.

South London Electric Supply Corporation, Ltd.

The annual meeting was held on April 16th, Lieut-Col. Sir Frederick Hall presiding. In moving the adoption of the report and accounts the chairman said that during the past year progress had been well maintained. There was an increase of 2,479,847 kWh in the amount of electricity sold, and a substantial increase in the kW applied for. As to the current year, the progress indicated by the first three months' business was excellent. The introduction of a two-part tariff scheme for consumers would shortly be announced, under which the proposed running charge would be 1d. per kWh.

North American Co.

The net earnings for 1928 were $22,582,721. The company, which controls the production and supply of electrical and gas power over five large sections of the United States, is one of the most important American public utility concerns, and its results are usually regarded as a valuable barometer of U.S. industrial conditions. The output of electricity by the various companies in the group reached the record figure last year of 6,000,000,000 kWh, an increase over the previous year of 14.36 per cent. The number of customers supplied was 1,169,046.

Malacca Electric Lighting Co.

After providing for depreciation, &c., and transferring $20,000 to reserve, the accounts for the past year show a profit of $107,999. A final dividend of 7½ per cent. is paid, making 12½ per cent. for the year, and $14,249 is carried forward, subject to directors' fees.

Constantinople Telephone Co.

The Times states that 3½ per cent. interest (3s. 6d. per share) will be paid on the share capital of the company paid up for 1928, to those registered on April 20th, and on Coupon No. 5 attached to bearer share certificates.

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Manitoba Power Co.

The annual financial statement of the Manitoba Power Co. showed that 1928 was the best year in its history, sales of power having increased 38 per cent. over the previous year. Gross operating earnings amounted to $1,218,125, against $1,002,290 for the previous year, and net earnings were $398,606, an increase of $156,000. Dividends of $2,50 per share were paid, and after all deductions a net surplus of $72,959 was carried forward.

Canada Northern Power Co.

Substantial progress in the operations of the Canada Northern Power Co., accompanied by an expansion of earnings, are indicated by the annual report for the year 1928. During the year two new units in the Quinze plant were completed, adding 27,000 kVA to the capacity. Gross earnings were $3,088,529, as compared with $2,812,514, and net earnings were $2,198,789, against $1,961,701. After deductions for dividends, depreciation, &c., there remained a profit and loss surplus of $1,490,460.

City Electric Light Co., Ltd. (Brisbane).

The directors' report for the year ended January 31st, 1929, showed that after providing for sinking fund, renewals, replacements, reserve, &c., there was a credit balance of £120,308, to which was added £34 brought forward, making £120,342. Interim dividends amounting to £59,138 were paid in September last, and further dividends (including 5 per cent. on the ordinary shares, free of State tax) are being paid, totalling £61,165, and leaving £39 to be carried forward.

Bath Electric Tramways, Ltd.

In addressing the annual meeting on April 16th, the chairman (Mr. E. H. R. Trenow) said that the continued depression in the coal industry had led to a decrease in the company's revenue. They had increased their generating efficiency and reduced their fuel costs, and they hoped to do even better during the current year. They had been able to continue their fares at 40 per cent. above the pre-war level. The dividend of 3½ per cent. was maintained.

Bridgwater and District Electric Supply and Traction Co., Ltd.

The profit for the past year, after meeting debenture interest, depreciation, and preference dividend, was £1,463, and £783 brought forward is added, making £2,246. The directors propose to pay an ordinary dividend of 6 per cent. and to carry forward £1,047. During the year the capital was increased to £130,000, and 50,000 7 per cent. £1 preference shares were issued.

Cornwall Electric Power Co.

The profit of this (Parliamentary) company for the year ended December 31st, 1928, was £17,607, as compared with £26,135. A dividend of 7 per cent. is recommended on the ordinary shares, against 8 per cent. for 1927.

Cornwall Power Co., Ltd.

The profit for the past year was £20,608, as compared with £20,728 in the preceding year. To this is added £2,588 brought forward, making £23,196. The ordinary dividend is 4 per cent., against 5 per cent. for 1927, and after writing £1,500 off preliminary expenses, £2,696 is carried forward. The meeting was to be held yesterday (Thursday).

Winnipeg Electric Railway Co.

The gross income for 1928 was $6,076,638 and the net income $1,219,023. The preferred stock dividend has been paid, and two dividends of $1 per share have been paid on the common shares. After contributing $77,500 to the sinking fund reserve, $374,373 is carried forward.

Yorkshire (Woollen District) Electric Tramways, Ltd.

The total receipts for the past year were £271,758, and after meeting all expenses and setting aside £40,000 for the renewals fund, there remains £19,455. From this £10,000 is placed to reserve, and 6 per cent. is paid on the ordinary shares, leaving £17,894 to be carried forward.

Official Announcement *re* Companies.

In our issue of March 29th we printed the official *Gazette* intimation to the effect that the Forward Electric Co., Ltd., would be struck off the register unless cause were shown to the contrary within three months. We are asked to state that this announcement was made by the Companies Registration Office because several letters addressed to the company's last recorded registered office had been returned marked "Gone away." We understand that the proceedings have now been stayed.

Mansfield and District Tramways, Ltd.

The accounts for the year ended December 31st last record a profit of £1,936 (against £10,568), to which is added £4,717 brought forward, making £9,653. After providing for debenture interest, &c., there remains £3,366 which the directors propose to carry forward.

Associated Electrical Industries, Ltd.

The directors of this company recommend a dividend of 6 per cent. on the ordinary shares for 1928. Last year a similar distribution was made on the ordinary shares of the Metropolitan-Vickers Electrical Co., Ltd.

Western Union Telegraph Co.

The gross revenues for the quarter ended March 31st last were $35,228,385, against $32,210,169 for the corresponding period of 1928. The net income was $3,586,194, against $2,980,032.

Great Northern Telegraph Co. of Denmark.

The total dividend and bonus for the past year is 20 per cent., as in 1927. Of this 5 per cent. has been paid. The reserve and renewal fund receives £33,333, and the pension fund £38,888; £224,823 is being carried forward.

Hopkinsons, Ltd.

The profit for the year ended January 31st last was £94,708, as compared with £71,578 in 1927. The dividend is maintained at 10 per cent., and £20,000 (against £10,000) is put to reserve, £19,311 being carried forward.

Calcutta Electric Supply Corporation, Ltd.

The directors recommend a final dividend on the ordinary shares of 7 per cent., making 12 per cent. for the year; also a bonus in cash of 4d. per ordinary share.

Erinoid, Ltd.

An interim dividend of 2½ per cent. (against 3 per cent.) has been declared.

Lima Light, Power and Tramways Co.

A dividend of 72 centavos (or 1s. 2.8d.) per share has been declared on the ordinary shares.

Haslam & Newton, Ltd.

An interim dividend at the rate of 2½ per cent. per annum has been declared on the ordinary shares.

Howard & Bullough, Ltd.

A final dividend of 1¼ per cent., making 8½ per cent. (against 10 per cent.) for the year has been declared.

Herbert Morris, Ltd.

An interim dividend at the rate of 10 per cent. per annum has been declared on the ordinary shares.

Brush Electrical Engineering Co., Ltd.

A dividend of 10 per cent. is recommended in respect of the past year. The distribution was the same for 1927.

Wood & Cairns, Ltd.

The directors have declared a dividend of 5 per cent. on the ordinary shares for the year ended December 31st, 1928.

Austrian Company.

The *Siemens-Schuckertwerke Gesellschaft*, Vienna, proposes to alter the share denomination from 15 to 150 schillings by combining ten of the old shares into one. The value of the shares will then be increased to 200 sch. by capitalising 8½ millions from the special reserve fund, the capital being thus raised from 26½ to 35 million sch. If the proposals are approved a dividend of 6 per cent. will be paid on the new capital total for the last financial year.

Belgian Companies.

The *Société de Constructions Electriques de Belgique* reports that the orders booked in 1928 showed notable progress over those in the previous year. This has rendered necessary the enlargement of certain departments at the Herstal works. For 1928 profits of 3,232,000 fr. are recorded, and the dividend is at the rate of 15 fr. per share.

The *Société Belge pour la Fabrication des Câbles* states that the results obtained in 1928 were most satisfactory despite the expenses involved in the further modernisation and development of the works. The extensions of the cable department are in process of being completed, but it is intended further to enlarge the programme in order to be able to meet the demands of customers, particularly those overseas. The net profits are returned at 2,600,000 fr., and the dividend on the ordinary shares is at the rate of 61.80 fr. per share.

The *Société de Ateliers de Constructions Electriques de Charleroi* reports a gross profit of 24,826,921 fr. for last year as compared with 20,555,401 fr. in 1927. After allotting 9,580,000 fr. to depreciation and making provision for reserves, &c., the net profit amounts to 12,815,634 fr. (approximately £73,232) as against 10,946,211 fr. (£62,550) in the preceding twelve months.

French Company.

The *Compagnie Electro-Mécanique* reports net profits of 13,094,000 fr. for 1928. The dividend is raised from 7 to 9 per cent.

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Dutch Companies.

The *Nederlandsche Kabelfabrik Maatschappij*, The Hague, is paying a dividend of 21 per cent. for the past financial year on a capital of 5 million guilders as compared with 30 per cent. on 2½ million guilders for the preceding twelve months.

The Amsterdam correspondent of the *Financial Times* states that Philips Glow Lamps, Eindhoven, announces the issue next month of new ordinary and new cumulative preference shares. The new ordinary shares will be offered to existing ordinary shareholders on a basis of one new share for each two shares held, the issue price being 250 per cent. New cumulative preference shares will be offered in the same ratio to existing preference shareholders at 130 per cent.

Swedish Company.

A.B. Elektrolux.—This concern reports a net profit of Kr. 8,520,227 for 1928. From this provision is made for taxation, depreciation and the writing-down of patents to Kr. 1, and Kr. 1,000,000 is placed to reserve. After the payment of a dividend of 9 per cent. on the "A" and "B" shares there is a surplus making the total surplus Kr. 700,968.

German Companies.

The *German Telephone Works and Cable Industry Co.*, Berlin, reports net profits of 87,000 marks for the past year, against 600,000 marks in 1926-27.

The *German Cable Works Co.*, Berlin, reports net profits of 334,000 marks for 1928 (against 30,000 marks). As the American loan is due for repayment in 1930, it is considered advisable to conserve the profits.

The *North German Cable Works Co.*, Berlin, announces net profits of 470,000 marks, against 250,000 marks in 1927; the dividend is raised from 8 to 10 per cent.

The *Concordia Electricity Works Co.*, Dusseldorf, states that the net profits declined from 263,000 marks in 1927 to 175,000 marks. The dividend is reduced from 6 to 4 per cent.

The *Electricity Supply Co.*, Berlin, reports that it has obtained a concession from the Turkish Government for 50 years for the establishment and operation of electricity works in Adana; it is intended to form a Turkish company with a capital of T£1,000,000 to carry out the undertaking. The net profits for 1928 were 3,789,000 marks, against 3,231,000 marks in 1927, and the dividend remains at 10 per cent.

The *Bergmann Electricity Works Co.*, Berlin, reports that the turnover in 1928 increased by 15 per cent. to 115,000,000 marks. Both in Germany and abroad the results suffered from the low level of prices and further increases in wages, taxes, &c. The support which foreign electrical industry receives from financial groups renders it increasingly difficult for the Germans to carry on export trade, and the penetration of foreign industries into Germany has become stronger. The net profits amounted to 4,480,000 marks, and the dividend remains at 9 per cent.

The *Duisburg Cable Works Co.* proposes to maintain the rate of distribution for 1928 at 10 per cent.

The *North German Cable Works Co.*, Berlin, intends to pay a dividend of 10 per cent. for 1928 on share capital of 4,000,000 marks, this comparing with 8 per cent. on 2,500,000 marks in the previous year.

Oriental Telephone and Electric Co., Ltd.

A final ordinary dividend of 8 per cent. (free of tax) is recommended, again making 12 per cent. (tax-free) for the year.

Bournemouth and Poole Electricity Supply Co., Ltd.

A final dividend of 9 per cent. is recommended on the ordinary shares, making 15 per cent. for the year, as for 1927.

Richmond (Surrey) Electric Light and Power Co., Ltd.

The directors have declared a final dividend of 7 per cent. on the ordinary shares, making 11 per cent. for the year, against 10 per cent. for 1927.

Stocks and Shares.

Monday Evening.

The tendency of Stock Exchange markets as a whole is coloured by the advent of the General Election. It will be needful, unfortunately, to refer to this consideration on various occasions during the next few weeks, because it becomes increasingly obvious that investment feels a twinge of uneasiness at the prospect of what may happen as a result of the contest. The Budget has had very little effect upon prices in the Stock Exchange, and by the time that these paragraphs appear it will have been almost forgotten. The various proposals put forward by the different political parties in regard to unemployment are accepted at their face value, though from statements which have appeared in responsible quarters within the past week or so, it is apparent that trade has taken a definite turn for the better. Strong efforts will be made, at all events for a time, to impart whatever assistance can be afforded to industry through the medium of Governmental action. Therefore the prices of stocks and shares in purely industrial companies are well maintained. Reference to our own lists of the present week shows that there is no apprehension on the part of the considerable body of investors interested in electricity supply, manufacturing and allied undertakings.

Marconi Controversy.

Clouds of controversy continue to surround the position of the Marconi Company in relation to its participation in the merger undertakings. Holders of the £1 shares are not going to sit down quietly under the company's proposals already outlined in these pages. Put in a nutshell, they—the proprietors—maintain that their £1 shares are worth in all respects exactly twice the 10s. shares. Committees of both classes of shareholders have been formed, threats of legal action arise from one side or the other; and, in the meantime, the price of the 10s. shares moves within narrow limits in the market. Marconis stood at 86s. 3d. on the eve of the merger particulars being announced. They fell to 82s. on the announcement, recovered to 86s. 6d., and now are back to 83s. 9d. If the contention of the £1 shareholders should be correct, and the claim put forward by themselves is upheld, this might easily bring in selling on behalf of holders of the 10s. shares. It is the uncertainty in regard to the precise situation of affairs which is causing the present dullness in the market. Unless agreement can be reached, or a compromise effected, the prospect is for lengthy and costly disputes, which, while they are in course of progress, will prevent the share settling down into a steady market. Meanwhile, the £1 shares are 5s. better, at £5, and the 7 per cent. participating preference shares show a gain of 2s. 6d. at £5. Marconi Marines have strengthened to 65s. Canadians are 32s. 6d.

The Cable Group.

Stocks and shares in the cable group eased off to a trifling extent, as a natural sequel to the publication of terms which had been expected for more than twelve months. The realisation of their hopes by people who had bought the stocks and shares considerably lower down has been followed by profit-taking. This is, of course, the ordinary procedure which is anticipated in the Stock Exchange. Prices recovered as soon as the few sellers had finished dealing. It is not too optimistic to look for Eastern ordinary to go to about £300, and Eastern Extension and Westerns to the relative neighbourhood of £30. Globe Telegraph and Trust are deemed by some people to be cheaper than either of the other three issues, though the fact of the company not being actually included in the combine detracts sentimentally, and, for the time being, from the value of the shares. The Indo-European Company has declared a dividend and bonus of £1 17s. 6d. net, the same as that of a year ago. This makes 10 per cent. net for the full twelve-month. Of the Anglo-American descriptions, the deferred hardened to 24¼, the preferred to 102½. Spasmodic movements in the Anglo-American group have resulted in American Telephone and Telegraph being quoted at 235, and Internationals at 270, both substantially higher than the figures of a few days ago. A new trust company, called the Radio Securities Corporation has been formed in New York. A million "A" shares of 5 dollars each were offered. The trust's holdings will include Marconis, General Electrics, and a variety of others.

Home Railway Heaviness.

Working in conjunction with each other, the London and North-Eastern and the London, Midland, Scottish announce that this month will see the commencement of the erection of the overhead electrical equipment for the Manchester South Junction and Altrincham line. Considerably accelerated train services are promised when the electrical traction system starts. Home Railway stocks are dull in consequence of the meagre additional aid promised in the Budget to the industry. Many stockholders had been looking for more tangible relief to the railway companies than Mr. Churchill proposes to give. Undergrounds have sympathetically drooped. Falls occurred in Metropolitans, in Districts, and in the two active issues of the Underground Electric Railways of London.

General Electrics.

There is an air of anti-climax about the withdrawal of the hotly-debated General Electric proposals to issue "British" capital. The chairman says that nothing was further from the minds of the directors than any scheme which would prejudice the property rights of, or act unfairly towards, "any of our shareholders." The incident is closed by the abandonment of the company's proposals. The price of the shares is 3/16 higher at 3¼, and the recent animation has given way to quieter conditions in the market.

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Electricity Supply.

County of London ordinary shares rose 1s. 6d., to 54s. 6d., as a result of the meeting and the reading of Sir Harry Renwick's speech, which combined illumination with optimism County of London proprietors cannot complain that their chairman's hopefulness has ever, so far, failed them. Lively anticipation awaits details of the new issues to be made at bonus prices. Brompton Electrics are a shade lower at 26s. 6d. Electric Supply Corporation at 56s. 3d. are 1/16 up. Lancashire Light and Power ordinary at 29s. have gone back 1s. The company's offer of new shares, at 27s., proved attractive, and the subscription lists were open but a short time. In the foreign group, Whitehall 7½ per cent. preference came into favour, and the price at 21s. has gained sixpence.

Clyde Valley.

The meeting to sanction the Clyde Valley Company's new issue proposals was called for Wednesday in this week. It may be recalled that three new ordinary are to be offered, at 20s. for every four old shares now held. The price of the latter is 43s. 3d. Under the present proposals, the 200,000 unissued second preference shares will be cancelled.

Jump in Associated Electrics.

British Insulated ordinary at 4⅝ are 1/16 up, the issue of new shares having been duly authorised at the meeting held last week at Liverpool. One new ordinary for every four, and three "A" preference in respect of every eight ordinary are to be allotted, these being distributed as a bonus to the present proprietors. Siemens have fallen back to 36s. 3d., and India-Rubber shares to 12s. 6d. Otherwise, the manufacturing group displays a hard tone, with improvements in British Aluminium at 48s. 3d., and Enfield ordinary at 4¼. The section provided one of the few excitements of the week, in the shape of a violent jump in Associated Electric ordinary, on New York buying. The shares rose from 38s. 3d. to 50s. 6d. in three days. Then it reacted to 47s. 6d., leaving the price 9s. 3d. higher on the week. For what especial reason the Americans were so keen upon giving such a price had not transpired up to the time that this was being written. Shrewd guesses hinted that the newly-formed Radio Securities Corporation might be a big buyer. English Electrics keep very dull at 7s. No recovery has occurred in Telegraph Construction shares at 24.

"Utilities."

The Hydro-Electric Securities Corporation, with which the late Mr. Alfred Loewenstein was so closely connected, has published its second annual report. No dividend is to be paid, but the company is making progress. Its investments had a value, at the end of last December, of nearly 51½ million dollars, as compared with 40½ million dollars at the corresponding date of 1927, and the appreciation has further increased to over 15 million dollars, since the accounts were made up. The report states that over 89 per cent. of the investments is in important American utility companies. The price is ¾ lower at 36¼, and International Holdings have gone back to 8⅛. Brazilian Tractions lost 1½. Better news from Mexico, concerning the so-called rebellion, resulted in a further rise of two points in the common shares of the Light and Power Company, while Mexico Tramways 5 per cent. bonds went similarly better, to 71½. Shawinigan Water rallied after its sharp fall, and is four points up, at 78½. Power Corporation of Canada shares are quoted at 108¼; Montreal Light and Power at 107; the two classes of British Columbia "A" and "B," at 50 and 32½ respectively. There is no alteration in Atlas, at 26s. 3d.

Dividend Effects.

The Shropshire, Worcestershire and Staffordshire Electric Power Company, Ltd.—to give the full portentous title—has increased the dividend on its "B" ordinary shares from 7 per cent. to 7½ per cent., and the price is a shade better at 37s. The "A" ordinary shares are to get 8 per cent., the same as for last year, and the price keeps good at 40s. 3d. Bath Electric Tramways suffered, according to the annual report issued last week, from the effects of the coal depression. Reduced takings were counteracted, however, by savings in expenses, and the company maintains the previously-paid dividend of 3½ per cent. on the preferred ordinary shares, the price of which stands at 6s. The last-recorded transaction in the Stock Exchange was on Christmas Eve, 1928, when shares changed hands at 5s. A bargain in the 5 per cent. preference shares was marked at 12s. about a fortnight ago, and dealings have taken place this month in the 4½ per cent. first mortgage debenture stock on the basis of 66. Anglo-Portuguese Telephone ordinary shares are firm at 23s. 9d. upon the appearance of a satisfactory report. The dividend is again to be 8 per cent., on the larger amount of capital ranking this time, and the "A" ordinary will also receive 8 per cent.

Ever-Ready shares are a quiet market at 23s. 6d. The rubber section is dull on weakness in the prices of the raw product. Tin and copper, the metals, have undergone heavy falls during the past week. The engineering share-list shows no alterations of particular interest.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Approx. Dividend. 1927,	1928.	Price April 22 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	—	64/6	—	... ...
Brompton Ordinary	1	8½	8½	26/6	—6d.	5 5 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 8 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	43/3	—	3 14 1
County of London	1	7½	10	5 /6	+1/6	3 13 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	56/3	+1/16	3 18 3
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—1/-	5 3 5
London Electric	1	8½	9	27/-	—	5 3 8
Metropolitan	1	9	9	2 1/16	—	4 7 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	36/3	—	4 2 9
Newcastle on-Tyne Ordinary ...	1	6	6	1¼xd	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/-	—	5 3 3
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	—	43/3	—	... ...
Westminster Ordinary	1	8⅝	8⅝	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	+6d.	6 5 0
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

Home Rails.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	3	3½	60½	—1	5 15 8
do. District	,,	4	5	76	—½	6 11 7
Underground Electric	£1	5	7	23/6	—	5 13 10
do. do. Income ...	Bonds	6	6	113	—1	5 6 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	+½	5 17 1
do. Def.	,,	1½	1½	24½	+½	6 2 5
Automatic Telephone	1	10	12½	2⅛	—1/16	5 18 0
Eastern Extension	10	10	10	28	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	282	—	*3 11 0
Globe Tel. and T. Ord.	10	10	10	28	—	*3 11 5
do. do. Pref.	10	6	6	11¼	—	5 9 0
Great Northern Tel.	10	20	—	33½	—½	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	10	—	4 3/16	—⅛	... ...
Marconi-Marine	1	12½	15	3¾	+⅛	4 12 4
Oriental Telephone Ord.	1	12	—	2⅞	—	...
Western Telegraph	10	10	10	28	—	3 11 5

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—1/16	7 11 8
do. do. 2nd Pref. ...	5	6	6	3 13/16	—1/16	7 19 0
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	—	850	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	60½	—1½	3 6 1
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	71½	+2	6 19 10
Mexican Light Common	100	Nil	Nil	84½	+2	... ...
do. 7% Pref.	100	7	7	75½	—	9 5 6
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		1926,	1927.			
Assoc. Elec. Ord.	1	—	—	47/6	+9/3	... ...
Babcox & Wilcox	1	13	15	28⅝	—	*4 8 9
British Aluminium Ord.	1	10	10	48/3	+9d.	*4 8 0
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅝	+1/16	3 5 0
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	4⅝	—	3 9 8
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 3
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4¼	+⅛	4 11 1
English Electric	1	Nil	Nil	7/-	—	... ...
do. do. Pref.	1	8	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	10	3¼	+1/16	8 1 6
Henley...	1	25	25	6	—	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	12/6	—1/8	... ...
Johnson & Phillips	1	12½	10	36/3	—⅛	5 10 4
Siemens Ord.	1	7½	7½	1⅝	—	5 9 1
Telegraph Construction	12	10	10	24¼	—	*4 19 3

* Dividends paid free of Income Tax.

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Swiss Industry and Development.

A Review of the Economic and Financial Position.

MR. M. ASHTON JOHNSON, of the Commercial Department of the British Legation at Berne, has prepared a report on economic and financial conditions in Switzerland for the Department of Overseas Trade (Stationery Office, 1s. 6d. net). The author prefaces his report with a commercial summary which, *inter alia*, mentions that Switzerland has an area of 15,950 sq. miles and a population of just under four millions. In 1928 the imports were valued at 2,745 million francs and exports at 2,134 millions (excluding specie). There is 2,142,000 h.p. of installed hydro-electric plant, and in February last a further 539,000 h.p. was under construction. The consumption of electricity per head of the population is about 1,000 kWh per annum.

The introduction to the report states that consolidation was the hall-mark of economic life in Switzerland during the past year. In spite of the pessimistic tone prevailing in certain industrial circles, especially the textile industry, economic conditions showed a definite improvement. Public finances have been placed on a sound basis, and foreign trade showed a marked upward trend. The majority of Swiss industries were very active and unemployment has practically disappeared, although the return on invested capital was inadequate and below pre-war standards. Continental manufacturers are fully alive to the opportunities which exist in the Swiss market, and competition is very keen. This should not, however, deter enterprising British firms from extending their trade to Switzerland.

The Electrical Industry.

The heavy electrical industry, which relies principally upon exports for its subsistence, was well occupied throughout 1928, and was able to give employment to a larger number. Every effort was made to maintain and improve the quality of manufactures, to reduce production costs by a "rationalisation" of methods, to adapt prices to a keen and remorseless foreign competition, and to execute orders with the minimum delay. As regards the last, the industry was assisted by being able to work 52 hours a week instead of 48. The increase in output was not, however, accompanied by a corresponding increase in profits, as circumstances compelled manufacturers to cut prices in order to obtain sufficient work for their plant. Moreover, exports continue to meet with many obstacles. Although the future is uncertain, it does not appear unfavourable. Notwithstanding the completion of railway electrification work and the fewer orders from this source, manufacturers of electrical materials and apparatus were able, owing chiefly to more numerous private orders, not only to maintain but even to increase their activity in comparison with 1927. The production of insulating materials and of materials for electrical installations was more extensive, while the manufacture of heating and cooking apparatus and of meters was also satisfactory. As in the heavy electrical industry the financial results were not, however, so satisfactory, as severe competition prevented selling prices from being adapted to the higher costs of production resulting from an increase in the prices of raw materials.

Tariffs and Treaties.

The provisional tariff of 1921 still remains in force, although active measures were instituted during the second half of 1928 with a view to expediting the preparation of the draft tariff which is intended to replace it. A special commission of experts was appointed, and it met several times and achieved considerable progress in the task of harmonising different economic interests in respect of duties upon agricultural products, and in re-drafting the sections relating to silk, wearing apparel, and electrical goods. Efforts were made to obtain a classification of goods under these categories which would concord, as far as possible, with the Geneva proposals for uniform Customs nomenclature. Many delays must arise before the revised tariff can be passed into law, and it is considered improbable that there will be any drastic changes before 1932 or 1933 at the earliest.

After extended negotiations, a commercial agreement was concluded between Switzerland and France. Difficulty arose from the fact that any concessions made by France would be automatically extended to Germany, and this particularly applied to a number of the Swiss exports, *e.g.*, machinery and electrical appliances. Agreement was reached, however, and the arrangement came into force in February, 1928.

Water Power Development.

As stated in the preface, the hydro-electric plant installed in Switzerland at the beginning of 1929 was rated at about 2,142,000 h.p., distributed among 6,012 power stations, of which 56 of more than 10,000 h.p. each accounted for 1,675,500 h.p. At that date eight hydro-electric works of a total rating of 539,000 h.p. were in course of construction, including one each of 175,000 h.p., 120,000 h.p., 50,000 h.p., and 135,000 h.p., the last output being shared, however, equally between Switzerland and the State of Baden (Germany). Only one small station of 3,700 h.p. was completed in 1929. The continuous rating of existing stations reaches 637,000 h.p., or about 25.5 per cent. of the total water power resources of the country. The stations building, with 142,500 h.p. continuous rating, represent a further 5.7 per cent. In 1928 Swiss water-power stations produced nearly 5,000 million kWh. In comparison with 1927 the increase in production approximated 9 per cent. It is computed that the output of these stations is absorbed at the rate of 45 per cent. for lighting and heating and as industrial power; 25 per cent. for the electro-chemical and electro-metallurgical industry; 20 per cent. for export; and 10 per cent. for traction. The capital invested in hydro-electric plant amounts to fr. 1,100-1,200 millions, exclusive of the distribution equipment. About 95 per cent. of all Swiss towns and villages are served by electricity. The number of domestic electrical appliances is believed to exceed 1,300,000.

Railway Electrification.

The Swiss Federal Railways showed very satisfactory financial results in 1928; there was a net profit of 17 million fr. after providing for all charges. Among the factors which contributed to this result, by enabling economies in expenditure to be made, was electrification. With the completion of the first stage in their programme of electrification the Federal Railways have been able to cut down expenditure in construction work considerably. The outlay on this item is now devoted chiefly to the improvement of existing installations rather than to extensions. The first stage of electrification has involved 1,666 km. (or 58.1 per cent. of the whole) carrying about 85 per cent. of the total traffic. The work just completed after a period of ten years is undoubtedly a remarkable achievement; it has proved, and will in fact continue to prove, of considerable economic value to the country. Its execution has been the means, on the one hand, of providing employment for important industries during a period of economic depression, and, on the other, of increasing considerably the efficiency of the State railway system. Electric traction is shown to be much more advantageous than steam traction, and it is computed that the capital of fr. 618 millions invested in the electrical equipment of the Federal Railways yields a return of 8 per cent. In 1929, as a result of electric traction, the Federal Railways expect to save fr. 20 millions on coal (550,000 tons), fr. 17.5 millions on staff expenditure, and fr. 16 millions on costs of maintenance and upkeep. At the end of 1928 the Federal Railways had some 426 electric locomotives and motor coaches in service. No new electrification work is to be undertaken for some time, but in virtue of an agreement between Switzerland and Italy, the electrification of the Italian State Railway section between Iselle and Domodossola, on the south side of the Simplon Tunnel, is to be carried out by the Federal Railways, the already electrified section between Brigue and Iselle through the tunnel being converted at the same time from 3-phase to single-phase traction. This work is to be completed by May, 1930. Only 38.7 km. of private lines were electrified in 1928. A normal gauge railway, 6 km. long, and a narrow gauge one 35 km. long, both privately-owned, will introduce electric traction in 1929.

Communications.

The net profit of the Swiss Telegraphs and Telephones Administration for 1928 is put at fr. 2.7 millions. Telegraphic traffic continued to decrease but the telephone business showed a further advance of 11 per cent. This was mainly due to the active propaganda for promoting the use of the telephone. The number of subscribers rose from 171,451 in 1927 to 185,257 in 1928. The use of underground cables is becoming general. No large automatic exchanges were put into service in 1928, but existing exchanges at Lausanne, Basle and Zurich had been, or were being, enlarged at the end of the year. The second main exchange at Geneva will be made automatic in 1929. The extension of automatic operation to suburban and, in a few cases, to rural traffic, is progressing steadily, there being at present 114 automatic exchanges and sub-exchanges. At the same time the equipment of manual exchanges is being continually improved. Communication by telephone is now possible not only with most European countries, including Great Britain, but also with North and South America.

As regards radio communication, the Radio Suisse, S.A., is about to build a 62-kW transmitter at a place 15 miles from Geneva for the use of the League of Nations; it is to be completed by October next. Broadcasting is in an unsatisfactory

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condition and a reorganisation is under consideration. A reduction in the number of stations and an increase in the power of those remaining seem to be favoured in various quarters. The number of licensed receiving sets rose from 59,066 at the beginning of 1928 to 70,183 at the end of the year. Swiss broadcasting stations receive 80 per cent. of the revenue derived by the Telegraph Administration from the issue of licences, which cost fr. 15 per annum. A sum of fr. 802,460 was distributed in this way by the Administration in 1928.

The Electrical Imports of Ceylon.

THE following table shows the value of Ceylon's imports of electrical and allied materials during last year. The figures have been taken from the recently published official returns. The corresponding statistics for 1927 have been added and notes of decrease or increase are also given :—

	Rupees. 1927.	Rupees. 1928.	Rupees. Inc. or dec.
Control and switchgear—			
Total, mainly from U.K.	41,000	39,000	− 2,000
Generators, alternators and dynamos—			
Total	215,000	178,000	− 37,000
From United Kingdom ...	197,000	154,000	− 43,000
,, Germany	6,900	18,000	+ 11,100
,, United States ...	3,200	1,000	− 2,200
Motors—			
Total	63,000	56,000	− 7,000
From United Kingdom ...	57,000	50,000	− 7,000
,, United States ...	3,000	4,500	+ 1,500
Transformers and convertors—			
Total	5,800	3,100	− 2,700
From United Kingdom ...	100	3,100	+ 3,000
,, United States ...	5,700	—	− 5,700
Magnetos, ignition—			
Total, all from U.K. ...	—	175	+ 175
Magnetos, road—			
Total	4,400	5,400	+ 1,000
From United Kingdom ...	4,400	5,000	+ 600
,, United States ...	—	300	+ 300
Electric wires and cables (insulated)—			
Total	296,000	1,114,000	+818,000
From United Kingdom ...	281,000	1,098,000	+817,000
,, Germany	3,600	5,600	+ 2,000
,, United States ...	500	50	− 450
,, Holland	1,000	1,500	+ 500
Electrical machinery not elsewhere specified—			
Total	528,000	1,384,000	+856,000
From United Kingdom ...	276,000	1,213,000	+937,000
,, Germany	16,900	37,800	+ 20,900
,, United States ...	59,000	94,000	+ 35,000
,, Italy	8,600	11,500	+ 2,900
Telegraph and telephone instruments and apparatus—			
Total	401,000	390,000	− 11,000
From United Kingdom ...	313,000	338,000	+ 25,000
,, United States ...	14,000	6,800	− 7,200
,, Sweden	3,700	1,800	− 1,900
,, Germany	*	25,800	—
Electric lighting accessories and fittings, including switches—			
Total	442,000	603,000	+161,000
From United Kingdom ...	287,000	346,000	+ 59,000
,, Germany	42,000	62,000	+ 20,000
,, United States ...	55,000	142,000	+ 87,000
,, Holland	43,000	29,000	− 14,000
Electrical goods and apparatus not elsewhere specified—			
Total	650,000	628,000	− 22,000
From United Kingdom ...	420,000	473,000	+ 53,000
,, India	34,000	22,000	− 12,000
,, France	8,500	400	− 8,100
,, United States ...	143,000	86,000	− 57,000
,, Germany	32,500	39,000	+ 6,500

* Figures not available.

A New Wiring System.

"Tenby" Apparatus and Accessories.

THE system recently introduced by Messrs. S. O. Bowker is designed for surface wiring employing tough-rubber and metal-sheathed cables. Its principal features are its simplicity and flexibility, in conjunction with general security. The essential part of the system is the "Tenby" universal junction box, which is supplied in three sizes, two-way, three-way and four-way. These boxes are constructed of sheet brass, very heavily tinned. The cables are clamped to the base by means of bars which span suitably-placed projections at the cable entries, equipped with tightening-up screws, and punch "pips" on the underside of the bars "bond" the cable to the base. The 4-way box is claimed to be of ample size for 12 cables, three on each side of the box. The box lid is secured to the base by means of internal projections at two opposite corners, which fit over lips on the corresponding corners of the base. Compression at the

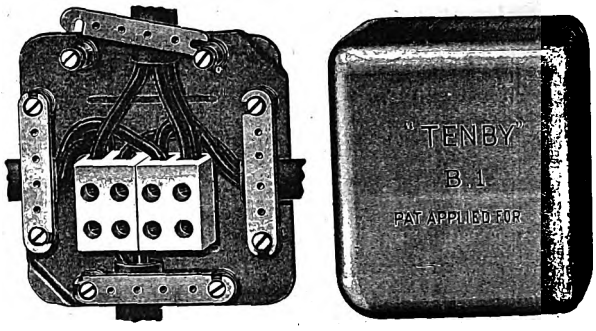

Fig. 1.—Base and Cover of Universal Junction Box.

plain corners releases the lid. Fig. 1 shows the construction of the four-way box and lid separately. A particularly interesting feature is the provision for cable entry at the sides of the lids. Cuts in the metal allow lugs to be turned inwards, so as to leave the necessary gaps. Because the cuts are so fine, and due to the fact that the necessary pressing of the covers is effected after the cuts are made, the sides of the box containing the cuts present practically a solid surface. Porcelain-type connectors are employed for the actual cable connections.

The system also employs one-, two-, and three-way bonding bars and a circular bonding clamp, fig. 2, which, it is claimed, cover all the requirements for the class of work for which the system is designed. Cable fixing is provided for by suitable

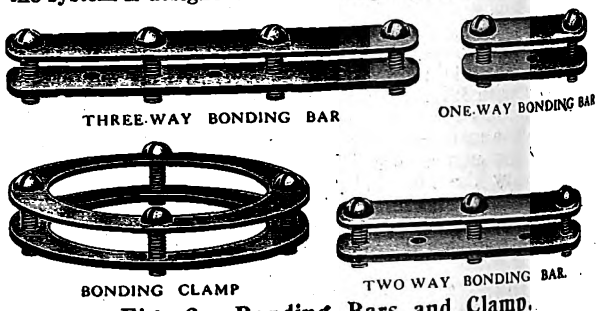

Fig. 2.—Bonding Bars and Clamp.

clips and saddles, and brass and copper earthing clips are also available. A feature of the bonding devices is that the screws are of sufficient length to allow of the cables being inserted or removed without taking the component parts adrift.

Faraday House Scholarships.

As a result of the entrance scholarship examination held at Faraday House Electrical Engineering College on April 9th-11th, the following awards have been made by the Governors :—J. Rosenkrants, Central Foundation School, London, two years in college and one year in works 50 g. p.a.); H. T. Horsfield, Erith County School, one year in college and one year in works (50 g. p.a.); J. Ruston, Borden Grammar School, Sittingbourne, one year in college and one year in works (40 g. p.a.); J. Salomovitch, Central Foundation School, London, one year in college and one year in works (40 g. p.a.); P. G. Chick, King Edward VI School, Norwich, one year in college and one year in works (30 g. p.a.); A. M. Midgley, University College School, one year in college and one year in works (30 g. p.a.); H. R. Rowbotham, Aldenham School, Herts., 20 g.; R. W. Partridge, Repton School, 20 g.; and G. S. Pillans, Brighton College, 10 g.

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Selected Radio-telephone Apparatus.

Recent Developments and Improvements.

A.L.F. Transformer.

A low-frequency inter-valve transformer made by A. C. Cossor, Ltd., comprises a core of iron having good magnetic properties and sectionalised windings, housed in a protective case which also affords a measure of shielding. The design ensures high self-inductance (primary 45 Henries) and low self-capacity, whilst practically the whole of the magnetic flux in the core is passed through both windings; copper and hysteresis losses are reduced by the employment of moderately thick wire for the windings and alloy for the core. The latter material is composed of laminations of a metal that has special properties due, not only to the particular alloy and lengthy manufacturing processes, but also to the heat treatment after the laminations have been punched from the sheet; as a result it has been found possible to produce a transformer of small bulk and good performance. The primary and secondary windings are wound in sections and inter-leaved in order to ensure that the higher frequencies are amplified without distortion. The transformer may be used after a valve having an anode impedance of 25,000 ohms, or more, and it is particularly suitable for use following the Cossor r.c. valve, having an impedance of 60,000 ohms and used as a cumulative grid detector, high magnification being thus obtained. For valves of lower impedance a fixed condenser of 0.0005 or 0.0003 mfd. should be connected between the h.t. and "A" terminals. It is advisable that the anode current flowing through the primary winding be limited to 3 mA by adjustment of grid bias and high tension. The transformer has a ratio of 3 to 1.

B.B.C. Switchboards.

The Relay Automatic Telephone Co., Ltd., recently carried out a contract for a new switchboard for the Manchester transmitting station of the British Broadcasting Corporation.

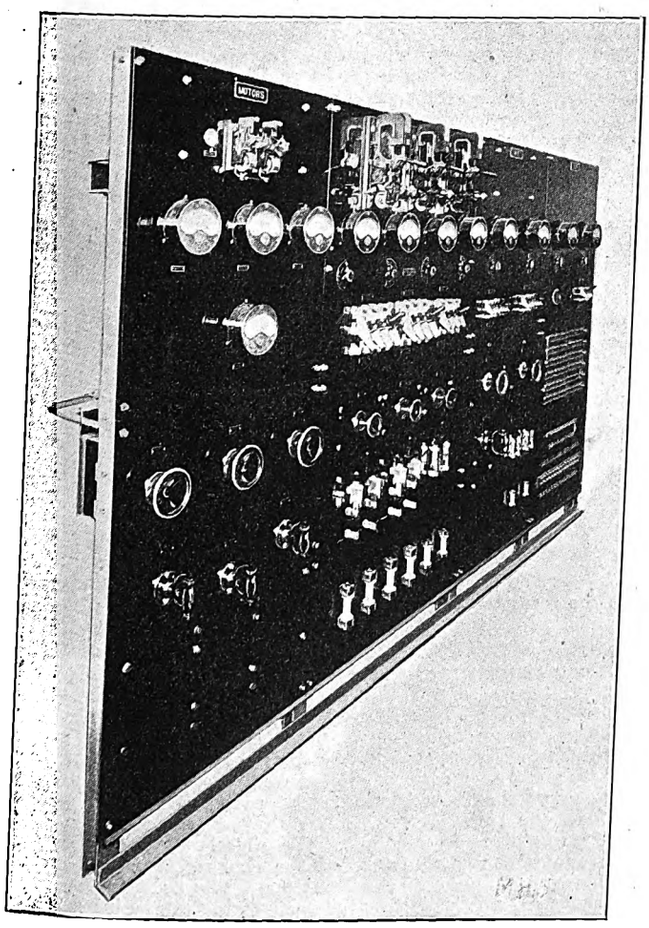

Fig. 1.—Battery Plant Control Board; Front.

Figs. 1 and 2 are front and back views of the board, which controls the machinery for charging the large batteries that energise the valves and also various subsidiary circuits.

The power board controls three charging motor-generators and carries the necessary switches for changing over the batteries from charge to discharge. The main supply is at 400 volts; the large batteries are of 6, 8, and 50 volts, while the smaller ones used for grid-bias purposes are of 300, 150, and 24 volts. The board also includes a distributing fuse panel for small subsidiary circuits. Fig. 2 shows the horizontal main-fuse switches for the generators, the motor separators, and an earth bar on the first panel. On the second

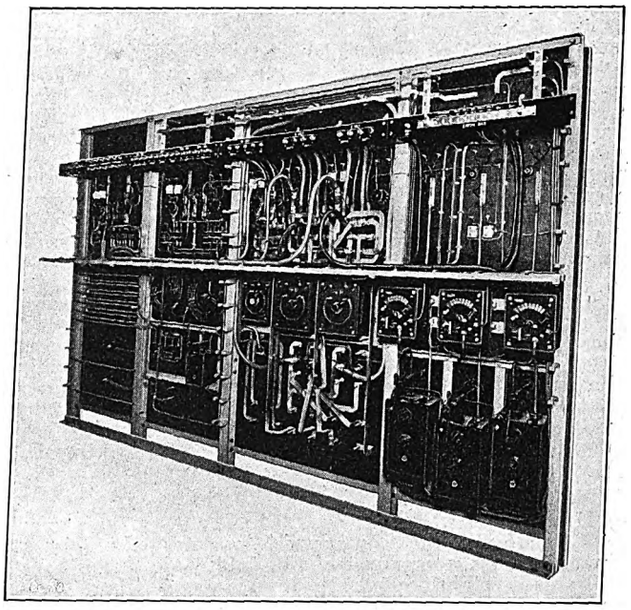

Fig. 2.—Battery Plant Control Board; Back.

the field regulators and the connections for the main battery change-over switches can be seen; also the termination of the larger battery connections. On the next panel are the charging resistances for the 24- and 300-V batteries and the change-over switches. On the end panel can just be seen the rotary switch for changing over three 24-V grid-bias batteries to two discharge circuits, so that the other may be charged.

Public Address Relays.

Following the recent achievement of relaying a political speech from the Albert Hall, London, to 13 other towns, plans were made for a speech delivered last week at Manchester to be transmitted over the General Post Office's trunk telephone lines to no less than 29 other centres in the North and Midlands, as indicated by the accompanying diagram

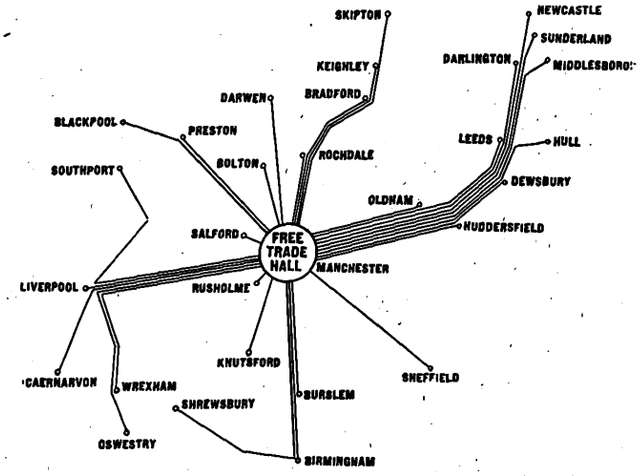

Fig. 3.—Public Address Relay Diagram.

(fig. 3). Thus previous efforts of a similar nature in this country were eclipsed. As on the previous occasions, Marconi-Reisz microphones were installed at Manchester with a duplicated two-stage "A" amplifier and a distributing panel; the latter was in two sections of fourteen valves and output circuits each. Every circuit had its own volume control,

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listening point, and 2-way output, since every trunk line was duplicated throughout its entire length, a total of over 3,000 route miles. Standard Marconiphone "Public-Address" amplifiers were installed at each hall, with two or more special loud-speakers. In all, 29 valve anode accumulator banks of 300 volts each were employed, in addiiton to filament accumulators. "Exide" batteries were used.

In spite of the agreement now reached between the three political parties on the subject of broadcasting Parliamentary election addresses, plans in hand for yet further extensive use of Marconiphones indicate an appreciation of the great advantage which the system confers, in that it carries the speaker's message to a body of electors who are definitely interested.

Power Valves.

The Mullard Wireless Service Co., Ltd., has sent us a sample dull-emitter 5-electrode power amplifier which is suitable for use with a large loud-speaker. It has an auxiliary grid terminal at the side of the cap; the filament should not be allowed to grow, as a higher voltage than the rated figure (6 volts, 0.17 ampere) will definitely shorten the life of the filament. When used with a 6-V accumulator, a fixed resistor should not be used, and a filament-control resistance is not essential. The valve has an impedance of 25,000 ohms and the large amplification factor of 50, so that it will generally take the place of the last two l.f. stages. Its maximum anode voltage is 150 V (18 mA), and it must not be operated without grid bias, for it may be ruined by so doing, even for a very short time, as with zero bias at 150 volts the anode current will exceed 45 mA. If resistance-capacity coupling is used before the PM. 26 valve, the grid leak should be less than 0.5 megohm.

We have received details of two power amplifying valves of low-impedance (2,000 ohms) which are intended to operate the largest loud-speakers. The type DO/20 filament needs 7.5 V and 1.3 A and an anode voltage up to 425 V, at which the grid bias would be 51 V negative and the anode current 40 mA. The DFA.9 type filament is rated at 6 V and 0.6 A, with an anode voltage up to 250 V. The amplification factor of each is 5 and the mutual conductance 2.5 mA per volt.

A Miniature Oilcan.

Messrs. Joseph Kaye & Sons, Ltd., have sent us a sample "K" oil feeder, the body of which measures only 1.5 by 0.75 by 0.75 inches, approximately. Probably unique, this beautifully-made polished-copper miniature is complete in all details, and should interest users of wireless and other small apparatus, which needs lubricating just as much as larger gear, though the fact is not often thought of. These oil feeders are made specially for Messrs. Meccano, of Liverpool, being obtainable from their accredited agents. The body is seamless; the spout and all joints are serrated, and even a valve is provided.

Constructional Cart.

Messrs. Ferranti, Ltd., have sent us a constructor's chart which will simplify the building of an anode battery eliminator at home, with the aid of their components exclusively. It is suitable for use with any 3-stage receiver of good design, the output being up to 100 milliamperes at 200 volts; a Westinghouse metal-oxide rectifier is incorporated for connection to a.c. mains. It should be emphasised that this type 5 eliminator, when built in the manner described, complies entirely with the requirements of the Institution of Electrical Engineers.

Reed Cone Movement.

For use in portable receivers and small loud-speaker assemblies, an adjustable reed cone movement has been introduced

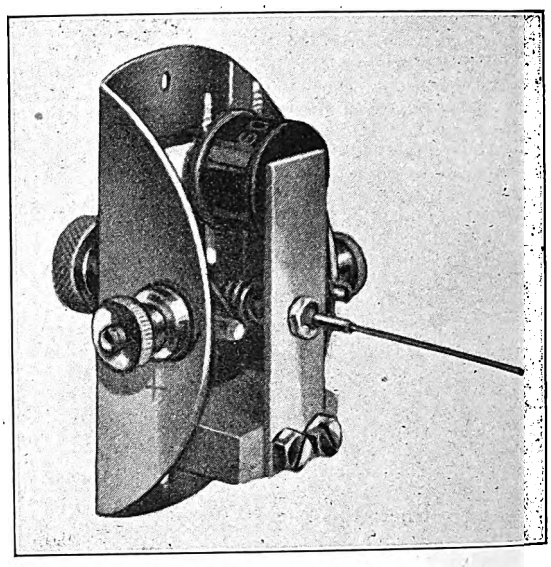

Fig. 4.—G.E.C. Cone Speaker Movement.

by the General Electric Co., Ltd. Hitherto it has only been available in the complete "Gecophone Junior" plaque speaker. As there is a demand for the particular type, especially when the primary considerations are weight and space, it has been decided to market the movement as a separate product. It consists essentially of a substantial electro-magnet mounted beneath the free end of a reed armature (fig. 4). A large thumb-screw at the back of the magnet and armature supporting frame controls a helical spring armature adjustment, and positive control of the distance between the pole-piece of the electro-magnet and the reed armature is thus achieved by a robust method of assembly. The reed, which has a length of just over 2½ in., is rigidly fixed to the upper side of the armature and is little susceptible to "chatter." As the movement is of the single-pole type, polarity is important, but if an output filter is embodied to prevent d.c. passing through the magnet winding, the polarity of the terminals need not be considered. The device is compact and of sturdy construction.

Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

A New Oven-temperature Indicator.

We have received from Messrs. Credenda Conduits Co., Ltd., Oldbury, near Birmingham, a sample "Creda" oven-temperature indicator. This will perhaps be more readily ac-

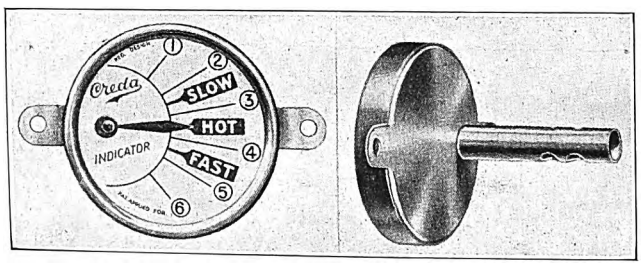

Fig. 1.—"Creda" Oven-heat Indicator; Front and Back Views.

ceptable to cooks operating electrical equipment, in that it is probably more easily read than the ordinary mercury thermometer. Front and back views of the device are shown in fig. 1. The projecting tube contains a bi-metal spiral, one end of which is attached to the pointer, and is capable of revolving; the other end is fixed to the tube. The "unwind" of the spiral, as the result of heating, turns the pointer.

A New Cooker.

Some interesting claims are made for the "Angelus" Empire cooker, fig. 2, a recent production of Messrs. Charles Joyner & Co., Icknield Square, Birmingham. The design of the castings is unique. All the corners have been carried round in a radius, and instead of the front castings finishing at the extreme edge of the cooker, they continue at right angles to the front casting. The radius of the leg castings follow the front casting, giving the appearance, when fixed, of being made in one unit. The rigidity of the leg castings is another unique feature of the cooker. The hob casting follows the radius of the front one. The right-hand panel is fitted with a door, so that the oven wiring can be inspected. A hinge cover also protects the circuit fuse. Where possible, the busbar system of wiring has been introduced. It is proposed to first market this cooker with "Sadia" boiling plates, so that engineers will not feel they are committing themselves to anything of an untried nature. A new "Angelus" circular boiling plate, however, of very high efficiency is under test, but it will not be put on sale until long endurance tests have been completed. The overall dimensions of the cooker are: width 27 in., depth 21¾ in., and height 36¾ in. The total wat-

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tage at full heat is 6 kW, which is sub-divided as follows: left front hot plate, 1,600 W; rear small plate, 800 W; right-hand plate, 1,600 W; oven top, 1,000 W; and oven bottom, 1,000 W. The finish is of good-quality white vitreous enamel. The oven elements are housed at the top and bottom of the oven, and are plugged in to self-aligning contacts. Ample contact surface is available. Each of the elements is arranged for three-heat control. All circuits are single-pole fused.

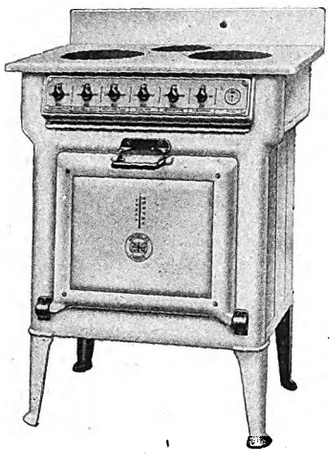

Fig. 2.—"Angelus" Empire Cooker.

Provision is made in the back of the cooker, by means of a one-inch screw bush, for the conduit to come direct to the cooker; this feature assures a permanent earth connection. Following a favourite practice on overseas cookers, the switches are fixed directly under the hob plate. The switches and indication plate are inclined, giving a very refined appearance.

Airship Cooking Equipment.

Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Liverpool, has just completed the manufacture of a special light-weight electric cooking and water-heating installation for the new British Government airship R.101, now under construction at Cardington. The problem set by the Air Ministry was no light one; cooking accommodation for 100 persons was specified, and the complete installation was restricted as to maximum permissible weight and the electric power available for this specific duty. Furthermore, due to the proximity of large volumes of inflammable hydrogen, all the elements had to be rated for low-current density, ensuring "black" heat at full load and an absence of risk of ignition of any escaping gas. To this end also all switch controls had to be of special design, in flame-proof enclosures, following the usual procedure for safeguarding electrical apparatus in collieries. The equipment, into the construction of which duralumin largely enters, comprises five separate items—hot cupboard, hot-water storage tank, cooking range, urn, and a vegetable steamer—which are all shown in fig. 3 in the order named. The cooking range has four boiling plates and in oven 24 in. by 24 in. by 18 in. The two back boiling plates are each of 8¾ in. diameter and loaded at 1,500 watts, whilst the front plates are each 7 in. in diameter and loaded at 1,000 watts. The plates are all totally enclosed and constructed on the latest "Xcel" high-efficiency principle. The hob plate is surrounded by a guard rail to ensure the stability of utensils placed upon it. The oven has two heating elements, each of 1,250 watts, and the entire range is wired for three-heat control through the medium of a totally-enclosed control switchbox, the supply being at 220 volts, 100 cycles a.c. There are three sliding rack shelves in the oven. The vegetable steamer, which has a capacity 18 in. by 22 in. by 24 in., is equipped with elements giving a total loading of 1,500 watts, and is furnished with single-heat control. It is fitted with removable wire tray baskets. A ball-valve tank is attached to the right-hand side of the steamer for maintaining a continuous supply of water to compensate for the evaporation loss. A hot cupboard measuring 3 ft. 6 in. by 1 ft. 10 in. by 2 ft. 8 in. is heated by elements totalling 2,000 watts, and is equipped for single-heat control. It has sliding doors and perforated metal shelves, and the top is recessed to function as a carving table and to facilitate the retention of plates and utensils placed upon it. To ensure a supply of hot water for dish-washing, &c., a 40-gallon cylindrical hot-water storage tank is provided. It is equipped with three immersion heaters, one of 1,000 watts, and two of 750 watts, making a total loading of 2.5 kW. Smaller demands, for tea, &c., are met by a 3-gallon "Xcel" urn equipped with two 750-watt units, protected against burn-out in the absence of water by a thermal cut-out connected in series with their common junction. Having regard to the importance of weight limitations, it is interesting to record that the total weight of the completed equipment worked out within 10 lb. of the limit set by the Air Ministry.

Electrical Equipment for Canteens.

In an article under the above heading in the current issue of *Industrial Welfare*, by Mr. Norman Severell, some interesting notes and suggestions are given concerning the installation of electrical cooking apparatus in works canteens.

One of the greatest difficulties in arranging canteen accommodation in old-established works is that of finding suitable spaces, and a solution of the problem can often be found in the use of electrical equipment. The principles of kitchen planning and location that have developed with the use of coal or gas stoves require revision when electricity is employed as a source of heat, power and refrigeration. In cases of re-planning and modernisation an electrical layout, cookers should not be buried in the "tomb" formerly occupied by the kitchener or other stove superseded. A position by the side of a window is ideal. Provision in the kitchen and other offices of a works canteen of at least three other power points is necessary, in addition to permanent connections.

Electricians are notoriously unimaginative in the choice of wall-socket positions, and the works manager, house engineer, or factory architect should define these positions in the specification. Good cooking is as necessary in a works canteen as it is in a hotel. Electric cooking is done in pure air, which is not required to support combustion. The "totally-enclosed" principle of the electric oven is one of its most valuable features. It is not what cuisine *is*, but what cuisine *does*, that matters. Game and poultry cooked in a closed electric oven is moist and rich, with a precious aroma dear to the educated palate. In comparison with other methods of cooking, electricity, to be directly competitive, should cost ½d. per unit; but

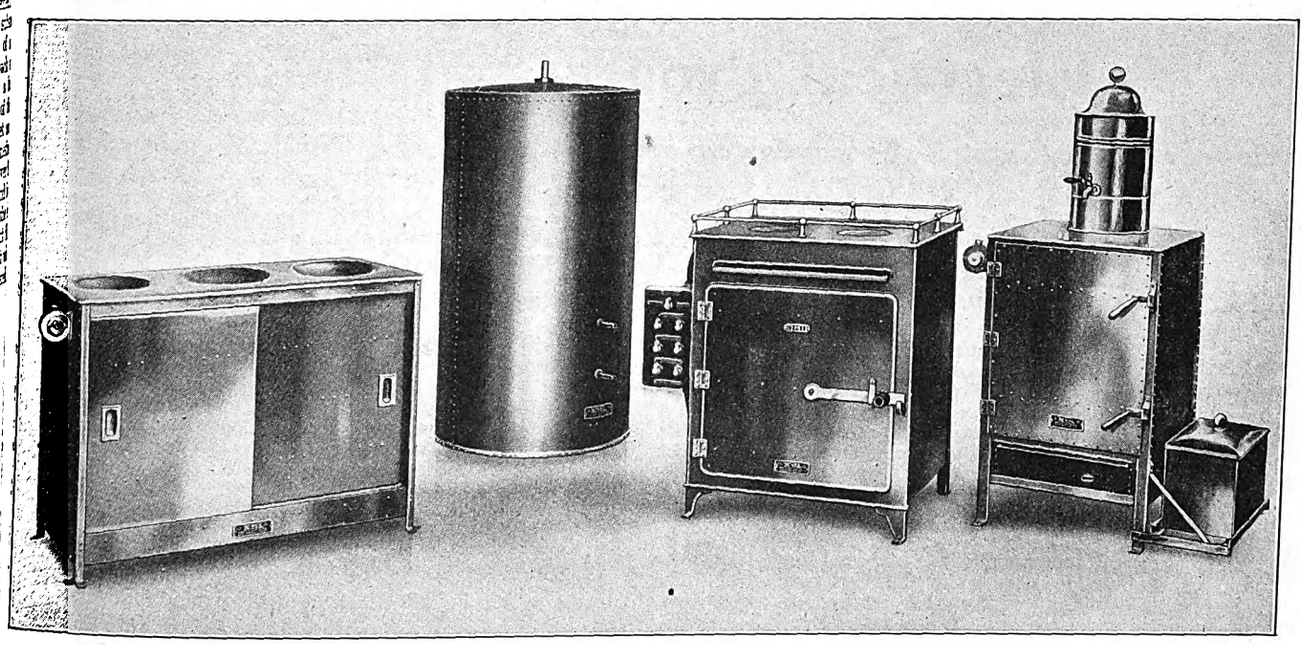

Fig. 3.—Electric Cooking Apparatus for Airship R.101.

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allowing for its superior efficiency the cost might be ½d. to 1d. per unit. In choosing electric cooking apparatus, the following conditions should be ensured :—

1. Ovens sufficiently lagged and lined with an incorrodible or vitreous-enamelled sheet.
2. Heating elements easily replaceable and controlled, and each adjustable to three degrees of heat by visible indicating switches.
3. Runners and guides for oven shelves removable for washing.

In the maintenance of electric cookers easy replacement of elements is one of the first considerations. Spare elements should be in charge of the house engineer or factory superintendent's department, and replacement should be allowed by staff electricians only. Finally, cleanliness is not less important in electrically-equipped kitchens than elsewhere.

"Bare-element" Water Heating.

In describing recently various electrical methods and apparatus available for the supply of domestic hot water, Mr. H. C. Sanders, M.I.E.E., of Santon, Ltd., Newport, referred to the advantages to be gained by heating water by inserting bare resistance spiral into the water to be heated. From experiments made and results obtained from extended tests of apparatus during the last ten years, he said, it was increasingly evident that in future years very great use would be made of the many advantages of that system. The use of a bare element for water heating demanded certain considerations in the construction of the apparatus, without which success appeared to be impossible. For instance, if a bare resistance spiral were inserted into an earthenware basin or bowl of water and connected to a 200-V d.c. supply in an attempt to heat the water, it would probably be found that one end of the spiral would be eaten away by electrolysis long before the water had boiled. That effect was very difficult, if not impossible, to entirely eliminate, but it was a very simple matter to reduce it; that was, to increase the life of the spiral, from a matter of ten minutes or so to two years or more. The required increase in the water resistance was obtained by placing the resistance spiral in a long narrow channel of non-hygroscopic insulating material. The water, on conforming to the internal shape of the container, assumed a small sectional area and increased length, its end-to-end resistance being many thousands of ohms. The same principle could be further used in designing apparatus which would give almost any combination of results required by the designer. For a bare-heating-element geyser required to operate on a three-phase four-wire system with earthed neutral, the three elements would be placed in narrow channels and connected together at one end, and to a triple-pole switch at the other end, thus forming the usual "star" connection. The water circuit could be similarly "star" connected by allowing the inlet water to enter a portion of the container set apart to form a reservoir. Three water channels of high end-to-end resistance would connect this reservoir with the element channels at the high-voltage end of each of the three elements. The other end of each element channel—at the point where the neutral bar was attached—converged into a single channel which sloped downward to the metal outlet spout which was adapted for permanent connection to earth. On switching on the current the three elements were energised through the "star" connection, maintaining the neutral at or very near to earth potential. As water was fed from the common reservoir to all the elements, and delivered to the phase end of each element through water channels of equal resistance, it followed that the water system was also a "star," the three water channels forming the legs naturally maintaining the water in the reservoir at "earth" potential. Cold water entering the reservoir from supply mains would be electrically neutral, carrying no earth current. Again, the cold water fed to the "phase" end of each element chamber would, in travelling along each channel, increase in temperature, and decrease in potential above "earth" until it flowed over the neutral bar. The three streams would then unite and flow down the slope, having reached its maximum temperature, and neutralised its potential before reaching the "earth" metal outlet spout. It should be noted that the object of the sloping channel between the neutral bar and the earthed spout was to ensure that the neutral was never earthed by the apparatus. The slope caused increased water velocity at that point, which resulted in less water and greater ohmic resistance between neutral and earth when water was flowing, and entire insulation when not in use.

Electrical Progress in India.

So far as the large centres of population are concerned, the electrical branch of engineering has recently played a more intimate part than any other.

By A. T. COOPER, M.Inst.C.E., M.I.Mech.E., M.I.E.E., M.Cons.E.

(*Extracts from a paper read before the* Indian Section *of the* Royal Society of Arts.)

STATISTICS of recent imports of electrical machinery and apparatus into India broadly indicate the country's electrical progress. During the past five years the total annual value of imports of electrical apparatus, machinery, and accessories has averaged 5½ crores of rupees (about £4,000,000) and has not varied more than 10 per cent. on either side of that average, excluding the many items of plant and material ancillary to electrical development.

Telegraphy.

The principal improvements in land-line telegraphy which have been introduced by the Government of India Telegraph Department during the last six or seven years have been in connection with long-distance circuits employing high-speed printing systems. The installation of regenerative repeaters, or retransmitters, has rendered quadruple "up and down" working on the Baudot system possible over the longest circuits operated by the Department. Specially designed Baudot typewriter keyboards and converted Murray keyboards with tape transmitters have been recently installed on some of the main circuits as a labour-saving experiment, and their operation is being closely watched. On short and less important circuits similar efforts towards saving labour and plant have been made by the introduction of modern types of concentrator switches and of the composite method of Morse working, while in the large telegraph offices, Lampson carriers have been installed for the conveyance of messages to and from the instrument tables.

Radio-telegraphy.

Stations for point to point working were installed in the Bay of Bengal as early as 1905, and in 1918 there were some 30 stations of the spark type in operation. They have since been fitted with continuous-wave transmitters and receivers employing three-electrode valves. The most recent application of wireless telegraphy is of outstanding importance. In 1925 the Indian Radio Telegraph Co. was floated for the purpose of establishing a system of reciprocal wireless communication between India and Great Britain, and a short-wave transmitting beam station at Kirkee, near Poona, and a receiving station at Dhond were officially opened by the Viceroy in July, 1927, and came into public use two months later.

An extension of the beam system from India to other countries is under negotiation, and developments in this direction are anticipated as soon as the merger between the submarine cable and wireless interests has come into active operation.

Telephony.

Developments in telephony are broadly divided into two classes: (i) Those relating to the modernising of old exchange equipment, and (ii) those in connection with long-distance working with the aid of thermionic repeaters. Within the last few years a number of automatic exchanges have been installed by the Government in place of manually-operated plant, and upon their working the Government will shortly be in a position to decide which system of automatic working is best suited to Indian conditions. The telephone service in the three Presidency Cities, and also in Karachi and Ahmedabad, are in the hands of private companies working under licence. Bombay (9,000 subscribers) and Madras (3,000 subscribers) have both recently changed over to automatic working, but Calcutta (9,000 subscribers) still retains manual operation. Extensive development in the Government long-distance trunk service has recently taken place and the network is now very comprehensive, but India is evidently very backward in long-distance telephony, in spite of the urgent need for an efficient service for linking up the ports with the capital and with industrial centres.

Electricity Supply.

General supplies of electrical energy are now available in all Indian cities of any importance, while many licences to supply in the smaller urban centres have recently been granted. The demand per head of population varies from 5 to 6 kWh per annum in some of the smaller cities to about 200 in the case of Bombay.

In Calcutta the demand for electrical energy has recently increased very rapidly, and energetic steps had to be taken

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by the Electricity Supply Corporation to keep pace with the requirements of its area with its population of 1.5 millions. In 1925 some 100 million kWh was sold; last year the output reached 148 millions, while the estimate for the current year is 168 millions. The first section of a new southern power station, of an ultimate capacity of 150,000 kilowatts, came into operation at the end of 1926; it is equipped with stoker-fired water-tube boilers and turbo-alternators generating at 3-phase 6,000 volts, circulating water being taken from the River Hooghly; 24,000 kilowatts of plant has so far been installed and a further 15,000-kilowatt set is due for installation this year. Although this new station was designed more with an eye to high reliability and low maintenance than to spectacular steam results (only 200 lb. per sq. in. pressure and a total steam temperature of 600 deg. F. being utilised) yet its actual performance works out favourably, when compared with moden home stations of the same size and equipped for much higher steam pressures and temperatures. The overall thermal efficiency last year was in the neighbourhood of 14 per cent., in spite of the many tropical disadvantages met with, including circulating water temperature at times up to 93 deg. F. The southern station is linked with the older northern station at Cossipore by means of two 6,000-volt trunk feeders laid along separate routes.

An interesting recent addition to the distribution system was a large rotary sub-station arranged for an ultimate capacity of nearly 40,000 kilowatts of convertor plant. As it is situated in a somewhat critical position in the bazaar, it is fully equipped for "siege conditions" during periods of communal disturbances, special window and door protection having been arranged, together with provision for rationing and emergency sleeping quarters for the running staff.

The outstanding recent development in connection with the general electricity supply to Bombay was the completion of the change-over from thermal power station to bulk hydro-electric generation, which necessitated building a large receiving station alongside the old steam station. It is fed at 20,000 volts 3-phase from the Tata receiving station and is equipped with 20,000/5,500-volt transformers and the necessary switchgear. The change-over of the 550-volt feeders to the new receiving station was of necessity a gradual one, but the whole of the load was finally transferred in January, 1926, and the power station shut down. The middle-class Indian has not been slow to take advantage of the domestic amenities which electricity offers in appliances, while the electric *dhobi* is rapidly gaining favour, and the charcoal *sigri* will shortly become a memory. The G.I.P. Railway recently decided to instal electric cooking apparatus throughout the large restaurant in the new building at its Victoria terminus, whilst the B.B. and C.I., the other railway running into Bombay, has adopted flood-lighting of its administrative block for notifying the arrival of mail trains at night.

Madras is supplied with electrical energy on the same lines as those obtaining in Bombay and Calcutta, *i.e.*, direct current at the centre and alternating current at the outskirts. The Madras climate, which has been described as "three months hot and nine months hotter," calls for the continuous use of electric fans, which, while contributing to the satisfactory annual load factor of 45 per cent., have been recently utilised as a means of improving the power factor of the alternating-current system. Condensers have been incorporated with all fan regulators, bringing the system power factor up to 0.95, and sometimes to the neighbourhood of unity.

In Delhi an English company has for many years furnished a public supply in the old city from an oil-engine plant, while the requirements of the new Imperial City and the cantonments are catered for by a small steam power station built by the Government in 1925 and equipped partly with old and partly with new generating plant, transmission being at 6,600 volts, 3-phase, with distribution on the direct-current system. Lahore is now supplied by the local company on modern lines from a new steam-turbine station with 3-phase generation and 6,000-volt underground transmission to rotary and static sub-stations. As Lahore is shortly destined to become the terminal station of the long-distance transmission system from the Mandi hydro-electric installation referred to later, its supply of electrical energy appears to be well assured. [Brief particulars are also given of the arrangements for the supplies of electricity in Ahmedabad, Karachi, Cawnpore, and Aden.]

Supplies in the States.

One-third of the total area of India, containing a fifth of her population, is ruled over by hundreds of Indian princes having their own internal governments. Many of those rulers have been quick to recognise the advantages of the use of electrical energy and possess up-to-date installations. For instance, in Hyderabad the Nizam's Government early recognised the value of an electricity supply, and a new power station built on a rocky promontory in the Hussain Sagar Lake came into operation after a few years. It is equipped with "unit" coal pulverisers, water-tube boilers, and 6,600-volt, 3-phase, turbo-alternators. The lake water is circulated for condensing purposes.

Indore is about to build a new power station in the heart of the industrial area of the city, in which there are nine cotton mills and sundry other industries. It will generate 3-phase energy at 6,600 volts and the initial plant will be oil-engine driven on account of the difficulty in obtaining sufficient water for steam operation. It is estimated that a 10,000-kW plant will be necessary in a few years' time.

Travancore State has just instituted an electricity supply undertaking at a cost of over Rs. 4 Lakhs for supplying the capital, while four small installations of water-power plant are in operation in the tea districts.

Jaipur State built in 1926 an up-to-date oil-engine power house and a complete system of underground mains in the city for palace lighting and general supply.

Hydro-electrical Development.

Mr. J. W. Meares, in the paper he read before the society in 1922, described the arduous work which had been carried out by him and his colleagues in connection with the location and assessment of the water-power resources of India, and the schemes which had at that date been carried out. Since then three outstanding projects have presented themselves for record.

(*a*) The Tata Power Co.'s scheme forms the third section of the development of water power in the Western Ghats for transmission to Bombay City and its environs, so courageously undertaken by the firm of Tata & Son. The first two sections were those of the Tata Hydro-electric and the Andhra Valley Companies. The Tata Power Co.'s scheme was commenced in 1919 and came into operation the year before last. A 150-ft. dam, 5,000 ft. long, closes the outlet from a catchment valley which was originally the source of two rivers, and formed a junction of the dam site. A 4,000-ft. approach cut and 15,000 ft. of tunnel lead the water to the pipe lines descending to a power house, which contains five 17,500-kW, 11,000-volt, generating sets driven by double overhung Pelton wheels operating on a static head of 1,640 ft. Four 30,000-kVA transformer banks step the voltage up to 110,000 V for transmission over a double-tower line to a receiving station at Dharavi in Bombay, where it is stepped down to 22,000 volts for underground cable distribution in conjunction with the Andhra Valley Co.'s supply.

(*b*) The Punjab hydro-electric scheme is usually referred to as the Mandi or Uhl River project. The site was discovered in 1922, and after exhaustive survey the scheme was sanctioned in 1925, and in the following year a new hydro-electric branch of the P.W.D. was formed under the leadership of Colonel B. C. Battye, D.S.O., to carry it out. It is proposed to make use of the snow-fed waters of the river Uhl, a tributary of the Beas which it joins in the Mandi State in the hills above Simla. A 2.5-mile tunnel will lead to a pipe line, falling 1,800 ft. to the first power station that is designed for 36,000 kW with provision to increase up to 70,000 kW. As soon as this load has been placed the tail race can be taken through three miles of duct to a second fall of 1,200 ft. and to a second power house of another 48,000 kW. There is also a third fall of 750 ft. which can be developed if required. Supply over a wide area is contemplated, but for the present primary transmission will be limited to 176 miles at 132 kV to Lahore and about 200 miles of 66-kV branch lines.

(*c*) Madras Presidency estimates have recently been put forward in connection with a 40,000-h.p. development in the Nilgiris, called the Pykara-Moyar project, involving the construction of two power stations in series hydraulically and with heads of 3,250 and 1,000 ft., respectively. It is proposed to transmit at 150,000 volts along the Southern India Railway to Madras, a distance of 350 miles. The total outlay, including Rs. 130 lakhs for transmission lines, is put at over Rs. 4 crores, and it is apparently anticipated that the necessary revenue will be obtained at the comparatively high average bulk-supply rate of 0.80 anna per kWh sold. The justification for transmitting 350 miles, with all the risks and losses involved thereby, in order to sell electrical energy at a rate higher than that possible with a thermal generating station on the spot appears to be somewhat doubtful.

Industrial Electrical Developments.

Special reference must be made to the Tata Iron & Steel Co.'s works at Jamshedpur, about 150 miles to the west of Calcutta, which are electrically self-contained and own two steam stations, having capacities of 11,750 and 25,000 kW, respectively. An 18,000-kW set is shortly to be installed in the larger station, and the smaller one will then be shut down, leaving a single station of 38,000 kW capacity.

The application of electricity to coal mining in India is slowly gaining ground, the h.p. of motors on the surface having increased from 13,564 in 1924 to 16,440 in 1927, whilst underground the figures have increased from 29,938 to 43,099 h.p., respectively. The use of electrically-driven coal cutters has not yet been developed to any great extent, the number in use having only increased from 109 in 1924 to 124 in 1927, about equal numbers of the American chain and the British bar types being employed. Although many Indian coal mines have their own power plant, colliery supply undertakings have been formed in certain areas.

Electric Traction.

Although electric tramways have been in operation in the principal cities of India for many years, the application of electric traction to railways has been somewhat backward. Realising the necessity for a measure of standardisation, the British Government appointed in 1920 an Advisory Committee upon the electrification of railways, and its report (published in 1921), as revised last year, lays down as standards generation and transmission on the 3-phase, 50-cycle, alternating-current system, and conversion to 1,500-volt direct current for use on the tracks, with collection from an overhead conductor. As this standard system was decided upon as far back as 1912 by the two railway companies operating the suburban lines running out of Bombay city, overhead con-

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ductors being then chosen mainly on account of track-flooding difficulties and, incidentally, of the tendency of Indians to trespass on the lines, its choice is evidence of the foresight of their consulting engineers, Messrs. Merz & Partners.

With regard to the main-line electrification of the G.I.P. Railway from Bombay to Igatpuri and Poona, *via* the Ghats where the maximum ruling grade is 1 in 37, special high-speed locomotives will be used for drawing the ordinary rolling stock. Over a few miles the railway mounts more than 2,000 ft. and the tractive conditions are, therefore, specially arduous; when coupled with the exacting climatic conditions of high temperature, torrential rainfall, and liability to track flooding, the greatest care upon the part of the consulting engineers and the manufacturers has been called for in deciding upon a suitable design. After consideration of different British and Continental designs, three sample locomotives were ordered from different manufacturers, and after trials and tests, twenty-one passenger and forty-one freight locomotives were ordered from the Metropolitan-Vickers Electrical Co. All are arranged for regenerative electric-breaking, and it is anticipated that their operation, coupled with the elimination of the present reversing stations rendered possible with electric traction, will reduce the running time between Bombay and Poona (119 miles) from over four hours to under three hours. The overhead equipment on the mountain sections of the mail line possesses novel features, as in view of the heavy currents to be dealt with a total section of 1 sq. in. of copper is carried above each track, divided between a main catenary (0.5 sq. in.). The whole of the power for the operation of the two Ghats sections of the G.I.P. railway will be drawn from a thermal power station now under construction at Kalyan. This will be equipped with four 10,000-kW generating sets and six stoker-fired boilers arranged for 270 lb. steam pressure, 725 deg. F. total steam temperature, and fitted with oil-firing equipment for overload forcing purposes. Generation will be at 6,600 volts, 3-phase, 50 cycles, stepping up to 95,000 volts for transmission to eleven rotary sub-stations, some arranged for manual and others for supervisory remote control. Work on this important main-line electrification is well advanced, and it is hoped that electrical operation will come into force on the Poona section this summer and on the Igatpuri section during next year.

With regard to other Indian railways, the electrification of the South Indian suburban section between Madras Beach and Tambaram has been sanctioned, and propositions in respect of certain main-line sections of that railway have been put forward, but so far no decision has been arrived at.

Radio-telephony.

Wireless broadcasting on the lines of the British Broadcasting Corporation came into operation in 1927 through the medium of stations in Calcutta and Bombay operated by the Indian Broadcasting Co., a subsidiary of the Indian Radio Telegraph Co. The stations, although of the same transmitting power as 2 LO, viz., 3 kilowatts, have been found under Indian climatic conditions to possess much greater transmitting ranges and regular reception is reported from the North-West Provinces, from Ceylon, and even from the Malay States 1,800 miles away. So far broadcasting has not captured the imagination of the Indian public to a degree sufficient to make it a financial success, but the company is of the opinion that if it is patient and keeps a good service going it will eventually obtain the necessary number of licence holders, which is at present less than 10,000. Should financial success be ultimately achieved, additional transmitting stations will no doubt be installed at such centres as Delhi and Madras.

Discussion in London.

Mr. J. W. Meares, one of the pioneers of the electrical industry in India, in opening the discussion, said he noticed that Simla was absent from the list of towns having automatic telephone equipment, but he believed that town had the first automatic system in India. Darjeeling had the first hydro-electric scheme, but it had been followed by quite a number of highly successful hydro-electric schemes in the hill stations. Sooner or later those hill railways would have to be electrified. As a matter of history, when he arrived in India in 1896, the only public lighting installation, so far as he knew, was at Calcutta. It consisted of Jablochkoff candles, which were introduced in the seventies, and disappeared from the face of the earth elsewhere in the eighties. When he suggested in 1896 that they should be replaced by a modern system the Bengal Government said: "What is the matter with them? They have been working for thirty years, and will go on working for quite a long time. Why replace them?" It was afterwards found that those Jablochkoff candles cost three times as much per annum as the whole upkeep of the modern lamps which replaced them. That was an example of economy in capital expenditure and squandering money on maintenance. Mr. Cooper seemed to think that all the able work on the hydro-electric survey would not come to much. In initiating that survey, Sir Thomas Holland was looking a long way ahead. The work done remained on record, the sites were known, and to a certain extent investigated. Sir Gunga Ram's hydro-electric scheme for irrigation by pumping in the Punjab was an application of electricity which made use of water power from the local canals and had immense possibilities. He had grave doubts, however, whether it would be possible for the Punjab hydro-electric scheme mentioned in the paper to make a profit, because of the enormous number of small places which would have to be supplied. The capital cost would be absolutely prohibitive, but he thought there was still a place for larger stations transmitting to industrial areas. Those areas might not exist at the moment, but where power was available industry often followed.

Mr. Gill (Messrs. Merz & Partners) said that as three-fourths of the population of India was engaged in agricultural pursuits, comparatively few people came into touch with and used electricity to any extent. Therefore, it could hardly be expected that in electrical development India would ever equal countries which were much more highly industrialised. The author mentioned some direct-current extensions with rotary convertors, but was it not more usual nowadays to extend with alternating current? Electrification work in India was accompanied by difficulties which were unknown in this country. The nesting habits of the Bombay crow, for instance, had been the cause of trouble with overhead equipment; the railway service was considerably interferred with and wires burned through. Eventually a very expensive system of guards had to be employed to prevent the continuance of the trouble, and had been largely successful; but a certain amount of trouble from the crow had always to be provided for. Copper bonds and wires, too, were frequently stolen. With regard to the electrification of the Ghats section of the G.I.P. Railway, where there was a rise of practically 2,000 ft., maintenance conditions during the monsoon were very difficult, and a third line had been put down which could be switched in if necessary. There appeared to be a considerable lack of Indian artisans for electrical work, though there were some good men. Far too often English manufacturers had to send out their own men to do work which ought to be done by Indians. Could not the Government see that men were trained in India to maintain electrical progress and development there?

The Chairman (Sir Stanley Reed, K.B.E.) thought that the comparatively low consumption of electrical energy per head in India arose from the fact that only one company in the whole of India had ever attempted to sell electricity, though large numbers of companies were supplying it. There was all the difference between supplying electricity and selling it. If the question of selling was systematically dealt with, the great centres of population in India would no doubt respond. The paper was valuable for what the author had suggested regarding the gigantic cost of hydro-electric schemes. A very large capital outlay was necessary on hydro-electric works before one unit of power could be sold. His own belief was that they were only on the verge of the development of thermal efficiency through high pressures and the pre-treatment of coal. It was a mistake to think that it was possible to sell electrical energy in bulk, or by retailing large quantities for domestic purposes at a higher rate than 0.5 anna per kWh.

Mr. H. R. Bhatia asked the author's view regarding the transmission voltage adopted for the Punjab hydro-electric scheme. Compared with long-distance transmission lines elsewhere, a higher transmission voltage would seem to be justified. He understood that the construction of the third section of the Tata power scheme was undertaken in view of the demands of the electrification schemes of the suburban railway companies of Bombay, which were now erecting their own power plant. Was the author of opinion that the Tata Power Company would be able to secure a greater demand for the power house?

Mr. J. C. Griffin pointed out that with very long transmission lines there was a possibility of failure of supply due to political troubles. He believed that there were a considerable number of towns in India of under fifty thousand inhabitants where electricity supplies would be profitable if the right methods were adopted and the organisation was properly arranged.

Mr. Cooper, in reply, said that he did not know why 132,000 volts was selected by the promoters of the Punjab scheme; it happened to coincide, he thought, with that used by a British scheme. Mr. Meares had rather reproached him for not mentioning some of the earlier electrical schemes. He only intended to deal with progress during the last five or six years, and Mr. Meares had already discussed those earlier schemes in his own paper in 1922. With regard to the extension of direct-current areas, most of the supply authorities in India started in the days when everything was direct current. As time went on and the advantages and flexibility of the generation and distribution of alternating current came to be realised, Madras, Calcutta and Bombay (he knew it was so in Bombay, because he had been personally concerned) put a cordon round the original direct-current area and said: "Thus far and no further." All the outskirts were dealt with on alternating-current lines. The advisability of changing those areas from direct- to alternating-current had been considered. In the case of Indian distribution that was a much more expensive matter than in this country, because of the enormous number of fans, and the question became rather a financial than a technical one.

An Irish Invention.

In a recent issue we mentioned that the Irish Free State Government had voted £5,000 to acquire certain rights in an invention of Mr. James H. Drumm, who since 1920 has devoted most of his time to research work at the National University, Dublin. The nature of the invention was not disclosed, but the British Patent Office records show that Mr. Drumm has recently filed an application for a patent in connection with electric storage batteries.

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Pulverised Fuel.

Experimental work at the Birmingham Corporation's electricity station has demonstrated, amongst other things, that the use of powdered coal results in a higher combustion heat efficiency in the boiler than is obtained with mechanical stokers.

By R. A. CHATTOCK, M.I.E.E.

(*Extracts from a Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IN 1924 the author visited America and inspected pulverised-fuel equipment in many of the large electric power stations in that country and, as a result of that visit and the information obtained, the Birmingham Electric Supply Committee decided to fit pulverised-fuel equipment to boilers that were then in course of construction for Prince's electric power station, Nechells.

The installation consists of six Vickers-Spearing water-tube boilers, each having a heating surface of 5,400 sq. ft., four of them being fitted with economisers and two with air-heaters. The normal evaporative capacity of the boilers is 35,000 lb. of steam per hour (actual), the overload capacity being 42,000 lb. of steam per hour (actual). The Lopulco system was adopted, which had at that time found most favour in America. A central pulverising house was fitted with four electrically-driven Raymond mills, each capable of pulverising approximately 5½ tons per hour, and equipped with vertical rotary steam-operated coal driers for reducing the total moisture in the coal to about 10 per cent. The mills are air-swept, the air being heated also by steam coils, and the pulverised fuel produced is passed into cyclone collectors which discharge into either of two bunkers, whence the fuel is conveyed by a Fuller-Kinyon pump and air pressure to bins over the boilers, which feed through motor-operated screw-type feeders four fishtail burners in each boiler furnace. The combustion chambers, which each have a volume of 5,814 cu. ft., are surrounded by hollow brick walls, through which the secondary air required for combustion is drawn. The end wall is of solid brickwork, and is protected by vertical water-circulating tubes, coupled to the Lopulco water-screen tubes across the bottom of the chamber above the ash pit. The circulating and screen tubes form part of the boiler circulation, and provide an additional heating surface of 364 sq. ft. in each boiler. It was considered that the convection-type superheaters which were fitted to the boilers would not be sufficient to give a steam temperature of 700 deg. F., owing to the fact that some of the heat would be taken out of the furnace gases by the circulating tubes before they reached the boiler tubes proper. In order, therefore, to obtain the required degree of superheat, it was decided to fit a radiant-type superheater also on the back wall of the combustion chamber, through which the steam from the convection-type superheater was passed on its way to the steam header.

The operation of these boilers has been, on the whole, satisfactory, although the cooling effect on the brickwork of the air that passed through the hollow combustion chamber walls was not sufficient to allow the CO_2 content to be raised higher than 14 per cent., with a result that the thermal efficiency obtained was not quite as high as it might have been. The steam-operated coal driers also proved unable to remove sufficient moisture from the coal, and it has been necessary to select as far as possible those coals which do not normally carry more than 15 per cent. of moisture, in order to obtain a resultant moisture content of about 10 per cent. in order to prevent the packing of the coal in the Fuller-Kinyon pumps, bins, and in the screw feeders to the burners, which tends to uneven feeding of the coal into the furnaces and reduced efficiency of operation. Apart from these troubles, which can be overcome by careful operation, the plant has worked quite satisfactorily.

A very careful test was carried out (detail figures in original paper), and the combustion heat efficiency actually obtained was 80.35 per cent., which takes into account the six hours during which the boiler was banked each day. This figure compares with a boiler-house combustion efficiency of 72 per cent., covering the operation of stoker-fired boilers only. Some three years ago it was necessary to increase the capacity at Prince's station; the increased capital costs over an installation of mechanical stokers necessitated the employment of much larger boilers, so it was decided to install units having a normal evaporation of 150,000 lb. of steam per hour (actual) and an overload evaporation of 180,000 lb. of steam per hour (actual) of the double Stirling type.

Four boilers have been installed, each having a heating surface of 21,140 sq. ft. in the boiler proper, and being equipped with two superheaters and two economisers. The combustion chamber, which has a volume of 19,000 cu. ft., has all four walls protected by water tubes having a surface of 4,700 sq. ft., which form part of the circulation system of the boiler. The tubes are fitted with tiles which form a continuous thickness of firebrick between the tubes and the furnace gases in the combustion chamber. No water-screen tubes are employed in the chambers, but the ashes at the bottom are kept in a molten state until they drip into the pit beneath, at the bottom of which they fall into a water sluice which carries them away. The combustion chambers are fitted with three burners at each end, through which the pulverised fuel with its primary air, and also the secondary air, enter the furnace. The boilers were designed by Messrs. Simon-Carves, Ltd.

Four large coal driers of the rotary-kiln type are fired by small pulverised-fuel furnaces, and reduce the total moisture in the coal from 20 to 6 per cent. without driving off any material part of the volatiles contained in the coal. The dry coal is conveyed by elevators and screw conveyors to bunkers

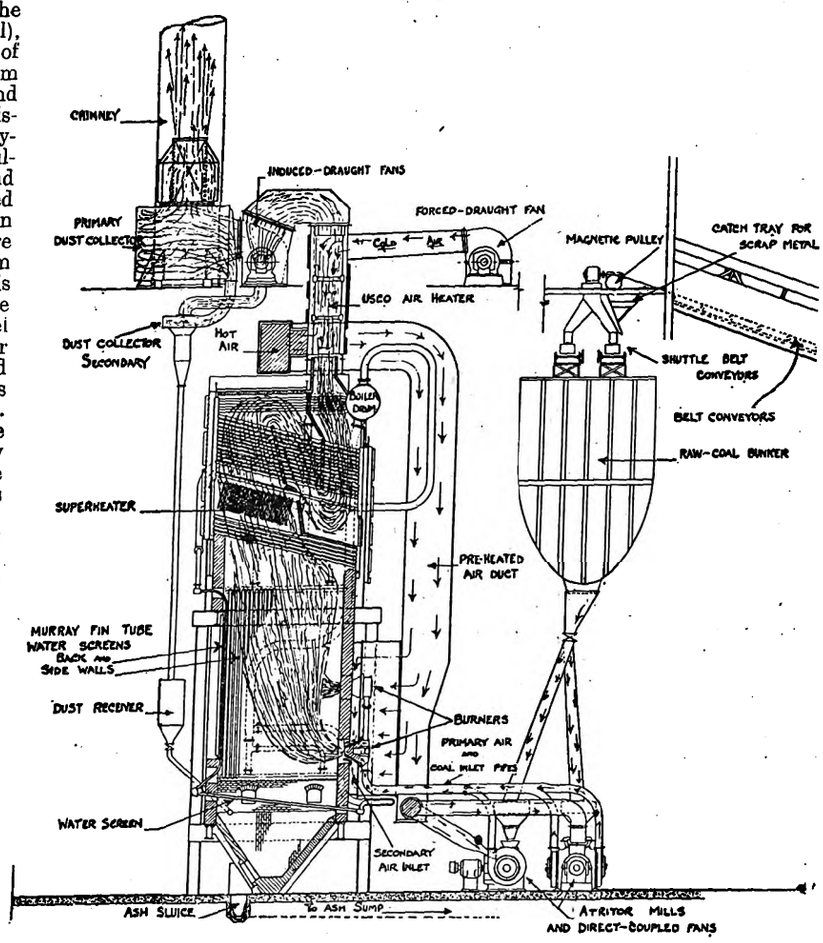

Fig. 1.—Hams Hall Pulverised-fuel-fired Boiler; Unit System.

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in the boiler house proper, whence it is fed to four large motor-driven ball mills, each capable of pulverising 12 tons per hour. They are air-swept, and the fuel is caught in cyclone collectors and stored in bins over the boilers, from which it is delivered by means of special feeders to the six burners installed in each furnace. Any mill can supply any bin by cross screw conveyors.

Two of these boilers have now been in operation for about 12 months, and it is apparent that the following modifications are desirable. The large amount of moisture that is driven off in the coal drier does not all get away through the vent provided, but a quantity of it passes over with the coal through the screw conveyors, which have to be hermetically sealed in order to prevent the dust from getting out. The temperature of the coal and the vapour in the conveyor is about 200 deg. F., and the moisture condenses on the inside surface of the conveyors and tends to promote clogging. The conveyors have had to be lagged to prevent contact with the external low-temperature air. With coal of low moisture content there is no trouble of any kind as regards packing in the pulverised-fuel bins, and there is no intermittent working of the coal feeders to the burners. If the CO_2 in the gases is allowed to rise above 14 per cent., the brick tiles in front of the tubes become burnt away, and it has now been decided to leave all the tubes exposed and to insert the brick tiles behind them to form a wall between the tubes and the outer casing. In this way it is anticipated that the CO_2 can be raised to 16 per cent. and a higher thermal efficiency obtained.

A test has recently been carried out, and the combustion heat efficiency obtained was 84.69 per cent. The test was carried out over a continuous period, and is not therefore comparable with the test on the Vickers-Spearing boiler. It compares, however, with a stoker-fired boiler combustion efficiency of 80 per cent. obtained under similar test conditions.

For the Hams Hall station now under construction for the Birmingham Electric Supply Committee it has been decided :—

(1) To adopt still larger boilers of 200,000 lb. evaporation per hour each.

(2) To form the water walls of the combustion chambers of Murray fin tubes, so as to do away with all possible brickwork in the furnace.

(3) To use unit pulverisers, five mills to be fitted to each boiler (one spare).

This arrangement is shown diagrammatically in fig. 1. The boilers are equipped with superheaters and air heaters, the whole of the air required for combustion being heated to a temperature of about 350 deg. F. The "Atritor" mills are air-swept with hot air. In this way the moisture content of the coal which is not dried, but is fed to the mills in its raw state, is vaporised before the pulverised fuel is blown into the furnace. The great attraction of this arrangement is its simplicity and considerably reduced capital cost. Both in America and on the Continent this system of firing is being largely adopted, and satisfactory results are being obtained.

Discussion in London.

Mr. W. H. Patchell remarked, with reference to the author's correction of the heating surface figure of the second installation, that apparently some 5,000 sq. ft. was due to the water walls, and if the whole story could be told it would be very interesting. The results of experience of the Hams Hall installation would be instructive. The dust-emission problem was a matter of £ s. d.; he knew of dust being caught in the chimney electrostatically in a satisfactory manner, but his experience was that dust from the bins was very much dirtier than that from the chimneys.

Mr. L. L. Robinson explained that, although he had had no personal experience of pulverised fuel, he had investigated the subject in connection with a boiler house he was erecting. A point that struck him during investigations in England, France, and Germany was that all p.f. boiler houses looked like buildings in course of erection; bricklayers were always busy all over the place, tubes were first installed and then smothered with brickwork. The dust problem could only be tackled electrostatically, which was an expensive method. What was the difference between the efficiencies of p.f. and stoker firing? Were the author's figures real ones? Stoker design had improved greatly lately, and their efficiency was nearly that of p.f. plant. Solid coal could be weighed, but the quantity used in the powdered form had to be calculated and nobody had yet stated what the accuracy of such calculations was. He had eventually decided to use stokers.

Mr. D. Wilson thought the use of the word modern in the title of the paper was unfortunate, for practice had, and was, changing rapidly. The installation at Brighton would come into prominence. Some of the author's statements would not make people too keen on the system: the nigger was in the heat balance, for losses by radiation, in the combustible ash, and unaccounted for of 7 and 0.87 per cent. in the Vickers-Spearing and Simon-Carves installations, respectively, were ridiculous. The stated efficiency of 72 per cent. of stoker firing was also ridiculous, for engineers were present in that room who claimed much more than that, and an average of 85 per cent. was obtained in several installations. Hitherto they had been trying to burn p.f. in boilers that were unsuitable for it, but now a specially adapted type was available that was smaller and less costly which came into direct line with stoker-fired plant; the extra power required for preparing and conveying the fuel was not more than 16 kW, or 4d., per ton. The dust problem had been solved long ago, and only the method needed selecting. As he would not be in their circle much longer, he would advise them to watch developments at Birmingham and Brighton.

Mr. J. Burns was glad to hear that the dust problem had been solved. He was more concerned with the emission of sulphur fumes and asked what had been done at Hams Hall to prevent a repetition of what had occurred at Manchester. The main features of p.f. were flexibility, ease of control, and economy. The paper illustrated the evolution of the system very well and the Hams Hall plant was much more impressive than the author's diagram indicated. Many people would be glad to do without the very large stokers that would be needed for the size of boiler mentioned in the paper; they could be operated satisfactorily, but maintenance figures were not yet available for them. The use of p.f. must be a little more costly, but the better results obtainable would make good the balance sheet.

Capt. J. M. Donaldson thought there was more in the paper than appeared at first sight, and he thanked the author for his frankness in detailing the steps which had led up to the latest type. For moisture reduction hot air must be used in the mill; for grinding, the author had reverted to the British "Atritor" mill. Dust extraction without involving large space would not be too good; the water system appeared to be satisfactory at the moment, but was certainly messy.

Mr. Theodore Levens referred to the emission of dust and fumes.

Mr. J. Christie remarked that he had taken his courage in both hands and used a combustion chamber which was the furnace itself, and operated with 16 per cent. CO_2, without an economiser, but with two air heaters. Everything was well lagged and, though he used unit pulverisers, a 30-ton bin had been provided to avoid any time lag between the pulverisers and burners; moisture in the coal was reduced to from 4 to 5 per cent. A feature of p.f. was that it was exceedingly flexible and they had had some wonderful experiences at Brighton. There was no risk in operating at the higher ratings now advocated, and he had not had trouble with priming; a flow meter was fitted to each boiler and so set that it admitted feed water according to the output; thus they were able to operate for hours without a variation of more than ⅛ in. in the gauge glass. Even if the whole plant were not fired with p.f., a section to deal with load fluctuation was very desirable.

Dr. R. Lessing said that seven years ago he sounded a warning that the smoke nuisance would be followed by the grit nuisance, but it had not apparently been taken to heart. If coal were passed through a commercial process at the colliery, he stressed the word "commercial," a large part of its ash content which was emitted from the chimney could be eliminated; such "clean" coal would then contain only about 2 per cent. of non-combustible ash, and it was surely better business to pay a little more for better calorific value and less ash and dust. The cost of transporting, by the railways alone, the useless ash content of coal was erroneous and some of that money could be spent in better ways.

Mr. W. N. Clinch drew attention to the flexibility of p.f. and claimed that coal of a varied character could be burned. The main difficulty was in drying the fuel, the mill temperatures at present used being too low; for good operation the moisture content should not be more than 2 per cent.

Mr. W. F. Slater complained that the paper did not contain power or maintenance cost figures. Powdered coal received more than its fair share of blame for dust emission, for stokers were by no means clean.

Mr. R. A. Chattock, in reply, pointed out that the cost of his earlier installations had been higher than if they had started *de novo*, as the plant had to be adapted to existing buildings, but it had been faced in order to acquire experience for the Hams Hall station. When he read his paper again before the South Midland Centre he hoped to include more details, as steam was now being raised in the Hams Hall plant. With cyclones they could arrest from 85 to 90 per cent. of the dust that went up the chimney from a stoker-fired furnace, but p.f. was different in nature; it would pass through a 300-mesh and they could only catch from 30 to 40 per cent., which was not nearly enough. With a second cyclone in series, however, they caught 70 per cent. and hoped to increase that figure. He had himself had to burn double-screened and washed nuts in order to reduce dust; when that problem was solved they could get back to cheaper coal. Electrostatic and water apparatus could not be installed on the roof, as it was too bulky and costly. Stoker efficiency was improving, but so was that of p.f. too. The figures Mr. Wilson had criticised certainly did not look correct; he had suspected them himself and had had them checked; so far as they could ascertain they represented the conditions obtaining during the test. The power consumed by auxiliary plant was more in the case of p.f., but the reduced labour balanced the extra power. He agreed that coal should be cleaned before use, but if the collieries did it they would want to add 4s. or 5s. to the price per ton of the coal, which was too much and could not be faced. Reduction of the coal's moisture content to 10 per cent. was not quite enough; by the use of a rotary kiln it could be reduced to 1.5 per cent. if necessary. Mill replacement cost under 2d. per ton of coal pulverised.

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Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Co-ordination of London Transport.

On April 16th the Select Committee of the House of Commons which is considering the Bills promoted by the London County Council and the Underground group resumed the hearing of evidence.

Sir Lynden Macassey, K.C., for the Underground group, submitted a list of amendments designed to meet objections and suggestions by the Committee and opponents of the Bills. These dealt with a number of matters, and one of them provided that the Ministry of Transport could order an inquiry upon representations by a local authority where material alterations of fares or services were proposed.

Lord Ashfield was further cross-examined, and in the course of his replies, said that although the extension of the Trade Facilities Acts might do something to meet the traffic problem, he deprecated any arrangement which would put the full financial responsibility on the public. He claimed that the Bills would bring about advantages by the standardisation of rolling stock and through the wider financial resources which would result from the common fund.

This concluded the promoters' case, and Mr. Moon, representing opposing Metropolitan borough councils, addressed the Committee. He said that the travelling public should have the dominant voice in traffic matters, whereas the Bills gave a virtual monopoly to private companies. The London transport system should be placed under the control of a public body as the water supply had been.

Upon the resumption of proceedings on April 17th, Mr. Arthur Collins, speaking on behalf of the Metropolitan borough councils opposing the Bill, considered that the ordinary passenger received insufficient protection under the Bills and the machinery, for control was inadequate. In his view the objects of the Bills would be met by a working agreement with respect to traffic facilities without the complication of a common fund arrangement. Witness thought that the proposed Tramways Board might well contain unforeseen elements of danger. He maintained that tramways should be allowed to run until the end of their economic life, when they could be gradually replaced by other forms of transport.

Alderman F. C. R. Douglas (Battersea) also considered that a working arrangement between the L.C.C. and the Underground group, to meet the difficulties of competition, was all that was necessary. He had no objection to the setting up of an authority which would control the whole of the London transport.

On April 18th, Mr. Rowand Harker, K.C., representing the Middlesex County Council, said that the Metropolitan Electric Tramways were very much in arrears with their obligations. There was an outstanding debt of £1,100,000 and the track required considerable reconstruction and repair. The Middlesex County Council was asking that it should be allowed to take part in the negotiations between the L.C.C. and the Underground group before the first agreement was made, or at least to have an opportunity of criticising the agreement. The Council now had either to grant a new lease on the best terms which it could get or take over the operation of the tramways itself.

Sir Lynden Macassey said that the Underground group had already offered to allow owners of tramway undertakings in the area to participate in the negotiations.

Mr. R. Stafford Cripps, K.C., who appeared for a number of metropolitan borough councils, said that his clients objected entirely to the preamble of the Bills. In their view the Bills did not really deal with the co-ordination of traffic but provided only for a financial merger of the municipal and company undertakings. He maintained that if the Bills were passed anybody could appeal to the Courts to restrain the L.C.C. from expending public funds except under the control of the proper committee of the Council.

It was announced on April 19th that the promoters had agreed to a new clause providing that all owners of tramways in the London traffic area should be allowed to participate in the framing of the agreement between the L.C.C. and the Underground group.

Mr. H. D. McMillan thereupon stated that his clients, local authorities including the Hertfordshire County Council and the Croydon Corporation, would withdraw their opposition.

Mr. Rowand Harker, however, said that the Middlesex County Council would continue to oppose the Bills, considering that the agreement should have been scheduled to the Bill and that it should form the subject of a public inquiry.

Sir Lynden Macassey said that only eleven of the 132 local authorities in the area were now opposing the Bills. He considered that the promoters had already gone too far in the matter of safeguards.

The Chairman said that if it was thought desirable to have a controlling body, the Bills would facilitate matters.

Mr. Charteris said that the L.C.C. believed that the Bills secured the largest measure of public control consistent with efficient management.

The Committee concluded its proceedings on April 22nd. After announcing that it found the preamble of both Bills proved it went on to consider clauses. Referring to one in the Underground Bill which provided that money might be spent out of revenue for research and experiment and for alteration and betterment, Lord Ashfield said that this was the standard practice of transport undertakings. The clause was discussed and Sir Lynden Macassey offered to withdraw it. The Committee decided, however, that it should stand provided expenditure was limited to research and experiment. Upon representations by Mr. W. J. Jeeves, K.C., for the Association of Local Government Officers, the Committee accepted a clause (after modification) providing that employés of other authorities affected by an agreement under the Bills should be placed in a position not less favourable than that of L.C.C. employés with regard to compensation. The Committee struck out a clause providing that the Minister of Transport could apportion the costs of exercising his powers under the Bills between the parties, and the Bills were ordered to be reported to the House.

The Battersea Power Station.

On April 18th, Lord Sandon asked the Minister of Transport whether he would immediately refer the question of the complete elimination of sulphur fumes from the working of electricity generating plant to some body for scientific investigation and research; and whether, in the meantime, he would insist on sites for such purposes being chosen with full regard to the public interest, especially in the case of Battersea, in view of the effect of such fumes on the fabric of the Houses of Parliament.

Col. Ashley said that in approving sites for power stations regard was, of course, paid to the public interest and opportunity was given for the hearing of any representations made, and no site in the County of London could be approved by the Electricity Commissioners without the consent of the Commissioners of Works, unless the authority of Parliament had been obtained. When consent was given to the erection of the Battersea power station which was now under construction, an obligation was placed upon the London Power Co. to take the best known precautions for the due consumption of smoke and for preventing, so far as reasonably practicable, the evolution of oxides of sulphur. He was assured by the Electricity Commissioners that in this modern power station effective steps could and would be taken to prevent the emission of grit and smoke. He was also informed that, with a view to compliance with its obligation, the company had employed research chemists to work on the problem of the elimination of sulphur fumes, and had stated that satisfactory results had already been obtained in laboratory experiments. In view, however, of the public interests involved, the Electricity Commissioners, with his approval, had asked the Government chemist to examine those results and to keep in close touch with the progress of the company's investigations. In conjunction with the Department of Scientific and Industrial Research, he would advise the First Commissioner of Works and the Electricity Commissioners as to the efficiency of the measures proposed to be adopted to comply with the conditions on which consent had been given to the erection of the new station. The Ministers concerned with the various aspects of the question would remain in consultation with one another and watch it closely.

Lord Sandon asked whether it was not a fact that, in Cologne, with similar conditions, there were no fumes.

Col. Ashley said that was what they hoped for, that when those conditions were carried out there would be no fumes.

Sir H. Brittain asked whether these regulations applied to all other power stations in the London area.

Col. Ashley said they did not. Only the newer stations had the conditions imposed.

Legal.

Atlas Light and Power Co., Ltd.

In the Chancery Division, on April 22nd, Mr. Justice Maugham sanctioned an alteration in the objects of the Atlas Light and Power Co., Ltd.

Mr. Cecil Turner, for the company, said it was formed to carry on waterworks, power stations, and tramway and railway undertakings in Argentina. It had recently sold all its investments in that country for £8,500,000, and owing to the restricted character of its investment powers the company would have difficulty in using this large sum to advantage. It therefore desired to alter its objects so as to take the general powers of a trust investment company.

Handley & Robinson, Ltd.

In the High Court, Dublin, before Mr. Justice Johnston, on April 18th, Mr. Morgan Byrne, B.L., on behalf of Marconi (Ireland), Ltd., applied for an order that Mr. G. H. Tulloch, 39-41, Dame Street, Dublin, be provisionally appointed liquidator of Handley & Robinson, Ltd. Counsel moved on the affidavit of Mr. Archibald Wright, secretary of Marconi (Ireland), Ltd., who stated that Handley & Robinson, Ltd., were indebted to that company for £213 for goods. Marconi (Ireland), Ltd., had presented a petition to the Court for the

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winding up of the company. The company was carrying out various contracts with different customers, and he was informed by the manager of the company that a sum of about £250 for wages must be paid on April 19th to keep the employés of the company at work, and that the bankers of the company had refused to give them any further credit, and the company had not sufficient cash to meet this and other demands. Unless immediate arrangements could be made for financing the business, work on the various contracts would cease, with the result that claims for breach of contract might be made against the company.

Mr. Justice Johnston made an Order appointing Mr. Tulloch liquidator, pending the hearing of the action.

British Thomson-Houston Co., Ltd., v. Harris's.

In the Chancery Division, on April 16th, before Mr. Justice Luxmoore, the British Thomson-Houston Co., Ltd., moved for judgment in default of appearance and defence, against Harris's, Shudehill, Manchester, in respect of the infringement by the defendants of letters patent for incandescent electric lamps. The plaintiffs asked for an injunction to restrain the defendants from infringing the patent, and also applied for an order for delivery up and an inquiry as to damages. The order asked for was made, with costs.

Petition Against R. I. & Varley, Ltd., Dismissed.

In the Companies Winding-Up Court, on April 22nd, Mr. Justice Maugham heard a petition by Oliver Pell Control, Ltd., and Mr. J. M. G. Rees, for an order for the compulsory liquidation of R. I. & Varley, Ltd., a company which acts as selling agents for the radio and other products of Oliver Pell Control, Ltd., and Radio Instruments, Ltd.

Mr. F. K. Archer, K.C., for the petitioners, said that Oliver Pell Control, Ltd., and Radio Instruments, Ltd., had equal holdings in R. I. & Varley, Ltd., and acute differences had arisen between Mr. Joseph and Mr. Rees, representing Radio Instruments, Ltd., and Oliver Pell Control, Ltd., respectively, on the board of the respondent company. Mr. Joseph, said Counsel, claimed to act as chairman, and as such had passed resolutions and had made it possible for him to sign cheques alone on behalf of the company, ignoring Mr. Rees. This had caused a deadlock and business could not be carried on.

Mr. W. P. Spens, K.C., for Mr. Joseph, said that the only deadlock was caused by Mr. Rees refusing to attend meetings of the board. He read an affidavit by Mr. Joseph, who, after stating that he was a pioneer of the wireless industry in this country, alleged that Mr. Rees had disregarded his authority as managing director of the company, had been extravagant in his commitments as sales director, had refused to discuss important business matters with him, and had written letters of an offensive character to him.

After hearing further evidence the parties came to an agreement by which it was arranged that there should be a voluntary liquidation, the petition being by consent dismissed.

Safety of Life at Sea.

An International Conference held in London.

The first meeting of the International Conference on Safety of Life at Sea commenced on April 16th, at the Foreign Office, London. Official delegates were present from Belgium, Denmark, Finland, France, Germany, Italy, Japan, The Netherlands, Norway, Russia, Spain, Sweden, and the United States, besides the delegations of the United Kingdom, Canada, Australia, the Irish Free State, and India; representatives of the League of Nations were also present.

The Conference was welcomed by Sir Philip Cunliffe-Lister, President of the Board of Trade, who conveyed a message from the King, and extended to the delegates a welcome on behalf of H.M. Government. He stated that every State to whom they addressed their invitation had accepted, and, happily, not a few met again who took part in the last Conference. The purpose of the Conference was to review the Convention of 1914 and the conclusions reached 15 years ago in the light of the knowledge and experience gained in those critical years. Great developments had taken place in wireless-telegraphy, which was becoming, if it had not already become, the most important element in safety of life at sea. In order that the Conference might pursue its work rapidly, they felt that it would be convenient that, well in advance of its meeting, they, as conveners of the Conference, should submit to all the Governments concerned tentative, but detailed, proposals for revision. Several Governments had furnished their considered observations on the proposals, and their observations had in their turn been circulated. Thus every delegation had had a full opportunity of presenting its own views and studying the views of others before they met. Sir Philip hoped that in that way they might have expedited business and facilitated agreement.

Dr. Sthamer (German Ambassador in London and head of the German delegation) replied on behalf of all the delegations partaking in the Conference. Reasonable hope might be entertained that the deliberations of the second Conference would lead to a complete solution of the complicated questions on the agenda.

The Hon. Wallace H. White (head of the United States delegation) asked Vice-Admiral Sir H. W. Richmond, chairman of the United Kingdom delegation, to become president of the Conference.

Admiral Sir Herbert Richmond then took the chair, and read the reply which it was agreed to send to the King's message.

At the conclusion of the presidential address, Mr. Arens, on behalf of the Soviet Government, made a declaration, in the course of which he stated, *inter alia*, that one of the most important problems facing the Conference was the regulation of the installation of alarm devices and the effective use of all other means of radio-telegraphy. Therefore, as the subject of international radio-telegraphy was very essential at the Conference, he, on behalf of the Soviet delegation, considered it necessary to point out the abnormality of the fact that U.S.S.R., being a signatory to the International Radio Convention, and having a developed radio system, was not invited to take part in the work of the International Radio-telegraphy Conference convoked at Washington in 1927, whose problems were of exceptional importance to all countries. The interests of international communication should not be subordinate to purely political considerations. Important questions of international radio-telegraphy remained unsettled, especially the cardinal and delicate problem of the distribution of wavelengths. Having in view the great importance of the work of the Conference, the Soviet Delegation, although being in no way bound by the Washington Acts, would use its best endeavours to contribute to the best solution of all the problems which had brought about the convocation of the Conference.

The plenary meeting of the Conference agreed to appoint a number of committees to deal with the principal groups of subjects included within the scope of the Conference, together with a drafting committee for drawing up, on the basis of the other committees' reports, the articles of a new Convention on Safety of Life at Sea. Four committees have already begun their work, including one on radio-telegraphy, under the chairmanship of Mr. Giess (German delegation). Each of the committees includes representatives of nearly all the delegations.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

H.F. Alternator Development.

In your issue of the 12th inst. you publish under the above title a description of what is claimed to be a new type of h.f. alternator made on the Continent. We should like to draw your attention to the facts that h.f. alternators of this type have been manufactured by us for several years past and that many are now running in England and abroad.

This type of alternator, however, does not compare favourably with the single-coil double-core type in the following respects:—

(1) Additional iron loss in the rotor due to change of polarity.
(2) Additional excitation loss owing to the plurality of field coils.
(3) Magnetic noise unless magnetic densities are kept very low.

Inductor-type high-frequency generators are no doubt very efficient machines, a 200-kW, 1,000-cycle generator driven by a 50-cycle induction motor having an overall efficiency as high as 85 per cent., or even greater.

Electro Dynamic Construction Co., Ltd.

London, *April 18th*, 1929.

Proposed Technical Society for Meter Engineers.

The Meter Engineers' Technical Association came into being in 1926, and, as a separate Association, fulfilled its mission by bringing into due prominence the subject of electrical measurement. Meter engineers thus gained their point, secured recognition, and, when invited by the I.E.E. to assist in the formation of a special section of the Institution, agreed by a substantial majority that such a step would be to their advantage, and would provide a better medium for the discussion of their specialised technical problems. It seems astonishing, therefore, that anyone should now suggest "that the needs of the majority of the meter fraternity are not being catered for from a technical standpoint," as Mr. H. F. Hudson does in his letter which appeared in your issue of April 19th. As a member of the Meter and Instrument Section of the I.E.E., he must surely be aware of the five papers read before the Section this winter, each of which specifically dealt with meter and/or instrument matters. How then can he justly say that a review of the past four months' I.E.E. papers supports his view?

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The desirability of avoiding an unnecessary multiplicity of small associations—which view influenced members of the late M.E.T.A. to give their adherence to the new Meter and Instrument Section of the I.E.E.—would now operate very strongly and justifiably to cause them, or any other meter engineers, to react vigorously against any project for a new and separate association.

Mr. Hudson, and those who think with him, and surely they cannot be many, would do well, if they are dissatisfied with the present position, to take an *active* interest in the I.E.E. Meter and Instrument Section, and do their best to mould it according to their views, even to the extent of forming local Meter and Instrument Sections, as provided for in the rules, so that distance from London need not form such a bar to the enjoyment of the advantages offered by the Section.

An ill-timed and disruptive proposal such as the one put forward by your correspondent would, if persisted in, do the greatest disservice to meter engineers, who have at last achieved unity and concentration of forces on the technical side, and who would undoubtedly look with extreme disfavour on any attempt at division and dispersion of their efforts.

Geo. D. Malcolm.

London, *April 20th*, 1929.

Changing Over to A.C.

With regard to Mr. R. H. Rawll's article in the issue of April 12th under the above heading, we should like to point out a slight discrepancy which appears in the paragraph on battery eliminators, in which a reference is made to the Westinghouse metal rectifier.

Mr. Rawll states that "if a metal rectifier is employed, in most cases it is not necessary for a transformer to be used"; this is qualified by the further remark that "from a purely operating point of view, but it is most desirable."

We should like, however, to make it perfectly clear that a double-wound transformer is absolutely necessary to isolate the metal rectifier from the system, and this applies to any apparatus which has any "earth" connection; the mere fact of a condenser being inserted in the earth lead, is not sufficient. Where metal rectifiers are used for charging h.t. batteries the transformer can be dispensed with, always providing that the batteries are entirely disconnected from the radio set; neither is it necessary when energising high resistance pot windings of coil-driven loud-speakers.

We shall be obliged if you will take what steps you consider advisable to correct any misapprehension which might otherwise arise.

Westinghouse Brake & Saxby Signal Co., Ltd.,
Frank P. Moulder, *Sales Manager.*

London, *April 18th*, 1929.

It appears that the Westinghouse Brake & Saxby Signal Co., Ltd., has either misunderstood my remarks regarding metal rectifiers, or has not carefully read the context of the article in which they appeared.

In the first paragraph on page 646 I stated that "if a metal rectifier is employed, in most cases it is not necessary for a transformer to be used *from a purely operating point of view.*" That is the whole point. A metallic rectifier when connected between the a.c. supply and a d.c. eliminator will operate the receiving set satisfactorily. As I then pointed out, from the safety point of view, a transformer "is most desirable in that the vast majority of wireless sets working off d.c. mains have many exposed parts which are alive, &c."

For these reasons, when a consumer using a d.c. high-tension battery eliminator is changed over to a.c. the rectifier is always isolated from the mains by means of a double-wound transformer. Unfortunately, however, the price of a metal rectifier plus a transformer is considerably more than that of a thermionic rectifier (a transformer for which is essential in its construction), and consequently, the latter at present is installed for supplying current to high-tension battery eliminators. As I stated in the third paragraph on page 647, "if a metal rectifier is used to supply the current of the energising coil of a loud-speaker only, *and not to the receiving set as well*, it is not necessary to employ a transformer to isolate it from the supply mains," for which case, from the point of view of first cost only, it is slightly cheaper than the thermionic rectifier.

Reg. H. Rawll,
A.M.I.E.E., A.M.I.Mech.E.

Birmingham, *April 22nd*, 1929.

Cleaning Machinery.

"Charge Engineer" should realise that the maximum possible suction is 14 lb. per sq. in. at the nozzle of a vacuum cleaner, while it takes quite 30 lb. per sq. in. nozzle pressure to move most of the dirt inside the centre of a machine; also, many special fittings would have to be devised to replace a well-directed stream of air with the end shields of the machine removed. The only solution to this problem is to collect the dust disturbed in a hood, or tent, connected to the air inlet of the same pressure machine with two or three suitable filter bags, or screens, between the hood and inlet; the hood need not be too airtight.

In connection with vacuum cleaners, I have never seen stated what the "suction pull" one foot from a vacuum cleaner nozzle is, and, for the want of a better term, what might be called "back suction" due to a dirty collecting bag, or too closely woven fabric (I have held my hand over the air outlet, so completely stopping it); even if pressure which does not effect efficiency is generated in the bag it must increase the power required to work the cleaner.

W. J. Minton.

Ilford, *April 22nd*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

31,541. "Electrically-operated horns." Compagnie Industrielle et Commerciale du Cycle et de l'Automobile and L. Chollet. November 23rd, 1927. (308,629.)

31,633. "Illumination and working of advertising signs." W. A. Burns. November 24th, 1927. (Cognate application, 17,341/28.) (308,669.)

31,640. "Microphones." Siemens Bros. & Co., Ltd., and G. F. Dutton. November 24th, 1927. (308,630.)

31,696. "Electric blasting fuses and detonators." W. O. Littlebury and Imperial Chemical Indust ies, Ltd. November 24th, 1927. (308,701.)

34,858. "Telephone transmitters." A. J. Aldridge, E. J. Barnes and E. Foulger. December 23rd, 1927. (308,638.)

35,029. "Electric telegraphic receiving apparatus." Creed & Co., Ltd., F. G. Creed, R. D. Salmon and S. E. Kirk. December 24th, 1927. (308,672.)

35,104. "Electric protective arrangements." A. Reyrolle & Co., Ltd., N. Cooke and B. H. Leeson. December 28th, 1927. (308,744.)

35,134. "Annealing furnaces." Akt. Ges. Brown, Boveri et Cie. December 27th, 1926. (282,799.)

1928.

1,433. "Luminous reproduction of circuits." Siemens & Halske Akt. Ges. January 19th, 1927. (283,893.)

1,933. "Electric bell installations fed from small transformers." Siemens-Schuckertwerke Akt. Ges. January 28th, 1927. (284,325.)

2,602. "Slow-motion adjusting devices for wireless instruments." Igranic Electric Co., Ltd., and S. R. Wright. January 26th, 1928. (308,856.)

4,646. "System of connections for telephone installations." Siemens and Halske Akt. Ges. October 22nd, 1927. (299,295.)

6,438. "Electrical remote-control systems." H. Froger. March 1st, 1928. (308,876.)

6,857. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 5th, 1928. (308,879.)

7,964. "Electric furnace for heating strip metal by induction currents." Hirsch Kupfer-und Messingwerke Akt. Ges. and M. Tama. September 17th, 1927. (297,311.)

8,014. "Cord grips for electrical fittings and appliances." P. R. Shackell and Ranton, Ltd. March 16th, 1928. (308,888.)

8,644. "Electromagnetic vibratory devices for use, for example, in reproducing or recording sound." Gramophone Co., Ltd., and E. M. Payne. March 21st, 1928. (308,892.)

9,254. "Indicating or warning devices for excess electric currents.' J. E. Brown, E. G. Anness and W. Meacher. March 27th, 1928. (308,895.)

10,415. "Wireless apparatus." E. H. Newman and M. Baynes (trading as Langham Radio), and V. S. Knight. April 5th, 1928. (308,902.)

10,615. "Resistance lamps and rectifying installations embodying such lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 7th, 1927. (290,157.)

11,801. "Shade fittings for electric and other lamps." Best & Lloyd, Ltd., and W. Morris. April 21st, 1928. (308,908.)

12,022. "Electric flasher." A. Andersson, K. Ohlsson, G. Sanderson and B. Sanderson (trading as A Sandersons Linjeringsmaskinfabrik). April 24th, 1928. (308,910.)

12,354. "Apparatus for reproducing recorded sound." H. J. Kuchenmeister. November 2nd, 1926. (Divided application on 280,188.) (289,447.)

12,505. "Electric resistances." R. Amberton and Electrical Apparatus Co., Ltd April 28th, 1928. (308,913.)

12,539. "Variable electric condensers." Soc. Belge Radi-Electrique. April 30th, 1927. (289,731.)

15,485. "Testing sets for locating faults in electric transmission lines." West Manufacturing Co. July 5th, 1927. (293,378.)

15,659. "Manœuvre-indicating devices for use on road vehicles." C. H. Clinton and J. Baxter. May 29th, 1928. (308,923.)

21,333. "Subaqueous sound transmitting or receiving apparatus." Electro-acustic Ges. August 2nd, 1927. (294,959.)

29,341 "Frequency changers for use in picture and other high-speed telegraph systems." Telefunken Ges. fur Drahtlose Telegraphie. October 12th, 1927. (298,614.)

30,480. "Electric switches." A. C. Wynne. January 21st, 1928. (Divided application on 307,584.) (308,951.)

32,294. "Rail for railway and tramway lines, and method of its manufacture." Vereinigte Stahlwerke Akt. Ges. February 27th, 1928. (306,888.)

1929.

1,432. "Apparatus for electrically transmitting to a distance the indications of a measuring instrument or the like." A. E. O'dell (Deutsche Telephonwerke und Kabelindustrie Akt. Ges.). October 24th, 1927. (Divided application on 279,510.) (308,673.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 17th :—

Design only. No. 494,639. Class 8. Radio-telegraphic and telephonic instruments and apparatus and sound producing, reproducing, transmitting and recording instruments and apparatus.—Ormond Engineering Co., Ltd., 199-205, Pentonville Road, N.1.

Aeonic. No. 496,367. Class 8. Radio-telephonic apparatus.—J. L. Gottlieb and Co., Ltd., 15, Cromer Street, W.C.1.

Philips' Metalix. No. 491,638. Class 11. X-ray tubes for surgical and curative purposes.—Naamlooze Vennootschap Philips' Gloeilampenfabrieken, Eindhoven, Holland. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALTRINCHAM.—91 houses, Oldfield Brow site, for U.D.C.; H. E. Brown, surveyor, Town Hall (returnable deposit £2 2s.). Extensions, High School for Girls (£5,000); Cheshire Education Committee.

BARKING.—Development of 400 acres at Creekmouth for factories, &c.; Land Co.

BARNET.—Boys' secondary school (£50,000), for Herts. E.C.; director of education, Hertford.

BARNSLEY.—Mining and technical college, for the borough E.C.; Evan Davies, director of education (returnable deposit of £5 5s).

BEDFORD.—Handicraft centre, for the Harpur Trust governors; P. Allen, architect, 81, High Street (returnable deposit of £2 2s.).

BEXLEY.—Houses (50), Pickford Lane estate, for the U.D.C.; Blackwell & Meyer, builders, Erith Road. Factory, Gravel Hill, for Mandrews, Ltd.

BILLINGHAM (Stockton-on-Tees).—Public offices, for the U.D.C.; Kitching & Archibald, architects, 21, Albert Road, Middlesbrough.

BOURNE.—Cinema; A. J. Thraves, architect, 12, Victoria Street, Nottingham.

BRANSTON (Burton-on-Trent).—Development of 150-acre estate for houses (approximately 1,000); Frank Rist, architect, Branstone Road.

BROMLEY (Kent).—Reconstruction of Grand Theatre; F. C. Mitchell. St. Andrew's Church, Burnt Ash Lane (£9,000); Sir Charles Nicholson, architect. Roman Catholic school, Plaistow Lane; Rev. Father Cox. Extensions, County School for Boys, for the E.C.; H. P. Burke Downing, architect.

CHATTERIS.—Printing works, for F. H. Aspinall & Son.

COVENTRY.—Residential hotel (120 bedrooms), Eaton Road; W. H. Jones.

DIDSBURY.—Cinema (£30,000); P. Cummings, architect, 51, King Street, Manchester.

DOVER.—Cinema (£50,000); County Theatres, Ltd.; E. G. Bygrave.

DUNDEE.—Buildings in Caird Hall Square (£23,000), for Montague Burton & Co., clothiers, Leeds; R. Pert and Sons, builders, Montrose.

DURHAM.—Central school, Whinney Hill, for the city E.C.; director of education.

ECCLES.—Houses (68), for the T.C.; Heelan & Yates, builders, Blackpool.

EDENBRIDGE (Kent).—Hospital (£17,000), for the War Memorial Cottage Hospital Committee; Miss M. B. Winch, hon. sec.

EDINBURGH.—Garage, with showrooms, workshops, &c., for Moir & Baxter, Ltd.; the manager.

ESTON.—Garage, for Blue 'Bus Service, Hewley Street; F. Taylor.

FAIROAK.—Senior school (£8,000); Hampshire Education Committee.

FALKIRK.—76 houses (£23,000), for Corporation; burgh surveyor.

GLASGOW.—Alterations (£7,512) to Trades Hall Buildings; J. Keppie & Henderson, architects. 84 cottages, 272 flats, and 384 tenements, West Drumoyne; housing director. Observation ward, Belvedere Hospital; city engineer and trade contractors. Miners' hall, Garngad Road; Robroyston Miners' Welfare Society. 160 houses, Netherton estate and 934 houses, Carnwadric estate; housing director.

GRANGEMOUTH.—Chemical block (£13,750), for Scottish Dyers, Ltd.; the manager.

GRIMSBY.—Fish dock (£1,418,000); engineer, L. & N.E.R. Co.

HERTFORD.—Reconstruction, County Hospital (£35,000), with X-ray and electrical department; Elcock & Sutcliffe, architects, 21, Northumberland Avenue, London, W.C.

HITCHIN.—Additional 45 houses, for the U.D.C.; A. Carter, builder, Luton.

HODDESDON.—Cinema, High Street, for Stephen & King.

IRISH FREE STATE (Galway).—Houses (50), for the U.D.C.; W. Binns, borough surveyor.

(Kells, Co. Meath).—Technical school, Bective Street, for the U.D.C.; M. Grace, architect, Oldcastle.

LINCOLN.—Extension of the county hospital (£90,000); Board of Governors.

LLANDUDNO.—Reconstruction, Links Hotel, for W. H. Parry.

LONDON (Shoreditch, E.).—Extensions, model welfare centre (£12,000); medical officer of health.

(Ilford, E.).—Warehouse, St. Luke's Avenue, for Pickfords, Ltd.

(Fulham, S.W.).—Additions, Peugeot Motor Works, Filmer Road; J. Yellan & Son. Additions, Beaumont Works, Beaumont Road; R. Dixon & Sons.

(Ealing, W.).—Factory, Horsenden Lane; A. S. R. Ley and Sons, architects, 214, Bishopsgate, E.C.2. 319 houses: Mansell Road (61), Portland Crescent (95), Fermoy Road (18), Garrick Road (54), Mornington Road (91); H. S. Bostock, Broadway Chambers, Southall, architect; George Wimpey & Co., Ltd., contractors. 23 shops and 36 houses, Pitshanger Lane, Queen's Walk, and Glencairn Drive; Hall-Jones & Dewhirst, architects. 107 houses (£42,408) and 12 flats (£3,765), Pope's Lane, and 91 houses on Humes Avenue site (£33,019), for T.C.; contractors: George Wimpey & Co., Ltd.

LOWESTOFT.—Home, St. Margaret's Road; Waifs and Strays Association.

MARKFIELD.—Isolation hospital (£120,000), for Leicestershire C.C.; clerk.

MARPLE.—School (£16,717), for Cheshire E.C.; Gladden and Davies, builders, Manchester.

MERTHYR TYDFIL.—Smallpox hospital, for the T.C.; borough surveyor.

MILTON REGIS (Kent).—Houses (92), for the U.D.C.; A. V. Stinton, builder, Rainham, Gillingham.

NEW MALDEN.—Central school, Ballards estate; Surrey Education Committee.

NORTHERN IRELAND (Newcastle, Co. Down).—Technical school, for County Regional Education Committee; C. J. Love, architect, 11, Chichester Street, Dublin.

NOTTINGHAM.—Shops and showrooms, for the Star Supply Co., Ltd., London; M. Evans, architect, 292, High Holborn, W.C.2.

OLDHAM.—X-ray department, Boundary Park hospital (£4,000), for the Board of Guardians; clerk.

PRESTWICH.—94 houses, Park Road and Brooklands Road; Didsbury Park Estate, Ltd. 52 houses, Half Acre Lane; Mr. Titterton, for U.D.C. Sewage scheme; H. C. Whitehead, Birmingham, consulting engineer.

READING.—Workshops and offices, for R. Cort & Son, Ltd., Reading Bridge Ironworks. Church hall, Caversham Heights, for the Wesleyan trustees; secretary. Houses (165), for the T.C.; A. A. Moynihan, builder, Theale.

REPTON (Derbyshire).—Extensions to Repton School chapel and restoration of the Priory (£10,000), for the governors.

RETFORD.—Electric lighting installation, King Edward VI Grammar School for Boys, for the governors; clerk.

RINGWOOD (Hants.).—Water supply scheme, with electrically-driven turbine pumps (£27,500), for the R.D.C.; W. E. Easdale, engineer, Westminster.

ST. ALBANS.—College of housecraft, for Herts. E.C.; director of education, Hertford.

SALE.—Boys' Secondary school; Cheshire Education Committee. Extensions, High School for Girls (£16,000); Cheshire Education Committee.

SCUNTHORPE.—Housing scheme (30) (deposit £2); W. Farrar, surveyor to U.D.C.

SOUTHEND-ON-SEA.—Church, Churchwell Park (£8,500); J. C. Flaxman & Sons, Ltd., builders, Southchurch Road.

STOURBRIDGE.—Houses (74), for the T.C.; Arthur M. Griffiths & Sons, Ltd., builders, Wolverhampton.

STRATFORD-ON-AVON.—Housing scheme (100), for the T.C.; borough surveyor.

STRETFORD.—Cinema, Moss Road; J. Maunders.

SUTTON.—Central school, Robin Hood site; Surrey Education Committee.

SWANSEA.—Joinery works, Sun Fuel works site; J. Roberts. Alterations, High Street; F. W. Woolworth & Co., Ltd.

WARRINGTON.—Extensions, library and museum (£8,300), for the T.C.; borough engineer.

WARWICK.—Housing scheme (106), for the T.C.; R. Wormell, borough engineer (returnable deposit of £2 2s.).

WEYMOUTH.—Extensions, grammar school; governors.

WHITEHAVEN.—Motor-'bus station, for the Cumberland Motor Services, Ltd.; secretary.

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The

Electrical Review

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City Power Stations.

HAVING been led to expect so much from the national system of co-ordinated electricity generation, it is hardly astonishing that the public should be now asking itself why a large capital station is to be erected in the heart of London?

Opposition to the building of the London Power Co.'s station at Battersea, belated though it be, has been well organised, but we hope that after the Chiswick and Barton battles the present agitation will not be allowed to go far enough to involve further waste of public money without full consideration of the facts of the case. What would be the result of abandoning the Battersea site, which has been acquired and in respect of which contracts have already been entered into representing £1,500,000? A delay of at least two years in the station's completion, which implies the postponement of any possible reduction of the cost of energy consequent, not only on the necessity for its transmission from an outside source into the metropolis, but also on the inevitable delay in shutting down older and comparatively inefficient generating stations which the new plant would make possible. Moreover, the fact must not be overlooked that several years hence when the full complement of plant has been installed in the new station and it would be discharging the maximum amount of products of combustion into the atmosphere, it should by then have displaced more than the corresponding quantity of such fumes now emitted by domestic chimneys, private householders being by far the worst offenders in the aggregate in this respect. Because they do it by the million, their offence passes unnoticed, just as power stations have hitherto not called forth protests because of their scattered locations. All recent agitation has coincided with the building of large capital stations.

Apart, however, from such considerations, it is evident that exaggeration has been rife. When the London Power Co. obtained consent to build its station at Battersea, it assumed an obligation to avoid, so far as is reasonably possible, the committal of any nuisance. The prevention of the emission of grit and dust is no longer a problem of magnitude, being merely a question of expense and the choice of a system; little, if any, visible smoke emerges from modern power chimneys, but sulphur fumes are in a different category. The latter

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problem is, however, being attacked vigorously in this country and elsewhere with results that promise well for the future. Indeed, fuels generally have received a deal of consideration lately, and two of them are compared elsewhere in this issue. We have been assured that a German concern has succeeded in producing oil from brown coal commercially, and it was recently announced by the I. G. Farben dye concern in Germany that negotiations carried on with the Standard Oil Co. of New Jersey, U.S.A., relative to the manufacture of synthetic oil had been successful, the results of experimental work on both sides having been such that it has been found possible to draw up a common programme for the general introduction of the new process.

Lignite is used as a fuel to a considerable extent in the electricity generating works established in the vicinity of Bitterfeld, Germany, which supply power not only to large chemical works, but also for transmission over the long distance to Berlin. From the use of lignite to that of lignite dust is but a step further, and this stage has been reached in the large Boehlen power station, where for the first time on a large scale lignite dust is being used for the operation of a big station. The conditions for this purpose were favourable in so far as the power station has been erected in conjunction with a modern lignite briquette works, so that the drying plant for both works could be built in common. Attention to this fact was drawn by Herr Zeuner, of Dresden, at the recent meeting of the German Lignite Industry Association held in Berlin. The author pointed out that the use of lignite dust for boiler-firing purposes permitted of the erection of the largest boilers. At present the station has a machine capacity of 169,500 kW, which will be increased to 209,500 kW by the autumn. Some of the boilers are fired with crude lignite in conjunction with an addition of dust, while others, including two of the largest boilers in Germany, burn dust solely. The production of the dust takes place in a central pulverising installation in which seven coal-dust mills of various types are arranged. All the apparatus for controlling the boilers is concentrated on a switch desk, and only one man is necessary to look after four boilers.

Thus is progress being made: hitherto attempts have been made to burn coal in the powdered state and other fuels under boilers designed to consume raw coal, but boilers are now being designed rationally for the new conditions, and when clean coal which has been suitably treated at the collieries becomes available at an economic price, we shall hear no more of the emission of grit, dust, and fumes from power-house chimneys. With regard to Battersea, we cannot help feeling that both the Electricity Commissioners and the London Power Co. must have given serious consideration to the whole problem, and that the public will be well advised to leave the matter in their hands.

The British Industries Fair.

We wish to direct the attention of electrical and allied exhibitors interested in future British Industries Fairs to the communication appearing in our "Correspondence" columns to-day from the pen of Mr. E. J. Jennings, honorary secretary of the Electrical Committee, to whom so much is owing for the success of past displays. We have not yet been over-impressed with the suggestions for a change of date, because the Government will take a good deal of convincing that there is an overwhelming majority view that the entire Fair, London and Birmingham, should be altered. The figures quoted from the electrical questionnaire of last year are mildly described as "inconclusive," but if we add to the number definitely favouring February/March those who did not even reply, and who therefore may be regarded as satisfied with a continuance of the present dates, it seems that the subject is hardly worth pursuing. It might be as well to recognise that the Fair as a whole without a good Electrical Section is now unthinkable; also that at May-June the I.M.E.A. Convention, with an increasingly important exhibition, in yearly changing localities, also other conventions, are occupying a great deal of attention. If the D.O.T. and the Birmingham Chamber of Commerce can ascertain from a majority of all classes of exhibitors that February or March is unsuitable, that no doubt will go far to settle the matter, but no sectional attitude can control the whole. The one outstanding thing at the moment is that the date has been definitely fixed for the 1930 show, and space has already been booked.

Cooking Without Tears.

The British Electrical Development Association is this month devoting its energies to the advocacy of electric cooking, and its activity is most opportune. Even the most enthusiastic devotee of the coal range cannot contemplate without apprehension the prospect of summer days spent in the stifling atmosphere of the kitchen, and this should assist in the electrical education of the housewife.

The periodical advertisements, which are now becoming quite a familiar feature, will put forward during the month several good reasons why cooking should be done electrically. As usual, attractive and compelling "lay-outs" for use in local newspapers are available at reasonable prices, and a special lecture and lantern slide have been prepared. Electrical dealers and others again have the choice of two window displays. One of these depicts an electrically-equipped kitchen with the cardboard figure of a lady operating a breakfast cooker. The other contains examples of large and small cookers and two electric kettles. Above the display is the "At a Touch of the Switch" sign which is appearing in all the Association's advertisements.

The Home and Overseas Markets.

In an article which appeared in the February *Journal* of the British Chamber of Commerce in the Argentine Republic mention is made of the sale of the "Atlas" undertakings in the Republic to American interests. It is argued, in effect, that although this will probably mean the diversion of orders for electrical plant to the United States, the British electrical industry will not suffer very much as the home market will keep it going. The Electrical Review is quoted for evidence that the industry is more favourably placed than most other British industries, and it is said that the scope for domestic progress is a "trump card" for the industry. While we will not deny that the potential business in the home market is very considerable, it will never be able to replace our export trade. It may be of interest to refer to statements made by the chairmen of two or three of the leading electrical manufacturing concerns. At the last annual meeting of the General Electric Co., Ltd., Sir Hugo Hirst stated that over 20 per cent. of the company's products was exported. At Henley's last meeting Sir George Sutton said that more than one-third of the total turnover was attributable to overseas buyers. In the course of his speech at last year's meeting of the Metropolitan-Vickers Co. Sir Philip Nash said "the British manufacturer (of large electrical plant) has to depend, in order to maintain an economic load in his factories, on obtaining at least 50 per cent. of it in the overseas market." It is clear, therefore, that the loss, or threatened loss, of any market cannot be looked upon with equanimity by British electrical manufacturers. On the contrary, every nerve has to be strained to retain and cultivate those markets in which we find business, while new outlets have ever to be sought.

It is true that there was a kind of proviso in the Atlas sale agreement that "for at least ten years, British manufacturers should be given preference for the bulk of the electrical equipment required, other things being equal," but the transaction, though eminently satisfactory to the Atlas shareholders, must eventually have an adverse effect upon our exports to Argentina.

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A Near-East Development.

Notes on a visit to the hydro-electric works at present in the course of construction on the River Jordan in Palestine.

By OUR SPECIAL CORRESPONDENT.

ABOUT five miles south of the Sea of Galilee on the Lake of Tiberias, the River Yarmuk joins the Jordan from the East. It is a rapid stream with numerous waterfalls and drops from sea level to 800 ft. below sea level in a distance of a few miles. The hydro-electric scheme makes use of the last of those falls, some 27 ft. high, and also of the drop in the River Jordan itself in the same neighbourhood.

Fig. 1.—The Yarmuk Dam.

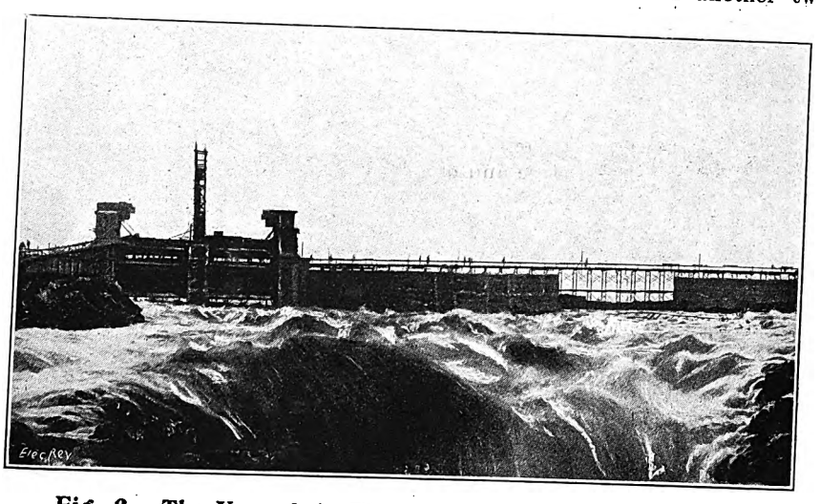

Fig. 2.—The Yarmuk in Flood during Construction of Dam.

A dam, figs. 1 and 2, 8½ metres high, and with 90 metres overflow and two 10 ft. × 4 ft. stone sluices, is being constructed across the Yarmuk to form a lake, fig. 3, of 1,000,000 sq. m. surface area, containing from 2 to 2½ million cu. m. of water, of which a million cu. m. will be available for diurnal storage. A canal less than 400 metres in length leads from the new lake to the forebay, from which four penstocks of three metres diameter will take the water down to the turbines.

An 8-metre dam is also being constructed across the Jordan, and from above the dam a canal, fig. 4, 1,800 metres in length and capable of carrying 60 cu. metres per second, is run to the new lake on the Yarmuk; thus the whole of the water in the Yarmuk and the Jordan is available for use by the turbines, and the Lake of Galilee will provide the seasonal storage. The bed of the Jordan below the power house is being deepened at present. The surface of the lake is 201 metres below sea level in winter and 203 in summer. It may be lowered to 204 m. when the works are in full swing. The Yarmuk dam is nearly completed; the head race is largely excavated, the forebay is three parts concreted, and the foundations for the turbines are going in. The Jordan canal has just been started, a powerful oil-engine driven Ruston drag-line excavator being hard at work—doing the work of 100 men—and a smaller excavator further along.

In Galilee all the rain falls in the winter months and none in the summer. The past winter has been abnormally wet, 21 inches of rain having fallen, compared with approximately 10 inches in 1927-28. The floods did considerable damage, washing a large amount of soil into the foundations of the power house, fig. 5; to save the forebay, a temporary dam of bags of soil had to be constructed. It also delayed the work, which is now, however, going ahead well, and which the engineers hope to complete within another twelve months. There are from 500 to 600 men employed on the scheme, which, in the main, started in July, 1928, although preparatory work started a year earlier.

The present scheme only makes use of approximately one half of the fall of the River Jordan between the lake and the power house, and when the present installation is fully employed additional power can be obtained by constructing a second power station higher up the river to utilise the

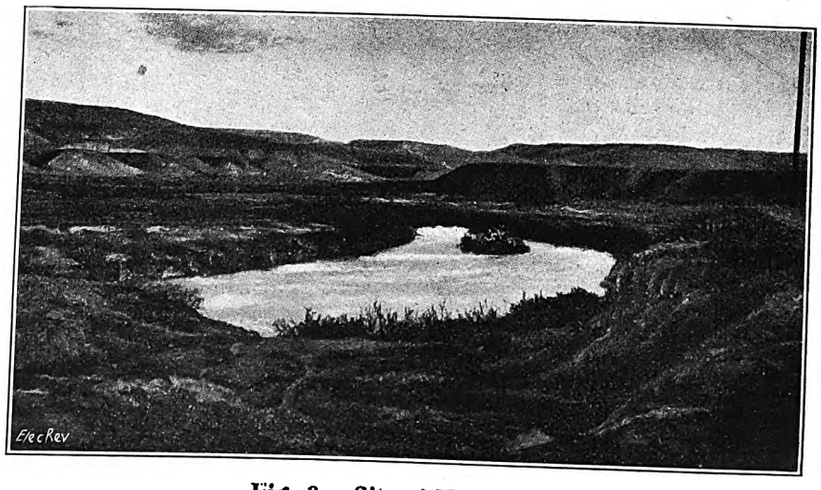

Fig. 3.—Site of New Lake.

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other 27 ft. of head available, and finally it will be possible to construct a canal to carry the Yarmuk into the Sea of Galilee, and so make use of all the power available in both rivers. The site has one advantage over any other on the Jordan; the branch of the Hedjaz railway, which runs from Deraa to Haifa, passes through it; in fact, a small deviation had to be made to clear the railway track from the line of the head-race canal before the latter could be commenced.

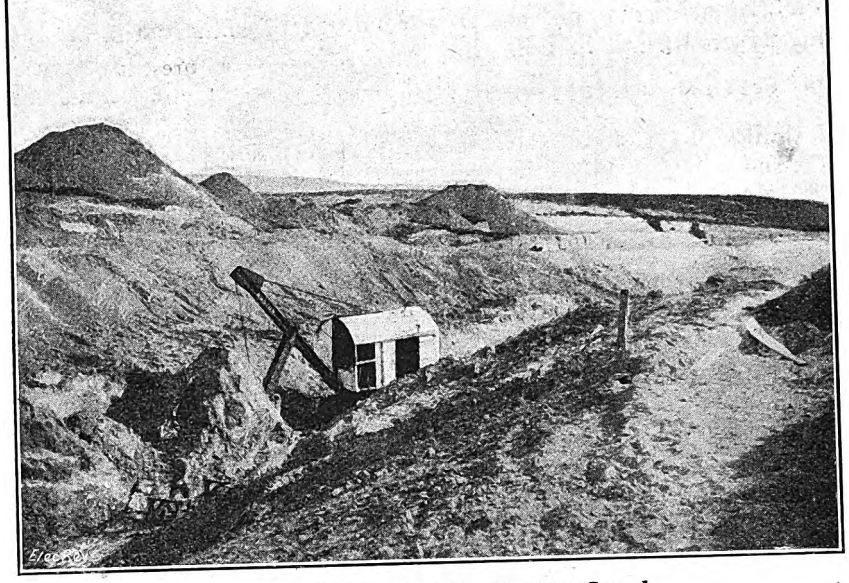

Fig. 4.—Excavating for Jordan Canal.

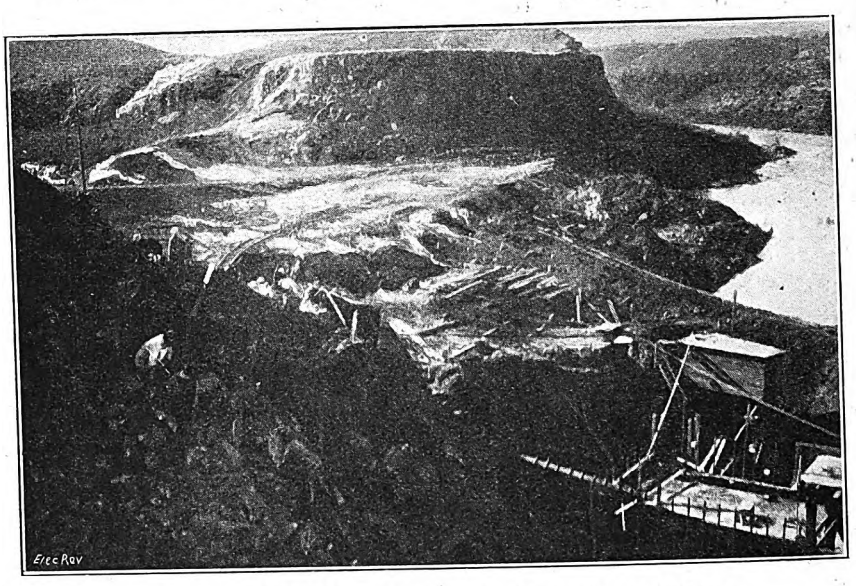

Fig. 5.—Construction of Power House Foundations.

Every care has been taken to provide for the health and comfort of the staff and workmen. Permanent bungalow-type houses, fig. 6, have been built for the staff and the first thing done was to lay out the grounds and plant trees, some of which are now firmly established and look healthy and green. It is most pleasing to see such care taken to make the works a civilised place. A camp has been built for the workpeople. There is no town of any size nearer than Haifa, 62 miles away. A hospital, with a doctor and nurse, is also provided, and there is a large dining room capable of seating some 500 persons, with window space all round, filled in with mosquito netting.

The generating pressure at the main station is to be 6,000 V, and it will be stepped up to 66,000 volts at an outdoor sub-station. Reinforced-concrete is being employed throughout for the structures, including the roof of the power house.

An interesting arrangement has been provided for clearing the grids of *debris* by back flushing. There are two gates and grids to each penstock, and flushing valves are fitted below, so that by closing either gate and opening the valve a back flush will carry the *debris* into a tunnel constructed in the concrete of the forebay, and so down to the river below. One double-circuit pole line on 19-metre poles will run from the works 62 miles to Haifa, and then down the sea coast to Jaffa. The Palestine Company's concession covers all Palestine, except Jerusalem, but if in the future the capital city should take a supply in bulk, the line would probably be continued on to there from Jaffa, and a return line to the works constructed up the Jordan valley.

The line from the works to Haifa will be steel-cored aluminium, 81 sq. mm. al. and 22.1 sq. mm. steel, but that by the sea will be copper, 64½ sq. mm. Difficulties have been experienced by the engineers in other places with corrosion of the composite wire when used near the sea. The poles are calculated for a larger section of conductor than will be strung at first, and for a pressure of 110,000 volts, to allow for increased load. The poles are being made in the company's workshops at Haifa, and are of the lattice-work type of construction. A commencement has been made with the erection of the line between Haifa and Jaffa. The foundations are made on the Malone principle; 15-centimetre holes are bored 2 metres deep, and a small charge of dynamite exploded at the end. When the leg of the pole is inserted it is grouted in and appears to make a very secure job. The local distribution will be at 400/230 V, transformed down in three stages, 22,000 V, 6,000 V, and 400 V. The 22,000-V lines will be used for transmission to villages in the neighbourhood of the towns supplied.

To encourage the growth of the load, temporary Diesel plant has been erected and set to work at Haifa, Jaffa, and Tiberias. The last-mentioned is a small town a few miles from the works on the west side of the Sea of Galilee. At Haifa and Jaffa the temporary plant

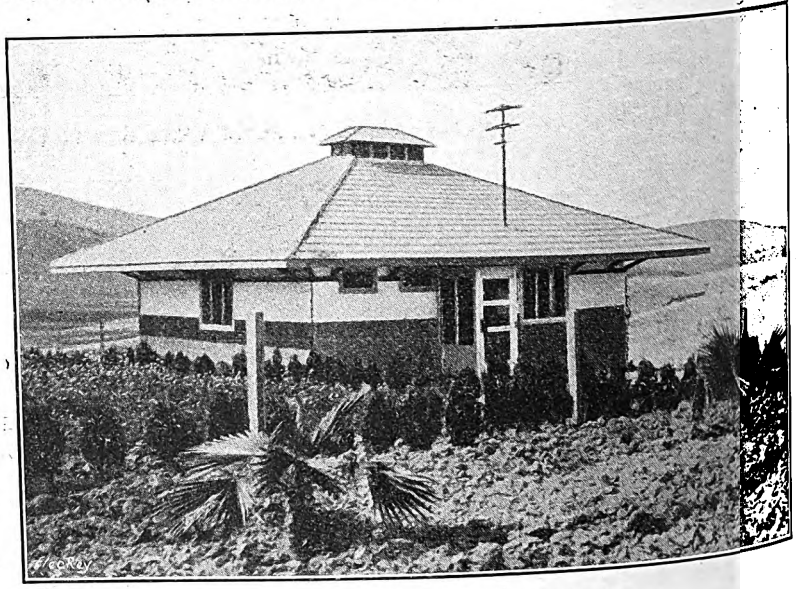

Fig. 6.—Typical Staff Residence.

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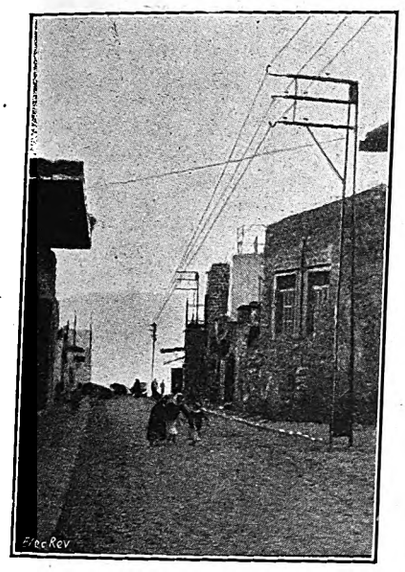
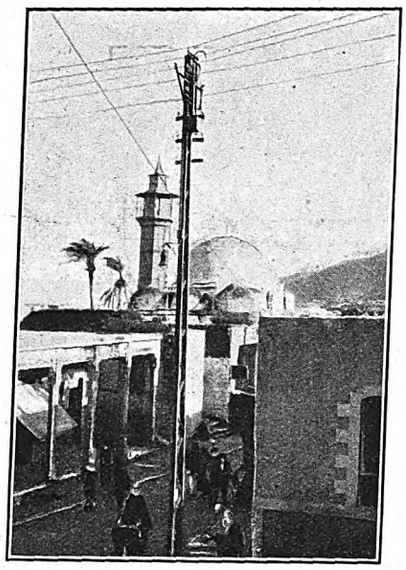
generates at 6,000 volts and supplies by underground mains to sub-stations. At Tiberias generation is at 400 V. All the l.p. distribution is overhead, and it may be described as too well done. The lattice poles, cross arms, insulators, and the workmanship of erection are as good as in any overhead work anywhere. Figs. 7 and 8 are views of the overhead lines in Tiberias.





Figs. 7 and 8.—Overhead Lines in Tiberias.

The design of the small power houses is remarkable. In outside appearance they are like private houses of the modern Dutch or German styles, figs. 9 and 10; no one at first glance would take them for power houses. At Haifa there is about 1,200 h.p. of plant, and at Jaffa about double that figure. The load for the works will come from lighting, ice-making in the towns and villages, power in Haifa and Jaffa, and pumping load in the coastal area, where the valuable orange crops require water. In the future water supply to towns and, finally, irrigation schemes will probably call for large amounts of power.

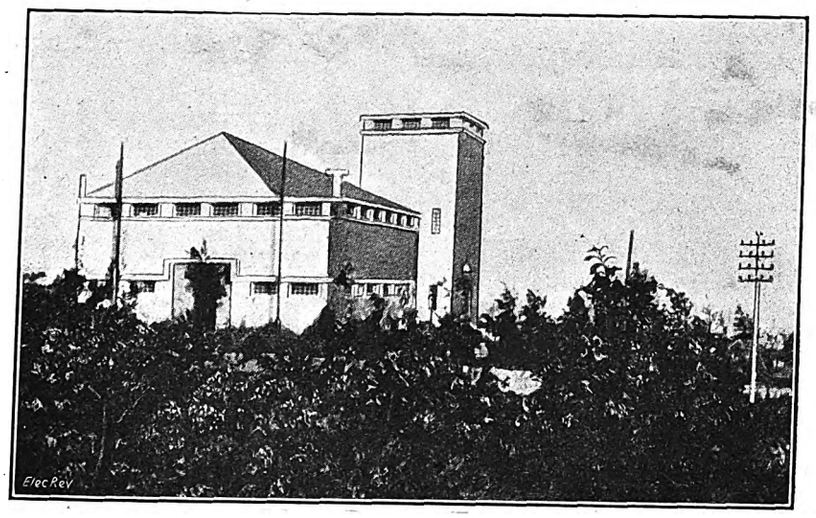


Fig. 9.—Diesel Station at Tiberias.

The government is about to start on the construction of a harbour at Haifa, and as there is no harbour which large vessels can enter to unload on the whole Palestinian or Syrian coast, this port, under the shelter of Mount Carmel, is likely to grow into an important commercial centre. It is also probable that the pipe-line bringing oil from Persia will terminate at the same point; this has not yet been settled.

The author is informed that the whole scheme is controlled, financed, designed, and constructed almost entirely by Jews, which is, of course, right and proper for a supply to Palestine.

Thanks are due to Mr. Rutenberg, at the works, and his staff, for the above information and the courtesy extended to the writer of this article on the occasion of his visit. The chairman of the company is Lord Reading, while Lord Melchett and Sir Hugo Hirst are on the board of directors. The authorised capital is £1,000,000; no public issue has yet been made. Fig. 11 shows the company's offices. The government requires that all plans of the works and mains should be submitted to the authorities for approval. There are no published regulations at present.

The design of the main power house is unusual; the windows are low down and the roof is a great reinforced-concrete vault. The structure is designed to suit the engineering conditions, and, incidentally, the vault roof will tend to keep the house cooler in summer when the outside temperature reaches on some days 112 deg. F. in the shade, in a deep river valley 800 ft. below sea level.

The efforts that the company has made to preserve the beauty of the country side where the power stations are erected are most striking. Palestine is a land of much beauty and unparalleled interest, and the company has set it as one of its aims that these amenities shall not be disturbed more than can be avoided.

Active steps have been taken to fight malaria, a prevalent complaint in the surrounding villages, with good results. In October, 1927, 17 per cent. of the men employed were down with the complaint, in October, 1928, 1.4 per cent., and to-day almost none. Besides keeping the "bugs" off with mosquito netting, they have been attacked by dusting Paris green on the surface of the ponds and pools in the neighbourhood.

The Government Health Authorities warned the company very seriously before it started work that owing to the prevalence of malaria the site selected was most unsuitable for the construction of a large works. The disease is chiefly fought by very strict discipline; all beds are fitted with mosquito curtains and every room in the camp is inspected every

Fig. 10.—Haifa Temporary Oil-engine Station.

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night. No men may sit out of doors after sunset; they may walk, but must not sit. Any man who has a temperature for 24 hours is put to bed in the hospital until it is seen what is wrong. Scientific records of all illnesses are carefully kept and tests made as to the number of "bugs" in the air, in rooms, &c. The company has to try and keep the surrounding villages free from disease as well as its own works.

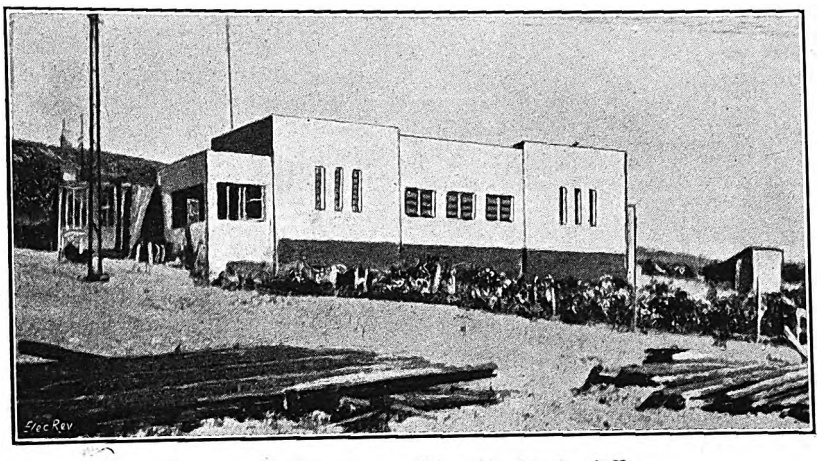

Fig. 11.—The Hydro-Electric Co.'s Offices.

The management takes no risk with regard to health. The men are fed extremely liberally, and not only do they keep well, but also work well. Numerous small accidents have occurred to the men, but there have been no cases of permanent disablement, and only one fatal accident.

The four turbines, of 8,500 h.p. each, are being constructed by Messrs. Boving & Co., Ltd., and the four 6,000-kW alternators by the General Electric Co., Ltd. All the plant has been purchased in Great Britain: excavators from Messrs. Ruston & Hornsby, Ltd.; shunting locomotives from Messrs. Hunslet; temporary Diesel plant from Messrs. Mirrlees, Bickerton & Day, Ltd.; compressors from Messrs. Reavell and Co., Ltd., and aluminium overhead conductors from the British Aluminium Co., Ltd.

Electricity on Shipboard.

Features of the Electrical Equipment of the Motor Boat "Rangitiki."

THE *Rangitiki*, the 17,000-ton ship recently built by Messrs. John Brown & Co., Ltd., for the New Zealand Shipping Co., is claimed to be the largest ship at present employed in the New Zealand trade, and also the first motor-propelled vessel in the owners' fleet. She is equipped with two 5-cylinder, 10,000-h.p. Brown-Sulzer Diesel engines for propulsion, which give the ship a service speed of 15 knots. Practically all the auxiliaries and services on the vessel are electric, and are supplied from two 500-kW and one 100-kW Diesel generating sets, employing Brown-Sulzer engines and generators by the English Electric Co., Ltd.

Some idea of the extent of the electrical installation may be gathered from the fact that 90 miles of cable and wire have been used, all of which was supplied by the Pirelli-General Cable Works.

In the contract for the electrical equipment of the ship, the General Electric Co., Ltd., was allocated a large share, an important section of which covers electric motors and switchgear. In all there are upwards of 120 motors installed for operating engine-room auxiliaries, deck machinery, steering gear, fig. 1, boat davits, ventilating fans, and so on. The switchgear includes a main switchboard, emergency board, nine auxiliary boards, refrigerator-plant switchboard, and also the motor control gear, much of which is of the automatic contactor type. The motors range in output from 150 h.p. for Reavell compressors, down to 1 h.p. for driving small Windsor fans. The deck motors are totally enclosed and watertight. The engine-room auxiliaries are served by 23 motors aggregating nearly 700 h.p.; these are of the drip-proof pattern. Several of them are also vertical-spindle machines, including those driving Drysdale forced-lubrication (fig. 4), sanitary, general-service, bilge, and fresh-water pumps. Many of them have variable-speed characteristics and are continuously rated. The motors for driving the winches, capstans and windlass, manufactured by Messrs. Clarke, Chapman and Co., Ltd., form an important group. Aggregating in all 940 h.p., they consist of twenty-four 30-h.p. winch motors, fig. 2, two 60-h.p. capstan motors and one 100-h.p. windlass motor. Four 12½-h.p. totally-enclosed watertight motors are provided for operating Welin-MacLachlan boat davits. Probably the greatest interest centres in the control of the motors. The 24 winches are

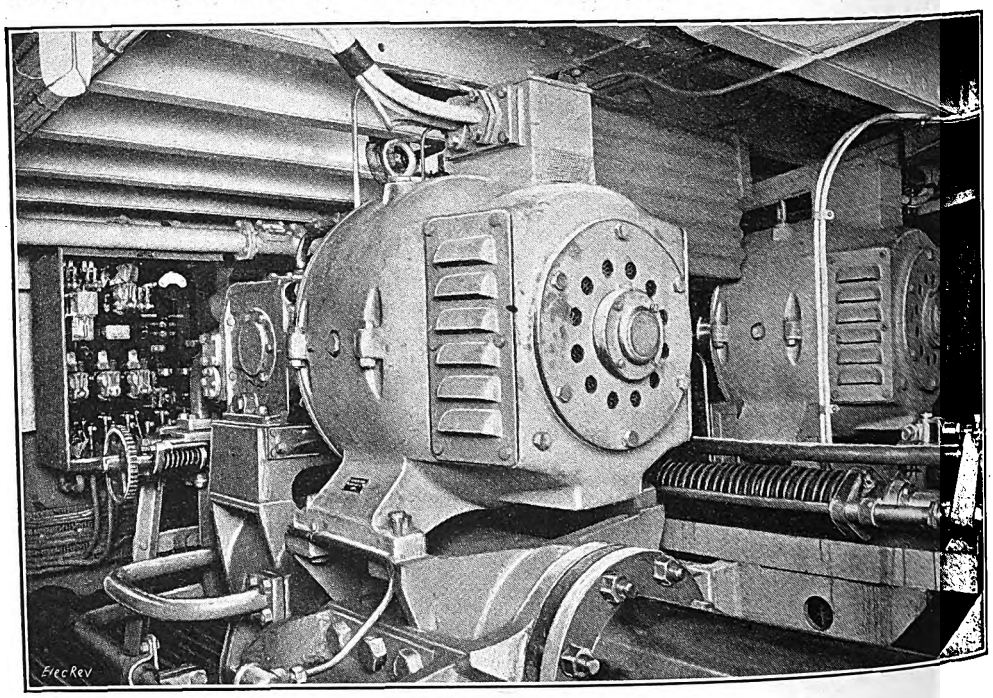

Fig. 1.—50-h.p. Steering Motors.

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each governed by a master controller which actuates a contactor panel, and the acceleration of the winches takes place under current-limit control, thus safeguarding the equipment from overload, while allowing high speeds to be obtained when running light. A special relay is provided to prevent damage from premature closing of the contactors, or from rapid reversal. In order that extra heavy loads may be dealt with, certain of the winches are arranged to be coupled in pairs and controlled by one master controller. Similar, but larger, equipments mounted below deck actuate the two aft capstans and the windlass. The numerous fans, which are driven by motors of from 1 to 5 h.p., fig. 6, are remotely controlled by automatic starters mounted below deck. These starters are of the type in which the motor's acceleration is controlled by its own counter e.m.f., and the field rheostat for speed variation is incorporated in the same case. This arrangement serves for the smaller sizes of motors in the engine room, while for the larger sizes pillar-type starters are used in which "line" contactors are employed in conjunction with hand-operated drum switches. The usual overload and no-volt protection is furnished, and the pillar may be isolated by a switch in its base, which must be opened to gain access to the interior. In the case of the 150-h.p. main air-compressor motors, the starters are of the pillar type in which the drum switch is replaced by a multi-switch starter which is actuated by a handwheel outside the case.

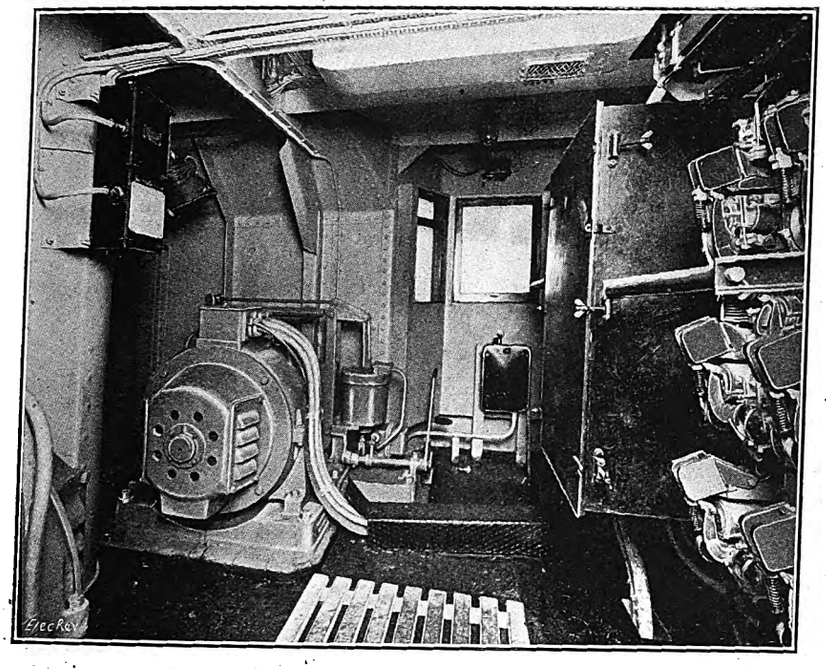

Fig. 2.—Winch Motor and Control Gear.

The two Hele-Shaw pumps of the steering gear, which are driven by 50-h.p. motors, are controlled by time-limit starters. These motors are arranged to be started up automatically by remote control from the engine-room switchboard, from the bridge, or by local control in the steering-gear compartment itself. In all cases the starting is fully automatic, and push-button operation is furnished. The main 220-V switchboard, fig. 3, is of the flat-back type. Of its 11 panels, two control the 550-kW main generators and two the 150-kW generators, while the remainder are feeder panels which distribute power to the nine auxiliary boards and also to other distributing points throughout the ship. A special feature of this board is the provision made for ensuring that certain "preference" circuits shall be in operation as long as possible in case of emergency. If for any reason the power supply is insufficient to maintain the whole of the services desired, provision is made on the board for enabling non-essential circuits to be tripped out. This is accomplished by a series of relays, with variable time settings, which come into operation in suitable sequence. The "preference" circuits are connected directly to the main bus-bars, the only overhead protection included being the generator circuit-breakers. The preference circuits include those supplying the steering gear, engine-room auxiliaries, emergency switchboard and the engine-room lighting.

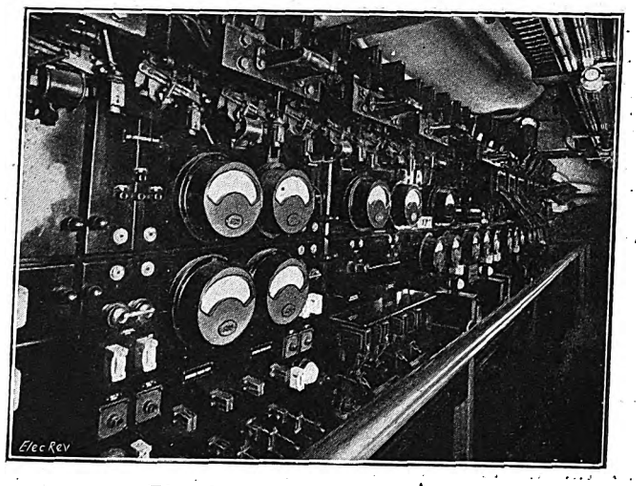

Fig. 3.—Main Switchboard.

The emergency switchboard has three panels, one controlling the emergency generators and the other two a panic battery, navigation lights, gyro compass, emergency lighting, floodlights for boat launching, searchlights, wireless, and so on.

One of the feeder circuits from the main board is taken to the 4-panel refrigerator board, from which are controlled the motors driving the brine pumps, water pumps and fans of the refrigerator equipment. This consists of three large horizontal twin-compressor CO_2 machines, each driven by a variable-speed 110-h.p. electric motor manufactured by Messrs. W. H. Allen, Sons & Co., Ltd. This in-

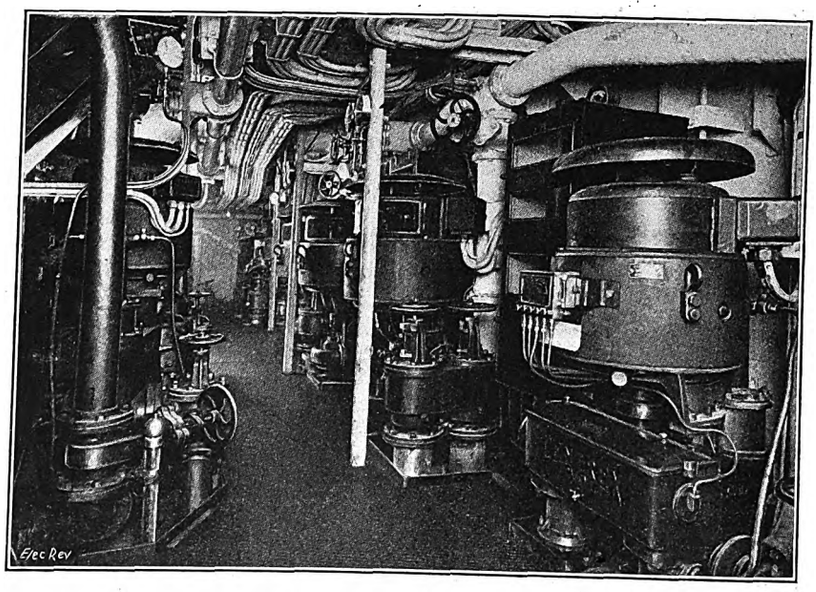

Fig. 4.—Drysdale Vertical-Pump Motors.

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stallation was provided by Messrs. J. & E. Hall, Ltd.

The General Electric Co. also supplied all the electric lighting fittings for the richly decorated public rooms, fig. 5. The lounge is illuminated by eight large bowl ceiling fittings and ten two-light wall brackets; these are of the Georgian style and finished in gilt to harmonise with the surroundings. The smoke room is lighted by means of four large amber glass ceiling lanterns and eight two-light candle brackets, giving a very pleasing effect. Beyond the smoke room is a verandah café in which are installed nine star ceiling fittings. In the forward drawing room are one large centre and six smaller bowl fittings which make the room particularly cosy. Table standards provide local illumination on the writing tables. The entrance and landings are lighted by means of a large number of small ceiling fittings, which provide a high degree of even illumination and are placed so as to be free from damage when luggage is being moved.

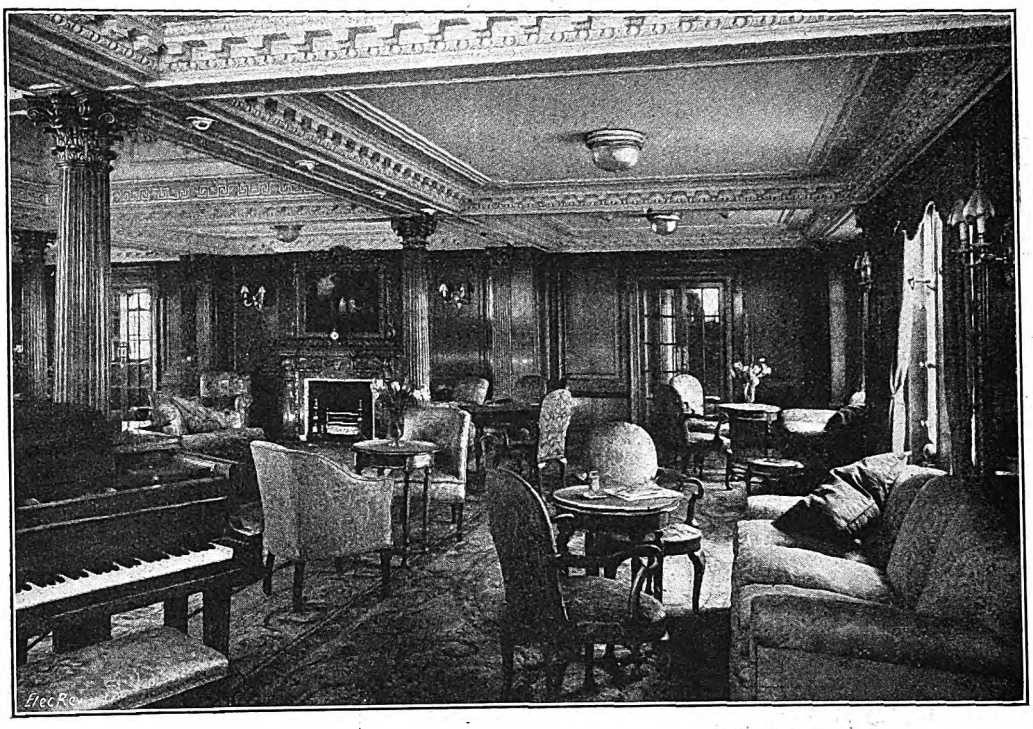

Fig. 5.—Lighting Fittings in one of the Public Rooms.

The ceiling bowl fittings so far described are fitted with crystal glass bowls frosted and cut. In marked contrast to these are the bowls in the dining saloon, where there are no less than seventeen ceiling fittings fitted with bowls of moulded glassware. Ten wall brackets to harmonise with the ceiling fittings are provided, and in addition there is local lighting from twenty-five table standards. The lighting of this saloon is brilliant, but without glare, and the sources of light are well screened. By means of dimmers the intensity of illumination can be varied, and different effects obtained.

The illumination of the first-class cabins is of an exceptionally pleasing character. Semi-indirect wall brackets of Roanoid, with tinted nacrolac shades, and pendant and berthlight fittings to match, produce an attractive and restful effect. Mirror brackets of similar design provide local lighting. In the En Suite Rooms the lighting is further amplified by means of moulded glass bowls set in the ceilings. The second-class public rooms are also well lighted, ceiling fittings with crystal bowls and globes and others with nacrolac bowls being employed. Additional lights in brackets are provided, and the whole effect is pleasing and harmonious. The lighting fittings provided for the third-class accommodation are of simple design, but throughout the rooms a bright and cheerful effect has been obtained by means of carefully chosen fittings.

The working alleyways and spaces are illuminated throughout by means of watertight brass stirrup fittings, while the decks and exposed positions are equipped with watertight bulkhead fittings. The engine room is lighted by means of lanterns fitted with gasfilled lamps, and a number of insulated portable handlamps are provided. The equipment for providing illumination for handling cargo at night is worthy of mention. Twenty-four derrick fittings of special design, equipped with 500-W gasfilled lamps, flood the decks and hatches with a high intensity of light, and fifty-four portable fittings with 100-W "Pearl" lamps are used in the holds and for temporary local lighting.

To comply with the Board of Trade regulations for launching lifeboats at night, eight overside lanterns, each with four 100-W lamps, are installed, and in addition four G.E.C. marine-type floodlights equipped with 500-W lamps are provided.

The G.E.C. fire-alarm system which is installed enables an alarm to be given from a large number of convenient positions about the vessel. At each call point means are provided for the insertion of a hand telephone into the circuit, so that communication can be made quickly between the call point and the officer on watch. A very complete system of passenger call bells has been supplied by the G.E.C., and includes local mechanical drop indicators, with bells adjacent to draw attention to the calls. The ship is equipped throughout with a system of intercommunication telephones, and a number of electric vacuum cleaners are carried for cleaning the carpets, upholstery and hangings in the various rooms, cabins, and so on.

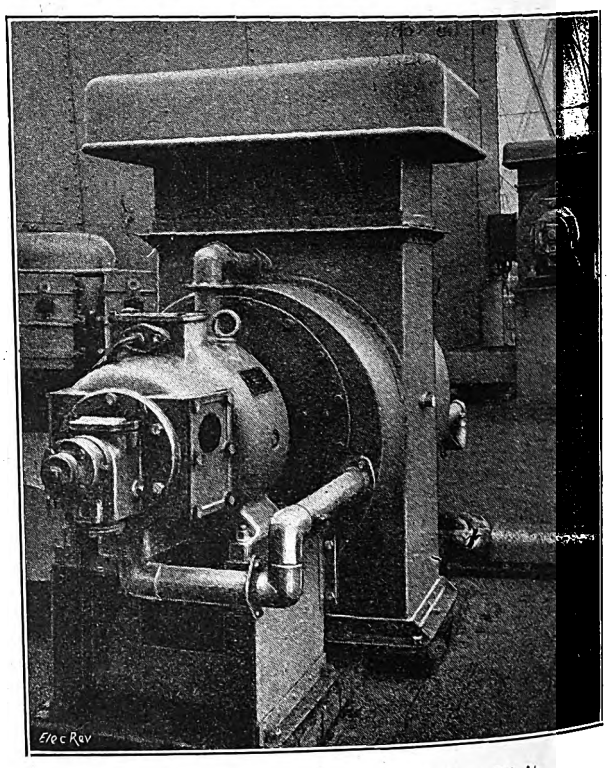

Fig. 6.—Motor-driven Ventilating Unit.

We are indebted to Messrs. William Esplen, Son and Swainston, Ltd., naval architects for the ship, and to the General Electric Co., Ltd., for the above details and photographs.

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Modern Coal-burning Methods.

A Comparison of Solid and Powdered Fuels, with Particular Reference to Revenue Production.

By WILLIAM D. WYLDE, F.Inst.F.

THE existing rivalry, healthy though it may be, between those concerned in the boosting of each of the two methods of raw-coal firing predominant at the present time calls for unbiased thinking if the essential facts, distinct from elaborate claims, are of any importance in arriving at a decision as to which method will prove to be in practice superior to the other from the revenue producing point of view. The two methods referred to are the firing of coal in a pulverised state, and what is generally referred to as solid-fuel firing with the aid of mechanical stokers. For the purpose of these notes the writer is confining himself to the coal to furnace rate of flow in each case, which is, of course, one of the items usually included in the list of claims pertaining to the particular method advocated.

Taking, for the sake of simplicity, a half-inch sided cube of coal as the basis of the reasoning involved we are aware that the cubic content of a piece of coal of the foregoing dimensions is 0.125 cu. in., its weight at 80 lb. per solid cubic foot is 0.0058 lb., and the area exposed to air attack is 1.5 sq. in. By powdering the same cube so that the product is round about 125 microns, passing with ease through a 100 mesh sieve, the alteration in physical state is accompanied by the superficial area being raised to approximate 120 sq. in., the number of particles to 578,000 and the volume of each particle reduced to 216×10^{-6} cu. in. From this it is seen that with the coal in a powdered state one pound exposes 20,640 sq. in. of surface area, whereas half-inch cubes fired solid to reveal the same area of coal surface would require 20,640/258 = 80 lb.

Based on the fact that air and coal contact surface area is one of the main controlling factors of combustion speed, it would appear in the case cited that the rate of oxidation in one case is 80 times greater than in the other. This certainly is the case if we take the individual cube of coal pulverised in one case and solid in the other and time their rate of burning under identical conditions of air availability. Taken collectively, however, the foregoing desirable increase does not follow as a matter of course, because in the one instance the stated area is produced by one pound of coal being burnt in a fraction of time, and in the other the same area is available from 80 lb. of coal being thermally decomposed at one and the same time. In other words, up to and including the limiting area of exposed surface of the coal mass decided by the weight it is possible to have in the furnace at any instant, the difference in the rates of consumption per square foot of coal surface exposed in the two cases under consideration is nil.

What has just been stated does not of course signify that there is no difference in the weight of coal it is possible to consume in a given time, for the one reason that the former concerns coal weight and surface area and the latter coal weight and time.

To enhance the feasibility of the reasoning, let us take the case in which powdered coal of the aforestated degree of fineness leaves the fuel pipe at a velocity of 48 ft. per second, and in which the exposed surface area as it leaves the burner is 240 sq. in.

On this basis and taking the modern method of injecting the coal whirlwind fashion, the amount entering the furnace per foot of travel may be taken as being equivalent to the superficial area of a rectangular tube 12 in. × 16 in. × 15 in., *i.e.*, 0.0359 lb. Thus at a distance of say 8 ft. from the burner the weight admitted would be 0.287 lb., which at the velocity mentioned would be renewed six times per second.

Whatever distance from the burner is taken, with the injection speed constant the weight of coal entering the furnace per second remains the same, and in this particular instance is $48\ (12 \times 16 \times 15)/120 \times 0.0058 = 1.72$ lb., which is the same as saying that the rate of firing is 297 half inch cubes of coal per second with the coal pulverised.

Taking the weight of coal delivered as being proportional to the increase in the speed of injection, the rates of consumption are as follows :—

Fuel and air velocity	48 ft.	per second	= 1.72	lb.	per sec.
,, ,, ,,	56 ft.	,, ,,	= 2.0	lb.	,,
,, ,, ,,	64 ft.	,, ,,	= 2.29	lb.	,,
,, ,, ,,	72 ft.	,, ,,	= 2.58	lb.	,,

The method of representing the coal entering the furnace here quoted cannot be assumed to be the length of flame travel, although if the coal were solid carbon the representation would be more accurate than in the case where volatile or extraneous matter was in evidence to a marked degree. In the case of ash the particles not only retard inflammability, but they also remain in suspension. Taking it for granted that they take only a fraction of time in which to lose their luminosity, the speed at which they are travelling is such that the expiration of the flame is somewhat delayed. As an example, assume an injection velocity of 72 ft. per second with the speed at the tail end of the flame travel reduced to 40 ft. per second. By taking the time required by the ash particles to lose their light-emitting radiancy as 1/20 second, the flame extension would be 2 ft. The beneficial aspect of allowing the ash particles to give up their radiant heat before entering the first gas pass needs little comment. Further, it cannot be conclusively inferred that the length of flame travel is a function of the rate of coal to furnace flow in all cases for reasons exemplified by the fact that with the coal and air intimately associated before actually leaving the burner, it is possible to consume a given weight with the distance travelled by the air and coal stream in the furnace considerably curtailed. From this it may be reasonably concluded that the length of flame, apart from such considerations as coal-dust inflammability and explosive propensities, is controlled by (1) the speed of injection, (2) the weight of combustible per unit weight of coal, (3) the volatile content, (4) the size of the coal particles and those previously mentioned, viz., the ash content per unit weight of coal and the extent to which the coal and air are mixed prior to leaving the burner. In the case of (1), for a given set of conditions, increasing the speed at which the mixture leaves the burner would normally increase the rate of firing which would have for its resultant an increase in flame length proportional to the increase in the weight of coal entering the furnace and to the increase in the distance travelled by the coal per unit of time; on the other hand, increasing the velocity of injection with the fuel rate constant produces a flame length proportional to the increase in the injection speed only.

Based on the instantaneous rate of combustion under ideal conditions of fuel and air mixing, it would appear theoretically that by increasing the velocity by say 100 per cent. the distance travelled to complete combustion would be doubled, and with it the length of flame. On this basis it could also be stated that in the case

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where the coal weight entering the furnace increases proportionately with the coal and air speed, the resulting flame travel is four times the original length. The results obtained in practice should not deviate to any great extent from the theoretical desiderata here referred to.

The variation due to (2) may be taken as being similar to that accruing from an increase in the rate of firing for reasons attributable to an increase in the weight of combustible per unit weight of coal being equivalent to an increase in the weight delivered to the furnace per unit of time; in other words, at the same injection velocity more combustible is consumed in a stated time with a corresponding increase in the actual flame length. Coupled with this there is, however, the fact that as the combustible increases the ash content decreases, and with it the prolongation of flame travel brought about by the ash particles as previously referred to. It is evident from this that there is a tendency towards a cancelling out procedure when the decrease in flame length with less ash equals the increase in flame travel due to the higher combustible content of the coal.

In the case of item (3) it is necessary to bear in mind that the subject of our attention plays a prominent part in deciding the distance travelled before combustion is completed, with the other controlling factors remaining constant. The why's and wherefore's are best examined by reference to the coal-burning process. By so doing we find that each particle of coal, after being raised to the volatile liberation temperature, is enveloped in the burning product of its own distillation, which, although to an infinitesimal extent, retards the air availability so essential to, and on which the rapidity of combustion depends. Considering the number of particles being dealt with the actual retarding effect becomes significant and represents a noticeable increase in the length of flame travel, even when the ideal air to fuel arrangements are in evidence. It is thus seen that for a given flame travel an increase in the volatile constituent necessitates a simultaneous reduction in the rate of firing, and the speed of injection to avoid the well known losses associated with the non-expiration of the flame before reaching the water cooled heating surface.

Item (4) is of importance in that the exposed area of the coal for a given weight increases proportionately with a decrease in the size of the particles, from which naturally follows a decrease in the time taken to burn the same weight with the cubic contents of the space occupied by the coal remaining constant. From the foregoing it may safely be contended that the minimum length of flame under ideal conditions of fuel and air mixing, when burning the nearest approach to solid carbon in a fine state of division, may be represented by the external surface area of a tube of the aforementioned dimensions renewed six times per second with the fuel velocity 48 ft. per second at minimum consumption, and by a tube 12 ft. long replaced six times per second at maximum consumption with the injection speed 72 ft. per second. Due allowance can be made for the flame-extending propensities of volatile and ash, and that resulting from the inefficient mixing of fuel and air before leaving the burner by catering for their needs when deciding the position of the burner and the combustion space volume required per burner for any particular grade and type of coal that it may be compulsory to consume from time to time.

Having outlined the rate of delivery to the furnace when firing coal in powdered form with one burner fulfilling the aforementioned requirements, the grate area required to consume the same weight of coal per hour in solid form may now be taken as a comparison. Referring again to the half-inch cube of coal, it is important to note that to obtain the same coal surface area exposed to air attack it would require 23,800 of the cubes in question at the lower rate of consumption, and 35,500 cubes at the higher coal consumption figure.

By reducing the coal size to $\frac{1}{4}$-in. cubes the figures are 95,200 and 142,000, respectively. On the other hand, by increasing the coal size to one cubic inch, the number of cubes required at the lower consumption is 5,950, and 8,900 at the higher rate of consumption, per second. Stated in terms of coal weight necessary to give the same superficial area, the foregoing is replaced by the following:—

Weight of $\frac{1}{2}$-in. cubes to give same area as 1.72 lb. of coal pulverised to the aforementioned degree of fineness = 138 lb.

Weight of solid equivalent of 2.58 lb. pulverised = 206 lb.

With $\frac{1}{4}$-in. cubes the weight for the same superficial area would be 69 lb. and 103 lb., respectively. For 1-in. cubes the necessary weight to expose the same area is as follows:—

1.72 lb. pulverised to 125 microns = 276 lb. solid.
2.58 lb. ,, ,, ,, = 412 lb. ,,

As before stated the difference in the coal weights when fired in pulverised and solid form does not signify that there is also a wide disparity in the weights consumed per unit of time. There is one thing, however, that is worthy of mention because of its significance, and that is that as the coal size is increased so does the difference in consumption in a given time tend to become pronounced as the coal weight per square foot of grate area per hour limit is approached.

It is evident from the preceding weights that with the coal reduced to half the original size, *i.e.*, $\frac{1}{4}$-in. cubes, the grate area required to obtain the same coal surface area is somewhat less. As will be seen the coal weight required is one half of that necessary with $\frac{1}{2}$-in. cubes, and the grate area required could theoretically be reduced to one half of the original area with the rate of coal to furnace flow doubled to maintain the same coal consumption per square foot of grate area, and at the same time meet the requirements of the more rapid rate of combustion made possible by the increase in the surface area exposed per unit weight of coal entering the furnace.

Conversely, when firing one-inch cubes the grate area required for the same effective air to coal surface area would be twice that required with half-inch cubes, with the rate of coal delivery halved to maintain the same consumption per square foot of grate area and allow for the decrease in the combustion rate brought about by the decrease in the coal's exposed surface area.

From this it would appear that to burn the same weight in the same time the grate area required would assume abnormal dimensions at the higher evaporative capacities and tend to cut out the competitive element associated with the two methods of coal firing.

Should the same coal be used in each case with the air distributing arrangements identical, the previously mentioned increase in grate area would not be compulsory if the conditions referred to later were realisable. Further, it is necessary to admit that in practice the coal size in question would have a somewhat higher heat value per unit weight, therefore the amount required for a given steam output would be less with the same overall efficiency maintained, thus offsetting to a certain extent the difference in the grate area required to produce the same superficial area as that of low-grade pulverised coal.

Referring again to the minimum consumption for the burner under consideration with a fuel and air velocity of 48 ft. per second, *i.e.*, 1.72 lb. per second, or 6,192 lb. per hour, it is seen that by allowing the conservative figure of 20 lb. of coal per square foot of grate area per hour, the grate area required is 310 sq. ft. In both cases, with the actual evaporation taken as 7 lb. per lb. of coal, the steam output would be approximately 44,000 lb. per hour. Comparing this with the higher coal-consuming rate, *i.e.*, 2.58 lb. per second, or 9,288 lb. per hour, with an injection velocity of 72 ft. per second, the grate area necessary with the consumption per square foot of grate area per hour as before would be 464 sq. ft.

The steaming rate based on the same evaporation per lb. of coal would rise to approximately 65,000 lb. per hour.

Allowing for an alteration in coal size it is seen that by halving the coal dimensions in the specific case out-

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lined, the grate area at the two rates of consumption could be reduced to 155 sq. ft. and 232 sq. ft., respectively, with the coal replacement speed doubled. In other words, by raising the hourly consumption per square foot of grate area to 40 lb.

To those concerned with the commercial production of steam the latter may appear to be an absurdity. In any case the fact remains that given the same conditions of air availability in each case, it is possible to increase the speed at which the coal enters the furnace by reducing its size. This simply means that less weight is in the furnace at one and the same time, with the rate of renewal greater, therefore, with less weight of coal in the furnace at any instant, the grate area required is less, regardless of the apparent fiction attached to the figure obtained by dividing the coal consumed per hour by the grate area.

It matters not whether we have, say, 2 tons in the furnace renewed three times per hour, or 1 ton renewed six times per hour, the consumption remains the same providing the rate of combustion allows the higher rate of renewal to be attained. There is, of course, a limit to which the coal size can be reduced under the heading of solid-fuel firing, and that limit is obviously realised some time before the dividing line between the solid and the powdered state is reached, or, as it may be stated, when the weight of each coal particle is such that air in motion makes it mobile, the aforementioned limit has been reached and passed. Furthermore, it would require special attention to the air to coal distributing arrangements of the coal-carrying medium to overcome the blanket-like formation of a mass made up of exceptionally small pieces of coal.

This serves to emphasise the fact that to meet the needs of the various coal sizes met with in practice, it is essential that the grate should be designed for burning the smallest variety likely to be encountered, for the specific reason that it is easy to burn nutty coal on a grate designed for smalls, but not *vice versa*.

The effect of increasing the size to 1-in. cubes would also appear to demand in the two cases cited an increase in the grate area to 620 sq. ft. at the minimum consumption, and 928 sq. ft. at the maximum consumption, with the coal replacement speed reduced by 50 per cent., or stated another way, by halving the consumption per square foot of grate area per hour. Here again the rate of renewal question crops up. Under identical conditions of coal grade, air supply, &c., it takes a greater weight of coal to produce the same rate of decomposition, from which it is a foregone conclusion that either the grate area or the weight carried per square foot of area must be increased with a corresponding reduction in the speed of renewal. Obtaining an increase in the consumption for the same grate area with the speed of replacement lowered does not appear to be in this case a feasible accomplishment.

As it so happens, however, it would be possible in the majority of cases to increase the thickness of the fuel bed by 100 per cent. with coal of the size in question, without impairing the efficiency of the burning process, and it is on this score that it is possible to maintain the same rate of consumption at half the original speed of renewal with the air availability requirements as before.

It is evident from the preceding that by increasing the coal consumption per square foot of grate area per hour, by taking advantage of the available ways and means made possible by the increased superficial area per unit weight as the coal size decreases, coupled with modern methods of air to coal delivery from which rapid combustion accrues, it is possible to considerably reduce the grate area required by burning more per square foot for a given steam output.

Incidentally, it should be noted that it is also possible to assist in bringing about the latter by raising the steam pressure.

The advantages of these procedures will be seen at the higher steaming capacities, as for example, a 312,000-lb. boiler with the same evaporation, *i.e.*, 7 lb. per lb. of coal, would require five of the burners referred to, compared with a grate area of 1,114 sq. ft. with an hourly consumption of 40 lb. per sq. ft. of grate area.

By increasing the steam pressure from, say, 250 to 600 lb. per sq. in., in which case the actual evaporation would increase to approximately 8 lb. per lb. of coal brought about by the higher temperature of the water entering the boiler, the number of burners would be reduced to four and the grate area to 975 sq. ft. for the same consumption per square foot per hour.

Such a grate area in these days of mechanical stokers, 24 to 30 ft. wide, is easily accomplished; therefore, from a rate of burning point of view the question of superiority recedes into insignificance.

Providing we do not take the criteria of the ideal method of burning raw coal as being the number of B.th.u. liberated per cubic foot of furnace volume per hour, which after all is not exclusively the decider of steam production efficiency, we are left with the microscopic difference in the thermal efficacy obtainable from the two methods of firing remaining as hitherto the only loop-hole for those who wish to be ultra-controversial in matters concerning the economical production of steam.

An Electrified Metal Mine.

Some Notes on the Use of Electric Haulage Locomotives in an Open-cut Copper-ore Mine in America

(COMMUNICATED).

THE mining properties of the Utah Copper Company at Bingham, in the United States, are said to be the world's largest electrified metal mine. Although the actual mining operations had already been electrified, up till the middle of 1928 the haulage system was of the steam type. Trials were made with an electric locomotive, which proved satisfactory, and plans were then made for the employment of 20 more, with suitable sub-station equipment. An additional 20 are to be added as soon as they can be built and delivered, and possibly even a few more will be required. Thus, the mine will have in use what is claimed to be by far the largest number of electric locomotives ever applied to open-cut mining operations.

The copper ore is found on both sides of the canyon in which the town of Bingham is situated. Electric shovels of the largest size, working on successive terraces, cut in the mountain face, remove the over-burden which covers the ore, and then the ore itself. The overburden is deposited in wagons that are hauled away by the electric locomotives and dumped down another side of the mountain, while the ore itself is hauled to the mills at Magna, 17 miles distant.

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The locomotives were specially designed for this service; seven of the 41 machines are of a combination type particularly valuable for operation where power cannot always be collected from the usual overhead system. Each locomotive has facilities for overhead collection of electricity, side-arm collection, or for operation by means of storage batteries. In addition, the 41 locomotives are each equipped with a cable-reel collector by means of which power can be delivered to it over a considerable distance from the supply point by means of a trailing cable. The locomotives are of very heavy construction, each being rated at 75 tons.

Power for the haulage system is to be supplied from a number of sub-stations, two of which are already in use, and an extensive electrification system will be necessary for distributing the power to the points where it is needed.

The electric locomotives haul the ore cars up the side of the mountain by means of switchbacks, over the various benches, and to the shovels. There the wagons are loaded and hauled back to the foot of the mountain, where they are made up into long trains and transported to the mill by the railroad.

The locomotives are described as being of the articulated-truck, steeple-cab type, with rigid frames, made up of heavy steel-plate sides carried on combination semi-elliptic and helical springs. The main cab of the storage-battery type engines is over ten feet square, and in the cab are the driver's seat and control gear with other necessary electrical equipment.

Four large totally-enclosed motors drive each locomotive; the motors are controlled on a single-unit, three-speed, control system arranged for series, series-parallel, and parallel operation, with resistors of sufficient capacity for the service cut-in and out by solenoid-operated contactors. Complete protection and metering equipment is provided by suitable relays and instruments.

The overhead pantagraph trolley is raised by a spring and lowered by air pressure, both operations being controlled by the driver in the cab. In addition, there are two side-arm pantagraph trolleys, one mounted on each side of the cab room; they are extended and withdrawn by air, and also under control of the driver.

The electric cable reel, mounted under the platform beneath the cab, carries a suitable length of flexible rubber-covered cable, and is of the vertical-axis type driven by a motor which automatically winds and unwinds the required length of cable as the locomotive moves toward or away from the source of power.

In the storage-battery locomotives a ball-bearing motor-generator set in the cab is arranged to charge the battery through its control gear without the use of a charging resistor. A two-stage air compressor, also in the cab, provides the necessary air for operating the air-brake equipment.

Small Electromagnets.

A Suggestion for a Simple and Effective Improvement in their Design.

By L. H. G. DINES.

It seems curious that in making small electromagnets for use in such apparatus as electric bells, relays, electric clocks, &c., very little attempt is usually made to obtain the maximum pull on the armature in relation to the current required to work the magnet.

The ordinary arrangement is similar to that shown in fig. 1: two soft-iron cores A and A^1 are fixed in the iron yoke Y; coils C and C^1 wound on bobbins are slipped on the cores, and an iron armature BB^1 mounted on a spring or on bearings is attracted towards the poles a and a^1 when the current flows. If we denote the mean thickness of the air gap between a and B and a^1 and B^1 by the symbol t, it is well known that the force of attraction on BB^1 increases very rapidly as t decreases. Hence any design

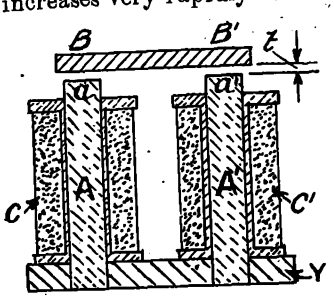

Fig. 1.—Ordinary Electromagnet.

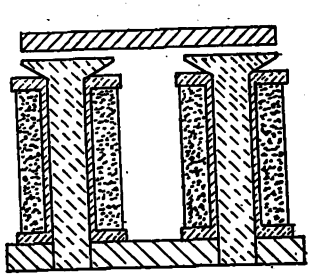

Fig. 2.—Magnet with Splayed Core-Ends.

will give a good pull when t is small, and the problem is to obtain a better pull when t is large at the expense of some of the unnecessarily large pull when it is small.

A very simple and effective way of doing this is shown in fig. 2: in this case the ends of the iron cores are splayed out till the area of each pole face is about six times as great as the cross section of the core, and the size of the armature is increased to correspond with them. By this means the pull on the armature is in general greatly increased; under conditions of working which do not involve too high a degree of magnetisation of the iron, the pull on the armature when t has its maximum practicable value may be increased to as much as three or more times its value in the case of fig. 1, the windings and current being the same in the two cases.

The explanation will be obvious to those accustomed to the design of electrical machinery—one is simply reducing the magnetic resistance of the air gap by increasing its cross section. The writer has made numbers of small electromagnets on this principle, and the practical results obtained have supported the theoretical considerations.

It is obvious that if efficient magnets are required the accepted canons of dynamo design must be respected; it is, for example, quite possible in increasing the area of the pole faces to so reduce the resistance of the leakage path that no benefit results. Also, less advantage will be gained if the cores are working under too high a state of magnetisation. As a rough guide the writer has found that so long as the winding does not exceed 40 ampere turns per centimetre of the total length of the magnetic circuit, the enlargement of the pole faces and armature described above is very advantageous.

Objection may be taken that the design shown in fig. 2 is more expensive to construct than that in fig. 1. This may be met by the simple expedient of threading the ends of the cores in fig. 1 and screwing on steel nuts to form the enlarged pole faces. A Whitworth nut gives an enlargement ratio of $3\frac{1}{2}$ to 1, which is enough to secure a considerable improvement in efficiency, but it is better if possible to obtain the full increase of 5 or 6.

In high-class work the coils would probably be wound directly on to the cores without separate bobbins. To such cases the type of core illustrated in fig. 2 lends itself well, for by constructing the cores with bottom flanges they form their own bobbins on which to wind the wire.

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Variable-speed A.C. Commutator Motors.

Notes and Comments on Some of the More Recent Types of Machine.

By C. V. HILL.

(Extracts from a Paper read before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.)

COMMENCING with a short historical survey, followed by descriptions of the early types of variable-speed commutator motors, both series and shunt, the paper then went on to describe rather more in detail the more recent type in which speed variation is produced by varying the voltage applied to the rotor through a transformer or induction regulator.

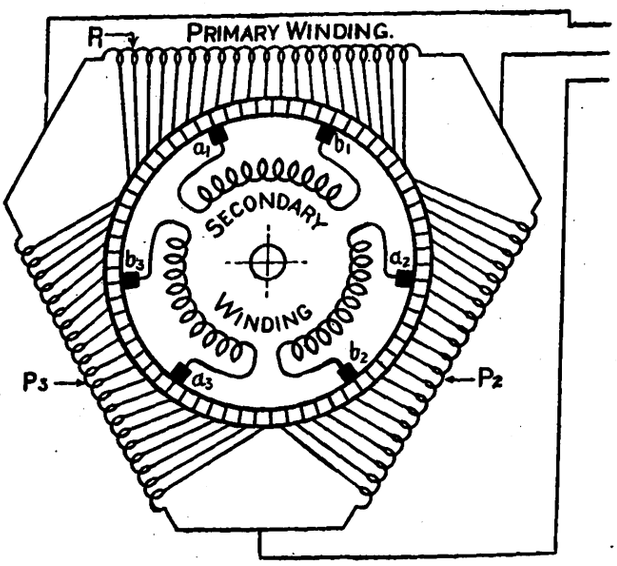


Fig. 1.—Elementary Diagram of 3-ph. A.C. Commutator Motor.

The Eichberg 3-phase Shunt Characteristic Commutator Motor.—The desirability of a machine having shunt characteristics is obvious, and there have been several attempts to produce such a machine. One of the earliest of such motors is the Eichberg motor; the stator resembles that of an ordinary induction motor, and the rotor is similar to that of a d.c. machine. The stator is connected to the supply mains, but the armature is connected to the secondary of the transformer, the primary of which is also connected across the supply mains. The secondary of the transformer carries a number of tappings, and hence the voltage impressed on the armature can be varied at will.

The principle of operation can be seen from the following considerations. The stator produces a rotating field which travels round the machine at supply frequency as in the case of the induction motor. The armature cutting this field has a voltage induced at the brushes which varies with the speed of the armature. At standstill this voltage is maximum, zero at synchronous speed, and once more the standstill value at a speed of twice synchronous speed, but with a reversed sign.

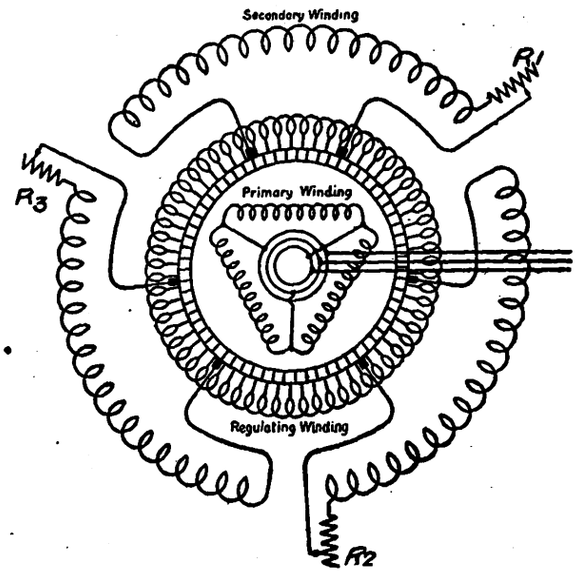
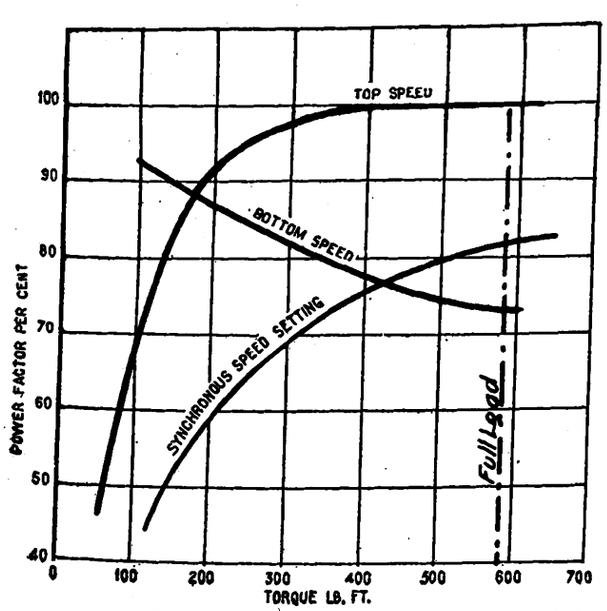
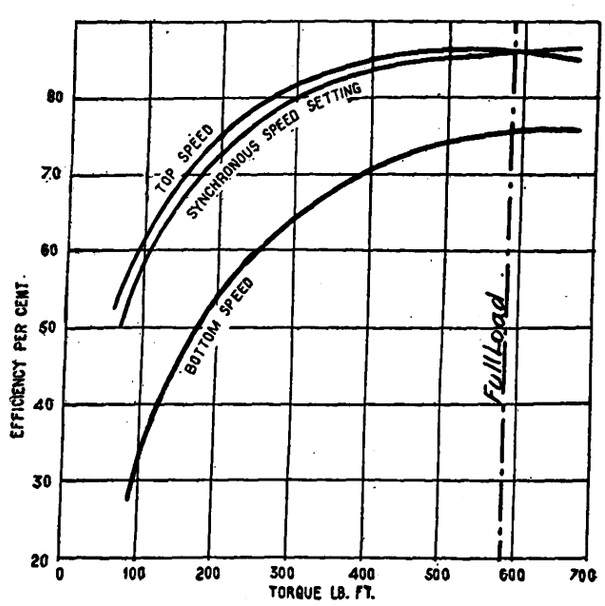


Fig. 2.—Diagram of Windings of Schrage Motor.

Since the brushes are stationary in space the frequency at the brushes due to the revolving field will always be full frequency. Hence it is always possible to apply to the brushes the voltage at full frequency derived from the supply mains through the transformer.

At light loads no torque-producing current must flow in the armature, so that it will readily be seen that the condition of stable running is at such a speed that the voltage induced by the main field taking account of the rotation of the armature shall be equal to the voltage impressed on the armature from the transformer.





Figs. 3 and 4.—Power-factor and Efficiency Characteristics of Type CH Motor.

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Speed variation is produced by varying the impressed voltage by means of the transformer tappings, and the number of possible speeds is limited to the number of such tappings available.

The Schrage Variable Speed A.C. Commutator Motor.—In order to remove the defects of the foregoing motor, it is necessary to resort to principles successfully embodied in a motor due to Schrage, which has proved to be the most successful variable-speed motor so far developed.

The principle of operation of shunt-characteristic variable-speed motors has been shown to be that an e.m.f. derived from some suitable source of the same frequency must be impressed on the rotor windings in addition to that voltage induced in them due to the rotation of the rotor

If the speed is to be above synchronism the impressed voltage must be in the same sense as the induced voltage, and if the speed is to be below synchronism the impressed e.m.f. must be in the opposite sense to the induced voltage.

The Schrage motor is an induction motor in which simple means have been found for producing such a voltage which can be varied so as to produce speeds either below or above synchronism. These means can be best understood from the following considerations. Fig. 1 shows a primary winding consisting of three phases connected to a commutator. A secondary winding is shown which can be connected to brushes carried in separate brush rings, so that the brushes (*a*) at the one end of the secondary phases can be separated from brushes (*b*) at the other end of the phases. The voltage impressed across each phase of the secondary winding will be proportional to the separation of the brushes. If now the secondary with the brushes is made to rotate in the same direction as the rotating field, but with the brushes disconnected from the windings, we see that the voltage across brushes (*a*) and (*b*) is constant, depending only on their distance apart on the commutator. The frequency of the voltage depends on the speed of the brushes. At standstill it is full frequency; at synchronous speed (the speed of the magnetic field) the frequency at the brushes is zero. Since the secondary windings are also rotating at the same speed, the frequency induced in them will be the same as at the brushes, so that the brushes can be connected to the secondary windings, without bringing together different frequencies. If now the brushes are brought together the arrangement of windings corresponds to a simple induction motor, and the machine will run as such with a speed near synchronous speed, according to the load. As the brushes are separated there is an e.m.f. impressed on the secondary in a sense which depends on the direction in which the brushes are moved, the voltage being independent of the load. Thus the conditions for a variable-speed machine with shunt characteristics as stated above are satisfied.

There are certain modifications to the above arrangement to make it a practical workable machine. It would obviously be difficult to rotate the brushes, and so the secondary winding and the brushes are attached to the fixed element or stator, and the primary is carried round on the rotary element. This, of course, does not in any way affect its operation as an induction motor, but it enables the machine to be fitted with a commutator of conventional type, carried on the rotor.

It is also necessary, in order to reduce the voltage between segments to a suitable figure, to keep the commutator and primary winding separate, arranging their turns such that the commutator winding obtains its voltage by transformer action from the primary, but suitably reduced in magnitude. The commutator and brushgear is thus kept isolated from the higher voltages of the supply mains, and they can safely be handled when the machine is running.

The actual arrangement is shown diagrammatically in fig. 2, and is as follows. The primary winding is placed at the bottom of the rotor slots and connected to the sliprings. The secondary winding, which is similar to that of an ordinary direct-current armature, is wound above the primary winding, and the ends of the coils are connected to the commutator just as in the case of a d.c. armature. The brushgear is arranged on two separate yokes, and these are connected together by racks and pinions. The starts of all secondary phases are connected to the brushes on one yoke, and the finishes of the phases to the other brushes.

On separating the brushes the impressed voltage varies in proportion to the separation, and in sense according to which direction the brush yokes travel. The maximum movement on either side of synchronism is 90 electrical degrees. The speed range depends upon the relation between the turns in the regulating and secondary windings.

If A is the ratio of the number of turns in the regulating winding to the number of turns in the secondary winding, and N is the synchronous speed, then the speed range of the motor at light load will be from N(1−A) to N(1+A). The value of A must be less than unity.

The motor runs efficiently at all speeds, only power proportional to the speed being taken from the mains. Since, however, the flux is constant, the torque will be constant for constant secondary current, the horse power being proportional to the speed. It is also evident that the commutator and regulating winding handle only power which is proportional to the departure from synchronous speed, *i.e.*, the slip power, and so are highly loaded, compared with the total output of the motor.

The Schrage motor can be built for a wide range of speeds and horse powers within the limits imposed by good design. Briefly, these are :—

In the first place the speed range obtainable is limited chiefly by considerations of the secondary power factor. The power factor depends on the ratio of resistance to reactance, and for constant current the reactance is low at synchronism, and higher as the speed is reduced below synchronism, due to the increasing frequency. This imposes a limit on the speed range, and since for small machines the ratio of resistance to reactance is greater than for larger machines. The possible speed range is of the order of 3 : 1 for 50-cycle machines, corresponding to a frequency in the secondary of 25 cycles, *i.e.*, the speed range goes from (50+25) to (50−25) cycles. Small motors up to about 20 h.p. can be built for 5 : 1 speed ranges, and for 50 cycles even up to 80-h.p. motors with 4 : 1 speed range have been successfully built, and for 25 cycles up to 100 h.p. with speed ranges as large as 4½ to 1.

Another design limit is imposed by the permissible voltage between adjacent segments of the commutator. It must be small, since it governs the current in the coil short-circuited by the brushes during commutation, and also to obtain smooth variation in speed. This voltage, assuming a single turn as the minimum possible, is dependent on the flux and the speed. This places a limit on the flux per pole and hence the output per pole. This tends to make the larger machine have a large number of poles, and hence to run at slower speeds than the smaller motors. The use of specially designed windings increases the range of output considerably, but the maximum output is found to be between 250 and 300 h.p. on 50-cycle circuits. Above this output, however, it is possible to employ two separate machines mounted in tandem with their brush-operating mechanism mechanically coupled, and sets of 500 h.p., as above, have been successfully built in this way.

The foregoing shows how important it is that the synchronous speed shall be placed in the middle of the required speed range, so that the power handled by the commutator shall be evenly distributed above and below synchronism, and so kept to a minimum. It is therefore always most economical to adopt the speeds that best suit the design, having reference to the output and speed range required, and to convert these speeds to those of the driven apparatus by interposing suitable gearing. Where this cannot be done, a large and comparatively expensive motor is usually the result.

Whilst the ratio of resistance to reactance makes for a poorer power factor below synchronism, the reactance drop only has this effect at sub-synchronous speeds, as at super-synchronous speeds the drop is a leading one and causes power factor improvement, the value obtained being high and often unity or slightly leading at full speed. It can, however, be improved at the lower speeds by adopting the principle of differential brush shifting. This means that one set of brushes is made to move faster than the other, and so the axis or mean position between the brushes is made to move in the opposite direction to that in which the motor is running. The phase of the voltage across the brushes is thereby altered, introducing a component 90 deg. out of phase with the main voltage, and making for power factor improvement. The starting torque and also the maximum torque of the machine are also improved.

At standstill, a value of approximately 1¾ to twice normal full load torque is obtained with the brushes in the position corresponding to the bottom speed within the range. The primary current with this value of starting torque will be approximately equal to 1½ times full-load current. Thus it will be seen that with the brushes set for bottom speed the starting current can be kept down to a suitable value without the introduction of any secondary starting resistance.

This means that for machines of normal speed range it is only necessary to connect them directly to the supply mains at starting through a simple oil switch or its equivalent. In order to ensure that the brushes shall be brought to the correct minimum speed position before the motor is started, a small interlock is provided on the endshield, which has its contacts bridged when the brushes are in the correct position by means of a striker on one of the brush rings. The interlock is in the low-voltage release circuit of the oil switch, which thus cannot be closed until the interlock is closed.

(To be concluded.)

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Severn Barrage Scheme.

On April 23rd, Colonel ASHLEY informed Sir W. Preston that the question of the practicability of constructing a barrage across the River Severn for the purpose of generating electric power by tidal water was being investigated by an expert committee which was appointed on the recommendation of the Committee of Civil Research. It was not possible to give any useful estimate of the number of men who might be employed on any scheme of that kind.

State Telegraph Services.

On April 23rd, Sir W. MITCHELL-THOMSON, the Postmaster-General, informed Mr. Wellock that the following were the

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approximate numbers of telegrams sent and received in the first quarters of 1928 and 1929:—By the Post Office "Beam" stations:—Last year, 451,000; this year, 506,000. By the Imperial Cables:—Last year, 115,000; this year, 123,000.

Television.

On April 23rd, Mr. DAY asked the Postmaster-General whether any agreement had now been arrived at between his department and the British Broadcasting Corporation by which facilities would be granted for the purpose of broadcasting television; and could he state which station the British Broadcasting Corporation would be utilising for the experiments.

Sir W. MITCHELL-THOMSON said he had already announced his willingness to agree to a B.B.C. station being utilised for television experiments outside broadcasting hours. The Corporation, however could not provide the desired facilities for simultaneous transmission of speech and television until the completion of its new station at Brookmans Park, which was expected to be ready in July next.

The Battersea Power Station.

On April 25th, in the House of Lords, Lord JESSEL called attention to the menace to the health and amenities of London by the erection of the Battersea power station. He said that the station would be erected within 300 yd. of Westminster and would be the second largest in the country. It was expected to consume some 800,000 tons of coal, and six chimneys, each 255 ft. high, would be erected. They would not be very picturesque and the sulphurous fumes would corrode many of the important buildings in the neighbourhood.

Lord LONDONDERRY, the First Commissioner of Works, said that, as a result of science, smoke and grit need no longer be a nuisance to the public. The erection of this station, which was only a third of the full scheme, would mean that three others already built at Horseferry Road, Westminster; Wood Lane, Shepherd's Bush; and Richmond Road, Earl's Court, would be dispensed with, and the sulphur fumes reduced by 30 per cent. He could give an assurance that the further extension of the station would not be undertaken unless there was no danger to health and no destructive sulphur fumes. Unless the Minister of Transport, the Minister of Health, and himself were satisfied on the advice of the Government chemist and of the Department of Scientific and Industrial Research that there would be no danger the scheme would not be completed.

Lord CRAWFORD, while welcoming the assurances of the Government, called attention to the fact that the "main transmission lines" were to be taken through Hyde Park and four other public parks. He objected to these lines being taken overground by unsightly upright metal structures, and, as for underground lines, he had always regarded the Royal parks as sacrosanct from digging operations. He hoped the Government would consider the long distance transmission of electricity, as had been done in the Ruhr.

LORD LONDONDERRY said that the scheme had been fully considered in all its aspects, and those responsible for it were convinced that the alleged dangers were largely illusory and that the difficulties would be overcome. Any further extensions would be reviewed in the light of the experience gained.

At the conclusion Lord Jessel withdrew his motion.

Galloway Water Power Bill.

On April 25th, in the House of Commons, on the order for the second reading of the Galloway Water Power Bill, Lt.-Col. MOORE moved its rejection. He objected to the proposals of the promoters to erect a high barrier at the mouth of Loch Doon, to raise its level from 23 ft. to 38 ft., and to reduce the quantity of water released to 45,000,000 gallons a day. That was a totally inadequate quantity of water to preserve the health of the community or to give the necessary assistance to the industrial organisations which depended on that water. The balance of the water was to be taken away by the promoters on to another watershed, the watershed of the Dee, in another county, and they were there going to erect power stations for generating electricity for a county outside that of Ayr, the county of Kirkcudbright and Galloway generally. The people of Ayrshire felt they were being robbed of their birthright.

Labour members opposed the Bill because they maintained it to be their duty to see that electricity was kept in the hands of the community and not used for exploitation by private persons.

Col. ASHLEY, the Minister of Transport, said it was against the public interest to oppose the second reading of a Bill simply because it was promoted by private enterprise. The whole idea of the scheme was to make electricity available, not only for other districts in Scotland, but for parts of North-West England. By it it was hoped that the cost of electricity to the consumer would be reduced. It was the considered opinion of the Electricity Board that the scheme would supply electricity to the grid, in the industrial areas of Scotland, and in the country districts as well, distinctly cheaper than would be possible from a steam station.

The Bill was read a second time by 99 votes to 39.

Private Bills.

The Chatham and District Traction, Cheltenham District Traction, Derbyshire and Nottinghamshire Electric Power, Jarrow and South Shields Traction, Mansfield District Traction, and Yorktown (Camberley) and District Gas and Electricity Bills have been read a second time in the House of Commons. These Bills have all passed the House of Lords.

The Dissolution Date.

The Prime Minister stated last week that the date of prorogation and dissolution of Parliament would be May 10th; nomination day would be May 20th, and the general election would take place on May 30th.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Australian "Anti-Dumping" Duties Revoked.

The Times reports that the Commonwealth anti-dumping duties, imposed after the war on the products of countries with depreciated currencies, were revoked by proclamation on April 26th. The countries affected are Germany, Austria, France, Spain, Portugal, Belgium, Czecho-Slovakia, Luxembourg, and Hungary.

Exports and Imports: Volumes and Values.

The *Board of Trade Journal* for April 25th reviewed our foreign trade during the first quarter of the current year giving the corresponding values in the first three months of 1924, the values in 1929 at the average values ruling in 1924, and the average values and quantities as compared with 1924. From the tables it is seen that the declared value of exported electrical goods and apparatus rose from £2,336,000 in 1924 to £2,788,000 in 1929, but, calculated on the 1924 values, the 1929 total amounted to £3,023,000. While the average values fell to 92.2 per cent. of the 1924 figure, quantities were 129.4 per cent. of the 1924 volume. Retained imports rose in value from £633,000 to £1,216,000, or in 1924 values to £1,488,000. The volume represented 235.1 of the 1924 volume, but the average value fell to 81.7 per cent. of the 1924 figure. So far as machinery (including electrical machinery) is concerned, while the exported quantity represented 129.4 per cent. of the 1924 volume, the value was 95.0 per cent. of the 1924 value. Imports of machinery rose to 199.6 per cent. in volume, and fell to 96.3 per cent. in value.

Supply Authorities' Publications.

We have received from the borough electrical engineer and manager of Halifax (Mr. F. N. Rendell-Baker) a copy of the April number of the Corporation's "Electric Supply Gazette." This is an attractive quarterly magazine containing well-illustrated articles and notes on varied electrical matters, particularly developments in Halifax. Some information is given regarding the Halifax Electrical Development Association, in which the supply department and local wholesalers and contractors are represented.

The borough electrical engineer and manager of Bacup (Mr. H. Tetlow) has sent us a brochure dealing with the Corporation's hire-purchase and assisted wiring schemes. This contains not only illustrated details of the apparatus available, but a great deal of general information regarding the use of electricity, including the cost per hour of operating various appliances.

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Batti-Wallahs' Society Luncheon.

Sir Hugo Hirst, Bt., chairman of the General Electric Co., Ltd., was the guest of honour at an exceedingly well-attended luncheon of the Batti-Wallahs' Society held on April 25th, at the Hotel Cecil. The new president of the Society, Mr. H. L. Howard, was duly installed by Mr. R. W. Hughman, the past president, who said how proud they were to commence a new session with a gathering which was a record.

Sir Hugo Hirst dealt mainly with his experiences as a member of the British Economic Mission to Australia, and suggested that as he was speaking on Anzac Day, a message of greeting should be sent from the Batti-Wallahs to Sir John Monash. He explained that the Mission went out with the idea of studying Australia from the Australian point of view, and with the intention of learning at first hand everything it could about Australian conditions. He pointed out that while the population of Australia was only some six and a half millions, the purchasing power of the population was far greater than a normal six and a half millions in European countries, and that far greater attention should be given to supplying the Australian market with what it wanted, rather than with what we had to sell at home. There were in Australia six self-governing States, each with its own special aspirations, and each of the States must be considered carefully as a separate entity. Australia was thought of in this country as being mainly agricultural, but two-thirds of the population actually lived in towns and those towns were just as advanced, or more advanced than, our own. We must get rid of the idea of the Australian population being engaged in agriculture. Australia was manufacturing, and would continue to manufacture, and it was our duty to study the products which could usefully be made in that country. Australians were intensely loyal and would far rather purchase the goods which they did not manufacture from Britain if economic conditions permitted them to do so. He was satisfied that a young country could not produce scientists and engineers quickly enough to meet the demand, and we must help them by sending out our own. Australians aspired to play a stronger part in all matters concerning the British Empire, and we should do everything by means of personal contact to enable them to realise those aspirations.

Sir Hugo's speech, which was most enthusiastically received by the large audience, was followed by a few words of thanks from Mr. Henry Horne, who did so much to assist Major Sir Henry Segrave to set up the world speed record with the "Golden Arrow."

A G.E.C. Fan Display.

According to the GENERAL ELECTRIC CO., LTD., the prospects for the sale of fans during the coming months are very bright, for l'Abbé Moreux, of Bourges Observatory, predicts that the summer of 1929 will be unusually hot and dry. Nevertheless, fans will not sell themselves and the company has therefore drawn up a scheme for aiding retailers. Advertisements of "Magnet" fans are to appear regularly in commercial, industrial and technical journals and high-class magazines. In addition, there will be available attractive folders (arranged for overprinting), show cards, and a "breezy" cut-out for window displays and counter demonstrations. The company has introduced a new range of induction-type fans for desk and bracket mounting.

An A.T.M. Play.

On April 15th, at the Balfour Institute, Liverpool, the A.T.M. Dramatic Society gave a very successful rendering of Noel Coward's three-act comedy "Hay Fever." As a result of close application and frequent rehearsing, this energetic society is making excellent progress, and the result as exemplified in this performance, reflects great credit on the producer, Mr. Thos. Fisher, as well as upon individual members. The musical portion of the programme was furnished by the A.T.M. Orchestra, some 30 strong, under the direction of Mr. C. Brandreth.

Local Exhibition.

BESSECARR.—An electrical exhibition was arranged last week by the Yorkshire Electric Power Co. The display was in charge of the assistant sales engineer, Mr. A. W. Thorpe, and demonstrations of electrical devices were given daily.

Book Notices.

"The *Electrician* Annual Tables of Electricity Undertakings, 1929." Pp. vii+212. London: Ernest Benn, Ltd. Price 10s. net.—This is the 42nd annual issue, and it has been revised so as to include particulars of many new undertakings, together with details of projected schemes, &c. Additional information regarding mains and distributors, converting plant, output for the year, showrooms, &c., which has been inserted in the present edition, increases the usefulness of these tables.

We have received from Sir Isaac Pitman & Sons, Ltd., a copy of their spring list of books for 1929, which includes a variety of subjects of interest to electrical engineers.

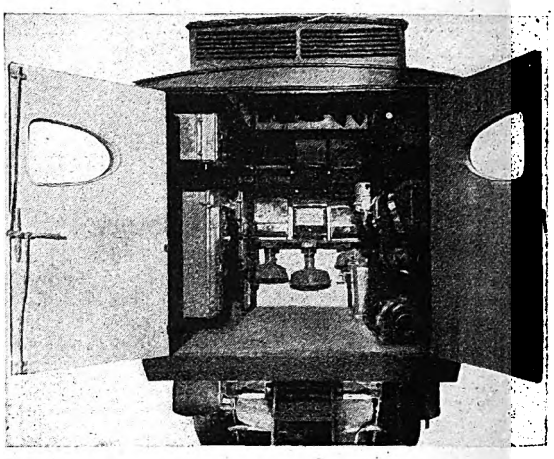
Publications of the Technical Section of the Association of Engineering and Shipbuilding Draughtsmen.—"Press Tools." By N. F. Tieldsend. Price 2s.

"Vibration Problems in Engineering." By S. Timoshenko. Pp. vi+351; figs. 165. London: Constable & Co., Ltd. Price 21s. net.

"Science Abstracts" (A & B). Vol. XXXII. Part 4. April, 1929. London: E. & F. N. Spon, Ltd. Price 3s. each.

A Travelling Exhibition.

A completely-equipped demonstration van is the latest addition to the "selling staff" of VERITYS, LTD., Aston, Birmingham. The body of the van has been specially designed and built with a well-ventilated roof, fitted with glass side panels, enabling a complete inspection to be made of a wide range of the company's productions. The accompanying illustration of the interior shows an exhibit of "Aston" motor-starting gear, "Maxlume" lighting equipment and radiators, electric



Veritys' Demonstration Van.

fans, &c. These are mounted on adjustable angle iron frames and staged on shelves, and are easily changed and replaced as occasion demands. The exterior is finished in a rich chocolate colour with a cream panel. The van will operate from the various branch offices and demonstrations by a trained staff will be given to electrical contractors and users of electrical apparatus throughout the country.

New French Companies.

Among the concerns recently formed in France are the Société Française d'Accumulateurs Electriques, Paris (12, Rue d'Aguessau), capital 7½ million francs; La Société Industrielle et Commerciale de la Dronne, Paris (39, Rue Vivienne), capital 600,000 fr., to operate a hydro-electric power station on the Dronne at Bourg-du-Bost (Dordogne); and La Société des Câbleries d'Epinay, Paris (18, Rue Duphot), capital 500,000 fr.

Another Industrial Conference.

In London last week representatives of the Federation of British Industries, the National Confederation of Employers' Organisations, and the General Council of the Trades Union Congress met to discuss means of promoting peace in industry. After a lengthy sitting it was decided to form a joint committee of the three bodies "to examine the best methods for consultation and co-operation between the three organisations and to report to a further meeting of the conference."

The General Council of the Trades Union Congress at its monthly meeting on April 24th instructed its representative to prepare a full report of the proceedings to be considered at a later meeting. The Labour Correspondent of *The Times*, in commenting upon the matter, says that the General Council has to consider, among other things, the effect of any arrangement with the organisations upon the Melchett-Turner conference. The main purpose of the latter was to prove the possibility of negotiations on the largest scale and the widest range of subjects between employers and trade unionists. At the outset there was a clear understanding that the employers associated with Lord Melchett were acting as individuals and not representatives, and that, although their influence was great, they could commit none but themselves. Such a conference could point the way to co-operation and show, by example, the kind of agreements into which employers and trade unionists could enter with the object of promoting the welfare of industry and thereby the welfare of those employed in industry. But the employers engaged in those discussions were, of course, unable to take operative decisions. Official negotiations on the same lines with the employers' organisations would necessarily supersede the work of the Melchett-Turner conference, which would by then have served its purpose.

New Indian Company.

The Berhampur Electric Supply Co. is the name of a new concern which has been formed at Berhampur, Bengal, with a capital of 300,000 rupees, to undertake the supply of electricity in that town.

New Zealand Electrical Imports.

The *Board of Trade Journal* reports that during the last quarter of 1928 electrical apparatus and appliances valued at £522,810 were imported by New Zealand, being the second largest class of imports. The bulk of the goods (£318,634) came from the United Kingdom, while the United States share was valued at £80,361, Canada's at £35,686 and Australia's at £8,521.

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A British Exhibition in Buenos Aires.

A leaflet accompanying the April *Review* of the Bank of London and South America states that a British Trade Exhibition, already in active preparation, will be held in Buenos Aires at the end of next year. The Exhibition, promoted under the auspices of the British Chamber of Commerce in the Argentine Republic, has the support of the British-owned banks, railways, public utility companies, and commercial undertakings generally in that country; the guarantee fund to date exceeds £50,000. The magnificent grounds and buildings of the Argentine Rural Society have been lent to the Chamber of Commerce for the purposes of the Exhibition. The period of the Exhibition will be for some eight weeks during the Argentine summer of 1930-31. While no doubt the bulk of the visitors will be Argentine, many, especially those with trade interests, will be attracted from the neighbouring countries in South America. Communications and inquiries regarding the Exhibition should be addressed to: The Secretary, Buenos Aires British Empire Trade Exhibition, 5, Parliament Mansions, Victoria Street, S.W.1.

New Egyptian Company.

A newly-formed company, known as the Société Egyptienne d'Electricité, is reported to be preparing plans for the erection of a large new power station near Cairo.

Bankruptcy Proceedings.

MABEL WOOLLDRIDGE, lately trading as The Woolldridge Radio Co., 26-39, Lisle Street, W.C.—At the London Bankruptcy Court, on April 23rd, Mr. Registrar Mellor conducted the public examination of this debtor, who failed last October with total liabilities of £362 (unsecured £332) and assets "nil." Replying to the Official Receiver, debtor stated that in 1923, with £30 capital, she commenced trading in equal partnership at 39, Lisle Street with a man named Hawkins as wireless dealers under the style of "S. Hawkins," but the venture proved unsuccessful; in 1924 her partner withdrew from the business, which she continued on her own account until the end of 1925, when she disposed of the stock and ceased to trade. In about May, 1926, with £100 (borrowed money) she, with another, commenced trading in equal partnership as wireless dealers under the style of "The Woolldridge Radio Company." In November, 1926, the business was acquired by a limited liability company, of which she was appointed a director, and was allotted 50 shares of £1 each; the company effected little business, and in August, 1928, a receiver was appointed by a creditor. Early in 1927 she commenced trading as a wireless dealer on her own account and in her own name at 22, Lisle Street; on May 9th, 1927, M. Woolldridge (Wireless), Ltd., was registered with a nominal capital of £1,500, and acquired her business; she was appointed a director of the company, which appointment she still retained. The debtor attributed her failure to legal costs and the collapse of two limited companies in which she was interested. The examination was concluded.

K. P. J. JOLIVARD (trading as K. Jolivard & Co.), electrical engineer, 66, Victoria Street, S.W.1.—The public examination of this debtor was held on April 26th at the London Bankruptcy Court before Mr. Registrar Francke, the accounts showing liabilities of £1,486 against assets valued at £85. Replying to Mr. Wheeler, Assistant Official Receiver, the debtor stated that prior to June, 1924, he was in employment. He then started business without capital; the trading was successful until 1927, but subsequently gradually declined. Owing to keen competition and pressure by creditors he discontinued the business in July, 1928, and had since been without occupation. Lack of capital was a further cause of the failure. The examination was concluded. The following are creditors:—

	£		£
Baxter & Caunter, Ltd.	85	Marian Harris (Miss)	230
Engineering & Lighting Equipment Co., Ltd.	38	Newquay Electric Light and Power Co., Ltd.	35
Falk, Stadelmann & Co., Ltd.	32	P. W. Rawes	493
R. Foote	68	W. Sanders	23
General Electric Light Co.	24	C. F. Tucker	150
		Yesley Electric Supplies, Ltd.	25

G. A. NORMAN, electrical engineer, 11, Freeman's Yard, Barnsley.—Last day for proofs for dividend, May 8th. Trustee, Mr. B. S. Briggs, Official Receiver, County Chambers, King Street, Wakefield.

J. WESTNUTT, electrical engineer, High Street North, Dunstable.—Last day for proofs for dividend May 7th. Trustee, Mr. A. J. Rogers, Official Receiver, The Parade, Northampton.

R. BENNETT, wireless dealer, 107, Devons Road, Bow, E.—Receiving order made April 23rd, on a creditor's petition. First meeting, May 6th; public examination, June 5th, both at Carey Street, W.C.

W. M. HORSFALL, electrical engineer, 7, Redcross Street, Liverpool.—Last day for proofs for dividend, May 11th. Trustee, Mr. J. Allcorn, Government Buildings, Victoria Street, Liverpool.

B. H. WISHAW, electrical and wireless engineer, Bakewell Road, Matlock.—Last day for proofs for dividend, May 11th. Trustee, Mr. L. A. West, Official Receiver, 22, Regent Street, Park Row, Nottingham.

Company Liquidations.

WILLIAM ALLAN & CO. (LIVERPOOL), LTD., 62, Dale Street, Liverpool, electrical factors.—A meeting of creditors was held on April 25th at Liverpool, Mr. J. Airey, who represented some of the principal creditors, presiding. The liquidators submitted a statement of affairs which showed ranking liabilities of £5,187, of which £5,111 was due to the trade, and net assets of £2,952, leaving a deficiency, so far as the creditors were concerned, of £2,235. It was reported that the company was registered in January, 1928, with a nominal capital of £3,000, of which £2,000 had been issued, and was fully paid. Shares to the value of £1,500 were issued for cash, and the balance were allotted for consideration other than cash. The deficiency, so far as the shareholders were concerned, was therefore £4,235, which was accounted for by losses on trading totalling approximately £2,800, and the depreciation of the assets. Voluntary liquidation was decided upon as proceedings had been commenced by certain creditors. During the year to December 31st last the sales were £16,420, with a gross profit of £1,180. The expenses, however, totalled £3,479, and there was a net loss of £2,299. During the current year the sales had been £3,347, with a gross profit of £167, and a net loss of £538. During the discussion it was stated that one of the two liquidators had been a director of the company. A resolution was passed in favour of an application being made to the Court for the appointment of Mr. J. Airey as liquidator, together with a committee of inspection consisting of Mr. P. S. Booth, Liverpool, and the representatives of Siemens Electric Lamps & Supplies, Ltd., and Ferranti, Ltd. The principal creditors are:—

	£		£
Philips Lamps, Ltd.	387	McMichael, L., Ltd.	183
Pye, W. G., & Co.	283	Mullard Wireless Service Co., Ltd.	175
General Electric Co., Ltd.	364	Ferodo, Ltd.	169
Siemens Electric Lamps and Supplies, Ltd.	790	Watson, W., & Co., Ltd.	105
Cossor, A. C., Ltd.	295	Marconiphone Co., Ltd.	102
Ferranti, Ltd.	237		

BEDALE AND DISTRICT ELECTRIC SUPPLY CO., LTD.—A meeting of members is called for May 31st at the Electric Power Station, Bedale, to hear an account of the winding up from the liquidator, Mr. R. W. Smith.

Dissolution of Partnership.

HAVIL MOTOR CO., automobile, electrical and radio engineers, battery repairing and recharging depôt, dealers in wireless accessories, &c., 30, High Street, Peckham, S.E., and Havil Street, Camberwell, S.E.—Messrs. W. H. BUTCHER, G. P. HALL and J. A. PHILLIPS have dissolved partnership. Mr. Phillips will attend to debts and continue the business.

Polish Foreign Electrical Trade.

During February last the value of "apparatus, conductors and other electrotechnical materials" imported into Poland was 8,558,000 zloty (about £198,000). Poland's exports of the same class were valued at 95,000 zloty (about £2,200).

Proposed Belgian Radio Exhibition.

For the past two years radio manufacturers and traders in Belgium have had a section in the annual Motor and Cycle Show in Brussels in December. This not having proved altogether satisfactory, the two Belgian radio trade associations—the Bourse du Matériel Electrique and the Chambre Syndicale de la T.S.F.—have decided to organise a purely radio exhibition at a more suitable period of the year. The exact date and locality have not yet been settled.

The Next Illumination Design Course.

We have received the preliminary programme for the nineteenth Illumination Design Course which is being organised by the E.L.M.A. Lighting Service Bureau, and will be held from June 10th to 14th next. The course will be new in many ways, and will include a number of subjects not dealt with in previous courses. In addition to this the Lighting Service Bureau has been to a great extent redesigned, and consequently greater facilities are available for the demonstrations accompanying the lectures.

West Indian Electrical Imports.

In an appendix to a report by Mr. J. Paterson, of the Trade Commissioner's Office, Trinidad, upon economic and financial conditions in the British West Indies and contiguous territories, some particulars of electrical apparatus imports are given. The principal market for this class of goods is Jamaica, whose imports rose in value from £39,059 in 1926 to £39,111 in 1927. The largest supplier was the United States whose share was £33,058 in 1926 and £21,902 in 1927. The United Kingdom's share rose from £4,952 to £16,049. Canada supplied goods valued at £237 in 1927. Trinidad and Tobago imported £32,859 worth of electrical apparatus in 1927, as compared with £24,030 in 1926. Here, again, the United States was the largest supplier, with a value of £14,699 in 1926 and £20,248 in 1927. Imports from the United Kingdom increased from £6,227 to £9,525, and Canada was credited with about £2,000 in each year. British Guiana's imports had a total value of £5,733 in 1926 and £9,153 in 1927. The United King-

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dom's share rose from £1,041 to £4,302, and that of the United States from £3,661 to £4,207. The totals shown for Barbados are £8,176 in 1926 and £11,752 in 1927, of which the United States supplied £4,571 and £7,067, respectively, and the United Kingdom £2,925 and £4,080. The report is published by the Stationery Office for the Department of Overseas Trade at 2s. 6d. net.

Foreign Trade Advice.

In the April *Bulletin* of the British Chamber of Commerce in Paris there appear the following "Byewords for the conduct of British trade abroad" which are appropriate at a time when salesmanship in foreign markets is the subject of much discussion:—(1) Teach your boys one or more foreign languages, but teach them at an early age, and thoroughly. (2) Send your young men abroad for study and for commercial training. (3) Study the requirements of foreign markets and make your goods to suit them. (4) Employ British travellers speaking your prospective customer's language in preference to soliciting by post. (5) Quote your customers in the weights and measures and currency of their country. (6) Quote for your goods delivered at your customer's door. Shipping agents will invariably quote free delivery, duty and all charges prepaid. (7) Your catalogues should be printed in your customer's language. (8) Endeavour to meet your customer's requirements from the point of view of credit. (9) Correspond with your customers in their own language and not in your own. (10) Help to maintain the high standard of British commercial integrity. (11) Make use, through your travellers and by correspondence, of our Commercial Attachés and Consuls and also British Chambers of Commerce abroad, who are able to help your business in very many ways.

New Catalogues and Lists.

Messrs. S. G. BROWN, LTD., Western Avenue, North Acton, W.3.—The "Brown Budget" for April containing interesting illustrated articles on the company's loud speakers, electro-megaphones, &c. One on the use of loud-speaker equipment at election meetings is topical.

MESSRS. PERRY, BEVAN & CO., LTD., Priory Road, Aston, Birmingham.—A folder containing illustrations, particulars and prices of "Priory" electric fires, including bowl and screen patterns.

MESSRS. W. C. DAVEY & CO., 27, Mortimer Street, Tottenham Court Road, W.C.1.—A leaflet advertising the "Hush-a-Phone" telephone attachment which eliminates overhearing.

MESSRS. ERNST B. WESTMAN, LTD., 39, Lombard Street, E.C.3.—An illustrated booklet dealing with Swedish charcoal iron.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Booklet No. 413 illustrating and describing "Philiray" reflectors for shop-window lighting. Priced.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Leaflet No. 171, describing the electrical equipment of a stone quarry in Scotland. Illustrated.

MR. G. MARSHMAN, Trinity Street Works, Bury, Lancs.—A leaflet containing an illustration and particulars of the "Two-Twelve" electrically-heated boiler.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—List W6117, containing exhaustive details, illustrations, &c., of the company's "Type BEM.1" h.t. supply unit for a.c. mains.

X-RAYS, LTD.—*Correction*: In our issue of April 19th (p. 699) we inadvertently gave this company's address as 47, Red Lion *Square;* this should have been 47, Red Lion *Street*, W.C.1.

VENNER TIME SWITCHES, LTD., 45, Horseferry Road, S.W.1.—A postcard illustrating one of the West End traffic signs and calling attention to the fact that these are equipped with "Venner" time switches.

Messrs. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.1.—A comprehensive illustrated catalogue dealing with high-pressure insulators and describing manufacturing processes.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Folder No. 4150/5, containing an illustrated description of the "Cadillac" portable electric blower for cleaning machinery. Priced.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Price List 49/1, illustrating and describing the company's a.c. automatic gate-end circuit-breaker. Priced.

MESSRS. GRIERSON, LTD., 4, Bloomsbury Place, W.C.1.—A brochure describing very fully the "Dulrae" electric panel warming system, with particulars of running costs, &c.

THE NELSON ELECTRIC CO., LTD., 138, Kingston Road, Merton Park.—A leaflet containing prices of the company's lamps.

MESSRS. RICHARD JOHNSON, CLAPHAM & MORRIS, LTD., Jacem House, Trafford Park, Manchester.—Illustrated price lists of lighting glassware, vacuum cleaners, gramophones, and portable radio sets.

THE RADIO COMMUNICATION CO., LTD., 34-35, Norfolk Street, Strand, W.C.2.—List X329, containing an illustrated description of the "Type R.A.76" direction-finder equipment for the navigation of ships.

CELESTION, LTD., Kingston-on-Thames.—An illustrated leaflet advertising a new loud speaker for portable sets.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—Two coloured prints illustrating "Marconi" valve window displays for the use of dealers.

MESSRS. BLAGG & JOHNSON, LTD., Newark-upon-Trent.—A booklet illustrating many examples of the company's sheet metal work, including air ducts, ventilators, air washers, &c.

THE AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Strowger Works, Liverpool.—A fully-illustrated brochure upon the company's fire alarm apparatus—closed and open circuit systems and firemen's call-bell system.

Employment during March.

The April *Ministry of Labour Gazette* states that employment in the engineering industry during March was quiet on the whole, but showed a general improvement. In electrical engineering employment remained fairly good, although there was no change as compared with March last year. The statistics show that at March 25th the number of unemployed in the engineering industry as a whole was 79,417, the proportion decreasing from 9.3 per cent. in February to 8.1 per cent. In the electrical engineering section the total was 6,228, and the proportion was 4.7 per cent. (against 5.4 per cent.). There was a rise to 1,249 in the number of unemployed in the electrical wiring and contracting industry, the proportion increasing from 7.7 to 8.0 per cent. The electrical cable, wire and lamp manufacturing group reported an improvement. The number of unemployed fell to 5,190, and the proportion from 6.5 to 6.0 per cent.

Unemployment.

The Ministry of Labour returns show that there was a decrease of 24,570 in the number of unemployed during the week ended April 15th. The total at that date was 1,153,500, as compared with 1,178,070 on April 8th, and 1,083,774 on April 16th, 1928.

Trade Announcements.

The London office of Messrs. CONNOLLYS (BLACKLEY), LTD., has been removed to Oswaldestre House, Norfolk Street, W.C.2. Telephone: Central 9722; telegrams: "Syllonnoc Estrand London."

Mr. N. F. BADLEY, London agent of the Metropolitan Electric Cable & Construction Co., Ltd., is now also acting as London agent for Mr. Geo. P. Cosway, Nuneaton, manufacturer of joint boxes and cable requisites.

Messrs. BRAYSHAW, electrical contractors, Cotton Street, Bolsover, have opened new showroom premises at Devonshire House, Holywell Street, Chesterfield.

The ENGLISH STEEL CORPORATION, LTD., Openshaw, Manchester, has taken over the commercial manufacturing businesses hitherto carried on by Vickers-Armstrongs, Ltd. (River Don, Openshaw and Elswick Works), and Cammell Laird and Co., Ltd. (Cyclops, Grimesthorpe and Penistone Works).

BAKELITE, LTD., 68, Victoria Street, S.W.1, has acquired the business of the Ideal Manufacturing Co., Sparkbrook, Birmingham, as from April 1st, 1929. Mr. F. A. Cook, manager of the Ideal Co., has joined the staff of Bakelite, Ltd., and all other employés have been taken over.

Messrs. BOUGHEY & POWELL, 18-24, Baldwin Street, Bristol, have been appointed agents of the Credenda Conduits Co., Ltd., for the Bristol and South-West England area. They carry stocks and have a showroom.

Messrs. TURNER BROS., 134, Upper Thames Street, E.C., inform us their telephone number is now: Mansion House 9365.

Patent Restoration.

An order has been made restoring patent No. 214,274 of April, 1923, granted to J. R. Robertson for "Improvements in apparatus for recording and reproducing sound."

Hungarian Electrical Imports.

According to a Budapest correspondent of *The Times Trade and Engineering Supplement* the value of electrical machinery and appliances imported into Hungary during 1928 was 21,300,000 pengos (about £760,000). This was a continuance of a steady advance, the values in the two preceding years being: 1926, 13,100,000 pengos (£468,000); 1927, 9,900,000 pengos (£350,000).

The E.D.A. and the Election.

The British Electrical Development Association has entered politics with a poster instructing the women of the country how to vote. The policy for which their suffrages are solicited is "Electricity in Every Home." The poster, which measures about 30 in. by 20 in., is obtainable in quantities at a reasonable price.

A Gift to an Infirmary.

Mr. W. H. J. Ryder, North Shields, recently presented to the Tynemouth Jubilee Infirmary a radio set for the entertainment of the patients and staff. The set, which has 70 headphones and six loud speakers, is of the "Met-Vick" "All-Electric" 5-valve type with volume controls provided where required, and it operates off a 240-V a.c. supply.

Lift Electricians' Wages.

Arising out of the recent strike of London electricians a conference was held on April 26th between representatives of the Engineering and Allied Employers' Federation and the Electrical Trades Union. The Union put forward a claim for an increase in the wages of men engaged on electrical work in connection with lift installations, but as it was decided that the views of the Amalgamated Engineering Union on the matter would have to be obtained, the conference was postponed indefinitely until an understanding between the two unions was reached.

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"Mazda" Lamp Depôts.

The BRITISH THOMSON-HOUSTON CO., LTD., is opening, throughout the country, numerous additional "Mazda" lamp stores to enable traders in towns at a distance from the principal branch offices and stores to obtain supplies more quickly. In the last few weeks depôts have been established in Edinburgh and Nottingham, and now others have been opened in Blackburn and Norwich. The new Blackburn stores in Old Bank Street, King Street, is associated with the Manchester branch of the company. The telephone number is "Blackburn 7093." The Norwich stores address is Cambridge House, 26, Tombland, and the telephone number "Norwich 2541." The telegraphic address for both depôts is "Asteroidal." A depôt will be opened in Derby shortly.

The Economic Mission to Australia.

In our issue of January 18th (p. 121) we summarised the conclusions and recommendations of the British Economic Mission to Australia (Sir Arthur Duckham, Sir Hugo Hirst, Bt., Sir Ernest Clark, and Mr. D. O. Malcolm). The full report has now been published by the Stationery Office at 2s. 6d. net. It comprises a broad and interesting survey of the many phases of Australian activity—financial, agricultural, and financial, among others—and discloses an independence of view which should lead to the acceptance of the Mission's recommendations by the Commonwealth and State Governments.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price April 30th.	Fortnight's inc or dec.
a Acid, Oxalic ...	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	"	£52	...
a Bisulphide of Carbon	"	...	...
a Borax ...	"	£25	...
a Copper Sulphate	"	£25 10s.	...
a Potash, Chlorate	per lb.	8½d. to 4d.	...
a " Perchlorate	"	5½d.	...
a Shellac	per cwt.	£18 10s.	...
a Sulphur, Commercial	"	£11	...
a " Roll	"	£11	...
a Soda, Chlorate	per lb.	3d.	...
a " Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	3¾d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£95 to £100	...
b " Wire	per lb.	1/1 to 1/9	...
b " Sheet	"	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metal—			
Grade I	per ton net.	£182	£6 dec.
Grade II	" "	£128	£4 dec.
Grade III	" "	£71	£3 dec.
e Brass (rolled metal 2" to 12" basis)	per lb.	1/ 7d.	¼d. dec.
e " Tubes (solid drawn)	"	1/1 to 1.1½d.	¼d. dec.
e " Wire, basis	"	11⅛	¼d, dec.
e Copper Tubes (solid drawn)	"	1 3¼	¼d. dec.
e " Bars (best selected)	per ton.	£112	£7 dec.
e " Sheet	"	£112	£7 dec.
e " Rod	"	£1 2	£7 dec.
d " (Electrolytic) Bars	"	£54	£5 dec.
d " " Sheets	"	£148 10s.	...
d " " Wire Rods	"	£94	£5 dec.
d " H.C. Wire	per lb.	11⅝	⅛d. dec.
f Ebonite Rod	"	2/8 to 2/6	...
f " Sheet	"	2/8 to 2/6	...
n German Silver Wire	"	2/2	...
h Gutta-percha, fine	"	nom.	...
h India rubber, Para fine	"	9¾d.	2½d. dec.
i Iron Pig (Cleveland No. 3.)	per ton.	68/6	...
i " Wire, galv. No. 8, P.O. qual.	"	£21	...
g Lead, English pig	"	£23	5/- inc.
g Mercury	per bot.	£22 2s. 6d. to £22 5s.	...
e Mica (in original cases) small	per lb.	8d. to 8/-	...
e " " medium	"	4/- to 8/-	...
e " " large	"	10/- to 20/- & up	...
p Phosphor Bronze, plane castings	"	1/3¾	...
p " " drawn bars & rods	"	1/5½	...
p " " rolled strip & sheet	"	1/4½	...
p " " wire	"	1/7½	...
c Platinum	per oz.	£18 17s. 6d.	...
d Silicium Bronze Wire	per lb.	1/3	...
r Steel, Magnet, in bars	"	7½d.	...
n Tin, Block (English)	per ton.	£198 5s to £198 15s.	£6 15s. to £7 dec.
n " Wire, Nos. 1 to 16	per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

Writing on April 27th, Messrs. James Forster & Co. stated that the lead market opened on Monday (April 22nd) a little firmer, but thereafter prices lost ground daily. The backwardation has also contracted slightly. There are no signs yet of any revival in demand from consumers. Arrivals during May are expected to be light, unless additional supplies are forthcoming from Mexico, and this, now that the troubles there appear to be over, is not outside the bounds of possibility. The future depends very much on how long consumers can hold off the market. If present conditions last much longer lower prices are inevitable.

Wages in the Cable-making Industry.

The Joint Industrial Council for the Electrical Cable-Making Industry notifies us that the recent increase in the wages of London electricians will affect the wages of plumber-jointers and their mates in the Greater London Area. The new rates, which will take effect on the first pay day in May for the period covered by that pay day, will be as follows:—Plumber-jointers, 1s. 10¾d. per hour; plumber-jointers' mates, 1s. 6¼d. per hour. The rates will remain in operation for a period of six months.

For Sale.

Birmingham Corporation invites offers for one 2,500-h.p. engine with a 1,500/1,875-kW generator and auxiliary plant. The Transport Department of Coventry City Council has for sale two 150-i.h.p. steam engines, each direct coupled to a 100-kW generator, and one 25-i.h.p. steam engine direct coupled to a 17-kW generator, complete with switchboard. (See our advertisement pages to-day.)

Recent Contracts.

Among the contracts recently secured by VICKERS-ARMSTRONGS, LTD., are one from Lever Bros., Ltd., for the hydraulic equipment for the entrance lock of their new dock at Bromborough, and orders for six hydraulic capstans for the Calcutta Port Commissioners, and two electrical capstans for the East Indian Railway.

Change of Address.

Mr. S. T. Allen, Central England Engineer to the Central Electricity Board, informs us that on and after May 6th the permanent offices of the Central England Area will be at 53, Wake Green Road, Moseley, Birmingham.

Lighting and Power Notes.

Australia.—VICTORIA.—The *Melbourne Age* reports that prolonged negotiations regarding the future source of electricity supply for Ballarat and Bendigo were recently completed, when it was announced that the Government had approved the purchase by the Electricity Commission of the electricity and tramway undertakings in Ballarat and Bendigo of the Electric Supply Company of Victoria, Ltd. The purchase price was £272,000, to be paid to the company on June 30th, 1934.

Ayrshire.—ELECTRICAL DEVELOPMENT.—The Ayrshire Electricity Board is to make application for consent to the construction of an overhead line to supply the village of Fairlie. The village is dependent on oil as an illuminant. The Central Board has quoted terms for a bulk supply to Skelmorlie, and if these are accepted it will proceed with the construction of the necessary transmission line from Greenock to Skelmorlie. The Board also states that it is anxious to proceed with the development of electricity supply at Wemyss Bay and Inverkip.

Bedford.—MAINS EXTENSION.—The Corporation Electricity Committee reports that, to meet an increased demand by the London Brick Company and Forders, Ltd., and for the purposes of a general supply to the intervening rural area, it proposes that the 3 phase main from the generating station to the Cryselco Lamp Works be extended to Wootton Pillinge. The proposal provides for the erection of an 11,000-V overhead line, with the necessary transformers, switchgear, &c., at an estimated cost of £4,900.

SUPPLY TO RURAL AREAS.—The Committee recommends that a supply of electricity be provided for the villages of Clophill, Maulden and Ridgmont, at an estimated cost of £5,000.

Birmingham.—YEAR'S WORKING.—At a recent meeting of the Corporation Electric Supply Committee it was reported that the sales of electricity during the past year showed an increase of 33½ million kWh, or 12 per cent., as compared with the previous year. The total sales amounted to 314½ million kWh. The gross revenue of the undertaking was £1,700,000, an increase of £121,000. During the past year 11,000 consumers were added to the system.

Blackpool.—YEAR'S WORKING.—The annual report of the Corporation Electricity Department for last municipal year shows a total output of 37,931,906 kWh (an increase of 4,295,546 kWh over the previous year). Less than half the supply was generated at Blackpool, over 19½ million kWh being purchased in bulk from Preston.

Canada.—HYDRO-ELECTRIC SCHEME.—The Winnipeg correspondent of the *Financial Times* reports that British financiers there are seeking to conduct negotiations with the Government for the development of a 300,000-h.p. hydro-electric scheme on a site on Nelson River, situated in the heart of the northern mineral district where mining developments assure smelting and concentrating and possibly pulp and paper projects in the near future. The group seeks priority rights during the

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examination of the site, and, if satisfactory, the development of a $6,000,000 initial scheme of 80,000 h.p. is probable.

Continental.—RUSSIA.—Good progress is being made with the construction of the Dnieprostrag hydro-electric power station which is being erected between Ekaterinoslav and Steporoshje to utilise the water power of the River Dnieper. The work, which is not expected to be fully completed until 1932, includes the construction of a dam 2,492 ft. in length and about 121 ft. in height. The installation will comprise seven turbo-generators, each of 35,000 kW, and the power generated will be transmitted at 100,000 V, a distance of about 60 miles.

A scheme is reported to be under consideration for the establishment of a hydro-electric station to utilise the water power of the River Msta, near Novgorod, for the supply of electricity to the Leningrad district. It is stated that over 200,000 h.p. is available.

GERMANY.—Plans are being prepared for the erection of a 45,000-kW hydro-electric station to utilise the power of the River Nordeifel, near Heimbach-an-der-Ruhr, in the Aix-la-Chapelle district.

BULGARIA.—A commission has studied the problem of supplying most of the towns in Bulgaria with electricity, and has drawn up a detailed programme for presentation to the Government. It is found that the cheapest hydro-electric power is supplied by joint stock companies (average 5.80 leva per kWh), followed by water power syndicates (7 leva per kWh), municipalities (7.80 leva), co-operative societies (8 leva), and people's banks (9.80 leva). There are at present in Bulgaria 36 hydro-electric stations, 24 steam stations, and 107 small stations with Diesel engines. These installations supply 65,300,000 kWh, or 12 kWh *per capita* of the population of Bulgaria.—*Reuter's Trade Service* (Sofia).

Cornwall.—ELECTRICAL DEVELOPMENT.—Good progress is being made with the electrification of Cornwall, the latest scheme to be sanctioned embracing three boroughs and 14 districts in the western area. The Special Order which has been secured by the West Cornwall Electricity Supply Co., Ltd., schedules the boroughs of Helston, St. Ives and Penryn, the urban districts of St. Just, Madron, Paul, Ludgvan, Hayle, Phillack, Padstow and Weybridge, the rural districts of West Penwith, Helston, East Kerrier, Truro and St. Columb Major, and part of the rural district of Redruth. It is explained by an official of the company that it is hoped to complete the entire scheme in two years. Newlyn and Helston have already been supplied, and it is expected to connect St. Erth, Marazion, Porthleven, Goldsithney, Breage, Hayle and Copperhouse this year, and possibly St. Just.

Faversham.—ELECTRICITY SUPPLY.—It was reported to the Town Council on April 16th that it would be necessary to increase the supply of electricity before the autumn as, even in the absence of a breakdown, the existing plant would not in December be able to meet the needs of consumers. The Electricity Supply Sub-Committee had discussed the alternatives of installing additional plant, if permitted, or of opening fresh negotiations with the Kent Electric Power Co. for a supplementary supply, and the Council decided that a deputation should interview the Electricity Commissioners in order to explain the position.

Forres.—ELECTRICITY AGREEMENT.—The Town Council has concluded an agreement with the Grampian Electricity Supply Co., Ltd., for the introduction of an electricity supply.

Glasgow.—BULK SUPPLY.—The manager having reported that the Central Electricity Board had offered to give a supply of electricity at Port-Dundas, in addition to Dalmarnock, the Corporation Electricity Committee has recommended that a supply be taken at Port-Dundas, on condition that should the Corporation at any time find that the taking of a supply there involves greater expense than would have been the case if it laid its own transmission lines, the Board will make such adjustments in the rates as will make the expense to the Corporation not greater than the cost of taking the whole supply at Dalmarnock and laying the necessary transmission mains, or, alternatively, that the Corporation may lay such transmission lines at any time it thinks fit, and take the whole supply at Dalmarnock, and, further, that, as the period of changing the frequency will necessitate the running of obsolete plant at Port Dundas, the Board will pay the amount which exceeds that which would have been incurred had Dalmarnock only been run.

Grimsby.—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £29,490 for the provision of new feeders, mains, services, &c.

Irish Free State.—THE SHANNON SCHEME.—The number of transformer stations now completed in the Leinster loop, in connection with the Shannon scheme, totals 16, and they have been handed over to the control of the Electricity Supply Board by the Ministry for Industry and Commerce. They are the first sections of the scheme to be completed and given to the Board to operate. The temporary station at Inchicore, Dublin, has also been handed over. The transformer stations are situated in the following centres: Waterford, Kilkenny, Wicklow, Wexford, Kildare, Naas, Maryborough, Athy, Carlow, Ballyhale, New Ross, Gorey, Enniscorthy, Arklow, Deansgrange, and Bray.

Lancashire.—ELECTRICAL DEVELOPMENT.—The Mersey Power Company has in hand a large programme of extensions, which includes a line from Runcorn through Halton, Norton, Daresbury and Hatton to Stretton. At Norton, Moore and Daresbury, sub-stations and distribution systems will be established. When the scheme is extended to Preston Brook, the lighting charge will not exceed 8d. per kWh, and the power charge for small consumers 2d. per kWh.

London.—BATTERSEA.—The Borough Council Electricity Committee has received sanction to the borrowing of £200,831 for extensions to the generating station.

ST. MARYLEBONE.—The Finance Committee has reported to the Borough Council that sanction has been received to a loan of £115,652 for cables, switchgear and transformers.

POPLAR.—The Electricity Committee is seeking sanction to borrow £2,750 for cable extensions at West India Docks and £2,023 for cable extension from the Wick Lane sub-station.

Porthcawl.—ELECTRICITY SUPPLY.—In connection with the Urban District Council's application for sanction to a loan of £23,000 to provide an electricity supply for the district, the Electricity Commissioners have informed the Council that, owing to its financial position, they are unable to sanction the loan. The Council has therefore decided to open negotiations with private companies, individuals, and other authorities with a view to obtaining a supply.

Southend-on-Sea.—LOAN.—The Town Council has applied for sanction to a loan of £48,516 for e.h.p. ring mains, in connection with the a.c. distribution scheme in the north-eastern, north-western, and western areas of the borough. A partial supply in bulk is to be taken from the County of London Electric Supply Co., Ltd.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by Mr. J. L. H. Williams, authorising him to supply electricity in the borough of Haverfordwest.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Derbyshire and Nottinghamshire Electric Power Co. to supply electricity in the rural district of Misterton.

The following Special Orders made by the Commissioners have been confirmed by the Minister of Transport: Glaslyn and Deudraeth Rural Districts; Warmley; Peacehaven; Culm Valley; Manchester Electricity (Extension); North Somerset Electricity (Extension); Tonbridge Electricity (Extension); Brentwood and District Electricity (Extension, &c.); and Liskeard.

Stretford.—"ALL-IN" TARIFF.—In dealing with this tariff in our last issue (p. 744) we gave the minimum net ratable value for the purpose of the scheme as £100. This should, of course, have been £10.

Tilbury.—LOANS.—The Urban District Council has applied for sanction to the borrowing of £5,000 for mains and services, £750 for plant, £4,200 for domestic apparatus, and £2,350 for wiring installations.

Truro.—INQUIRY.—An inquiry was held by Mr. F. Gordon Tucker on behalf of the Ministry of Transport on April 25th, into the application made by the Truro Electricity Supply Company for authority to use wooden poles in connection with the distribution of electricity. The application was opposed by the Corporation. For the company Mr. L. A. Hards said it was opposed to the use of steel poles because it considered that wood would be far more satisfactory. Steel poles had been used in various parts of the county, and it was found that unless they were extraordinarily strong, they bent directly they carried any amount of copper on them and it was difficult to keep them upright. There was not a great deal of revenue along the road where the company proposed to run its mains, and overhead wires and wooden poles would enable it to serve those areas and the poorer areas in Truro with electricity, otherwise a supply would be impossible. The cost of steel poles would be £1,500, as compared with £1,000 for wooden poles. Mr. W. A. Phillips, for the Corporation, pressed for steel poles to be used everywhere. The inspector said it was a matter in which the Ministry would prefer agreement to be reached between the parties, and suggested that better terms might be obtained by that means than by leaving it to the Ministry. The Mayor said the Council had decided that under no consideration would it agree to wooden poles, and no compromise could be arrived at without a further meeting of the Council.

Tynemouth.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to a loan of £11,000 for mains, services, transformers and switchgear.

Ulverston.—ELECTRICITY SUPPLY PROGRESS.—It was recently reported by the Electricity Committee to the Urban District Council that during the past year the increase in electricity sold represented 34.3 per cent.

LOAN.—Application is to be made for sanction to the borrowing of £3,000 for mains and services.

United States.—ELECTRICAL DEVELOPMENT.—According to *Power*, plans are being made by the Georgia Power Company for the construction of a 100,000-h.p. steam power plant on the Chattahoochee River, near Atlanta, which will be the largest of its kind in Georgia and among the largest in the country. It will be the largest single development undertaken by the company since the completion of the Tallulah Falls

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unit in 1913, and will serve as an auxiliary plant capable of bearing the entire load of the Atlanta metropolitan district. The plant will be linked with the general hydro-electric system of the company in north and central Georgia, and with large power projects in Alabama and other south-eastern States. The plant will consist of four units, with a capacity of 76,400 kW each, and construction is expected to begin as soon as materials and machinery can be assembled. The new plant will be equipped with a single steam turbo-generator, and will have two large boilers to deliver steam at a pressure of 450 lb. per sq. in. The boilers will be capable of delivering steam at this pressure and at a temperature of 725 deg. at a rate of 450,000 lb. per hour.

Walsall.—MAINS EXTENSIONS.—The Corporation Electricity Committee proposes, subject to a Government grant being made toward the cost, to carry out an unemployment relief scheme of mains extensions at an estimated cost of £7,000.

Watford.—ELECTRICAL DEVELOPMENT.—At a recent meeting of the Corporation Electricity Committee, the borough electrical engineer reported that during February 75 new consumers were connected to the system, 31 re-connected, and 25 disconnected, making a net total of 10,547 consumers, representing a connected load of 28,540 kW, and that during the month under review 2,559,694 kWh was distributed, as compared with 1,510,859 kWh during the corresponding period last year. This large increase was due to the exceptionally cold spell in the week ended February 17th. This increase, representing some three to four years' normal growth as compared with last year, was unforeseen, and certain districts, which, in the normal way would have been considered in the routine programme for alterations or extensions either next year or the year after, would have to be dealt with this summer. Preliminary estimates of the cost of laying additional mains and providing further sub-stations with increased transformer capacity, were now in hand, which showed that some £15,000 would be required for this purpose. He hoped to submit complete and detailed estimates at the next meeting.

Tramway and Railway Notes.

Continental.—SPAIN.—A new section, about 1¼ miles in length, of the underground electric railway in Madrid was recently completed and opened for traffic.

GERMANY.—The electrification of the Berlin city railway has now been completed, and electric trains have commenced running over the entire length.

ITALY.—The work of electrifying the railway between Bolzano and Le Brennero has recently been completed, and experimental trains are now in operation on the section. At first the power will be supplied from the Prati power station of the Società Elettrica Tridentina, but later part will be furnished from the power station at Carrano of the Società Idroelettrica dell' Isarco. The power is received at 60,000 V and stepped down to 4,200 V in seven sub-stations along the line, five of them having a capacity of 6,000 kVA, the remaining two being of 9,000 kVA. It is hoped to inaugurate a regular service of electric trains on the section during May.

London.—NEW TRAMCARS.—The L.C.C. has put into service two new hill-climbing bogie-cars, the first of their kind. They will be on services 56-84, Victoria Embankment and Peckham Rye, and 58, Victoria and Catford—routes that include Dog Kennel Hill, East Dulwich, one of London's steepest inclines. The cars are of Pullman type, with extra seating comfort and ventilation and other improvements. On steep routes they will provide smoothness, speed, and accommodation equal to the best of the L.C.C.'s growing fleet of Pullman cars.

Salford.—TRANSPORT SCHEME.—The *Financial Times* reports that the Parliamentary Agents to the Corporation have presented petitions to both Houses of Parliament for leave to introduce a Bill this session to provide for the constitution of a Joint Board for operating the tramway and omnibus undertakings owned by themselves and "any other local authority or authorities as may be parties to the scheme." As the time for depositing Bills for this session has long since expired, the petitions will be referred to the Standing Orders Committees for them to decide whether the Standing Orders not complied with in respect of time should be dispensed with and permission given to introduce the Bill.

South Africa.—ABANDONMENT OF ROUTE.—According to the *South African Engineer*, the Minister of Railways has applied for the authority of Parliament to abandon the Monument-Sea Point railway and remove the rails and overhead equipment. Dr. van der Byl urged that the route should be converted into a motor road. The line was losing heavily under steam operation even before road competition had developed strongly, and the results under electrical operation show that the loss has increased even beyond the extra charges incurred through electrification. It is estimated that by the time the line is scrapped, it will have cost the Administration £300,000, made up of purchase from the Metropolitan and Suburban Railway Company, reconstruction, electrification and accumulated losses. The losses since 1915 are approximately £150,000.

Telegraph and Telephone Notes.

Abyssinia.—WIRELESS COMMUNICATION.—The need for better communication has constantly been urged on the Abyssinian Government, and it has recently advertised for tenders for the supply and erection of a central wireless transmitting station of 20 to 25 kW for waves of 10 to 50 metres, capable of maintaining permanent communication with Europe, and of a receiving station capable of receiving from Europe and America. In addition, says *The Times*, tenders are called for for the supply and erection of five stations for use in the interior, capable of transmitting and receiving up to a distance of about 500 miles. The tenders are now closed, but the adjudication has not as yet been made known.

Austria.—TELEPHONE SERVICE.—The telephone cable system in Austria, which at present extends to a length of about 690 miles, is to be increased by 500 miles during the financial year 1929-30. The work includes a cable between Vienna and Gratz, with an extension to Wildon and Marburg. A second cable is also to be laid between Vienna and Linz.

Germany.—SIAM TELEPHONE SERVICE.—A radio-telephone service between Germany and Siam was inaugurated on April 26th. The service is conducted from the Nauen wireless station on a wavelength of 16.9 metres, the distance being some 5,300 miles.

Iceland.—TELEGRAPH SERVICE.—A recently-issued report shows that at the end of 1927 there were 1,892 miles of overhead and 80 miles of underground and submarine telegraph and telephone cables in operation in Iceland, an increase of about 150 miles during twelve months.

The Telegraph Service.—TARIFF REDUCTION.—Reduced rates for telegrams to the Far East became effective on May 1st on the systems of the Eastern Telegraph Co. and the Great Northern Telegraph Co.

HEBRIDES.—The Government cable-repairing ship has been successful in raising the broken cable in the Hebrides, providing telegraph facilities between Coll and Tiree. It has been repaired, and the wireless service to Portpatrick has consequently closed down.

The Telephone Service.—LONDON TOLL AREA EXTENDED.—With a view to improving the telephone service between London and the Home Counties, the lines serving 26 districts will in future be worked from the London toll exchange instead of from the trunk exchange, as at present.

AUTOMATIC EXCHANGES.—The services in the Colchester and Southend districts were recently converted to the automatic switching system.

United States.—FORD WIRELESS COMPANY.—The Ford Motor Company is organising a wireless communication company, the chief purpose of which is to link together the various Ford interests at home and abroad.—*Reuter's* (Detroit).

Radio Notes.

Australia.—STATE OPERATION.—The Post Office authorities are calling for tenders for the supply of broadcasting programmes throughout Australia. The Post Office will operate the stations and be responsible for all technical details.—*Reuters* (Canberra).

Belgium.—STATE MONOPOLY.—The Chamber passed on April 26th a Government Bill creating a State monopoly of broadcasting. The law authorises the collection of a fee of 60 fr. (7s.) for every receiving apparatus, and the establishment of a National Broadcasting Institute. According to *The Times*, the Minister of Posts and Telegraphs states that the new organisation will be a public educational body which will respect liberty of thought and opinion.

It is estimated that there are at present 200,000 receiving sets in use in Belgium, and licence fees have been paid on less than one-tenth of their number. Cases of fraud will be severely punished.

France.—STATE CONTROL.—Although the text of the Wireless Broadcasting Bill, which was approved by the Cabinet on April 25th, will not be published until it is distributed in the Chamber, the main lines of the measure are now available, says *The Times*. A special Government office with its own budget will be constituted to control all broadcasting in France. Expenses will be met by the levy of a tax on all

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receiving sets, varying from 20 fr. to 60 fr. (roughly, 3s. 4d. to 10s.), according to their strength. Licences to broadcast will be granted to private companies after the technical dispositions of their stations and the utility of their programmes have been approved by the central office. The Bill also provides for the protection of literary, artistic, and scientific rights, and establishes that no intellectual work shall be broadcast unless agreement has previously been reached between the responsible company and the author.

Poland.—SHORT-WAVE TRANSMITTER.—"Radio Poznanskie" is now engaged in erecting a short-wave transmitter, which, it is understood by *World-Radio*, will have 0.75 kW output power, and will be used both for broadcasting and telegraphy. The first experimental transmission will be carried out on a wavelength of 30.5 or 38.5 m., or, possibly below 20 m. The new station in Posen is to be used for publicity purposes in connection with the exhibition this month.

Germany.—LICENCES.—The number of broadcasting subscribers in Germany increased during the first quarter of 1929 by 202,327, the total on April 1st being 2,837,894. The increase since April 1st, 1928, says *World Radio*, is 603,162.

Sweden.—RECEIVING LICENCES.—The number of wireless receiving licences in Sweden (price Kr.10 a year) at the end of March, 1929, was over 400,000, an increase of 19,800 since the end of 1928, when the number was 380,860. There are now 65.8 licences for every thousand inhabitants, compared with 62.6 at the end of 1928.—*Reuter's Trade Service* (Stockholm).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—June 4th. State Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 5216.)*

June 26th (extended from May 15th). Victorian Railways. One geared three-phase electric winding engine. (A.7650 and A.7853.)*

June 18th. Posts and Telegraphs Department. Switchboard cable. (B.X. 5228.)*

June 25th. Telephone cable terminal boxes of the protected type. (B.X. 5231.)*

SYDNEY.—June 22nd. Public Works Department. Transformers and spares for Burrinjuck hydro-electric development sub-stations. (B.X. 5230.)*

June 4th. 18 electrically-operated water level indicators. (B.X. 5233.)*

July 10th. New South Wales Government Railways. One 750-kW turbo-alternator for Ultimo Power Station. (Specification No. 847, 5s.) 2,200-V ironclad switchgear for Argyle sub-station. (Specification No. 852, 2s. 6d.) Two switch operating batteries. (Specification No. 850, 2s. 6d.) Two motor-generator sets. (Specification No. 851, 2s. 6d.) Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

Belfast.—May 21st. Electricity Department. Supply delivery and erection of h.p. armour-clad switchgear, air preheaters, 22,000 V 3-phase transformers, and cable drum trailer and tractor. (See this issue.)

Bulgaria.—May 20th. Syndicat Hydraulique de la Centrale Vatcha-Kritechim Plovdiff. Supply and installation of two Francis-type turbines to utilise 5 cu. metres of water per second under a head of about 295 ft., two 5,000-kVA generators; two 6,000-66,000-V, 5,000-kVA transformers, two 6,000-66,000-V, 1,000-kVA transformers and two 6,000-380-220-V, 150-kVA transformers.

Chertsey.—May 18th. Board of Guardians. Installation of electric lighting at the Institution at Ottershaw. (April 19th.)

Dundee.—May 6th. Education Authority. Electric lighting installation for the new school at Dudhope Terrace. Specifications, &c., from Master of Works.

Edinburgh.—May 6th. Education Authority. Installation of electric lighting at the Gorgie new special school and annexe to Trinity Academy. Schedules from the Education Offices.

May 21st. District Board of Control. Electrical work for the two higher grade blocks and mortuary at Gogarburn. Schedules from S. Kaye, architect, 14, Hill Street, Edinburgh.

Egypt.—CAIRO.—May 15th. Ministry of Public Works. 120-kW d.c. Diesel-engine generating set and a small electrically-driven cooling water pump. Forms of tender from the Chief Inspecting Engineer, 41, Tothill Street, S.W.

May 15th. Diesel engine-driven electric generating set with accessories, for the Government Press Power Station at Bulaq. (B.X. 5246.)*

May 25th. Prison Administration. Stores (including lamps and electrical articles). (C. 3022.)*

Glasgow.—May 16th. Electricity Department. Supply of cables, cookers, meters, arc lamp carbons, and kettles for 12 months. (See this issue.)

Grimsby.—May 8th. Electricity Department. Supply of 8,000 yd. each of paper-insulated lead-covered, 6,600-V, and l.p. cable. (April 26th.)

Hull.—May 16th. Electricity Department. Supply and laying of underground cables. (April 26th.)

India.—May 8th. Assam-Bengal Railway Co., Ltd. Turbo-generator set for Pahartali. (April 19th.)

May 21st. India Stores Department. One 400-kW, 6-phase rotary convertor set and accessories for H.M. Mint, Calcutta. (B.X. 5255.)*

May 10th. South Indian Railway Co., Ltd. Spare parts for train lighting cells (wood sheet separators). (See this issue.)

Lithuania.—KOVNO.—Replacement of the existing horse tramway service by an electric tramway system. (A.X. 7863.)*

London.—BETHNAL GREEN.—May 22nd. Borough Council. Electric lighting installation at two blocks of tenement dwellings. (See this issue.)

ST. MARYLEBONE.—May 6th. Electricity Department. L.p. and e.h.p. underground cables for 12 months. (April 26th.)

CENTRAL ELECTRICITY BOARD. May 25th. Supply, delivery and erection of 33,000-V metal-clad switchgear for South-East England Electricity Scheme, 1927. (See this issue.)

WOOLWICH.—May 15th. Union Guardians. Supply of electrical refrigerator. (See this issue.)

Manchester.—May 6th. Electricity Department. Supply, delivery, and erection of three 1,000-kVA static transformers. (April 26th.)

Morocco.—Rabat. June 6th. Morocco Post and Telegraph authorities. Five tons of annealed copper wire, 1. mm. dia. 10 tons of bronze wire, 15/10 mm. dia. Five tons of bronze wire, 2 mm. dia. 55 tons of high-conductivity copper wire, 2 mm. dia., and 165 tons of high-conductivity wire, 3 mm. dia.

New Zealand.—AUCKLAND.—June 3rd. Auckland Electric Power Board. Pilot cable and accessories. (B.X. 5244.)*

WELLINGTON.—June 18th. Posts and Telegraph Department. Telephone cords. (B.X. 5251.)*

August 6th. Public Works Department. One 120-ton four-motor overhead travelling crane and runway. (A.X. 7810.)*

Rumania.—May 30th. Municipality of Cluj. Compressor for cooling plant with motor and condenser. (A.X. 7838.)*

South Africa.—JOHANNESBURG.—May 16th. South African Railways and Harbours. Electric signalling apparatus. (B.X. 5165.)*

June 20th. One 10-ton and three 4-ton electric level luffing cranes. (A.X. 7828.)*

BLOEMFONTEIN.—May 18th. Electric Supply Department. Turbine and generator, condensing plant and auxiliaries; switchgear and cables; cooling spray pond equipment, or alternatively cooling tower complete. (B.X. 5192.)*

PRETORIA.—May 23rd. Posts and Telegraph Department. Rubber-covered wire and telephone cables. (B.X. 5229.)*

May 30th. Telegraph materials, &c. (A.X. 7767.)

May 20th. Town Council. Cables, switchgear, and transformers. (B.X. 5245.)*

May 27th. Transformers. (B.X. 5258.)*

Stockport.—Electricity Department. Supply of electric lamps for 12 months. (April 26th.)

Uruguay.—MONTEVIDEO.—May 22nd. National Administration of the Ports. Four electric cranes (to lift 3 metric tons) mounted on trucks. (A.X. 7814.)*

Walthamstow.—May 8th. Electricity Department. L.p. distributor and service cables; e.h.p. and l.p. feeder cables. (April 19th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

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Contracts Closed.

Australia.—BRISBANE.—City Council.

Seven traction motors for new tramcars (£1,487).—British General Electric Co., Ltd.
Thirty-five do., with roller bearings (£8,636).—Metropolitan-Vickers Electrical Co., Ltd.
Thirteen do. (£3,406).—Australian General Electric Co., Ltd.
Control equipment, 3 sets (£546).—British General Electric Co., Ltd.
25 sets ditto (£5,725).—Australian General Electric Co., Ltd.

SYDNEY.—New South Wales Government Railways.
Two 750-kVA transformers (£1,135).—Australian General Electric Co., Ltd.
Two electric goods elevators (£3,534).—Major, Stevens and Coates, Ltd.

Public Works Department.
Three 600-kVA transformers for Port Kembla sub-stations (£1,905).—Standard Waygood, Ltd.
Three 60-kVA induction regulators for Barren Jack (£1,599).—Australian Westinghouse, Ltd.
Four 600-kVA transformers and spare bushings (£3,338).—Australian General Electric Co., Ltd.
Eight do. and spare bushings (£1,944).—British Electric Transformer Co., Ltd.
Switchgear for State transmission lines (£1,182).—Ferguson, Pailin, Ltd.

—*Tenders.*

Birkenhead.—Electricity Committee. Accepted:—
260 yd. 11,000-V cable (£165).—W. T. Glover & Co., Ltd.
Two miles l.p. single-core v.i.r. cable (£305).—Liverpool Electric Cable Co., Ltd.

Bridport.—Electricity Undertaking.
H.p. and l.p. cable, sub-stations, trenching and temporary reinstatement (£8,060).—Stanley Cooper & Co., Ltd.

Brighton.—Lighting Committee. Accepted:—
Duplicate telpher unit and runway at Southwick power station (£5,500).—Strachan & Henshaw, Ltd.
Ash disposal plant at Southwick (£5,360).—Ash Co. (London), Ltd.
Work in connection with extensions to circulating water system at Southwick (£1,038).—Brackett & Co., Ltd. (in lieu of previous quotation).

Ilford.—Electricity Committee. Recommended:—
500-kW transformer (£243).—Crompton Parkinson, Ltd.
Three-panel switchboard (£171).—Long & Crawford, Ltd.
Transformer for supply to Claybury Asylum (£104).—Foster Engineering Co., Ltd.

London. — POPLAR. — Electricity Committee. Recommended:—
Pipework (£106).—Millwall Engineering Co.
Valves.—Shaw, Son & Greenhalgh.
Pipework on evaporating system (£164), and auxiliary plant (£113).—Vickers, Ltd.
Soot blowers (£200); spray chamber (£506).—International Combustion, Ltd.

WAR OFFICE.
Zinc plates.—Edison Swan Electric Co., Ltd.

LONDON & NORTH-EASTERN RAILWAY.
Electric lamps.—Edison Swan Electric Co., Ltd.

BATTERSEA.—Electricity Committee. Recommended:—
Installation of duplicate 1,000,000 gal. per hour condensing water pump (£1,615).—Foundation Co., Ltd.

ST. MARYLEBONE.—Electric Supply Committee. Recommended:—
Two rectifier sets for Blandford Street sub-station (£17,412). British Brown-Boveri, Ltd.
One 2-bearing motor convertor (£9,430).—British Thomson-Houston Co., Ltd.
Switchgear (£4,110).—A. Reyrolle & Co., Ltd. (£1,996).—Ferguson, Pailin, Ltd.

METROPOLITAN ASYLUMS BOARD.—Works Committee. Electric lighting installation, The Hostel:—

J. HOLBROOK & TATTERSALL, LTD. (Recommended.)	£243
Carr Bros.	244
Telephone & Electrical Maintenance Co.	305
A. Hawkins & Sons	329
Alpha Manufacturing & Electrical Co., Ltd. ...	342
G. J. Alder, Thornton & Co., Ltd.	370
Read & Partners, Ltd.	388
W. J. Furse & Co. (London), Ltd.	395
T. Clarke & Co., Ltd.	400
M. J. T. Thomas & Co.	590
Aldwych Electrical, Ltd.	657

HACKNEY.—Electricity Committee. Recommended:—
Revised estimates for the 30,000-kW turbo alternator set, &c.—
Turbo-alternator and condensing plant (£104,052).—C. A. Parsons & Co., Ltd.
E.h.p. switchgear (£62,200).—A. Reyrolle & Co., Ltd.
Repairs to battery at Millfields Road (£990).—Tudor Accumulator Co., Ltd.
Alterations and improvements to boiler-house plant (£2,200).—Babcock & Wilcox, Ltd.

Sheffield.—Water Committee. Accepted:—
Electric motors and pumps for Rivelin pumping station (£1,055).—Rees Roturbo Manufacturing Co., Ltd.

Stirling.—Town Council. Accepted:—
Electrical work at houses in Drip Road.—A. Brewster.
At houses in Burnside Street.—Graham & Morton, Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted:—
E.h.p. and l.p. overhead transmission lines for 12 months.—Overhead, Ltd.

Mental Deficiency Committee. Accepted:—
Heavy oil engine electric plant for Stallington Hall (£898).—National Gas Engine Co., Ltd.

Housing Committee. Accepted:—
Wiring 16 houses at Eaton Street, Hanley, for electricity.—E. Holloway.

Health Committee. Accepted:—
Erection of overhead electricity cable to laundry at Stanfield Sanatorium (£105).—A. Bew.

Forthcoming Events.

Institution of the Rubber Industry.—Monday, May 6th. Blackfriars Theatre, William Street, New Bridge Street, E.C. 7.30 p.m. "Cements and Adhesives," Mr. S. D. Sutton; and "Heats of Combustion of Rubber, Gutta-Percha and Balata," Mr. T. H. Messenger.

Television Society.—Tuesday, May 7th. Engineers' Club, W. 7 p.m. "Some Practical Considerations in the Building of Television Apparatus." Capt. R. Wilson and Mr. A. A. Waters.

Electroplaters' and Depositors' Technical Society.—Wednesday, May 8th. Northampton Polytechnic Institute, E.C. 8.15 p.m. "Some Possible Uses of Alternating Currents in Electro-deposition." Mr. H. C. Cocks.

Institute of Fuel.—Wednesday, May 8th. Burlington House, W. 6 p.m. "The Scope of the Chemical Engineer, with Special Reference to the Boiler-house and the Fuel Industries." Dr. S. Wolf.

Institution of Electrical Engineers.—Thursday, May 9th. Institution, London, W.C. 6 p.m. Annual general meeting.

(London Students' Section).—Saturday, May 4th. Visit to an all-electric farm, East Grinstead.

Physical Society.—Friday, May 10th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, May 10th. Monico Restaurant. 6.30 for 7 p.m. Annual dinner.

Institution of Mechanical Engineers.—Friday, May 10th. Great George Street, S.W. 6 p.m. Special general meeting. To consider and, if thought fit, pass resolutions as to a petition for a Royal Charter.

Notes.

The Battersea Power Station.

At a meeting of Westminster City Council, on April 25th, the proposed power station at Battersea was discussed, and the following resolution was adopted: That this Council views with considerable alarm the possibility of serious injury to health and property which may be caused by the emission of sulphur fumes from the proposed electricity power station at Battersea, and that the Electricity Commissioners be asked to reopen the whole question of the erection of the proposed power station at Battersea with a view to consideration being given to the selection of a site for the station outside the metropolis, where the emission of fumes, smoke, soot, and dust cannot prove to be injurious to health and property.

Wireless Pictures from Australia.

When the ss. *Orvieto* sailed recently for Australia she included amongst her passengers Mr. J. A. Breen, an engineer on the staff of Wireless Pictures, Ltd., who is conveying the first wireless picture transmitting and receiving apparatus to Australia. On his way he will stay for a week at Colombo, where the apparatus will be demonstrated to the Ceylon Government. At Sydney he will meet the Australian agent of the company, Mr. W. Blogg, who is well known in this country as the late managing director of Amplion (Australasia), Ltd. Possibly it will not be long before short-wave enthusiasts are able to receive pictures from the stations at Sydney (2FC) and Melbourne (3LO).

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It is not perhaps generally known that in addition to the British stations (2LO and 5XX) the Vienna transmissions of still pictures by the Fultograph method on 520 metres are often relayed by Linz on 350 metres; when Vienna is jammed this station is frequently picked up quite well. In addition to the Koenigswusterhausen transmissions of still pictures, Berlin (Witzleben) has lately been conducting transmission at 8 o'clock on several evenings during the week, and sometimes this is relayed by other German stations.

Diesel-Electric Ferry Boat.

About October last we published some particulars of a Diesel-electric ferry boat, built for the Argentine by Messrs. Yarrow and Co., the electrical equipment being furnished by the Metropolitan-Vickers Electrical Co., Ltd. This little craft, whose dimensions are length 145 ft., breadth 39 ft. 6 in., draught (loaded) 4 ft. 5 in., and displacement 340 tons, which is designed for service on the River Parana, successfully crossed the Atlantic with only one stop at St. Vincent. The propelling machinery, designed, of course, for the intermittent service of a ferry boat, was in continuous operation for periods of eleven to seventeen days in the Atlantic, which fact is perhaps as good a proof of the reliability of the electric drive for ships as could be had. The electricity generating plant consists of two non-reversible four-stroke-cycle, single-acting, trunk-piston heavy-oil engines of the M.A.N. airless injection type developing 300 b.h.p. at 350 r.p.m. Each engine is coupled to a 170-kW direct-current propulsion generator and also a 35-kW auxiliary generator for supplying current for auxiliary purposes and for exciting the main generators and motors. The propulsion is by twin screws at each end of the vessel, each of the four propellers being driven by a 200-h.p., 250-volt, 350-r.p.m. motor. A feature of special interest is the control scheme, which provides for manœuvring control from each of the two pilot houses situated at opposite ends of the bridge deck, and from the engine room.

Water Power in France.

The development of French water-power resources is largely bound up with the financial state of the country. Hydro-electric plant requires large capital outlay and therefore easy money is a necessary condition for enterprise of this description. For some time past there has been in evidence a decided slowing down of water-power development in many parts of Europe, owing to the tightness of the money market and the high rates of borrowing, but just recently the financial position has improved, and it is now to be hoped that the prospects in the field of hydro-electric enterprise have become considerably brighter. The publication of the French Water-Power Year Book (Annuaire de la Houille Blanche Française) for 1928-9, which has just been issued by the *Revue Générale de l'electricité*, seems to justify a certain amount of optimism for the immediate future, though the tone of many of the articles in this publication is still cautious and reserved. Among several projects which have been started, or recommenced after temporary cessation, may be mentioned the Eygun-Lescun plant on the Gare d'Aspe in the Basses Pyrénées, of 14,400-kW capacity; the Pizançon plant of 19,000 kW; and the Kembs plant on the Rhine, 60,000 kW, to be subsequently enlarged. Of those which have been recommenced, mention should be made of the Brommat plant on the River Truyère in the Department of Aveyron, of 56,000-kW capacity.

Railway electrification will be continued on a fairly large scale. The line from Culoz to Modane on the Paris-Lyon-Méditerranée system, is now to be completely electrified, after hanging fire for some months, and it is hoped to complete the work next year. The power required will be derived from several sets of hydro-electric plant in the Sarvie district on the rivers Arly and Bonnant. Many of them are owned by the Soc. d'Electro-Chimie, d'Electro-Metallurgie and des Aciéries Electriques d'Ugine. Much of the work for the traction sub-stations has been entrusted to the Comp. Fran. Thomson-Houston. The third-rail system has been definitely adopted. Last year the Midi railway possessed 480 miles of electrified lines, but now the total is 546, the additional 66 miles being accounted for by the conversion of the line from Pau to Laruns, Buzy to Bedous, and then across the Pyrenees to Forges d'Abel. The complete electrification programme of the company contemplates further great extensions, namely, the conversion of 1,140 miles of existing track, and the construction of 358 miles of new line, the necessary current being derived from six hydro-electric plants already erected in the Pyrenees district. A seventh plant of 11,000 kW will be constructed at Artouste in the Vallée d'Ossan.

On the general subject of electrical power throughout France it is interesting to note from the statistics issued by the Ministry of Public Works that upwards of 11,000 million kWh of electricity was produced in 1926, compared with 7,480 million kWh in 1923. Working at 70 per cent. of full capacity, the hydro-electric plants produced 4,780 million kWh during 1926. Considerable economies in running cost have been effected by linking up hydro-electric and thermal power stations and adjacent electricity supply undertakings. One of the leading French railway companies will, it is said, obtain electricity for traction purposes from plant owned by an electro-metallurgical company; and in other ways the obviously sound policy of utilising plant to full capacity by judicious co-operation is being steadily pursued.

Appointments Vacant.

Electro-technical assistant for Manchester Corporation. Working engineer for Royal School for Deaf and Dumb Children, Margate. Meter tester (£200) for Hull Corporation. (See our advertisement pages to-day.)

Educational.

The governing body of Manchester Municipal College of Technology offers a scholarship of £50 per annum for three years. (See our advertisement pages to-day.)

A Large Electric Furnace.

A 30-ton electric steel-making furnace, the largest of its type built in England, is reported to have been completed by Messrs. Davy Bros., Ltd., of Sheffield. It will be shipped to Reinosa, Northern Spain, for installation there as additional plant for the production of high-class steel.

T.C.C. Condensers.

In the reference on p. 633 of our April 5th issue to the electrolytic condensers marketed by the Telegraph Condenser Co., Ltd., it was stated in error that the minimum working peak pressure was 12 V d.c., whereas, of course, the correct word should have been "maximum."

Electrolysis of Water.

Some particulars of experiments made with the electrolysis of water, given in *La Nature*, show that the energy necessary for electrolysis diminishes with an increase of pressure created by the gases produced. Left to themselves, the oxygen and hydrogen given off occupy a space 1,865 times greater than the amount of water treated; enclosed in a non-expansible cylinder, the gases will exert a pressure equal to 1,865 atmospheres. Thus with the expenditure of a very small amount of electricity the gases may be obtained under enormous pressures, which may be utilised for all kinds of industrial purposes, it is declared, while if allowed to generate free from pressure the gases, either separate or mixed, may be employed as an auxiliary for fuel already undergoing combustion. Mr. Hausmeister, who has been carrying out the experiments, has constructed, in conjunction with German railways, several installations which are claimed to work at high pressure for industrial purposes, and are said to be giving excellent results.

B.S.S. for Insulating Boards and Tubes, and Flame-proof Enclosures.

The British Engineering Standards Association has just issued B.S.S. No. 316-1929, for synthetic-resin varnish-paper boards and tubes for general electrical purposes, and B.S.S. No. 229-1929, for flame-proof enclosures for electrical apparatus. The provisions of the former specification are confined to what is termed Grade II material, *i.e.*, synthetic-resin varnish-paper boards and tubes, the principal characteristic of which is high electric strength at high temperature. This grade of material is suitable for use on high-voltage oil-immersed plant, and on low-voltage apparatus in air. The specification does not at present apply to Grade I material, which is defined as including boards and tubes, the principal characteristics of which are relatively low water-absorption, high resistivity, low dielectric losses at radio frequencies, and good machining properties. This material is such as is required for use on apparatus where it is important that high insulation resistance shall be maintained under all conditions of humidity. The specification lays down suitable working limits for the materials to which it applies. A series of appendices supplies detailed instruction for the carrying out of the necessary tests, and two of them give abridged schedules of tests recommended for application to boards and tubes intended for certain specific uses.

B.S.S. No. 229 defines the performance required for a flame-proof enclosure, and the tests to be carried out to verify such performance. The special features of design and construction of apparatus are specified in the several British Standard Specifications dealing with particular flame-proof apparatus. This specification, which is a revision of the 1926 edition, embodies the results of experience in testing which has been gained since the issue of the original specification. Provision is now made for preliminary observation tests, and the number of tests to be performed has been indicated.

Both the above specifications and the methods of test given therein have been based on information supplied by the British Electrical and Allied Industries Research Association, and represent the results of a considerable amount of research work carried out by the Association.

Copies of the publications may be obtained on application to the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

Training School for "Underground" Employés.

Work is being commenced on a new training school at Lambeth North station for the drivers, guards, signalmen and other grades concerned in the operation of the Underground Railways. The school will contain the latest forms of electrical and mechanical equipment, together with models of signals and lifts, and diagrams. The work will be completed in about two months.

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Lifts for Salmon.

The effects of river dam construction on Scottish salmon fishing were discussed on April 25th, when a Select Committee of the House of Lords resumed consideration of the Grampian Electricity Company's Bill, which seeks power to form reservoirs and erect dams for the supply of electricity to the Highlands.

Mr. Wilson Armstead, a fishery expert, showed with the aid of a model how salmon were to be helped over the lower and mid-Farrar falls by electric lifts. The salmon, he said, entered a pool 16 ft. by 8 ft. by 2 ft. deep. This pool rose to the top of the dam, where the fish emerged into the lock. It would be like swimming through a series of pools, except that one of the pools was a lift.

Aluminium Data.

We have received from the British Aluminium Co., Ltd., further data sheets for inclusion in the company's publication, the "Aluminium Handbook." Sheets C.2 and C.3 give revised information regarding span constants and constructions for steel-cored aluminium overhead lines; sheets A.73 and A.74 contain enlarged tables of the properties of stranded aluminium and steel-cored aluminium conductors, revised in conjunction with the British Engineering Standards Association (these sheets, together with C.2 and C.3, are intended to replace existing sheets in the handbook); C.16 is a new data sheet giving authentic information regarding the latest developments in aluminium-copper tappings; and A.166 is a new data sheet on expanded aluminium sheets.

New Radium Clinic.

A hospital exclusively for women, run entirely by women, and named after a woman, is shortly to be opened in Fitzjohn's Avenue, Hampstead, N.W. It will be the Marie Curie Cancer Hospital for Women, which, it is hoped, will be officially opened, says the *Daily Mail*, in the autumn by Mme. Curie, the discoverer—with her husband—of radium. It will be the first large radium clinic to be organised in this country by medical women. The plans for the alteration of the house have been drawn up by Miss Elizabeth Scott, the architect, and among the women who will help to run the hospital are three from the Cancer Research Board and the senior surgeons, respectively, of the South London Hospital for Women, the Elizabeth Garrett Anderson Hospital, and the New Sussex Hospital.

Local Society.

At the annual general meeting of the Paisley Association of Electrical Engineers on April 9th, the following officers were elected:—President, Mr. J. Orr; vice-president, Mr. J. E. Adam; hon. secretary, Mr. J. M. Barbour; hon. treasurer, Mr. George H. Fisher; committee: Messrs. H. Aberdein, G. U. Campbell, J. Durrell, J. S. Kilpatrick, F. E. Moss, and Alex. Todd. Auditors, Mr. J. Rothera and Mr. J. Cunningham.

Municipal Tramways Association.

The Mayor of Blackpool invited the Municipal Tramways and Transport Association to hold its conference in Blackpool in September next. The Association replied to the Tramway and Electricity Committee stating that in due course Mr. Charles Furness, borough electrical engineer, Blackpool, would be elected president of the Association, and that in the opinion of the Council of the Association the conference ought to meet in Blackpool during the year of Mr. Furness's presidency. The next conference will be held at Yarmouth.

German High-voltage Installations.

The Society for the Study of High-voltage Installations, of Berlin, recently held a conference at Cologne which was very largely attended. The Society occupies itself with the treatment of problems which are connected with the promotion of the transmission of power at high voltage, and its members consist of almost all the important German electricity works and constructional firms in the different branches, as well as of a number of high-school professors. Among the subjects discussed at the Conference was that of high-pressure cables. In this respect very difficult problems have to be solved before there can be any question of substituting to a larger extent the present overhead lines by underground cables. Another subject was insulating oil, it being considered to be of great importance to render again serviceable transformer oil which has become unserviceable. A further part of the discussion referred to the scientific explanation of the phenomena which are connected with the electrical break down of the oil.

A Three-Factor Two-Part Tariff.

In commenting upon the appointment by the Electricity Commissioners of a Committee to study methods of charging for electricity (ELECTRICAL REVIEW, March 29th, p. 553), we referred to the existing multiplicity of systems, and quoted an example of a two-part tariff which we thought was unnecessarily complicated. We had in our mind the possible trouble occasioned to the consumer, but we are interested to learn that in operating this tariff the details are not published in the schedule of charges. The consumer merely applies to the company for a statement of the annual fixed charge for his premises, and the company makes the necessary assessment and notifies him of the figure on an application form embodying the particulars.

The tariff is based on the principle that the primary or fixed charge should be as equitable as possible as between consumers, and is a combination of the three factors which can be used as a basis when assessing a fixed charge, namely, lighting connections, floor area, and ratable value. Any one of these, if used by itself with a fixed percentage or rate, is found to be inequitable, but by using the three in combination the anomalies of each are said to be smoothed out, giving a correspondingly fair result.

We are informed by the engineer of the company which adopted the scheme that statistics bring to light an interesting feature. It transpires that there is a very close approximation between a curve formed by the fixed charges calculated on the three-factor basis and a curve resulting from a sliding percentage of the ratable value, ranging from 18½ per cent. of the ratable value of houses of £15, down to 12½ per cent. for houses assessed at £75 and upwards per annum. He points out that anomalies inherent in a single-basis tariff still exist, but is hoping that under the 1925 Rating and Valuation Act a greater measure of uniformity will be attained in the reassessments, thus making a sliding percentage of ratable value a reasonably practicable basis for a two-part tariff which, in addition to being equitable and simple, would, by reason of its flexibility, be peculiarly adaptable to the differing conditions of various districts.

Electric Lamp Invention.

The part played by Mr. St. George Lane Fox Pitt in the invention of the carbon incandescent electric lamp, and the modern method of electric lighting, is the subject of a communication from Mr. A. A. Campbell Swinton, F.R.S., in the current issue of the I.E.E. *Journal*. He states that neither in Mr. James Swinburne's address before the Institution on Sir Joseph Swan's electrical work, delivered in December last, nor in the "Personal Recollections" of Sir Ambrose Fleming published in the February *Journal*, is due justice done to the valuable and pioneer work that was carried out on this important subject by Mr. St. George Lane Fox Pitt. He it was who first protected on March 20th, 1879, and more specifically patented in 1880, the method of treating a lamp filament by raising it to an incandescent state by sending a current through it while immersed in hydrocarbon, a process which became known as "flashing." Sir Hiram Maxim came after Mr. Lane Fox Pitt. Mr. Campbell Swinton's contention is that, though Swan was prior to Edison in inventing the lamp, Lane Fox Pitt was prior to both in what was a much more fundamental idea, namely, that of distribution at constant potential, with lamps, dynamos, and batteries all connected in parallel. Carbon-filament lamps are now obsolete, but Lane Fox Pitt's scheme of parallel distribution still holds the field.

Institution Notes.

Institution of Electrical Engineers.

KELVIN LECTURE.—The twentieth Kelvin Lecture was delivered on April 25th by Dr. G. C. Simpson, F.R.S., who dealt with the subject of "Lightning" in a fascinating manner. His lantern slides and explanatory diagrams were very instructive, whilst his theory and many of his statements quite upset commonly-held ideas on the subject. Sir Oliver Lodge proposed, and Mr. W. B. Woodhouse seconded, a vote of thanks to the lecturer, and the meeting was followed by an informal Council dinner at the Hotel Cecil.

LONDON STUDENTS' SECTION.—The Committee's report for the 1928-29 session shows that the number of students in the Section is now 1,307, a decrease of 56 since last session. During the session ten meetings were held, the average attendance being 68.5, compared with an average of 76 during the 1927-28 session. A joint meeting was held with the Institutions of Civil and Mechanical Engineers. The Committee hopes to take steps next session to increase the attraction of the meetings. The number of visits during the session was 11, the average attendance being 15; it was necessary to cancel two visits on account of poor support. A dinner and a dance were held, and were extremely well attended. The summer meeting in 1928 consisted of a tour through Holland and West Germany, 32 students from London and the provinces taking part.

WIRELESS SECTION COMMITTEE.—The following gentlemen have been nominated by the Wireless Section Committee to serve on the Committee from October 1st, 1929:—*Chairman:* Capt. C. E. Kennedy-Purvis, R.N.; *new ordinary members:* Mr. R. H. Barfield, M.Sc., Mr. A. J. Gill, B.Sc., Prof. E. Mallett, D.Sc., Mr. L. C. Pocock, and Commander J. A. Slee, C.B.E., R.N.

METER AND INSTRUMENT SECTION.—The meeting arranged today, May 3rd, has been cancelled.

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Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The many friends of Mr. A. BRAMMER, general secretary of the Association of Supervising Electrical Engineers, will be glad to learn that he is recuperating beside the sea after a serious illness from congestion of the lungs. He is much improved, and hopes to be back at his post next week.

Mr. J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E., who has held the position of assistant general secretary of the Electrical Power Engineers' Association for the past nine years, has now resigned his post in order to commence practice at the Bar. Mr. Thomas has joined the Northern Circuit, and his chambers are situate at 60, King Street, Manchester. We are sure that the large number of those who have had an opportunity of watching Mr. Thomas's progressive career will join with the ELECTRICAL REVIEW in wishing him every success. Barristers with an inside knowledge of the electrical industry are all too few, and we can foresee Mr. Thomas's services being in considerable demand before very long.

The Sheffield Corporation Electricity Committee has expressed regret at the resignation of Mr. S. E. FEDDEN, general manager and engineer of the Electricity Supply Department, congratulating him on his appointment under the Central Electricity Board as district engineer for the Mid-East England Electricity Scheme, 1929, and expressing best wishes for his future success. The Committee advises that applications be invited for the vacant position at a commencing salary of £1,250 per annum.

Mr. C. F. WALKLAND, of the Sheffield Electric Supply Department, has been appointed chief clerk in connection with the new Mid-East England Electricity Scheme. He has been in the employ of the Sheffield Corporation for the last 16 years.

Mr. KENNETH HUNTER, of Kyle, Palmer & Co., Ltd., writes from Kuala Lumpur, Federated Malay States, stating that as from April 15th he took over the duties of sales manager for the firm and started on a tour of Malaya from Singapore to Penang, and Southern Siam, as far as Victoria Point on the West Coast and Bangkok on the East Coast. He was to visit practically every tin and gold mine, large rubber estate, rice mill, Government department, consulting engineer, &c.

The staff of the Gravesend Electricity Works were entertained by the Corporation at dinner on April 20th to celebrate 25 years' working of the undertaking. The Mayor (Councillor R. McGregor), members of the Corporation and officials were present, and the toast "The Gravesend Electricity Undertaking" was proposed by Councillor J. W. Clunn, and replied to by the borough electrical engineer, Mr. C. F. McInnes, who presented cases of pipes to Mr. WILLIAM FOAD and Mr. GEORGE GARDNER in recognition of over 25 years' valuable assistance to him. Later Mr. McINNES was presented by the staff with a case containing a pen and pencil as a token of esteem.

Subject to the approval of the Council, Mr. H. A. BLACKBURN, of Huddersfield, has been appointed tramway manager at Keighley, at a salary of £500 per year. Mr. Blackburn was for four years rolling stock superintendent to the Plymouth Corporation Tramways Department, and was for two years commercial assistant with the Metropolitan-Vickers Electrical Co., at Trafford Park. At present he is technical assistant at Karrier Motors, Ltd., Huddersfield. He is the son of the Huddersfield tramway manager.

The marriage took place at Barnstaple, on April 20th, of Mr. HADLEY VICTOR BILLING, a member of the staff of the Westminster Electric Supply Corporation, and Miss G. I. HAM, of Newport, Barnstaple. From his colleagues the bridegroom received a canteen of cutlery and a silver and cut-glass bowl.

Mr. F. FAVELL, engineering assistant in the Stoke-on-Trent Electricity Department, has been appointed power house superintendent, in succession to Mr. G. A. VOWLES, appointed engineering assistant at Hull.

Major T. H. HOWARD, who has been in charge of the Sheffield relay station of the B.B.C. for the past three years, has been appointed to the Manchester station.

Mr. SVEN VELAUDER, formerly electrical engineer of the South Sweden Power Co., has been elected as hon. professor of the Electrical Plant Section of the Technical High School of Stockholm.

Mr. N. G. BARRACLOUGH has been appointed chief engineer to the Workington Iron and Steel Branch of the United Steel Companies, Ltd. Mr. Barraclough, who has been engaged as electrical engineer to the same company for about 20 years, was formerly in the engineering department of the National Boiler & General Insurance Co., Ltd., Manchester.

The staff and employés of the Dewsbury Electricity Department presented a mahogany clock to Mr. GEORGE HEATON on the occasion of his marriage.

According to the *Yorkshire Post*, Sir ANDREW DUNCAN, chairman of the Central Electricity Board, and Mr. ARCHIBALD PAGE, chief engineer and manager, left England on Saturday last on a visit to Canada and the United States for the purpose of investigating the present development in electricity supply in North America.

Mr. G. R. FERGUSON STRACHAN, until recently with the Hotpoint Electric Appliance Co., has been appointed as London representative for the Electrical Department of Carron Company.

A London paper reports that Mr ALLAN GRANT, assistant district engineer with the Clyde Valley Electric Power Co., has been appointed district engineer to the Grampian Electricity scheme works.

Three new directors have joined the board of Major & Co., Ltd.:—Admiral Sir SYDNEY FREMANTLE, Mr. G. F. WRIGLEY (15 years with the company), and Mr. E. HOTHAM (17 years with the company).

Brigadier-General the Hon. EVERARD BARING, C.V.O., C.B.E., has joined the board of the London Electric Supply Corporation, Ltd.

Indian Engineering states that Mr. H. M. PRICE is appointed assistant electrical engineer, G.I.P. Railway.

Obituary.—MR. G. D. MALCOLM.—We learn with great regret of the sudden death of Mr. G. D. Malcolm, chairman of the Meter and Instrument Section of the Institution of Electrical Engineers. Mr. Malcolm was to have delivered his address to the Section to-day (Friday); the meeting has now been cancelled.

Will.—The late Sir J. DENISON-PENDER left £237,503 gross (and unsettled) and £210,131 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Electric Sweepers, Ltd.—Private company. Registered April 22nd. Capital, £10,000 in £1 shares. Objects: To adopt an agreement with Sir Donald A. Makgill, Bt., and to carry on the business of agents for and dealers in mechanical appliances of all kinds, &c. The permanent directors are:—Sir John Donald A. A. Makgill, Bt., 48, Royal Avenue, Chelsea, S.W.3; R. J. R. H. Makgill, address not stated. Registered office: 405, Oxford Street, W.1.

Faradex-Seraphone Co., Ltd.—Registered as a public company April 24th Capital, £125,000 in 2s. shares. Objects: To acquire as from March 30th, 1929, the businesses, goodwill, and assets (excluding book debts, cash in hand and in bank, and liabilities) (1) of Rooke Bros., Ltd., manufacturers of wireless receivers and other radio components, Cardington Street, Euston Road, N.W.1, together with patents covering "A new and improved method of coupling thermionic valves for the amplification of electrical impulses, &c.," and the trade mark "Faradex"; and (2) of the Seraphone Co., Ltd., manufacturers of wireless sets, &c., with the trade marks "Seraphone," "Daneaphone," and "Orkestraphone." The subscribers (each with one share) are:—H. A. Amos and J. W. Pummell, 39-41, New Broad Street, E.C., and five others.

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Registered office: Friars House, 39-41, New Broad Street, E.C.2.

Major, Newman & Sons, Ltd.—Private company. Registered April 22nd. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, acoustical and general engineers, manufacturers of and dealers in wireless, acoustical, telegraphic, telephonic and electrical instruments, &c. The directors are:—Mrs. Lucy M. Pettitt, Cruickshank Lodge, Long Lane, Ickenham, Middlesex; Mrs. Alice B. L. Newman, 44, Halford Road, Hillingdon, Middlesex. Registered office: 34, College Road, Harrow, Middlesex.

Personic, Ltd.—Private company. Registered April 24th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio, television, and electrical apparatus, gramophones, phonographs, &c. The first directors are:—S. Spero, 9, Elgin Mansions, Maida Vale, W.9; and T. W. Rutter, 180, Norbury Crescent, S.W.16, radio manufacturers. Registered office: Peebles Works, Palmerston Road, Kilburn, N.W.6.

Electro-Vortex, Ltd.—Private company. Registered April 23rd. Capital, £5,000 in £1 shares. Objects: To carry on the business of patentees or manufacturers of plant relating to domestic laundry equipment, engineers, founders, dealers in electrical appliances, &c. The first directors are:—P. B. Mason, 9, St. Peter's Avenue, Knutsford, Cheshire, engineer (permanent managing director); W. Moreton, 18, Garden Road, Knutsford, chemist; A. U. Mason, 21, Hampstead Garden, Golder's Green, railway accountant. Solicitors: Sedgley, Caldecutt & Co., Knutsford.

Everett's International Accumulators, Ltd.—Private company. Registered April 24th. Capital, £1,000 in £1 shares. Objects: To acquire and experiment with patents, &c. The permanent directors are: G. R. Carr and C. H. Everett, addresses not stated; A. P. Evens, 168, Regent Street, W.1, accountant. Secretary: A. P. Evens. Registered office: Ulster Chambers, 168, Regent Street, W.1.

Distributors (British Electrical), Ltd.—Private company. Registered April 26th. Capital, £1,000 in 650 ordinary shares of £1 each, and 7,000 ordinary shares of 1s. each. Objects: To acquire the business of a ventilating, heating, and general electrical engineer, formerly carried on by E. E. Lee as "Distributors," at 25, Victoria Street, S.W.1. The permanent directors are: F. J. Mills, Hamley, 29, Sisters Avenue, Clapham Common, S.W.11; E. L. Lee, 24, Garbes Road, Forest Hill, S.E.23; C. H. L. George, 40, Colonial Avenue, Whitton, Twickenham. Registered office: 25, Victoria Street, S.W.1.

Savoy Engineering Co., Ltd.—Private company. Registered April 26th. Capital, £100 in 1s. shares. Objects: To carry on the business of manufacturers of and wholesale or retail dealers in wireless transmitting and receiving sets, component parts and accessories, gramophones, electrical apparatus, &c. The subscribers are: P. Wood, electrical engineer, and Mrs. L. P. Wood, both of 344, Green Lanes, Ilford. P. Wood is permanent managing director and chairman. Registered office: Woodbine Place, High Street, Wanstead, Essex.

Official Returns of Electrical Companies.

Gordon England, Ltd.—Satisfaction (1) in full on various dates from February 13th to March 20th, 1929, of debentures dated March 3rd, 1927, securing £19,500; (2) to the extent of £1,000 on February 13th, and to the extent of £1,000 on March 20th, 1929, of debentures dated September 9th, 1926, securing £2,000; (3) in full on February 13th, 1929, of debentures dated July 8th, 1925, securing £4,500; (4) to the extent of £600 on February 22nd, and to the extent of £7,500 on March 20th, 1929, of debentures dated December 21st, 1928, securing £15,000 (of which only £12,100 was issued); and (5) in full on April 15th, 1929, of trust deed and charge dated October 25th, 1927, securing £117,500 debenture stock.

L.P.S. Electrical Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1928. All shares taken up. £5,000 paid. Mortgages and charges, nil.

General Cable Manufacturing Co., Ltd.—Satisfaction to the extent of £1,600 on January 1st, 1929, of debentures dated June 30th, 1928, securing £41,400.

Edison Swan Electric Co., Ltd.—Capital, £432,565 8s. in 100,000 preference shares of £1 each and 1,662,827 ordinary shares of 4s. each. Return dated January 11th, 1929. 100,000 preference and 957,177 ordinary shares taken up. £223,185 8s. paid (being £1 per share on 100,000 preference, 8d. per share on 284,646 ordinary, 1s. 7 1/5d. per share on 26,415 ordinary and 4s. per share on 554,530 ordinary. £68,928 considered as paid (being 3s. 4d. per share on 284,646 ordinary, 2s. 4 4/5d. per share on 26,415 ordinary and 4s. per share on 91,586 ordinary). (£452 in arrears.) Mortgages and charges, £494,109.

W. Robson & Sons, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1928 (filed April 12th, 1929). 400 shares taken up. £300 paid. £100 considered as paid. Mortgages and charges, £600.

John Belton & Co., Ltd.—Capital, £3,000 in £1 shares. Return dated April 23rd, 1928 (filed April 6th, 1929). All shares taken up. £3,000 paid. Mortgages and charges, nil.

Unity Lamp and Accessories, Ltd.—Capital, £4,500 in 3,000 ordinary and 1,500 deferred shares of £1 each. Return dated April 2nd, 1928 (filed March 30th, 1929). 2,500 ordinary and 1,500 deferred shares taken up. £1,925 paid (being 17s. 6d. per share on the ordinary). £1,500 considered as paid on the deferred shares. Mortgages and charges, £1,515.

Electric Services (Liverpool), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1928 (filed April 3rd, 1929). 152 shares taken up. £152 paid. Mortgages and charges, nil.

Prince's Electrical Clocks, Ltd.—Capital, £3,000 in £1 shares. Return dated January 17th, 1929. All shares taken up. £1,000 paid. £2,000 considered as paid. Mortgages and charges, nil.

N.E.C., Ltd.—Capital, £1,000 in 900 preference and 100 ordinary shares of £1 each. Return dated December 31st, 1928 (filed April 17th, 1929). 175 preference and 60 ordinary shares taken up. £95 paid on 35 preference and 60 ordinary shares. £140 considered as paid on 140 preference shares. Mortgages and charges, nil.

City Notes.

British Thomson-Houston Co., Ltd.

The report for the year ended December 31st, 1928, records a total profit of £422,729, as compared with £462,444 in 1927. A balance of £200,513 brought forward makes available £623,242. After providing for debenture and loan interest, depreciation (£119,451) and preference dividends, it is proposed to pay a dividend of 4 per cent. on the ordinary shares, leaving £203,066 to be carried forward. No ordinary dividend was paid in respect of 1927. The report records the death of Mr. O. H. Smith, a director since 1902, and goes on to state that competition at home and abroad continued to keep prices at unreasonably low levels. The volume of factory output was comparable with that of the preceding year, but the profits remained unsatisfactory. The preliminary arrangements with several manufacturing companies referred to in the last annual report have now become effective. Associated Electrical Industries, Ltd., has purchased all the shares owned by the company in the Edison Swan Electric Co., Ltd., and Ferguson, Pailin, Ltd., and paid cash therefor. Associated Electrical Industries, Ltd., has also acquired from their respective owners all the ordinary shares of the company, so that the preliminary arrangements mentioned in the last annual report have now come to a satisfactory conclusion, and steps are being taken to put into effect as rapidly as possible the economies and co-operative efforts which are the object of the arrangements. The loans which at December 31st, 1927, stood at £1,310,000 have been reduced to £335,000, the proceeds of the sale of shares of the Edison Swan and Ferguson Pailin companies having been used for the purpose of making this reduction. Also the amount for shares in affiliated companies which at December 31st, 1927, stood at £989,402 has now disappeared, and the amount for shares and debentures in lighting, traction and other companies has been reduced from £516,352 to £369,638. In 1915 a suit was brought against the company for the alleged infringement of certain patents. After litigation lasting several years, the House of Lords finally delivered a decision against the company, and the balance of the liability was deducted before the amount available from the last financial year was carried to this year's balance sheet. The entire liability extends over a period of years; it has nothing to do with the current year's operations, and therefore it is taken out of the carry forward rather than out of the profits for the current year. Maj.-Gen. Sir Philip A. M. Nash has been appointed a director since the last general meeting and offers himself for re-election at the annual meeting on May 8th.

Reading Electric Supply Co., Ltd.

The profit for the year ended December 31st, 1928, amounted to £54,251, as compared with £53,118 for 1927. After providing for debenture interest, depreciation, &c., and adding £5,406 brought forward, there is an available balance of £24,977, which it is proposed to deal with as follows:—To investments reserve account, £408; to debenture stock redemption fund, £1,500; dividend of 10 per cent. (the same); carrying forward £6,177. The sale of energy rose by 3,018,020 kWh to 11,379,131 kWh. The first of the new 3,750-kW sets was in operation throughout the year and the other has now been placed in commission.

South Wales Power Co., Ltd.

The annual meeting was held on April 26th, Mr. W. North Lewis (chairman) presiding. In presenting the report and accounts (*vide* ELECTRICAL REVIEW, April 19th, p. 710) the chairman said the past year was one of the worst ever experienced in the coal trade in South Wales. Many of the collieries

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taking their power from the company were temporarily closed down, many were working short time, and some had gone into liquidation and had changed hands. This had meant a serious curtailment of demand from some of the largest consumers. To meet the position a policy of lower prices and simpler tariffs had been adopted, with the result that the fall in output as compared with 1927, only amounted to 7 per cent. Since the beginning of the year there had been a considerable improvement in the coal trade, and this was reflected in a marked degree in the curve of output. In the company's Electric Lighting Order areas, the results had been much better. The number of consumers had increased by 18 per cent., the electricity sold by 11 per cent., and the revenue by 12 per cent. The total length of l.p. distributing mains had increased by 18½ per cent., and the capital expenditure in the company's electric lighting areas by 15 per cent. Although the output was reduced, the efficiency of production improved, the coal used per kWh falling from 1.701 lb. to 1.61 lb. The erection of a 25,000-kW set at Treforest was nearing completion. The report and accounts were adopted.

Shanghai Electric Construction Co., Ltd.

The report of the directors for the year ended December 31st, 1928, shows a profit of £165,172 (as compared with £96,571 in 1927); to this is added £11,656 brought forward, making £176,828. This is to be allocated as follows:—Renewals, £50,000; taxation, £25,000; reserve, £25,000; staff provident fund, £2,299; dividend of 12½ per cent., free of tax (5 per cent. already paid); carried forward, £12,028. The Singapore Traction Co., Ltd., in which the company is interested, has been authorised to make certain extensions of its system. As managers, the company participated to the extent of £10,000 in the Singapore Company's profits; the prospects for the current year are satisfactory.

At the meeting on Wednesday last a resolution was to be submitted increasing the capital by the creation of 200,000 new shares of £1 each and the issue of 100,000 as fully paid (by way of capitalisation of profits) to existing shareholders in the proportion of one new share to each five held. The remaining 100,000 will be held in reserve for issue at some future date.

Bournemouth and Poole Electricity Supply Co., Ltd.

The accounts for 1928 show a capital expenditure during the year of £55,468. The balance on revenue account is £170,382 (against £160,074), and to it is added £7,290 brought forward, making £177,672. From this are deducted debenture interest, redemption fund instalments, depreciation, renewals, &c. (£35,000), reserve for taxation (£6,000), and general reserve allocation (£25,000). As already reported, the final ordinary dividend is 9 per cent., again making 15 per cent. for the year. The sales of energy rose from 12,237,993 to 13,366,746 kWh. During the year substantial reductions were made in the rates for all classes of supply. Negotiations with the local authorities in connection with the extension of the company's tenure are still proceeding. Interests have been acquired in other supply undertakings in the district and sanction is awaited to an application for an additional area. Application is to be made to the Electricity Commissioners for permission to erect a new station on the site already acquired at Poole. In May last year the board capitalised £360,000 of the reserves and distributed it as a share bonus to the ordinary shareholders. Meeting: To-day (Friday).

Associated Electrical Industries, Ltd.

The first report of this company (formerly the Metropolitan-Vickers Electrical Co., Ltd.), covering the past year, records a profit of £258,772. After providing for debenture interest, depreciation and general reserve (£25,000) and adding £99,676 brought forward, there is an available balance of £235,339. It is proposed to pay a dividend of 6 per cent. on the ordinary shares and to carry forward £101,850. The figures apply to the company's trading results only; no account is taken of dividends from the associated companies. The report states that the output from the company's works reached a record volume, and the orders in hand are maintained at a satisfactory level. Competition was exceptionally severe and price levels correspondingly low. Meeting: May 7th at Bush House, W.C.2.

Indo-European Telegraph Co., Ltd.

Presiding at the annual meeting on April 25th, Mr. H. L. M. Tritton (chairman) said that the company's lines worked efficiently during the year. The average times of transmission between Karachi and London, as well as on the company's other main circuits between London, the Continent, and Persia and India, were satisfactory, and the record for accuracy had been maintained. During the year under review arrangements were made in co-operation with the Indo-European Telegraph Department, for the installation of regenerators at various points on the line. The system was actually in operation on one line, in both directions, between London and Karachi, and had produced a very material increase in speed. The report and accounts were adopted.

North Somerset Electric Supply Co., Ltd.

During the past year the company's capital was increased to £250,000 by the creation of 100,000 ordinary shares, of which 50,000 were offered at par to existing shareholders. The purchase of shares in the Winscombe and Cheddar companies has proved advantageous; these companies have been wound up and merged in the company's accounts. The shares in the non-statutory undertaking at Wedmore have been purchased. The sales of energy rose from 4,243,364 to 6,329,109 kWh. The accounts for the past year show a net profit of £17,585 (against £13,983). The ordinary shares have received a dividend of 7 per cent.; £1,000 is provided for obsolescence and £1,000 for general reserve, leaving £1,572 to be brought forward.

Clyde Valley Electrical Power Co.

At an extraordinary general meeting on April 24th resolutions were passed cancelling the unissued balance of 200,000 cumulative second preference shares of £1 each, and sanctioning the issue of the unissued balance of share capital to the amount of £900,000 in the form of ordinary shares of £1 each, to be offered at par to the ordinary shareholders of the company in the proportion of three new shares for each four held.

Babcock & Wilcox, Ltd.

The annual meeting was held on April 24th. Sir John Dewrance (chairman), who presided, said that during the past year the company had spent on bringing its plant up to date a sum of money which was in excess of the capital of the company at the time he was appointed chairman 30 years ago. The result of that was that the company at the present time was in a good position to execute all the orders that it had in hand or could book immediately. For some time past there had been difficulty in executing orders as rapidly as customers had wished, but it could be safely said now that the company would be able to give very much better delivery than it had in the past. The associated companies had been very successful during the year, particularly the Spanish company, which had for some time not been showing such good results. This year it had given a splendid result. During the year competition seemed to have been extremely severe. There were signs that the trade of the country was improving, particularly in shipbuilding and in a variety of directions. The report and accounts were adopted.

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Accumulators (Birmingham), Ltd.
Advance Wireless, Ltd.
Atlas Wireless Co., Ltd.
Cambrian Electrolytic Zinc Co., Ltd.
Cooke & Whitfield Wireless, Ltd.
Electrical and Allied Instrument Mfg. Co., Ltd.
Electrical Specialities, Ltd.
Farndons Electric, Ltd.
Houghton's Electrical Engineering Co., Ltd.
J. H. Runbaken, Ltd.
Magnetic Transmission Co., Ltd.
Thor Electric Safety Lamp Co., Ltd.
Vauxhall Electrical Mfg. Co., Ltd.
Woodhall Wireless Mfg. Co., Ltd.

Ever-Ready Co. (Great Britain), Ltd.

The directors state that the net profit for the year ended March 31st last amounted to £210,167, against £187,963 for 1927-28. They propose to pay a final dividend of 5 per cent. on the preference shares, making the maximum of 10 per cent. for the year. The final dividend on the old ordinary shares will be 25 per cent., again making 35 per cent. for the year, and on the bonus ordinary shares there will be a distribution of 25 per cent.

La Plata Electric Tramways Co., Ltd.

The gross receipts for the past year amounted to £114,686 and the net receipts to £29,478 (against £31,463); the addition of £4,641 brought forward makes available £34,119. After providing for debenture interest, &c., it is proposed to allocate £8,000 to the renewals fund and to pay 7½ per cent. on the 6 per cent. cumulative preference shares, representing the year's dividend and 1½ per cent. off arrears. The balance carried forward is £5,190. Meeting: May 8th.

Cammell, Laird & Co., Ltd.

Presiding at the annual meeting on April 23rd, Mr. W. L. Hichens (chairman) said that he had seen statements made in the Press that at some time the company would have to reconstruct. In his opinion, the company stood in no need of financial reconstruction. It would gain nothing thereby, and might be prejudiced when prosperous days returned. The prosperity would not come at once. Reorganisation on a large scale took a long time to carry out, and it must necessarily be some years before the full benefits were enjoyed. The report and accounts were adopted.

Para Electric Railways and Lighting Co., Ltd.

The annual meeting was held on April 22nd, Sir Francis M. Voules (chairman) presiding. In moving the adoption of the report and accounts, the chairman said that he had noticed considerable fluctuations in the value of the company's shares.

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which had been based on the prospect of receiving a favourable offer from some American group. It was true that they had been approached by an important American group which had sent representatives to Para, but, while he would not say that there was no prospect of an offer being received, up to the present no offer had been made. The most hopeful feature for the future was that the State of Para appeared to be grappling with the disaster that overtook it when it ceased to have command of the world's supply of rubber. The report and accounts were adopted.

Rangoon Electric Tramway and Supply Co., Ltd.

After allocating £58,500 to renewals reserve and £4,000 to cables reserve, the net profit for 1928 is £58,058, against £60,326. The ordinary dividend is maintained at 1 rupee 12 annas for the year, and £20,624 is carried forward (against £24,232 brought in). Although the car-mileage increased during the year, there was a decline in the number of passengers carried. The sales of electrical energy, however, showed an advance.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

American Telephone and Telegraph Company.—$2,004,200 capital stock.

Pinchin, Johnson & Co.—2,069,934 ordinary shares of 10s. each, fully paid, Nos. 689,979 to 2,759,912.

Scottish Power Company.—600,000 ordinary shares of £1 each, fully paid, Nos. 750,001 to 1,350,000.

Underground Electric Railways Company of London.—10,731 ordinary shares of £1 each, fully paid, Nos. 7,102,637 to 7,113,367.

Hopkinsons, Ltd.

Presiding at the annual meeting on April 26th, Mr. R. A. Hopkinson (chairman) said that, following on the use of that company's electrical signal indicators in mines, they were being introduced in power stations. During the past year the company had been fully occupied in the manufacture of its patent electric valve controls, for which it had several months' orders still in front of it. With the higher pressures in boilers, safety valves had again become a very important adjunct, and at the present time over 1,000 safety valves were on order. The report and accounts were adopted.

West London and Provincial Electric and General Trust, Ltd.

The annual meeting was held on April 26th, Mr. H. Kahn (chairman) presiding. In presenting the report and accounts, the chairman said that, although the company had disposed of a further part of its holding in the Chiswick Electricity Supply Corporation, it still retained a comparatively large holding. The company had little to fear from the aftermath of the wave of speculation that had been going on for the last year, or from the uncertainties consequent on the coming General Election. The report and accounts were adopted.

Richmond (Surrey) Electric Light and Power Co., Ltd.

The balance on the 1928 revenue account (including £2,190 brought forward) was £48,677, against £42,573 in 1927. After providing for debenture interest, depreciation and renewals, taxation and general reserve (£10,000), there is an available balance of £26,251. The directors recommend a final dividend of 7 per cent. on the ordinary shares, making 11 per cent. for the year (against 10 per cent.), and £4,281 is carried forward. The amount of energy sold was 3,567,931 kWh, as compared with 3,142,103 kWh in 1927. Meeting: To-day (Friday).

Prospectus.

Faradex-Seraphone, Ltd.—On Tuesday last this company offered for subscription 750,000 shares of 2s. each at par. The total capital is £125,000 in 1,250,000 2s. shares, and of these 350,000 have been allotted to the vendors as fully paid. The company has acquired the businesses, patents, &c., of Rooke Bros., Ltd., and the Seraphone Co., Ltd., manufacturers of radio receivers and apparatus and gramophones. Particulars of registration are given on p. 796 of this issue.

The Cable Wireless Merger.

It is anticipated that the terms of the offer by Cables and Wireless, Ltd., for the exchange of their holdings will be posted to the stock and shareholders of the cable companies and the Marconi company on May 7th.

City of Buenos Ayres Tramways Co. (1904), Ltd.

A dividend of 1s. 3d. per share has been declared in respect of the three months ended March 31st.

Craigpark Electric Cable Co., Ltd.

The ordinary dividend for the past year is 5 per cent., against 4 per cent. for 1927-28.

S. Smith & Sons (Motor Accessories), Ltd.

An interim dividend of 5 per cent. has been declared on the preferred ordinary shares.

Stocks and Shares.

MONDAY EVENING.

MARKETS in the Stock Exchange show an irregular tendency which is due, in the main, to the spasmodic character of business as a whole. One day will witness a fair amount of activity; on the next day there may be nothing doing. When business is quiet, the tendency is nearly always dull. With absence of speculation noticeable in most departments, public disposition is to place capital into gilt-edged and first-rate securities for the time being, leaving other and more risky enterprise until such time as the outlook becomes a little clearer politically and financially.

Eastern Telegraph Group.

The three cable companies, the Eastern Telegraph, the Eastern Extension and the Western close their transfer books on the Tuesday of this week until May 21st, preparatory to obtaining from the holders of their ordinary stocks an expression of their willingness to join the Cables & Wireless, Limited, merger, about which so much has been written of late. It was mentioned here last week (on page 753) that the offer of Cables & Wireless, Limited, is conditional upon its acceptance by 60 per cent. (or such smaller percentage as may be approved by the Government) of the ordinary shareholders of the cable companies, together with the three classes of shareholders in the Marconi Company.

We may add that it will be necessary for shareholders in each cable company to give the necessary proportion of consent for the plan to be operative. That is to say, it will be no use for the Eastern Telegraph stockholders assenting as to, say, 100 per cent., and for the Western shareholders to assent by only 50 per cent. There can be little doubt as to the willingness of the cable companies' shareholders to acquiesce in the proposals now made to them. Prices are a trifle lower, Eastern ordinary and Westerns both showing declines, but Globes have risen 5s. to 28¼.

Marconi Shares.

With the Marconi Company the 60 per cent. assent is required from the three classes of shareholders taken, for this purpose, as one. Doubtless the proprietors of Marconi 10s. shares will provide, by themselves, the full proportion required, so the holders of the £1 ordinary and the 7 per cent. preference shares may deem it wise to accept the situation as it stands, throwing in their lot with the predominant class and deferring until a later date their claims to extra consideration. Marconi 10s. shares are better, at 85s. The £1 ordinary shares, after being 5¼, reverted to 5, at which price support came in. The 7 per cent. preference are also 5. Canadian Marconis remain at 32s. 6d.

Indo-European and the Soviet.

Great Northern Telegraphs have shed another 10s., coming back to 33. Indo-Europeans are firm at 55½ on the meeting held last week, when the chairman reminded his audience of his warning a year ago; namely, that the company's revenue would be bound to show diminution by reason of the beam wireless competition. Shareholders, he added, would appreciate that the full measure of prosperity enjoyed in recent years might not be so easy of realisation in the future. He referred to an exceptional interruption caused in the Crimea by a blizzard last February, when the Soviet Government came to the rescue by placing its wires at the company's disposal. The Soviet Government so rarely receives a word of approval that impartiality notes with interest this unexpected tribute to its capacity for friendliness upon occasion. American Telephone and Telegraph at 240, and International Telephone and Telegraph at 265 are below their recent best prices. Cuban Telephone Fives at 97½ and United River Plate 4½ per cent. debenture show gains of a point apiece

The "Dollar" Stocks.

The International Holding and Investment Company, in its report for the period to the end of last December, shows net revenue of $6,300,000, which excludes an exceptional profit of a little over 13 million dollars. A transfer of five million dollars to the investment account is made by way of provision for depreciation as at December 31st, 1928. This left $142,000 in the surplus account. The non-recurring profit of 13 million dollars has been dealt with by a transfer of about half of it to capital account, the balance remaining unappropriated in the surplus account, which latter now amounts to 6½ million dollars. The price of the shares is dull, at 7½, and so is that of Hydro Electrics, at 34¾. Hydros derived no benefit from the issue of the report, of which the salient figures were given here last week. Brazilian Tractions are now quoted ex dividend at 59½. In the Mexican group, the only change of any consequence is a fall of 7 points in Mexican Light & Power common shares, lowering the price to 77½. The 7 per cent. preferred shares have recovered to 75½ ex dividend, the interest payment being taken off the price last week. Anglo-Argentine Tramways 5 per cent. debenture stock strengthened to 74½. British Columbia A and B shares are 49 and 31, respectively. After dipping to 77½, Shawinigan Water rallied to 78½. Toronto Power 4½ per cent. guaranteed stock, the price of which moves but rarely, is better at 95½.

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Home Electricity Supply.

The yield on the money offered by investment in home electricity companies' shares makes a better showing this week by reason of the fact that a number of prices were quoted ex dividend at the last Stock Exchange account-day, April 24th. Some of the deductions have been partially recovered already. County of London ordinary at 55s. have regained the dividend and 6d. per share in addition. City of London ordinary are 1/16 up at 33s. 3d. Bournemouth and Poole are unchanged at 64s. 6d. on the announcement of a dividend of 15 per cent., the same rate as that of a year ago, when the capital was exactly half its present amount. The company has enjoyed a remarkably good year, and the dividend has been maintained at the full rate without unduly trenching upon allocations. Shropshire, Worcestershire and Staffordshire "B" are better at 38s. 9d. Midland Electric Power shares are a little easier at 35s. 9d. Richmond Electrics hardened on the announcement of a final dividend of 7 per cent., making 11 per cent. for the year, an increase of 2 per cent. over the 1927 distribution. South Wales Power preference are unchanged at 1: the company's report reflects the depression in the South Wales coal trade. It is thought that the outlook for 1929 is definitely brighter.

New Issues.

Clyde Valley shares are quoted this week ex the rights to the new issue. The price is 32s. 6d., and the new shares, with nothing paid, are 12s. premium over their par value of £1. The market is not very flexible, owing in part to the fact that a good many allottees intend to take up their proportion of the new shares. If the company is able to continue payment of the 8 per cent. dividend on the whole of the increased capital, Clyde Valley shares may be accounted reasonably-priced at their present level. Other fresh shares marketed this week are Lancashire Electric new, the issue of which appears to have been fairly heavily stagged, judged by the modest premium, 3d. to 6d., at which the price developed.

Egham and Staines.

The Egham and Staines Electricity Company requires that applications for the new ordinary shares that are being offered at 30s. per share, shall be completed and returned before noon on Saturday at the end of this week. The shares will rank for dividend as from June 1st this year. They are not issued *pro rata*, and, for this reason, it is likely that some of the shareholders will fail to take advantage of the opportunity offered to them for obtaining cheap shares. When people are allowed to apply for as many shares as they like, instead of being allotted a fixed proportion which they may or may not accept, as they please, the Stock Exchange cannot quote the "rights" as being of any fixed value, and the method adopted by the Egham and Staines Company may result in some of the shareholders neglecting their right to apply at 30s. The issue of the shares has been underwritten for a commission of 1s. 6d. per share, which looks extravagant in view of the fact that the price was standing at 35s. before the new issue was made.

Associated Electric Excitement.

Excitement, inspired by American buying and fanned by speculative support on this side, has been again a feature in Associated Electric shares. The price rose 9s. 3d. last week to 47s. 6d.; it jumped to 57s. on Monday morning in this week; and is now, at the time of writing, about 53s. 9d. middle. Curiosity remains on edge to learn what may be the reason for this violent demand on the part of New York purchasers, and all kinds of guesses are offered in explanation of it. At least some of the buying is said to come from the sources identified with the recent American appetite for General Electrics. The latter were rushed up, it may be recalled, to 4¼ before the incidents occurred that ended in the withdrawal of the proposed new issue of shares. General Electrics have been under 3 since they reached 4¼. At 3⅛ the price shows ⅛ decline as compared with a week ago.

Miscellaneous.

Babcock & Wilcox are 3 9/16 ex dividend. The chairman stated at the meeting the other day that the company at the present time is in a very good position to execute all the orders in hand, or that it can book immediately. He referred to the associated companies as having been very successful last year, particularly the Spanish Company, which in 1928 gave a very good account of itself. Signs of improvement in British trade, particularly in ship-building, were manifest, though competition last year seemed to have been extremely great.

Enfield Cable ordinary shares are better at 4 5/16; the new ordinary at 4⅛ also show improvement. English Electrics, both ordinary and preference, are flat, giving way to 6s. 3d. and 8s. 3d., respectively. India Rubber shares hardened to 13s. 9d. Ever-Ready shares are steady at 23s. 6d., upon the declaration of the same dividend as before, making 35 per cent. for the year in the case of the old shares. The company's figures are exceedingly good. Atlas Power 7 per cent. preference have hardened to 23s. 9d. In the Australian list, Adelaide Electric Supply 6½ per cent. preference lost a few pence at 23s. 6d. The engineering group of shares is dull on lack of business, and rubber shares are heavy because of a decline in the raw product to a shade below 10d. per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price April 29 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	64/6	—	4 13 0
Brompton Ordinary	1	8½	8½	26/-xd	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/-xd	—	5 7 8
City of London	1	10	10	33/3	+1/16	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	32/6xr	—	... ...
County of London	1	7½	10	55/-xd	+1/6	3 12 9
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	24/6	—6d.	5 14 3
Elec. Supply Corporation	1	11	—	56/3	+1/16	3 18 3
Kensington Ordinary	1	8.	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	27/-	—	5 3 8
Metropolitan	1	9	9	2 1/16	—	4 7 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	35/9	—8d.	4 9 6
Newcastle on-Tyne Ordinary ...	1	6	6	1¼xd	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-xd	+6d.	5 4 4
St James' and Pall Mall	1	8	8	26/6xd	—	5 1 10
Scottish Power	1	8	8	31/-	—	5 3 3
South London	1	8½	8½	26/6xd	—	5 5 8
Urban Ordinary	1	7	—	43/3	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

Home Rails.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	3	3½	60½	—	5 15 8
do. District	,,	4	5	76	—	6 11 7
Underground Electric	£1	5	7	23/6	—	5 13 10
do. do. Income ...	Bonds	6	6	112	—1	5 7 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	2⅛	—	5 18 0
Eastern Extension	10	10	10	28	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	280	—2	*3 11 5
Globe Tel. and T. Ord.	10	10	10	28½	+¼	*3 11 0
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	—	33	—½	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	10	—	4¼	—1/16	... ...
Marconi-Marine	1	12½	15	3½	—	4 12 4
Oriental Telephone Ord.	1	12	12	2⅞	—	... ...
Western Telegraph	10	10	10	27½	—½	3 12 9

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	3 13/16	—	7 19 0
do. do. 5% Deb. ...	Stock	5	5	71½	+2	6 14 3
British Electric Traction Def. Ord.	,,	5	—	850	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	59½xd	—	3 7 3
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/6	+6d.	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	71½	—	6 19 10
Mexican Light Common	100	Nil	Nil	7½	—7	... ...
do. 7% Pref.	100	7	7	75½xd	+2½	9 5 6
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	53/9	+6/3	2 4 3
Babcock & Wilcox	1	13	15	3 9/16xd	—	*4 4 3
British Aluminium Ord.	1	10	10	49/-	+1/8	*4 1 0
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 6
Br tish Insulated Ord.	1	15	15	4⅝	—	3 8 0
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	4⅝	—	3 9 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 9
do. 5% Deb.	Stock	5	5	86½	—	5 15 1
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4 5/16	+1/16	4 13 0
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	8/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—6d.	5 8 6
do. Ord.	1	7½	10	3⅝	—⅛	3 4 0
Henley...	1	25	25	6	—	4 1 9
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	18/9	+1/16	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 0
Siemens Ord.	1	7½	7½	1⅜	—	5 3 1
Telegraph Construction	12	10	10	24¼	—	*4 19 3

* Dividends paid free of Income Tax.

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The Electrical Imports of India.

Principal Sources of Supply.

FULL details of India's import trade in 1927-28 in electrical goods, showing the principal countries of supply, have recently been issued. From these the following particulars have been extracted. The corresponding figures for 1926-27 have been added for purposes of comparison and a note of increases or decreases given :—

	1926-27. Rs. (Thous.)	1927-28. Rs. (Thous.)	Inc. or dec Rs. (Thous.)
Control and switchgear—			
Total	3,240	3,650	+ 410
From United Kingdom ...	2,900	3,120	+ 220
,, United States ...	169	336	+ 167
Generators, alternators and dynamos—			
Total	4,942	3,810	−1,132
From United Kingdom ...	4,500	3,445	−1,055
,, United States ...	270	120	− 150
,, Switzerland	8	23	+ 15
,, Germany	150	135	− 15
,, Italy	5	23	+ 18
Motors—			
Total	2,935	3,540	+ 605
From United Kingdom ...	2,327	2,870	+ 543
,, United States ...	373	386	+ 13
,, Sweden	15	9	− 6
,, Germany	134	173	+ 39
,, Switzerland	11	23	+ 12
,, Italy	24	19	− 5
Transformers—			
Total	2,304	1,160	−1,144
From United Kingdom ...	1,679	941	− 738
,, United States ...	505	130	− 375
,, Germany	105	27	− 78
,, Italy	—	17	+ 17
,, Holland	4	13	+ 9
Turbo-generator sets—			
Total	771	180	− 591
From United Kingdom ...	677	153	− 524
,, Germany	2	1	− 1
,, United States ...	76	5	− 71
Other electrical machinery—			
Total	8,744	7,670	−1,074
From United Kingdom ...	6,519	6,117	− 402
,, United States ...	873	483	− 390
,, Switzerland	7	64	+ 57
,, Germany	568	460	− 108
,, France	30	24	− 6
,, Italy	48	78	+ 30
,, Belgium	242	330	+ 88
Electric fans and parts—			
Total	3,187	3,390	+ 203
From United Kingdom ...	2,121	1,834	− 287
,, Italy	602	790	+ 188
,, United States ...	156	188	+ 32
,, Germany	278	550	+ 272
Wires and cables, rubber insulated—			
Total	3,035	3,323	+ 288
From United Kingdom ...	2,832	3,125	+ 293
,, United States ...	33	33	—
,, Germany	121	112	− 9
Ditto, other insulation—			
Total	2,926	3,546	+ 620
From United Kingdom ...	2,611	3,125	+ 544
,, United States ...	144	224	+ 80
,, Germany	122	81	− 41
,, Holland	25	73	+ 48
,, Belgium	6	21	+ 15
Telegraph and telephone wires and cables—			
Total	97	72	− 25
From United Kingdom ...	83	57	− 26
,, Germany	11	4	− 7
,, United States ...	2	9	+ 7
Bare copper wire, electrolytic, other than telegraph and telephone wire—			
Total	2,087	2,099	+ 12
From United Kingdom ...	1,579	1,707	+ 128
,, Germany	129	170	+ 41
,, Holland	117	131	+ 14
,, Japan	—	19	+ 19
Telegraph and telephone instruments and apparatus—			
Total	477	587	+ 110
From United Kingdom ...	402	492	+ 90
,, United States ...	22	21	− 1
,, Sweden	48	58	+ 10
,, Germany	1	12	+ 11
Electric glow lamps—			
Total	2,065	2,593	+ 528
From United Kingdom ...	788	676	− 112
,, Holland	768	975	+ 207
,, Germany	135	214	+ 79
,, Austria	160	286	+ 126
,, United States ...	31	143	+ 112
Electric lamps, other sorts—			
Total	1,099	942	− 157
From United Kingdom ...	62	114	+ 52
,, Germany	69	129	+ 60
,, United States ...	901	649	− 252
Batteries—			
Total	1,017	1,100	+ 83
From United Kingdom ...	396	133	− 263
,, United States ...	432	660	+ 228
,, Germany	185	248	+ 63
Electric carbons—			
Total	64	122	+ 58
From United Kingdom ...	40	100	+ 60
Accumulators—			
Total	1,670	2,220	+ 550
From United Kingdom ...	1,435	1,930	+ 495
,, United States ...	104	142	+ 38
Electric condensers (nearly all from U.K.)—			
Total	182	23	− 159
Electric bell apparatus—			
Total	8	11	+ 3
From United Kingdom ...	1	2	+ 1
,, Germany	3	6	+ 3
,, United States ...	3	1	− 2
Lighting accessories and fittings, including switches—			
Total	1,506	1,555	+ 49
From United Kingdom ...	1,092	1,087	− 5
,, Germany	273	257	− 16
,, United States ...	93	161	+ 68
Meters—			
Total	551	669	+ 118
From United Kingdom ...	459	510	+ 51
,, Germany	48	110	+ 62
,, Switzerland	9	13	+ 4
,, United States ...	33	33	—
Electro-medical apparatus—			
Total	176	186	+ 10
From United Kingdom ...	45	63	+ 18
,, United States ...	60	86	+ 26
,, Germany	11	27	+ 16
,, France	47	8	− 39
Switchboards (other than telegraph and telephone)—			
Total	409	500	+ 91
From United Kingdom ...	395	488	+ 93
,, United States ...	11	3	− 8
,, Germany	2	6	+ 4
Electrical goods and apparatus, unenumerated—			
Total	3,625	4,674	+1,049
From United Kingdom ...	2,273	2,816	+ 543
,, Germany	551	610	+ 59
,, United States ...	584	965	+ 381
,, Japan	109	110	+ 1

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The Electrical Contractors' Association.

Annual Conference at Bournemouth.

THE Electrical Contractors' Association has sent us the provisional programme of its fourth annual conference, which is to be held at Bournemouth from Wednesday, June 26th, to Friday, June 28th. This follows very closely the lines upon which the previous conferences, at Brighton, Scarborough and Cheltenham, have been so successfully carried out.

The first day will be devoted to a meeting of the Council of the three allied associations—the others being the National Federated Electrical Association and the N.E.C.T.A., Ltd.—and to the arrival and registration of delegates. In the evening the President (Mr. W. H. Walton) will hold a reception in the New Pavilion, after which there will be dancing in the ball room.

On Thursday, June 27th, the annual general meeting will take place at the Town Hall, and the conference will be officially opened at 11.30 a.m. The Mayor of Bournemouth will welcome the delegates, and Mr. Walton, after responding, will deliver his presidential address. At the close of the meeting the official photograph and luncheon will be taken. The afternoon session will be occupied by the reading and discussion of a paper by Mr. A. G. Bruty (Dublin) on "The Mutual Responsibility of Contractors, Manufacturers and Supply Undertakings (*a*) to the Electrical Industry, and (*b*) to the Public." In the evening there will be a smoking concert in the Pavilion.

On the following day (Friday) a paper by Mr. H. R. Taunton, on "Possibilities for Contractors in Rural Electrification," will be read and discussed. Then, after the usual votes of thanks, the new president will be installed, and will deliver a short address. For the afternoon a special trip to Southampton for a tour of the *Aquitania* has been arranged, and the proceedings will conclude with a ball and supper at the Pavilion, at the invitation of the Mayor of Bournemouth.

Arrangements are being made for the entertainment of those delegates who desire to stay in Bournemouth over the week-end, and as at previous conferences the welfare of the ladies during the business sessions is being provided for.

Forms for registration and hotel accommodation, and a special railway concession are included in the programme.

The North-East Coast Exhibition.

Electrical and Allied Exhibitors.

THE North-East Coast Exhibition at Newcastle-upon-Tyne, which opens on May 14th, is expected to act as a powerful stimulant to industry and trade in one of the most important areas of the country. The displays which have been arranged are fully representative of the various phases of civic and industrial life, and the exhibitors are over 300 in number; of these about 10 per cent. are connected with the electrical or allied industries. A list of these exhibitors is given below:—

Palace of Industries:—

Bakelite, Ltd.
Beatty Bros., Ltd.
Belling & Co.
Electrolux, Ltd.
E.L.M.A.
Falconar, Cross & Co., Ltd.
Falk, Stadelmann & Co., Ltd.
Hoover, Ltd.
Jackson Electric Stove Co., Ltd.
Newcastle-upon-Tyne E.S. Co., Ltd.
Revo Electric Co., Ltd.
Ruberoid Co., Ltd.

Palace of Engineering:—

Babcock & Wilcox, Ltd.
British Broadcasting Corporation.
British Electrical Repairs, Ltd.
Cambridge Instrument Co., Ltd.
Clarke, Chapman & Co., Ltd.
Filtrators, Ltd.
Holmes, J. H., & Co., Ltd.
Ideal Homes Electrical Appliances.
International Combustion Co., Ltd., & Underfeed Stoker Co., Ltd.
Newcastle-upon-Tyne E.S. Co., Ltd.
C. A. Parsons & Co., Ltd.
Petters, Ltd.
Reyrolle, A., & Co., Ltd.
Robson & Coleman.
Slingsby, H. C.
Yorks. Electric Detonator Co., Ltd.

The Electrical Trades Benevolent Institution.

Annual General Meeting.

THE annual general meeting of the Electrical Trades Benevolent Institution was held in London on April 29th. The Council's report and statement of accounts for the year 1928, which were adopted, disclosed the facts that the income from contributions for the year was £3,937, making, with the receipts from dividends and other sources, a total income of £5,468. The result of the year's work was that an amount of £2,395 was carried to the capital account after the payment of grants and expenses. During the year a further £4,804 was invested, bringing the total of the invested funds up to £37,318 at cost.

The annual festival held in November, 1928, was presided over by Mr. Lawrence G. Sloan, J.P., president of the Institution, whose appeal resulted in the collection of £3,243, which amount has only been exceeded once before in the history of the Institution.

Each succeeding year demonstrates more and more strongly the necessity of this Institution; during the year under review the number of grants made was over 400, amounting to £2,535, as against 221 grants during the preceding year, accounting for £2,048. Every qualified applicant received assistance.

The Council was, during the year under review, able to grant seven pensions, which have been operative since April, 1928, and the results have been so gratifying that it is hoped during the current year to be able to extend the benefits of this innovation and thereby enable more beneficiaries to enjoy the advantages of an assured income, thus permitting them to adjust their circumstances so as to get the greatest benefit from their incomes.

At the annual general meeting referred to above, Lt.-Col. K. Edgcumbe, president of the Institution of Electrical Engineers, took the chair. In opening the meeting, he commented on the pleasing manner in which the E.T.B.I. and the I.E.E. pulled together. In proposing the adoption of the report, Col. Edgcumbe congratulated the Institution on its year's working. He was impressed by the manner in which the Institution had made investments, and by the increasing income therefrom. He was surprised at the few associates possessed by the E.T.B.I., but that was probably due to that class of membership being comparatively new to the body. A subscription of 5s. a year would no doubt attract many associates in the near future.

Mr. E. A. GATEHOUSE (ELECTRICAL REVIEW) seconded the adoption of the report, remarking that the year had been a gratifying one for the Institution; but they needed more and more money.

The hon. auditors and hon. solicitors of the Institution for the past year were re-elected for the coming year.

Votes of thanks were passed to the technical Press, to the I.E.E. for the loan of its building, and to the chairman. The name of Mr. Howard Marryat was mentioned in connection with the presidency for the coming year.

Electrical Fires in the United States.

The annual report of the Bureau of Electricity of the New York Board of Fire Underwriters states that during 1928 inspections of the complete wiring of 4,970 buildings, in which were 18,489 separate equipments, were carried out. Of these, 10,368 were found to be unsatisfactory, and in many cases unsafe. Since the re-inspection service was commenced on its present scale approximately seven years ago some 26,233 buildings have been examined.

The Bureau had 1,220 fires of reported electrical origin called to its attention during 1928. It was found upon investigation that 1,015 of them could be attributed to electricity, and between them they caused an aggregate loss of $254,706. The following ten classes of fires produced the largest losses:—

	No. of fires.	Losses. $
Heaters: electric pressing irons	216	70,058
Flexible cord: used for circuit work	93	47,261
Wireless: receiving sets	52	18,444
Motors and generators: sparks	24	13,682
Conductors in gutter space	33	11,535
Short circuits: accidental	38	9,031
Volatile liquids: ignition of varnish remover	21	8,996
Motors and generators: disturbance in winding	92	8,564
Short circuits: electrically-operated toys ...	9	8,976
Cables, armoured: heating of armour of interior cables	31	5,863

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Distribution Accessories.

Improved flexibility of growing systems is achieved because it is recognised that the design of accessories is a specialist's job.

By CAPT. P. DUNSHEATH, O.B.E., M.I.E.E.

(Abstract of a paper read before the LONDON LOCAL TECHNICAL GROUP *of the* ELECTRICAL POWER ENGINEERS' ASSOCIATION.)

THE security of a distribution system depends quite as much on the selection of suitable accessories as on the laying of suitable cable.

For simple and rapid assembly combined with reliability the cast-iron box is recognised to be the most effective accessory for jointing lengths of cable. In a split box which the author has in mind, an effective bond between the lead sheath and the box is made by a mechanical clamp, as shown in fig. 1, a cast-iron shuttle is forced down on the lead strip from a bridge across the compound filling hole, a "stop" being provided to prevent undue pressure being applied to the lead sheath. Wood bushes are always a possible source of failure in boxes buried in the ground. A very useful sleeve for the jointing of conductors is the "weak-back" ferrule. This is similar to the ordinary tinned-copper sleeve, except that it has a groove along its length diametrically opposite to the split. This design has the advantage that no undue bending of the paper-insulated cores is necessary.

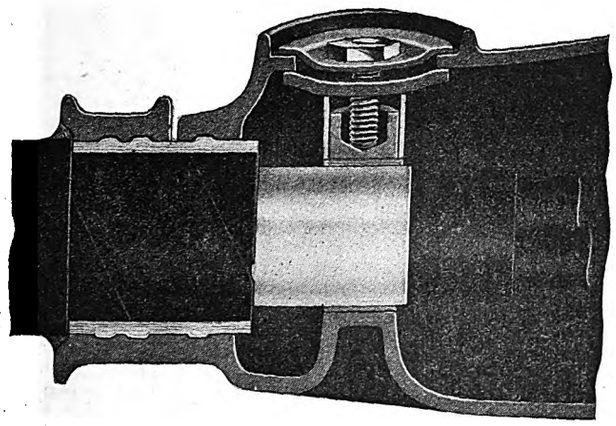

Fig. 1.—Mechanical-clamp Bonding.

An important feature in the design of service boxes is that as they are generally connected up while the cable is alive, sufficient room has to be allowed to accommodate the splayed-out joint. Regarding the advantages of the double-service box, apart from the desirability of having the minimum number of joints on the main cable, there is the important saving of time, labour and material. Economy of time in teeing off services and improved mechanical and electrical efficiency are obtained by the use of the claw connector shown in fig. 2. The fitting is made of soft tinned-copper, and the claws are easily bent round the main conductor. Figures obtained on a complete series of tests on several sizes of conductors showed a 20 per cent. advantage in favour of the claw over the earlier married type of connection. Where skilled plumber jointers are available, all-lead service boxes are a first-class proposition when made from lead sheet; a sound watertight and electrically continuous joint is obtained. As ordinary lead castings are susceptible to disintegration and porosity, particularly if subjected to vibration, a sheet-lead pressing is preferable.

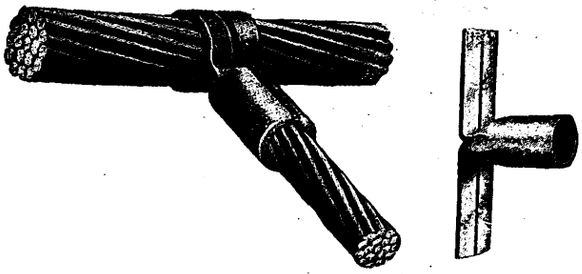

Fig. 2.—Claw Connector.

The designs of terminal boxes are influenced by many considerations, and ranges of boxes are available for indoor and outdoor working, wall, floor or pole mounting, and for varying sizes of incoming cables and outgoing cables, and, of course, for different voltages. All are provided with suitable armour clamps, when required, and with means of bonding the lead sheathing. Fig. 3 shows a l.p. box of the right-angle variety, required for floor fixing with the tails leaving vertically. The design is also arranged for erection on a ceiling or wall, or even on its side, and provision is made for filling in any position. Fig. 4 shows a useful outdoor box for l.p. working, having the outgoing conductors leaving the box from under a weather shed, through porcelain bushes. The box is filled with compound through the oval hole at the top, and this is protected by a domed cover held in position by clamping screws.

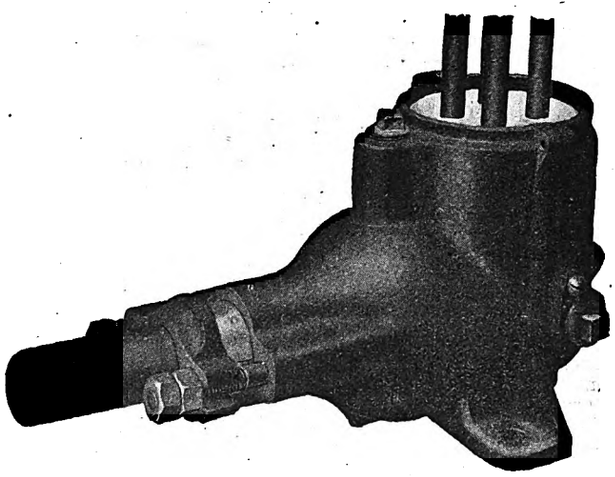

Fig. 3.—L.P. Right-angle Terminal Box.

There are two well-known types of h.p. and e.h.p. outdoor terminal boxes with protection against driving rain and snow storms; one has the outgoing insulators separately surrounded by metal bells to shield the insulators from rain, snow and deposits of dust, the other has exposed insulators with large petticoats which rely on their long creepage, and on rain to wash away any dust or foreign matter which may collect.

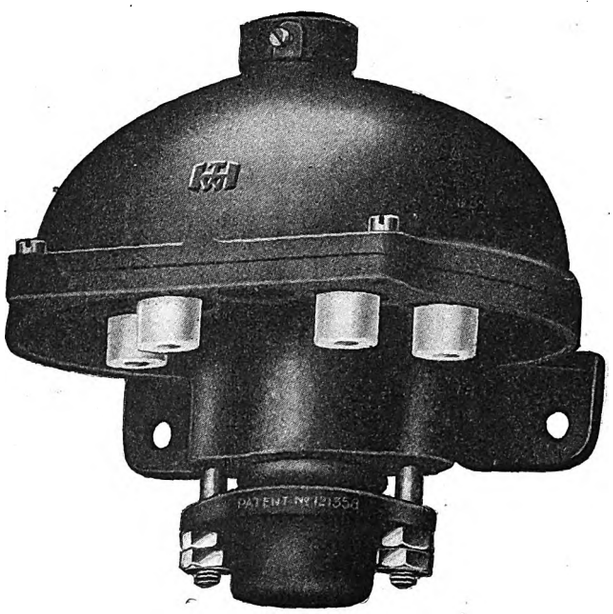

Fig. 4.—L.P. Outdoor Terminal Box.

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Fig. 5 shows an example of the latter type. The only satisfactory way of jointing up boxes of this description is to bolt the box to the terminal pole first, and make the joint after, suitable staging being provided for the jointer.

The design of the lid of disconnecting boxes is of considerable importance, as any entry of moisture may result in flooding the box and causing breakdown. The machined lid with a wide flange has proved very successful in the past, provided it is placed in position with care and the machined surfaces are carefully cleaned on each occasion. The diving bell lid is a very sound proposition, both simple and certain. It

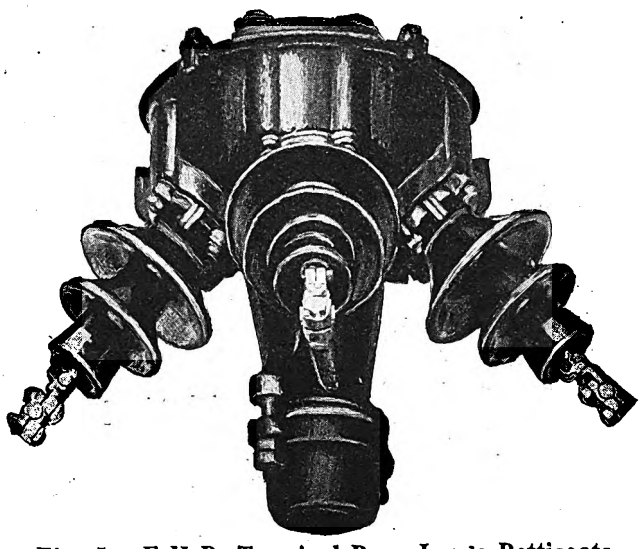

Fig. 5.—E.H.P. Terminal Box; Large Petticoats.

relies on the water being unable to rise inside the lip of the lid due to the back pressure of the air inside the box. The following may be regarded as some of the salient features of a good design of disconnecting box: elimination of joints, especially "dry" joints, under compound; high insulation properties; high conductivity of the current-carrying parts; simplicity in jointing and the provision of ample room for splaying the cores of the cables; water-tightness; efficient bonding and provision for dealing with the armouring of the cables; and substitution of interchangeable fuses for links. Fig. 6 shows a complete straight-through box. Such a box, it is claimed, will probably withstand safely a ten-foot head of water. There are occasions when it is convenient to do away with a brick pit and to substitute a disconnecting box with a combined cast-iron pit frame and cover. In view of the small space occupied by such a pit, this arrangement is very advantageous in localities where pathways are narrow. The saving in time of installation is also, of course, a strong point in its favour. Fig. 8 shows the pit and components separated. A feature is the ample space provided for splaying the cores of the cable.

Where greater accessibility is required than is furnished by a disconnecting box, the feeder pillar is employed. The "Henley" pillar is designed on the unit principle. The units consist of a cast-iron terminal box fitted to two solid-drawn steel tubes, insulated with micanite, on the front of which the fuse or link contacts and busbar connections are clamped. This arrangement entirely eliminates the use of v.i.r. tails from the terminal box to the fuse or link contacts, the cores of the cable being connected directly to the contacts by means of suitable fittings inside the terminal box. Units of varying capacities can be mounted side by side and connected together

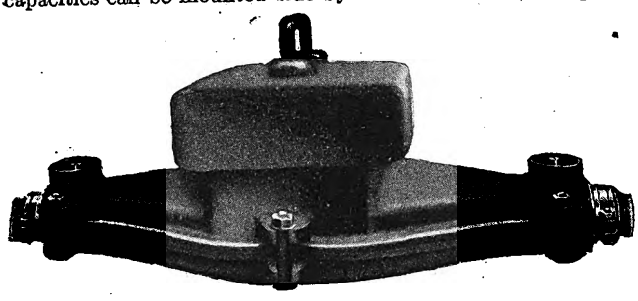

Fig. 6.—Straight-through Disconnecting Box.

by common busbars, the busbar connections on all sizes of units being arranged on the same level. The adoption of micanite as the insulation in the pillar unit is the result of much careful research, and it has been proved that this form of insulation offers many advantages, both mechanical and electrical, over other methods. Humid atmospheric conditions are often the cause of much trouble in pillars, and the use of a ventilation unit consisting of a carbon-filament lamp with a small fuse connected across the busbars has proved very efficient. The following tests have been carried out. Units were placed in the River Thames off the jetty at Gravesend, one set lying in the river mud and one secured to the jetty, in such positions that they were alternately covered with water and exposed to the weather, according to the state of the tide. After seven days of this treatment, the units were washed down with water from a hose, superficially dried, without the aid of artificial heat, and subjected to a series of puncture tests. The first breakdown occurred on the neutral fitting at 22,000 V, the second on the positive fitting at 22,000 V, and the third on the negative fitting at 23,000 V. It is interesting to note that after the flood of last year several of the pillars, after being completely submerged, were switched on and operated successfully without any restoring treatment, apparently no worse for their experience. Fig. 7 shows an application of the pillar units in which they are housed in a drip-proof casing as a d.p. distribution board in a large paper works. Thirteen such assemblies were employed in the one system, and in order to economise floor space the units are arranged in two tiers.

Discussion.

Mr. Harmer, commenting on a suggestion that the various accessories could be cheapened by lightening the metal, urged that simplicity and cheapness could best be effected by reducing the number of parts.

Referring to the trouble of condensation in the bell, he said it had been eliminated completely by applying cork dust to the inside of the bell, the method being to heat the bell, pour in a layer of compound, and dust the cork on.

Mr. A. G. Hilling said that the pressed-lead service box enclosed in a cast-iron cover would be an ideal arrangement if one could afford to disregard price. In his undertaking they used a lead sleeve in their service boxes; the jointer made it himself and did his own plumbing, and the cost was quite small. Some years ago his undertaking had used unit-type feeder pillars, but had found them most unsatisfactory because the compound oozed out at the back as soon as the cable became a little warm. They had tried to do away with the iron troughs, and used triple concentric tails, which were jointed at the works; these tails were re-painted about once a year with Voltalac varnish.

Mr. J. Morley said that from an examination of some of the elaborate net-work boxes, pillars, &c., which Capt. Dunsheath had illustrated, it had occurred to him that in many cases it would be practically impossible to put in another cable, or to take out a cable, while the boxes remained alive. It must be borne in mind by manufacturers that in future it would be more and more imperative that the supply should be continuous.

Mr. J. H. Wadman suggested that with the growing use of special disconnecting boxes, when fuses were fitted, it would be necessary to provide some form of testing socket, in view of the increasing loads. In the undertaking with which he was associated, a pavement test board was used, so that tests could be made before one began work on the boxes.

Mr. H. J. Henwood said that at East Ham Henley's boxes only were used for connecting services, and the whole of the jointers employed, with the exception of two, were semi-

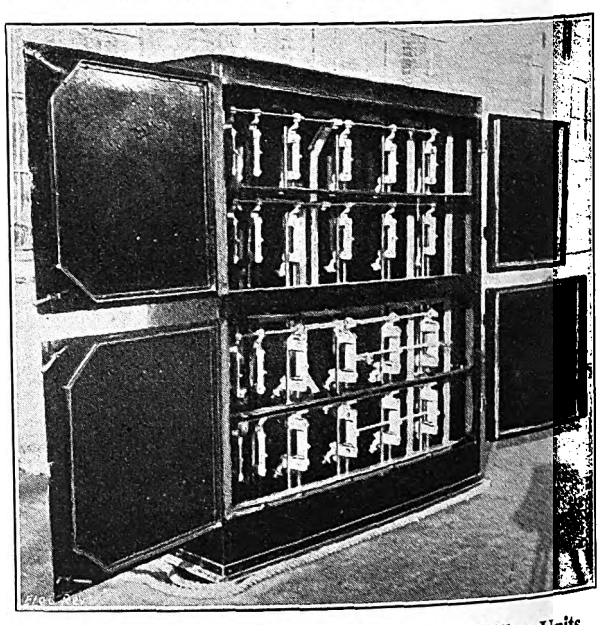

Fig. 7.—D.P. Distribution Board of Pillar Units.

skilled men. Some of them were the more intelligent of the labourers, and they had been trained by the undertaking's staff and had worked quite satisfactorily so far. He thought that sheet-metal feeder-pillar cases would be more dangerous than the cast-iron shells; if a lorry hit a pillar with a cast-iron shell, the shell would probably shatter and the pillar would continue to do its work, but a sheet-metal case would be bent badly, and the task of removing it would be a somewhat lengthy one.

Mr. E. A. Deacon complained of the small size of filling holes in some boxes. As the result of small holes, if a bituminous compound were used there was a tendency for it to solidify before it was distributed all over the box.

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Mr. WILLIAM F. ANDREWS said that if made-up lead sleeves were used the plumber-jointer would have nothing to do while waiting for his mate to come out of the hole; he might just as well be engaged in beating up the lead sheet as doing nothing.

Mr. PRATT thought that where a lead sleeve was used there was no need to enclose it in a cast-iron box. The practice of enclosing the sleeve in a concrete box was probably the best.

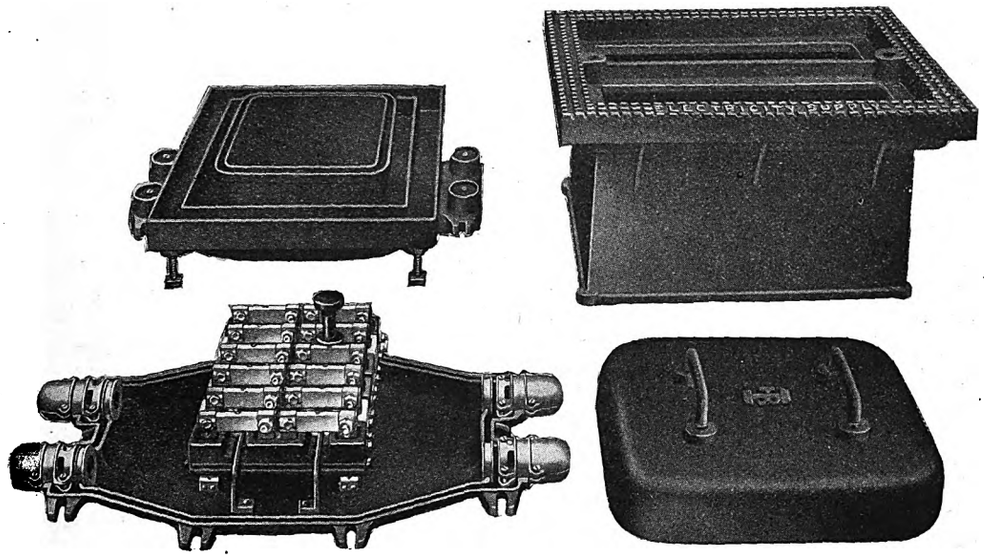

Fig. 8.—Combined Disconnecting Box and Pit.

His undertaking was very proud of its design of feeder pillar, but it had one bad feature, the ventilation hole at the top admitted dust. He also suggested that manufacturers might consider the inclusion in pillars of test shelves which would not vibrate when traffic passed.

The CHAIRMAN (Mr. A. H. Bennett) said that his undertaking was spending as much as £20 or £30 per week on occasions, owing to breakdowns due to the use of the cast-iron boxes. Subsequently the expensive cast-iron boxes were discarded, however, and lead sleeves employed, and so far as he knew there had not been a single failure with the lead sleeves. Breeches joints were adopted; the T joint occupied much more space, cost more money, and distinctly more time was required to make it.

Captain DUNSHEATH agreed that it was desirable to cheapen the various accessories by reducing the number of parts as far as possible, but that was not an alternative to improving the design; the two should go together. The application of cork dust to the inside of the bell was an excellent method of overcoming the accumulation of condensation. He was doubtful whether those other than manufacturers who made accessories for their own use knew what their costs were. He said that by organisation it should be possible to obviate the necessity for the jointer to wait until the navvy had dug the hole. If tails had to be painted once a year, the large undertakings of the future would have to employ armies of painters; it was better to aim at a sound engineering job which required very little maintenance. Discussing the reference to sheet-metal and cast-iron pillar covers, he said that the sheet-steel cover would provide the greater resistance to damage, and there was less likelihood of the lorry damaging the pillar at all. He agreed that a small filling hole in a box was useless; the point had been appreciated, and in most fittings large filling holes had been provided. The problem of installing test shelves in pillars depended, of course, upon space.

The National Physical Laboratory.

Abstract of the Annual Report of the Executive Committee for the Year 1928.

IN the annual report* on the work of the National Physical Laboratory during 1928 there is satisfactory evidence that the assistance the Laboratory can give to industry, by assuring high standards of quality and by solving manufacturing difficulties, has been more fully realised by the producers and users of British goods. In the further increase in the paid work of the Laboratory its general usefulness has been raised and a closer co-operation with industry secured. The total number of tests carried out during the year under review, excluding clinical thermometers (519,797), was 50,493, as compared with 43,130 for the previous year. The electricity department made 4,069 tests, an increase of 1,509 on the figure for 1927. The great increase in the electrical tests is largely accounted for by the tests carried out on reflectors in the photometry section, the figure being 1,026, as against 8 for the previous year. Time which it was hoped would be available for general research has been given to the test work and maintenance of standards, and although the cost of test work and special investigations for firms and outside bodies is defrayed by the interests concerned, additional staff with the necessary expert experience cannot at once be obtained. However, the work accomplished under the Laboratory programme, as well as under the programmes controlled by departmental boards and committees, has furnished results of high interest which are likely to be of great value in their industrial applications.

The scheme for the new physics building provides for the erection of the central block of the building, with accommodation sufficient for all the work of the physics department at present carried on in Bushy House, and the final plans for this central block have now been agreed upon, and the contract placed; its construction was begun in the new year. While not removing the difficulty of administering a department housed in a number of scattered buildings, this first instalment of the proposed physics building will enable the work of the heat division to be carried on under much improved conditions. Some of the space vacated in Bushy House will provide much needed accommodation for the electrical standards division.

The Air Ministry has received sanction for the construction of a compressed-air tunnel at the National Physical Laboratory, and the work has been commenced.

The erection of the million-volt transformers in the high-tension building was completed in June last, and preliminary runs were made on the occasion of the visit of the General Board on June 26th. At a later date the installation successfully passed the contract tests, which included a run of one hour at 10 per cent. overload. The completion of the remainder of the equipment proceeded during the autumn.

In the early part of 1928 an offer was conveyed to the Commonwealth of Australia Research Council by the Lord President of the Privy Council, on behalf of H.M. Government, to carry out without charge at the National Physical Laboratory the verification, over a period of five years, of the standards to be procured by the Commonwealth Research Council for use in Australia. Full information as to the standards likely to be required was sent to Australia in a report from the Laboratory. Assistance has also been given to Canada, India, and South Africa in connection with standards for specific purposes. Representatives of the Laboratory have taken part, during the year, in a number of important meetings and conferences directed to establishing or maintaining international uniformity and agreement in the standards of measurement employed for various purposes.

Dr. Kaye, superintendent of the physics department, attended the International Congress of Radiology, Stockholm, July 23rd to 27th, as the representative of the Laboratory; he also acted as one of the representatives of the British Institute of Radiology. Of the physical questions discussed two were of particular interest to the Laboratory, *viz.*, X-ray protection, and the adoption of an X-ray unit of intensity. The British X-ray and Radium Protection Committee submitted for international adoption proposals designed to unify protective measures in the different countries; these were unanimously agreed to, and the use of the measures which have been approved and recommended by the British Committee and the Laboratory has thus received international

* H.M. Stationery Office, price 9s. net.

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authority. Agreement was also reached on the question of establishing an international unit to serve as a basis for measurement of X-ray dosage.

A meeting of the Union Radio Scientifique Internationale was held at Brussels in September, and Dr. Dye attended on behalf of the British National Committee and of the Laboratory. Arrangements were made for international intercomparison of frequency measurements by means of series of special signals, and also by the circulation, as a frequency standard, of a self-contained piezo-electric quartz oscillator with temperature control. Simultaneous measurements are to be made by a number of national laboratories of the wave-length of signals transmitted from the naval experimental short-wave station at Arlington. In addition, comparative measurements, by various methods, of high-frequency current are proposed.

At the fifth International Congress of Refrigeration, held at Rome from April 9th to 15th, five papers by members of the Laboratory staff were presented.

Five papers were presented by members of the Laboratory staff at the plenary meeting of the International Commission on Illumination, held from September 22nd to 29th at Saranac Inn, New York. Dr. Walsh attended as general secretary, and was appointed hon. secretary for the succeeding three years. Mr. W. S. Stiles, a member of the staff of the photometry division of the Laboratory, will succeed him as general secretary of the Commission. On the subjects of daylight, coloured glasses for signals, and colorimetry, the British National Committee acted as international secretariat, and presented reports in each case, indicating the present state of the subject and the researches required for future progress. (ELECTRICAL REVIEW, September 21st, 1928, p. 473, and following issues).

In July, at a meeting of the Electrical Units and Standards Committee of the Laboratory, a memorandum was drawn up expressing the views of the Committee on a number of important questions regarding the electrical units, and the organisation and procedure desirable for securing international co-operation and agreement in the units and standards employed. This memorandum was presented to the Consultative Committee by Dr. Dye at its meeting in November, together with detailed technical information regarding the methods employed at Teddington, and intercomparison of standards effected with other national laboratories. It was agreed that the absolute C.G.S. units might with advantage be substituted for the international units for all scientific and industrial measurements, and that their adoption be recommended to the Comité International des Poids et Mesures. It was also agreed that further researches were necessary to fix the ratio of the international units to the absolute units with sufficient precision. These resolutions were in the main in agreement with the views expressed by the Electrical Units and Standards Committee. The International Committee also recommended that the following functions be assigned to the Bureau International des Poids et Mesures in connection with the electrical units: (1) to serve as a central secretariat for the organisation of a systematic exchange of standards, and to undertake the synthesis of the results of the comparisons made by the national laboratories; (2) to provide a laboratory to which the material standards representing the results obtained in the different countries can be sent for precise comparison; and (3) to be a depository of reference and working standards, including standards of inductance and capacity, with the necessary equipment for the comparison of other stands with those of the Bureau.

Under the auspices of the International Electrotechnical Commission, a meeting was held in Paris, in November, with a view to securing international agreement on a figure for the resistivity of high-grade commercial aluminium as now largely used in electrical conductors. The Laboratory has carried out much work on the resistivity of aluminium, and at the request of the British Committee Dr. Rayner attended in Paris to give assistance. The value 0.02873 ohm at 20 deg. C. was agreed for the resistance of a wire of hard-drawn aluminium of 99.5 per cent. purity, one metre in length and of a uniform section of 1 mm².

The Research Committee, under the chairmanship of Sir J. J. Thomson, continues to advise generally on the research programme of the Laboratory, and as to new researches proposed or which it is thought desirable the Laboratory should take up. It holds periodical meetings at the Laboratory, and inspects the work in progress. The Executive Committee has also the advice and assistance of a number of special committees in the control of the scientific work undertaken by the Laboratory under the headings of "General Research" and "Maintenance of Standards." An Advisory Committee for Metallurgical and Engineering Research on Materials was appointed in March, with Sir John Dewrance as chairman. At its first meeting in May they reviewed the programmes of research on materials in the metallurgy and engineering departments, and recommended a scheme of future research, which was adopted by the Executive Committee and is now being followed in the development of the work. In particular, they urged the importance of a redetermination, in the light of the greatly improved methods of present-day technique, of the iron-carbon equilibrium diagram, of which the first complete determination was made at the Laboratory by Carpenter and Keeling some twenty-four years ago. They suggested also the inclusion in the "general research" programme of the engineering department of an investigation into the stress-strain relations obtaining during rupture in an impact test, with the object of elucidating the many aspects of failure by impact that are at present obscure. Another investigation which the committee regarded as of special importance was the research into the behaviour of steels during solidification, with special reference to the liberation of gases.

A High-Tension Committee was appointed in October, 1926, to adivse the Executive Committee regarding the programme of research to be carried out with the million-volt installation then under construction. A provisional programme of research recommended by that committee has been approved, and work has been in progress, so far as circumstances have permitted, during the past two years. The work so far done has mainly consisted in the provision of special apparatus, and the study of methods of measurement that will be needed in the future researches.

A number of special visits have been arranged during the past year of bodies interested in the work of the Laboratory. In May some 80 electrical engineers attending an illumination design course organised by the Electric Lamp Manufacturers' Association of Great Britain were received. In June the Laboratory entertained 100 of the engineers attending the Centenary meetings of the Institution of Civil Engineers. In September, visitors to the Fuel Conference organised by the World Power Conference were received at the Laboratory, and in November some 150 members attending the meetings of the British Institute of Radiology were conducted over the physics departments by their president, Dr. Kaye, and other members of the Laboratory staff.

Good progress has been made in the physics department with a large number of important researches which have been continued over an extended period. The thermal and electrical conductivities of series of alloys of copper and aluminium, respectively, with a number of other metals, have been determined at temperatures from 50 deg. C. to 250 deg. C. The results are in general agreement with the law of Lorentz, according to which the product of the thermal conductivity and the electrical resistivity divided by the absolute temperature is a constant. Work has been begun with a view to measurements at higher temperatures, up to 900 deg. C.; the method will be comparative, pure iron being used as a standard. Interesting results have also been obtained in measurements of the thermal conductivity of solid and liquid sulphur, marked variations occurring at the melting point and at the physical-change points. Work has been commenced on the effect of a strong magnetic field on the thermal conductivity of a single crystal of bismuth. The results of the investigation into heat flow through insulating walls, as affected by certain modifications of shape, have been published. As usual, a number of determinations of the conductivity of heat-insulating materials have been made for firms. Preliminary experiments have been carried out during the year, with a view to the determination of the specific heats of gases at high temperatures and pressures. The Research Committee has recommended the continuation of these experiments during the coming year. Work on the heats of combustion of gases and the measurement of flame temperatures has been continued.

A very extensive programme of work has been carried out in relation to the international temperature scale, provisionally approved at the seventh "Conférence Générale des Poids et Mesures" in 1927. In this connection various improvements have been made in the high-frequency induction furnace constructed in 1927. Experiments have also been in progress with a view to providing suitable means of measuring the temperature of end bar wave-length standards to an accuracy of a few thousandths of a deg. C.

The radiology division has given important assistance to the engineering department in the investigation of the mechanism of the distortion of metallic crystals. The distortion of the three types of lattice when single crystal test-pieces of aluminium, iron and zinc were submitted to strain has been examined by X-ray spectrophotometric methods, and a number of interesting points were investigated in the course of the work. An interesting research has been completed on the relation between X-ray absorption and wave-length. On the basis of wave mechanics the absorption coefficient can be expressed in the form $a\lambda^n+b$, where a, b, n are constants for any element for values of λ between an adjacent pair of the K, I, N, &c., absorption edges; this form is found to be in excellent agreement with experiment. The absolute absorption in gold of homogeneous X-radiation was measured for some thirty wave-lengths between 0.6 and 2.0 Angstrom units, and corresponding measurements were made also for copper and platinum. In connection with the definition of X-ray intensity and dosage approved at the International Radiology Congress at Stockholm, a new ionisation chamber has been set up for standard measurements, and provisional determinations have been made of the pastille dose in "Röntgen" units. Experiments have also been made with a valve method of measuring ionisation currents. A constant high-voltage generator for X-ray work has been designed and constructed. Work for the departmental committee on the industrial applications of X-ray methods of crystal analysis has related to tungsten magnet steels, the effect of rolling on aluminium, materials for the manufacture of paints and varnishes, transformer steels and electrical insulating materials.

(To be concluded.)

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Good Radio Reproduction.

The anode-feed resistance system is claimed to be an important means of minimising the feed-back tendency of receivers, which causes distortion.

BRIEFLY, the system to be described consists in feeding the plate of each valve of a receiver through a resistance in order to drop the voltage to the required value, and of connecting the usual 2-mfd. by-pass condenser from the point at which the h.t. is fed to each component of the receiver to h.t. negative.

The circuit of the classical 3-valve receiver to which the anode-feed resistance system has been applied is shown in fig. 1: normally the h.t. from the battery would be taken direct to the points h.t.+1, h.t.+2 and l.s.+, from each of which points a 2-mfd. condenser is connected to h.t. negative. As the total h.t. available is generally required on the output valve v3, no resistance is connected in series with it, although

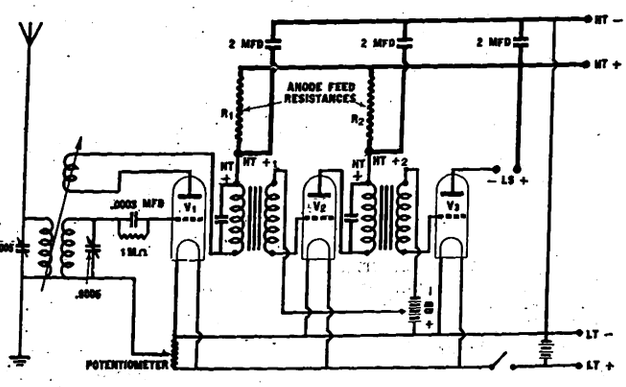


Fig. 1.—Anode-feed Receiver Circuit.

in certain cases it may be desirable if the voltage is higher than the output valve will stand. The voltage for each of the valves v1 and v2 is dropped by means of the resistances R1 and R2 to a suitable value, and in the general case when 120 volts is available R1 will require to be about 20,000 ohms and R2 about 15,000 ohms.

The calculation of the values of the resistances required is quite simple, provided that the characteristics of the valves employed are known. The anode-feed resistance required in any particular instance depends on the total h.t. available, the voltage required for the valve, and the plate current which the valve takes under working conditions. These figures can readily be obtained from the valve-makers' curves, and the resistance required is calculated from the voltage to be dropped divided by the plate current (expressed as a fraction of an ampere).

The object of incorporating the system in receivers will be understood from the following explanation: all sources of energy have appreciable internal resistance; the alternating impulses produced by the signal flow from the plate of each of the valves through the coupling components, and so to the h.t. negative, and in the absence of by-pass condensers the flow must occur through the source of h.t. supply. The output valve produces a very large pulsating current which, in flowing through the resistance of the h.t. supply, sets up an alternating voltage, the amount of the latter depending on the resistance of the h.t. supply and the strength of the signal delivered by the output valve, or valves, and it will be obvious that, as all the valves are connected to the one source of h.t., the alternating voltage must tend to feed back to the other stages and produce distortion. It will also be realised that if a receiver is provided with only one h.t. tapping, so that every valve has some voltage applied to it and is connected across the whole of the resistance of the battery, the maximum amount of back coupling results.

The first step towards overcoming this trouble is to provide an alternative path for the impulses, by using a separate h.t. tapping for each valve, or stage, and connecting a 2-mfd. condenser from the tapping (as near as possible to the component to which the h.t. is applied as can be) to the h.t. negative. The condensers offer an alternative path for the impulses to h.t. negative and reduce the tendency to back coupling to a large extent. The resistance, or impedance, of a condenser, however, varies with the frequency of the signal that it has to by-pass; for example, a 2-mfd. condenser has an impedance of about 900 ohms at 100 cycles and 1,800 ohms at 50 cycles, so that at those frequencies the condenser becomes relatively ineffective from a by-passing point of view, and to make it effective would mean an increase of capacity beyond that economically possible. The anode-feed resistance scheme, however, at a comparatively small cost, is claimed to overcome almost entirely the whole tendency of a receiver to back couple, and fig. 1 shows how the resistances are connected for the purpose. By connecting resistances in the manner indicated the resistance of the return path through the battery for each stage is made very high, usually not less than 20,000 ohms, so that the signal is literally forced to flow through the 2-mfd. by-pass condenser to h.t. negative, thus avoiding the source of h.t. supply. The same process is carried out with each stage, except the last, which is completely isolated from the other stages.

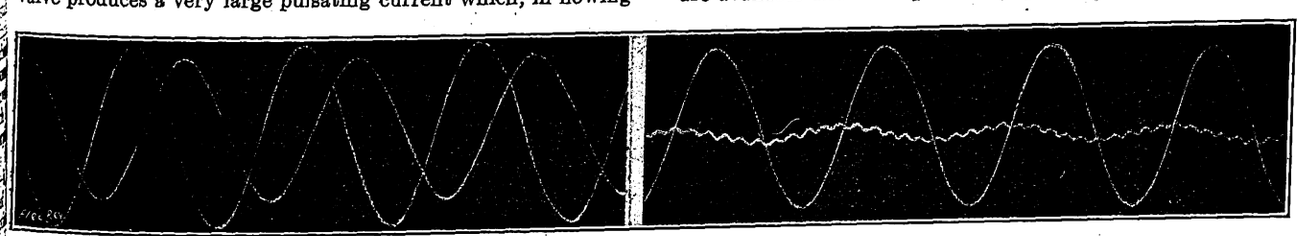
It is not essential to use resistances; in fact, a well designed audio-frequency choke having an inductance of the order of 50 henries under working conditions will be equally, if not more, satisfactory, but will not drop the voltage as is generally required, and will be considerably more expensive. However, the effectiveness of the system in preventing back coupling depends on the value of the various resistances being kept high with respect to the by-pass condensers, and, consequently, if the available voltage is low, say, of the order of 100, or less, it may not be permissible to drop much of the voltage in a resistance, and in such cases chokes should be used.

In the case of fig. 1 the input and output waves are identical: fig. 2 represents a receiver operating under ideal conditions, that is, with a separate anode battery for each valve; fig. 3 shows the same input wave applied to a receiver of which the anode battery has a high internal resistance, the wavy line representing the reduced output and the ripples indicating the high-pitched whistle caused by back coupling.

It should be clearly understood that this system is applicable to any receiver. As a rule the better the receiver the more desirable it is, since the tendency to back coupling is greatly increased with increase in amplification of the bass frequencies.

When applying the system to a screened-grid valve, or an anode-bend detector, two resistances should be connected in series and used in the form of a potentiometer. The screen of a screened-grid valve usually consumes about ½ milliampere, and if a series resistance is used for dropping the voltage to the figure required (usually about 80) its value tends to be inconveniently large, although a series resistance can be used if desired. An anode-bend detector, however, when using transformer coupling, for example, will usually have a normal impedance of not more than 15,000 ohms, and the h.t. and grid bias will have to be adjusted to the order of ¼ milliampere before any signal is received. If, now, 200 volts are available and we require to drop 100 volts, the value of the series resistance will have to be 400,000 ohms, which, apart from being somewhat costly, will prevent the detector functioning as it should, because any tendency of the h.t. current to increase with the signal will tend to be counteracted by the increased drop in voltage in the resistance. When the potentiometer anode-feed method is used in this case the total value of the resistance need not be more than 100,000 ohms, and rather less than half is actually in series with the valve. Further, by connecting the necessary 2-mfd. by-pass condenser from the point at which the h.t. is tapped off the valve, the voltage at that point can be made to remain steady by the reservoir action of the condenser.

The method of calculating the requisite resistances in the case of the potentiometer system is the following: assume



Figs. 2 and 3.—Oscillograms of Input and Output Signal Waves.

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that 200 volts are available, that 80 volts are required for the screen, and that we are going to use two fixed resistances in series across the source of h.t. supply. We can conveniently make the resistance which is connected at one end to the h.t. negative 50,000 ohms, and as the latter under working conditions has to have 80 volts across it, it will carry 1.6 milliamperes. The screen of the screened-grid valve usually takes about ½ milliampere, and therefore the resistance connected at the positive end has to carry 1.6 plus 0.5, namely 2.1 milliamperes. The resistance has therefore to drop the voltage from 200 to 80; that is, a drop of 120 volts when carrying 2.1 milliamperes. This value is therefore 120 divided by 0.0021= 57,000 ohms, and the resistances required will be, say, 60,000 and 50,000 ohms, respectively.

In the case of powerful amplifiers it is desirable to apply this system also to the grid-bias supply, and, in conclusion, it may be mentioned that the anode-feed resistance scheme, for the development of which Messrs. Ferranti, Ltd., have been largely responsible, has the incidental advantages of enabling a set to be constructed, if desired, with only two external h.t. terminals, and of preventing also the accidental destruction of the valves by an internal short circuit, a fault which can be particularly destructive in the case of screened-grid valves. Attempts are sometimes made to protect valves from destruction by connecting a fuse in the negative lead, but as the fuse must have appreciable resistance, it merely adds to the battery resistance and tends to increase back coupling, to the removal of which all efforts should be directed.

London's Electricity Supply.

Comments on some of the many problems which are being encountered and will have to be solved in the near future.

(Extracts from a lecture delivered before the LONDON TECHNICAL GROUP *of the* ELECTRICAL POWER ENGINEERS' ASSOCIATION.)

ELECTRICITY supply in London and the Home Counties was the subject of a lecture recently delivered before the London Local Technical Group of the Electrical Power Engineers' Association by Mr. F. W. Purse, who has served on many committees concerned with this matter, and has closely studied both its legal and technical aspects during recent years. His survey of the legislation affecting the industry, particularly in London, which had been passed since 1882, was prompted, not only on account of its historical interest, but also because he had found that many of those concerned had not a real appreciation of the obligations and duties which Parliament had thought fit to impose upon the industry from time to time. It served to emphasise the hindrances which had been due to Parliament rather than to the industry itself, although the industry was being criticised for the lack of progress which had resulted from the restrictions. He advised all to accept the 1926 Act in the best spirit and to do their best in the applcation of its provisions; the Central Electricity Board was functioning in an enthusiastic and conciliatory manner.

With regard to conditions in the industry generally, he suggested that in rural and sparsely-populated areas, at any rate, the house-to-house transformer system was likely to be adopted, or perhaps one transformer for every three houses, or something of that order. In some other places there would be at least one transformer in each street, and he urged the necessity for securing transformer and sub-station sites now and holding them until required, in view of the increasing difficulties of obtaining such sites. The 1926 Act had not interfered in respect of each local authority and company being allowed to retain its rights of distribution, but how long that state of affairs would obtain he would not like to say. He ventured to think the indications were that in, perhaps, 10 or 15 years' time there might be a move to combine in respect of distribution; possibly by that time there might be some standardisation of voltages.

Under the new scheme of generation controlled by the Central Board, it was idle for engineers to say that they could carry on just as well with their small stations; anyone who said that he could was denying his own faith. Quite a number of the smaller stations would in a few years drop out of existence so far as generation was concerned. Apart from the economy in coal and in generation costs generally, great economy would be effected, or it was supposed that it would be effected, by the reduction of the percentage of spare plant. He believed that at present between 50 and 60 per cent. of the plant was in the nature of spare plant, and it was hoped that that proportion would be reduced to 20 or 25 per cent. That would raise a very interesting problem, and when 20, 30 or 40 stations were running together in parallel it might be that, in order to get over "teething" troubles, at times of full load a group of half-a-dozen stations might have to be split off from the rest of the group, and a connection thrown in if there were unexpected trouble in any group; later on the number of stations would be reduced.

Generation would become highly specialised; it was becoming so already, and with the reduction of the number of stations one-time chief engineers and managers, as such, would lose their interest in it. Their successors might not have any interest, or any training, on the generation side, and distribution and sales men would come into their own. The problem of generation at high voltages was an important matter to be considered, and in connection with it also the problem of getting the load out of the stations. They might be limited unless they were given facilities for bringing the energy out of the stations on overhead lines at high voltages, which was a difficult matter in the London area.

The fact that the underground system for the "grid" in London was to operate at 66,000 volts would give rise to some very interesting problems. Every station connected to the "grid" would have to have very special protective gear; might have to have very elaborate reactances and controls, and might have to renew the whole of its switching. He gathered that meter makers had evolved some most interesting apparatus and instruments; there would have to be a new class of assistant (a meter-reading assistant) to take readings as they changed from hour to hour on each particular panel. Quite a big installation would be required in some stations for dealing with meter problems, he believed.

No doubt the time must arrive when electricity supply engineers would become "juice merchants," and the sooner they realised it and faced the new position the better for their peace of mind. They would then have to concentrate upon salesmanship and distribution. Uniformity of tariffs was very desirable, but the biggest of all problems was that of distribution. What was the use of struggling to reduce the cost of generation when one knew that that reduction could not be reflected in the price charged to consumers? Cost of services and standing charges to consumers must also be dealt with. The provision of more pre-payment meters was necessary, because electricity was being supplied to the grade of consumer who lived from hand to mouth, and could never save enough money to pay his accounts quarterly. Experience had shown that in certain classes of property more electricity was consumed if the consumers were provided with penny-in-the-slot meters than if they were provided with shilling-in-the-slot meters, because frequently they had not a shilling to put in.

Until recently he would have said there was no practical alternative for those undertakings at present distributing d.c. to changing over to a.c., but his views were changing as the result of the great improvements being effected in converting plant. Particularly, static rectifiers were very reliable; they did not require constant attention, could be shut up in their sub-stations like ordinary transformers, could be switched in by remote control, or time control, or automatically, according to the load. He ventured to think that in view of the high efficiency now obtainable at comparatively low cost many undertakers who were distributing d.c. would think twice before embarking upon a change over to a.c., particularly when they appreciated what the costs of changing over would be. It was difficult to see how electricity could be supplied more cheaply under such circumstances.

The acid test of the whole matter was whether the consumer was going to benefit. Benefit would be derived by proper regulation of the load between stations, and by a very carefully thought out rearrangement of the whole of their distribution. If the position were not pushed too far from a too highly academic point of view, there must be a substantial reduction in the cost of production which could be reflected in the charge to the consumers. It was possible, however, to push it too far. They need not look to the future in any spirit of pessimism. The future might not be entirely to their own liking, but they must take the line which presented the best opportunity.

Discussion.

The CHAIRMAN (Mr. J. R. Cowie) said that in view of the scarcity of sites suitable for large buildings on the river in London it was not impossible to conceive that some day sea-board stations, and stations on the banks of the large inland waterways, might be the main stations for feeding London.

Mr. GILBERT said the main object of the scheme by which generation was to be centralised in super-stations was to supply electricity at a cheaper rate, but whether the rate to the consumer would be lower as the result seemed to be very questionable. He gathered that each super-station was to take a base

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load, but he could hardly appreciate how a super-station of the size contemplated was going to have a base load the same at midnight as at mid-day, unless there was a very considerable number of other stations available to help in the distribution. With regard to the suggestion that within 10 or 15 years distribution might be taken over by some governing body, and that an endeavour would then be made to standardise distribution to one type and voltage, surely, if that were contemplated, the sooner it was done the better. If we were to wait 10 or 15 years and the demand increased as anticipated, it would be more difficult to convert the systems existing then than now. Finally, he urged the need for removing the existing restrictions and hindrances to the acquisition of sub-station sites.

Mr. WALLIS asked whether the London and Home Counties Joint Electricity Authority would take over the company undertakings in 1971 without further payment. If the sinking funds which had been arranged for were to pay for all the stations, and if those stations were supposed to be valueless in 1971, the companies might not spend further money on their undertakings during the last 20 years, or so, prior to 1971, but would simply allow them to become obsolete. How was that to be avoided?

Mr. WALTER J. JEFFERY pointed out that one of the disadvantages suffered by the London undertakings was that London was composed of three main types of area: the manufacturing, residential, and amusement areas, and each individual undertaking supplied practically an area of one of those types. There was no doubt that because those three types of area had never been worked together the price of electricity in certain areas had been much higher than it should have been. The standardising of distribution in London was at least as important as the standardising of generation. The maintenance of many different voltages and types of supply would be very disadvantageous as demand increased, and if one could buy from any store standard electrical apparatus which could be used on any supply system in London it would be all to the good and would certainly tend towards the cheapening of apparatus. In some parts of London two companies were supplying in the same area, and in one case three companies were supplying in the same street. In view of the crowding of London streets that was an anachronism, and should not be tolerated. The companies were tied down completely by recent Acts of Parliament, and there was no doubt that, by reason of the sinking funds which had been instituted, the assets of the companies would be handed over to the Joint Authority in 1971 without any charge being incurred by that body.

Mr. J. H. C. BROOKING emphasised the importance of an adequate study of distribution problems, and of the provision of more opportunities for their discussion.

Mr. BRETELLE pointed out in connection with the development of large stations that although, if costs could be reduced by very small percentage, one could not hand on that reduction immediately to the individual domestic consumer, one could effect a reduction in charges to large power consumers. The effect of that would be cumulative; one would be able to generate on a far better scale as the result of big supplies, and by developing the power load one would be able to reduce the cost to domestic consumers as well. It must be borne in mind that power consumers made a big contribution towards meeting standing charges.

Mr. W. J. OSWALD, referring to the development of the domestic load, indicated some of the problems met with by reference to his experience during the severe weather experienced in February of this year. In one particular week the output was 128 per cent. above that of the corresponding week of the previous year, and the top load was 84 per cent. above that of the corresponding week of the previous year. Abnormal weather could be responsible for very great differences in demand, and one-shift and two-shift stations would be called upon to meet unexpected demands.

Mr. HENWOOD, commenting on Mr. Purse's reference to the wonderful meters which were to be supplied by manufacturers, pointed out the great importance of accuracy, and said that an error of 1 per cent. on a set metering considerable quantities of power would nullify the extra efficiency obtained by the engineers in the power stations.

Mr. D. KINGSBURY said it seemed to him that a number of undertakings laid out many years ago with a view to supplying electricity purely for lighting purposes would have to spend at lot of money in order to provide sufficient copper to enable them to supply at a decent voltage. That was linked up with the problem of sub-station sites, and he could not help thinking that they would have to contemplate the use of underground sub-stations at comparatively frequent intervals.

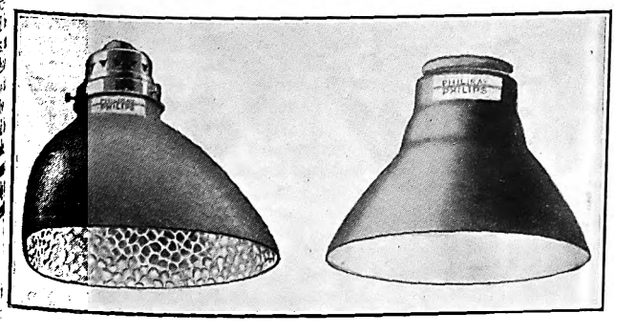
Mr. F. W. PURSE, replying to the discussion, said that when one realised that some of the large undertakings in the country was erecting large "windmills" and concrete cooling towers, one appreciated that seaboard sites were perhaps not all they were claimed to be. Sub-station sites could be purchased compulsorily, but the purchasers had to obtain a Special Order from the Commissioners and had to publish notices, and so on, and by the time the sites had been purchased one wished they had not done so. There were restrictions, of course, with regard to underground sub-stations; for instance, the maximum power supplied to any underground sub-station, or street box, must not, without the consent of the Commissioners, exceed 30 kW in the case of a sub-station or street box containing a single transformer, or 75 kW in the case of one containing two or more transformers. Again, sub-stations constructed below the surface of any street to which an extra-high-pressure was to be given must not contain switches or other apparatus than transformers. With regard to the purchase of the company undertakings in London, he said every company had to set aside a sinking fund according to a scale of depreciation, so that the assets would be liquidated within the time decided upon. In 1971 it would probably be found that new plant, machinery, &c., which had been installed during the last few years prior to that date had not been fully liquidated, and the balance would have to be paid. The company undertakings would be transferred to the Joint Authority practically debt-free. One of his criticisms of the 1926 Act had been that it had not provided for the standardisation of distribution, and that problem should have been tackled as fearlessly as that of standardisation of frequency had been.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Shop-window Reflectors.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2, have placed on the market a range of shop-window reflectors. Three patterns are made, namely, intensive



Figs. 1 and 2.—Intensive and Spotlight "Philiray" Reflectors.

(Type SA), extensive (Type SB), and spotlight (Type SC). The former is made in four sizes, suitable for lamps of 40-200 watts, whilst the SB and SC types are each made in two sizes, suitable for 100/200-watt lamps. These "Philiray" reflectors are made from crystal glass, highly polished on the inside, having numerous facets; each reflector receives two heavy coats of silver, protected by numerous applications of copper, electrically deposited by a new process, the exterior finish being made with two coats of aluminium. A close study of the reflector reveals that each facet reflects innumerable minute mirrors, thus ensuring the maximum possible reflection of light. A metal gallery is included, but for spotlights a special patent adjustable gallery can be supplied at extra cost. There is also available a swivelling gallery which enables the beam of light to be directed where desired. When used in conjunction with colour screens, very attractive lighting effects can be obtained.

The makers supply the colour screens and the necessary light filters. The screens consist of light-metal frames in which the colour filters (supplied in packets containing five assorted colours) rest. Figs. 1 and 2 show, respectively, types SA and SC reflectors.

New Flood-Lighting Units.

In a new series of "Holophane" flood-lighting units, fig. 3, Messrs. HOLOPHANE, LTD., Elverton Street, Vincent Square, S.W.1, have incorporated a novel feature in the employment of prismatic front lenses to further control the projected beam of light. These prismatic lenses, besides giving definite control and direction to the beams, enable the light rays to be split up and diffused in such a manner as to

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avoid the striation effect due to the image of the lamp filament.

The standard "Holophane" projectors are now made in three types—extensive for close-up projection, concentrating for more distant projection, and the rectangular-beam type for giving a beam with a rectangular spread. The three series of units employ different prismatic front lenses to obtain the requisite type of light distribution. In the extensive type of unit the front lens employs a series of concentric prism lenses which give spread to the beam; ordinary standard gas-filled lamps are used. The concentrating type has a front lens prism formation to give more concentration to the beam, as well as to break up the light rays, and the rectangular-beam type employs a lens with a vertical prism design which spreads the light in a direction at right angles to the line of the prisms. These three lenses are made of a heat-resistant glass which will stand the heat generated by such projectors. The projector housings are simple in design and made of heavy-gauge spun copper. The lampholder is fitted with a sliding tube lamp focusing device, to which is also fitted a screwed gland and horned cable outlet to protect the wiring from water. Side castings are fitted to the housing with a stirrup and swivel base, giving adjustment to the beam to any angle in both the horizontal and vertical planes. The extensive-type projector gives a strong, well diffused beam of light, having a divergence of approximately 40 deg.

The concentrating type gives a beam of 120 times the bare lamp candle power, with a divergence of 10 deg., while the rectangular type gives a concentrated rectangular beam 10×40 deg. In effect, a column or area of a length equal to four times the width can be illuminated with a single projector without undue spill of light.

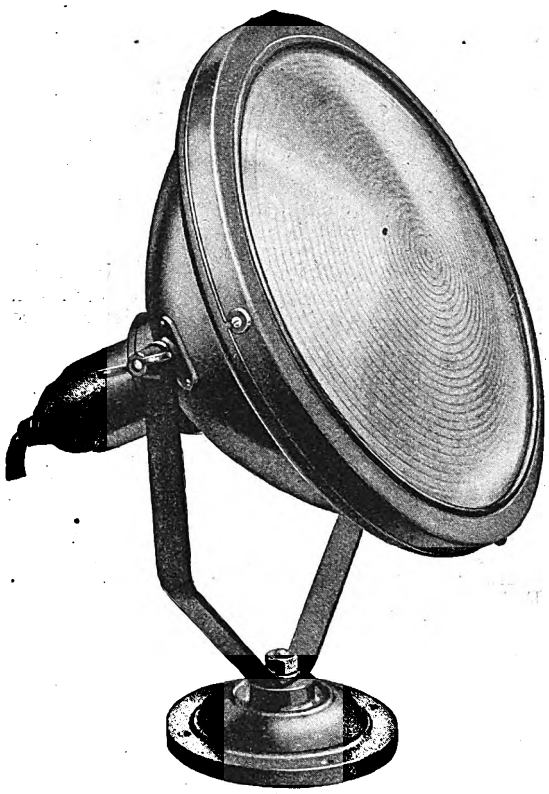

Fig. 3.—"Holophane" Floodlight Unit with Prismatic Lens.

A New Small Generating Set.

AUSTINLITE, LTD., 614, Australia House, Strand, W.C.2, and the NEW PELAPONE ENGINE CO., LTD., 45, Baker Street, W.1, have jointly developed a useful compromise, fig. 4, between the full-battery plant and the batteryless type by using an automatic generating set with a small full-voltage battery of the motor-car starter type. The function of the battery is to provide storage for emergency and to deal with loads of up to about six lamps. When the load gets greater, or when the battery is discharged to a pre-determined limit, the engine is automatically started and the lamps fed direct from the dynamo; at the same time the battery is recharged. When the load falls to about six lamps and when the battery is fully charged the engine is shut down. The dynamo and control gear are a modification of the standard "Austinlite" automatic generator. Briefly, the controller consists of a voltage relay which comes into operation when the battery voltage falls to 1.9 V per cell. This is used in conjunction with a maximum demand relay. Either of these relays have the effect of energising a contactor which motors the dynamo from the battery and starts the engine. When the battery voltage is restored to 2.7 V per cell, and when the load falls to below a pre-determined limit, the relays reverse the operation and shut the engine down by the usual magneto earthing switch. The generator is provided with two commutators, the first providing 112 volts for direct lighting and the second 28 volts used in series with the 110-volt side for charging the battery. The control gear is incorporated in the dynamo frame. The engine is a standard "Pelapone" of the heavy-duty, four-cycle, water-cooled type, with magneto ignition and automatic continuous lubrication. A patent carburettor is fitted which prevents any possibility of flooding or fuel leakage, and has a very ingenious device to ensure easy and positive starting. There is also an ingenious device on the controller for limiting the period during which the dynamo may be motored from the battery. If the engine fails to start through a shortage of fuel, or for any other reason, the battery is disconnected—after motoring for a pre-determined time—in order to avoid any wastage of current. A re-starting device is provided which can be instantly reset after the cause of stoppage has been located.

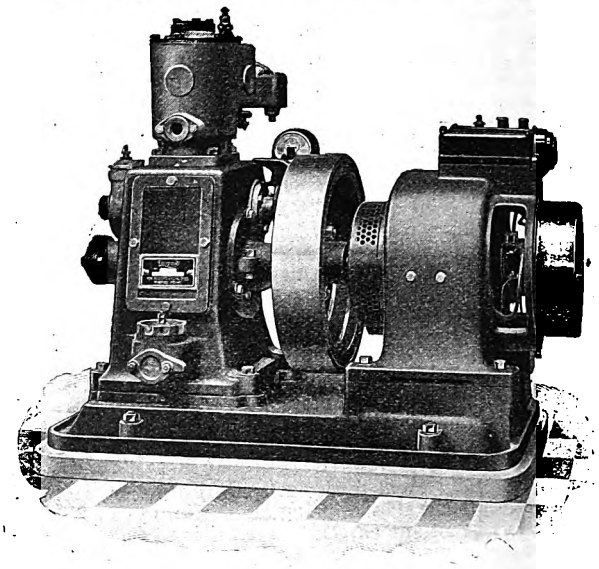

Fig. 4.—"Austinlite-Pelapone" Automatic Generating Set.

Legal.

The Marconi Company's Royalties Appeal.

MR. JUSTICE LUXMOORE, in the Chancery Division, on April 24th, again had before him the appeal of Marconi's Wireless Telegraph Co., Ltd., from the decision of the Comptroller-General of Patents in favour of the application of the Brownie Wireless Co. of Great Britain, Ltd., that the royalty per valve holder in wireless receiving sets should be reduced from 12s. 6d. to 10 per cent. on the wholesale selling price of the set, subject to a minimum charge of 5s. on the first valve holder and 2s. 6d. on each additional valve holder. The appeal had been adjourned to enable the Comptroller-General to make a definite order. An appeal involving the Loewe Radio Co., Ltd., stood over for a similar reason.

Sir DUNCAN KERLY, K.C., for the Marconi Company, said the two appeals had some common elements, but they would have to be dealt with separately. Dealing with the Brownie case, he said the Comptroller had completed the order, and had settled the licence. If the decision was upheld it was of so far-reaching a character that it might be fairly said that the position of patentees and patent monopolies in this country would be radically altered. His Lordship's decision would be a final settlement of the principles involved unless the legislature interfered with fresh legislation. The matter concerned two patents, dated 1913, of the Marconi Company, which owned some 13 patents which controlled practically all valve receiving sets. After broadcasting began in 1922 the Marconi Company began to license manufacturers of apparatus under a settled policy, which was now fundamentally attacked. Licences had been granted to 2,200 manufacturers. It was said that if the royalties were reduced the home constructor would be no longer tempted to infringe the patents, but would buy the manufactured sets on which royalties were paid, and the Comptroller's decision was based on this. The Brownie Company had made crystal sets which were not affected by the patents. Lately the company put on the market a two-valve amplifier which, used with a crystal set, was outside the patents, but if used with a valve set might infringe. Mr. Barber applied to the Marconi Company for a licence, and was told he could have the usual licence. He refused, and applied to the Comptroller for a compulsory licence, alleging that the Marconi royalties were too high. Though not a single licensee had come forward to say that the licence was unreasonable and trade could not be carried on at a profit, the Comptroller had come to the conclusion that

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the licence was unreasonable. His decision had altered the whole system of charging, and was based on erroneous propositions, one of which was that it was contrary to public policy to refuse to an applicant, who desired to make patented articles, a reasonable licence. The Marconi Company made the licensee pay 12s. 6d. on every valve holder, whether the apparatus was going to infringe the patents or not, and the Comptroller was apparently horrified at such a method of charging. He said: "No, you must only charge your royalty on articles which infringe the patent." If the Comptroller was going to be satisfied, and to find that the licence of the Marconi Company was unreasonable, it was essential that he should have before him the people who had been working under it, and must know whether they had been able to work under it with satisfaction or not. There was no evidence of that kind before the Comptroller. The hearing was adjourned, and upon its resumption, on April 25th, Sir DUNCAN KERLY, K.C., for the appellants, argued that the Comptroller-General had wholly rejected the business policy of the Marconi Company, and had forced on it an entirely new method. He had also forced an alteration of policy and trading on an enormous body of manufacturers and traders without having a single member of the trade before him, and without any examination of the existing system. The Marconi Company's policy was to insist on goods for this country being British made. It would be within its rights to grant licences to foreign manufacturers, and the evidence was that receiving sets in this country cost many times what they did in foreign countries. Suppose an English manufacturer was asked whether he considered 12s. 6d. too much to pay for protection from foreign competition. Could there be any doubt what the answer would be? The evidence was that the selling profit on existing sets was 50 per cent. of the retail price. The average price of a two-valve set was £5 4s. 6d., without valves. The royalty on two valves was £1 5s., and the distributors' profit was £2 12s. The Comptroller had found that there had been an abuse of monopoly rights by the Marconi Company, who were super monopolists. Counsel contended that there was no relevant evidence to support that conclusion, and that it was altogether contrary to law.

Mr. MORITZ, K.C., for the Brownie Company, said they disputed that the Marconi Company did not grant licences to foreign firms. Their case was that there were foreign corporations which the Marconi Company had licensed to bring apparatus into this country.

Evidence given at the inquiry before the Comptroller-General was read, and the hearing was again adjourned.

British Thomson-Houston Co., Ltd., Litigation.

IN the Chancery Division, before Mr. Justice Romer, on April 23rd, Mr. Trevor Watson, on behalf of the British Thomson-Houston Co., Ltd., moved for an injunction against the Unity Manufacturing Co., Liverpool, to restrain the infringement of the plaintiffs' patent relating to gasfilled electric lamps. Counsel said that the defendants were willing to treat the motion as the trial of the action, and to submit to the usual order for an injunction and delivery-up of the infringing articles.

Mr. Watson also moved in two similar cases by the same plaintiffs against the Zenith Electrical Supplies Co., Liverpool, and the Harwol Specialities Co., Liverpool. In each case the defendants consented to a similar order.

Counsel for the Harwol Co. said that the costs of the inquiry as to damages would be reserved.

Mr. Justice ROMER said that in each of the three cases there would be a consent order.

Fraudulent Consumption of Electricity.

T. W. BENETTO, of the "North Devon Radio Shop," was summoned recently at Ilfracombe by the Ilfracombe Electric Light & Power Co. for unlawfully abstracting electric current; he pleaded guilty. The company's solicitor stated that the meter inspector, on visiting defendant's premises, found that the apparatus had been tampered with, and energy evidently used without passing through the meter. Mr. Stewart, the manager of the company, was informed, and on visiting the premises found that electricity was being used in another room, defendant apparently requiring a fair amount for charging bat eries. The meter was then properly sealed, but a few days later the seal was found to have been broken again. Defendant told the magistrates that he was "quite open" about the second occurrence. It happened on the Thursday previous to Good Friday, when he did not want to disappoint a customer, and, finding the meter going up very fast, he thought it was faulty, and reconnected it. He went to the company's offices that night, but they were shut, and he was away on the three succeeding days.

The magistrates imposed a fine of £3, and ordered defendant to pay the advocate's fee.

Rating Appeal by the G.E.C.

THE General Electric Co., Ltd., appealed at the Coventry Quarter Sessions on April 26th against the assessment for rating purposes of its works at Stoke, Coventry, by the local assessment committee. The appeal was made on the grounds that the appellants were over-assessed, and that the assessment was unfair having regard to the assessments of comparable properties in the rating area. It was explained that the works were carried on for the manufacture of telephone apparatus, which entailed a considerable amount of female labour, and owing to the development of other industries it had become difficult to obtain the necessary amount of labour owing to the other industries being nearer the workers' homes, with the result that the company could not use the factory to its fullest extent, and had to re-open its Salford works. The company's ratable value was fixed in the draft list at £7,500, which was reduced upon objection to £6,000. The assessment of other works came out at 3.3d. per sq. ft. of covered area, and the appellants contended that 3d. per sq. ft. was a fair assessment for them in comparison with the other works which were much nearer the city. The company had spent £100,000 on a housing scheme for its employés, for which it could not get an economic return, and the result was a considerable expense.

For the respondents it was submitted that the arguments put forward could not be brought into account in arriving at the actual value of the hereditament.

After hearing the evidence of expert valuers on both sides the Recorder (Mr. J. F. EALES) dismissed the appeal, with costs.

Correspondence.

Correspondents should forward their communications* as early as possible. *No letter can be published unless we have the writer's name and address in our possession.

Proposed Technical Society for Meter Engineers.

With regard to Mr. H. F. Hudson's letter of April 19th, his criticism of the I.E.E. Meter Section's activities seems to me to be unjustified. During the past four months papers have been read and discussed before the Meter Section as follows:—

December 7th.—"Load-levelling Relays and their Application in Connection with Future Metering Problems," by W. Holmes, A.M.I.E.E.

January 4th.—"Precautions in the Use of Standard Instruments," by W. H. Lawes, B.Sc., A.M.I.E.E.

February 1st.—"Recent Developments in Electricity Meters, with Particular Reference to those for Special Purposes," by J. L. Carr, B.Sc., A.M.I.E.E.

March 1st.—"The Rotor Bearings of Electricity Meters," by W. Lawson, M.I.E.E.

Now Mr. H. F. Hudson's statement on "a review of the I.E.E. papers of the past four months" may be read as including all the I.E.E. papers, or only the Meter Section papers, but as he writes from a meter engineer's point of view, I assume he refers to the latter; in that case I am of the opinion that the above-mentioned papers are fully meeting the requirements of the majority of meter engineers. For instance, every meter engineer will appreciate the value of the paper on rotor bearings and how largely the correct functioning of an electricity meter depends on that small, but important, part. I may say that from this particular paper and the discussion on it I have obtained information that the careful examination of other meter literature has failed to reveal. Again, the paper by Mr. W. H. Lawes discusses precautions of primary importance to meter engineers. With regard to the difficulty of attending the meetings, this has been overcome to a certain extent, as in the case of Mr. J. L. Carr his paper was read at the Leeds, Liverpool, Manchester, Newcastle-on-Tyne, and London centres.

In discussing this matter with other meter engineers I find their opinions to be the same, namely, that the best interests of meter engineers are being served by the Meter Section of the I.E.E.

S. Garbutt,
Graduate I.E.E.

Altrincham, *April 23rd*, 1929.

Registered Electrical Contractors.

The writer was extremely interested in reading the annual report of the above Registration Board. Its advertisement also is most interesting. What the public, however, would like to know is who, amongst them all, is capable of doing an installation without the supervision of a recognised electrical consulting engineer. It apparently puzzles the Executive of this Board why South Shields should ignore such an august body; the answer is probably that South Shields Electricity Department are not blinded, perhaps hoodwinked, by the twaddle emanating from the above body. In their long experience it is most probable that they have come across one or two reputable contractors who are outside of both the E.C.A. and the N.R.E.I.C., and that they are determined to assist firms whose conscience does not allow them to subscribe to rules and regulations, then

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turn round and break them the following day, all for the sake of price-cutting. Personally, I have had the greatest pleasure in gutting jobs which originally were done by members of this Association—firms of long standing—and from the evidence gathered one can only conclude that they are trading on the good names made for them by first-class workmen employed before the war.

Instance 1.—A 415-V, 50-cycle, 3-phase, 200-h.p. motor earthed by 7/.036 insulated copper cable, and this in a factory. The firm was an old-established one.

Instance 2.—Heating plugs by the score with no switch controlling them.

Instance 3.—Four 7/.036 cables enclosed in ⅝-in. s.w. tubing which it was impossible to withdraw after a period of three years.

The Corporation rules for this particular district are that not more than two 7/.036 cables may be inserted in one ¾-in. tube. Is it possible for any electrical firm which does first-class work to compete with such scandalous methods? Yet this body shouts from the house-tops, "Place your installation work, &c." I trust that the public, to safeguard themselves, will be educated to secure the services of a consultant. Then, and then only, will the contracting business be cleaned up.

K. W. Cairney.

Troon, *April 24th*, 1929.

[With the letter our correspondent sends a section of the conduit referred to in his "Instance 3." The four cables are jammed in so tightly that it is impossible to move them. It is evident that they were bunched and pulled in all together, which must have been a pretty difficult job. While agreeing that this is a horrible example, we cannot let our correspondent's views pass unchallenged. These views are, no doubt, a fair example of the opinions of many contractors who are not members of the E.C.A. or upon the Register. Both the Association and the Register, being human institutions, are bound to include some who do not act up to the ideals for which these institutions stand. Nevertheless, it must not be assumed from this that all associated or registered contractors are thoroughly untrustworthy, nor that all contractors outside the pale are paragons of virtue. There is no doubt that, generally speaking, the public is well-advised to give its work to registered contractors; in this there is at least some guarantee even if confidence is occasionally misplaced. We are convinced that the Executive of the Register is doing its best to maintain a high standard in installation work, and no doubt it will be grateful to receive fully-substantiated information of delinquencies on the part of individuals or firms whose names are on the Register. The disciplinary action which has been taken in a number of cases, and the set of "rules" which were put before the annual meeting of the Board, are evidence of its determination to keep the Register clean.—Eds. Elec. Rev.]

The British Industries Fair.

The Advisory Committee for the Electrical Section of the British Industries Fair, at its meeting on Tuesday, the 23rd inst., had under consideration the important question as to what period of the year was most suitable for holding the Fair in future, having regard to all interests concerned.

The Committee had before it representations from various quarters that February was not a suitable date for the Fair. It was pointed out that when this question was under the consideration of the Committee last year a referendum of exhibitors was taken, the result being as follows:—

The number of exhibitors to whom the questionnaire was sent was 122.

Those who favoured the present period of the year, *i.e.*, February-March, numbered	41
Those who favoured the beginning of May numbered	37
Those who indicated that they were entirely neutral numbered	5
Those who put forward other dates as more acceptable numbered	7
Those who did not reply, and are apparently indifferent, numbered	32
Total	122

In view of the inconclusive character of the referendum no further action was taken last year.

The main consideration would appear to be to determine what part of the year overseas buyers are in this country in largest numbers, and from information obtained from the shipping companies, it would appear that the months of May and June are most favoured. It was pointed out, however, that the views of the majority of exhibitors, actual and potential, in all the classes of industry affected should prevail. It was further pointed out that, having regard to the arrangements already made and the fact that 40 per cent. of the 1929 exhibitors have booked up their space for the 1930 Fair already, no change of date could be made so far as the 1930 Fair is concerned. After reviewing the matter from all angles it was resolved unanimously:

(*a*) That representations be made to the Fair Management Committee (Birmingham) that this Committee is of opinion that the month of May is a more suitable date for holding the Fair than February; that it has received representations from various quarters to this effect, and that it is of opinion that the Department of Overseas Trade and the Fair Management Committee (Birmingham) should hold an impartial inquiry to consider the important question of whether the present date is the most suitable one, more particularly from the point of view of attracting the maximum number of potential overseas buyers.

(*b*) That the Fair Management Committee (Birmingham) be invited to take a referendum of the whole of the exhibitors at the Birmingham section of the 1929 Fair to ascertain their views on this important question.

The Advisory Committee also decided to make representations to the Fair Management Committee on the following matters:—

(*a*) The more complete grouping of trades within the defined schedules.

(*b*) Improved facilities for reaching the Fair from Birmingham—a better 'bus service being required.

(*c*) Improved parking arrangements.

(*d*) The transfer of the Conference Hall to a more suitable position, in order to secure freedom from noise, &c.

The Committee was gratified to learn that E.D.A. intended to take a much bigger part in the Fair next year, and that a substantial sum of money had been voted for this purpose.

E. J. Jennings,
Hon. Secretary, Electrical Section.

Birmingham, *April 26th*, 1929.

Telephone Development.

Why not suggest modified charges as a remedy? A £10 flat-rate service in 1911 now costs £30, in pennies!

Without inside information, I predict that cessations through commercial decay explain the smallness of the Manchester figure.

L. E. Wilson.

Manchester, *April 27th*, 1929.

Your editorial this week gives some rather startling figures, a conclusive argument against "Nationalisation," and after nearly 20 years we can still hear some people praising the old Telephone Company. Perhaps they are right, because, if there is a top dog to watch the public interest, it is quite a different matter from when that top dog runs the show himself, and has no one to call him to order.

I venture to suggest that the old National Telephone Co. would have made handsome profits in hiring out telephone instruments at 2s. 6d. per week, and then making an extra charge for touching them.

The whole system is so unbusinesslike, the accounts department delving into unnecessary details and worrying subscribers with them, the costly system of registering calls, &c. To bring this most useful luxury within the reach of the great majority of the middle classes, at least—and the working classes also have every right to be considered—some scheme should be possible whereby an agreement to pay a charge based on 10 per cent. of the assessment rate of the house, or business premises, would cover the cost of the instrument and fixing and unlimited calls. After all, this little island is really only local, and the word "trunk" redundant.

At present it is too expensive, as a luxury, and will not become a necessity until the majority of the nation can afford it, and it is the duty of a Government department to consider it in this light rather than to expend its ingenuity in devising methods whereby the largest number of staff can be employed at the expense of the subscriber.

R. B. Askquith Ellis.

Birmingham, *April 27th*, 1929.

The Compulsory Earthing of Prepayment Meters.

The tremendous increase in the number of prepayment meters in use throughout the country has led to discussion in many quarters as to the advisability of efficiently earthing the cases of this type of meter in the interests of public safety.

This is a matter which has been brought up on quite a number of occasions in recent years, but it is still left for each supply authority to decide as to the procedure to adopt on its particular distribution system.

The frequent handling of the prepayment meter by the consumer for the purpose of inserting coins is of vital importance, and it seems to be remarkable that, while ordinary domestic apparatus has received so much attention latterly in the matter of efficient earthing of exposed metal parts, the question of earthing prepayment meter cases is only brought up on occasions.

There are, of course, a number of electricity undertakings in this country which do carry out the practice, and from information at hand I believe it is general practice in the United States; at any rate there must be thousands of prepayment meters already on circuit and being installed at present in this country without attention being given to earthing the cases.

The workmanship, quality of materials, and tests prior to

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delivery of meters of British manufacture are usually of high standard, but it will be generally appreciated that the location of the meter on circuit has a great bearing on the condition of the insulating material after a period of service.

In my own Department, prepayment meters, as well as ordinary meters, are subjected to a "flash" test at 2,000 volts, alternating, between electrical circuits and case prior to installation, and, while this is an excellent test, there is still the problem of insulation depreciation in bad situations to be considered.

The danger to the consumer resultant from a bad insulation fault on an unearthed meter is obvious, and I think that the earthing of prepayment meter cases should be made compulsory.

It would be interesting to have the opinions of others on the matter, and I would also suggest that manufacturers should collaborate by supplying an earth terminal on the covers of all their prepayment meters.

H. F. Hudson,
Graduate I.E.E.

Electricity Works,
Hylton Road, Worcester,
April 27th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

25,549. "Electric distant recording system and apparatus therefor, applicable for use in connection with various phenomena." S. J. Harley. September 28th, 1927. (Cognate application, 20,685/28.) (309,049.)

26,007. "Thermionic amplifier circuits." B. Bleasdale, P. V. Johnston, and W. E. Denison. October 3rd, 1927. (Cognate application, 1,447/28.) (309,052.)

26,356. "Electric heating." F. A. L. Billerey. October 5th, 1927. (309,093.)

32,254. "Regulating devices for prime movers." International General Electric Co., Inc. November 30th, 1926. (281,668.)

32,321. "Apparatus for use in the electrolytic deposition of metal on meta. tubes." J. Stone & Co., Ltd., F. J. Pike, and C. J. Lyth. November 30th, 1927. (309,056.)

32,597. "Sound reproducing." S. K. Wilson and De Forest Phonofilms, Ltd. December 2nd, 1927. (309,208.)

32,640. "Junction box for electric cables." J. Birch & Sons and G. E. Taylor. December 3rd, 1927. (309,059.)

32,855. "Voltage-controlling means in systems for supplying electric consuming devices." Graham Amplion, Ltd., and P. K. Turner. December 5th 1927. (309,209.)

33,658. "Cooling systems of enclosed electric motors and other dynamo-electric machines." Enclosed Motor Co., Ltd., and P. A. H. Mossay. October 15th, 1928. (309,232.)

34,872. "Electromagnetic relays for use in telephone systems." C. H. V. Pate. December 23rd, 1927. (309,096.)

35,091. "Loud-speakers and the like." T. McClelland. December 28th, 1927. (309,214.)

35,123. "Electrical rectifying devices." Telefonaktiebolaget L. M. Ericsson. January 4th, 1927. (283,134.)

35,392. "Indicating devices, particularly for use in telephone systems." Automatic Telephone Manufacturing Co., Ltd., J. E. Ostline, and C. H. Evans. December 30th, 1927. (308,960.)

35,455. "Apparatus for rectifying alternating electric currents." Westinghouse Brake & Saxby Signal Co., Ltd. May 5th, 1927. (289,866.)

35,456. "Remote-control arrangements for alternating-current circuits comprising metal-sheathed cables." Westinghouse Brake & Saxby Signal Co., Ltd. May 11th, 1927. (290,238.)

1928.

25. "Arrangement for controlling an operation depending upon whether a device is in motion or stationary." Associated Telephone & Telegraph Co. February 21st, 1927. (285,804.)

165. "Magnetostrictive vibrator." G. W. Pierce. January 3rd, 1928. (Convention date not granted.) (283,116.)

171. "Electric condensers." W. J. Davis. January 3rd, 1928. (309,015.)

186. "Radio receiving systems." British Thomson-Houston Co., Ltd. January 3rd, 1927. (283,121.)

189. "Bushings for use with electrical apparatus." British Thomson-Houston Co., Ltd., and J. G. Wellings. January 3rd, 1928. (309,109.)

230. "Secret electric signalling systems." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). January 3rd, 1928. (309,063.)

264. "Electric switchgear." A. Reyrolle & Co., Ltd., W. J. Cook, and D. Kingsbury. January 4th, 1928. (309,064.)

316. "Devices for damping vibrations in acoustic apparatus. Electric Research Products, Inc. May 14th, 1927. (290,558.)

317. "Electron-discharge devices with high-emission cathodes." Dr. S. Loewe. January 6th, 1927. (283,176.)

382. "Measuring or protecting apparatus for electric circuits." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz. January 7th, 1927. (283,215.)

479. "Ignition devices for internal-combustion engines." British Thomson-Houston Co., Ltd., L. Griffiths, and C. J. Morton. January 6th, 1928. (309,220.)

487. "Electric switches." General Electric Co., Ltd., H. W. B. Gardiner, and M. S. H. Hunt. January 6th, 1928. (309,221.)

495. "Electromagnetic devices for recording sound and reproducing sound from records." Electrical Research Products, Inc. May 13th, 1927. (290,264.)

496. "Electromagnetic devices for recording sound and reproducing sound from records." Electrical Research Products, Inc. July 14th, 1927. (Addition to 290,264.) (293,847.)

497. "Electromagnetic device for reproducing sound waves." Electrical Research Products, Inc. May 14th, 1927. (290,559.)

514. "Acoustic devices." S. K. D. M Van Lier. January 6th, 1928. (309,223.)

579. "Manufacture of photo-electric cells." General Electric Co., Ltd., and N. R. Campbell. January 7th, 1928 (Addition to 306,996.) (309,224.)

600. "Telephone systems." Associated Telephone & Telegraph Co. January 17th, 1927. (283,853.)

602. "Acoustic devices." H. J. Round. January 7th, 1928. (309,226.)

966. "Signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). January 11th, 1928. (309,233.)

976. "Automatic switch devices for electric train-lighting and similar installations." J. Stone & Co., Ltd., and A. E. Honey. January 11th, 1928. (309,234.)

1,015. "Telephone systems." Associated Telephone & Telegraph Co. March 17th, 1927. (287,153.)

1,016. "Television systems." Electrical Research Products, Inc. April 6th, 1927. (288,234.)

1,305. "Electric lamp-locking device." H. Rhodes. January 14th, 1928. (309,240.)

1,392. "Electric discharge devices." A. A. J. Crowne. January 16th, 1928. (309,241.)

1,936. "Time-recording apparatus." Siemens & Halske Akt. Ges. March 24th, 1927. (Addition to 282,089.) (287,543.)

5,386. "Means for damping mechanical vibratory devices, such as piezo-electric crystals." Gramophone Co., Ltd., A. Whitaker, W. F. Tedham, and C. O. Browne. February 20th, 1928. (309,276.)

7,224. "Clip connections for electric conductors." L. H. Reid. March 8th, 1928. (309,284.)

7,888. "Radio apparatus." Igranic Electric Co., Ltd., and A. D. Hodgson. March 14th, 1928. (309,286.)

8,648. "Electric motor control systems." W. T. Gray, S. Griffiths, and Associated Electrical Industries, Ltd. March 21st, 1928. (309,290.)

9,115. "Circuit arrangement for the control of clocks over the lines of a telephone installation." Siemens & Halske Akt. Ges. May 31st, 1927. (291,371.)

9,276. "Dynamo-electric machines." M-L Magneto Syndicate, Ltd., and E. A. Watson. March 27th, 1928. (309,294.)

9,391. "Sound-reproducing or transmitting instruments." S. G. Brown, Ltd., and A. M. H. R. Brown. March 28th, 1928. (309,295.)

9,929. "Joints for electric cables." Pirelli-General Cable Works, Ltd., and R. E. Horley. April 2nd, 1928. (309,303.)

10,141. "Electric miners' lamps and the like." H. Leitner. April 4th, 1928. (309,305.)

13,698. "Electromagnetic sound-recording devices." Electrical Research Products, Inc. May 13th, 1927. (Divided application on 290,264.) (290,290.)

14,270. "Means for equalising the electrostatic stresses in armoured cables." International General Electric Co., Inc. May 21st, 1927. (290,977.)

14,298. "Prepayment electricity meters." Soc. Genevoise d'Instruments de Physique. April 28th, 1928. (309,329.)

14,299. "Prepayment electricity meters." Soc. Genevoise d'Instruments de Physique. April 28th, 1928. (309,330.)

16,450. "Induction measuring instruments." Landis & Gyr Soc. Anon. May 16th, 1928. (309,338.)

17,727. "Arrangement of core segments in the casings of dynamo-electric machines, rotary transformers, and the like." Siemens-Schuckertwerke Akt. Ges. June 29th, 1927. (292,999.)

21,085. "Telephone systems." Associated Telephone & Telegraph Co. March 17th, 1927. (Divided application on 287,153.) (294,217.)

21,208. "Automatic circuit breakers for fire-alarm systems." Telefonaktiebolaget, L. M. Ericsson, and O. I. H. Ekman. July 21st, 1928. (309,358.)

33,618. "Chamber furnaces." International General Electric Co., Inc. November 19th, 1927. (300,905.)

34,724. "Electric heating elements." A. J. Rhodes. November 26th, 1928. (309,376.)

36,543. "Television and like systems." Electrical Research Products, Inc. April 6th, 1927 (Divided application on 288,234.) (302,239.)

1929.

810. "Ignition devices for internal-combustion engines." British Thomson-Houston Co., Ltd., and C. J. Morton. January 6th, 1928. (Divided application on 309,220.) (309,230.)

6,148. "Alternating-current induction motors." Dr. B. Schwarz. November 29th, 1926. (Divided application on 281,344.) (306,840.)

6,149. "Alternating-current commutator motors." Dr. B. Schwarz. November 29th, 1926. (Divided application on 281,344.) (306,841.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 24th:—

Glovers Cables. No. 497,090. Class 8. Electric cables.—W. T. Glover and Co., Ltd., Trafford Park, Manchester.

Lyfa (lettering and design). No. 500,263. Class 15. Glass shades and reflectors for use in electric lighting.—Aktieselskab Kjobenhavns Lampe og Lysekrone Fabriek, Copenhagen. (British representatives: Boult, Wade and Tennant, 112, Hatton Garden, E.C.1.).

Aladdin. No. 499,500. Class 16. Shades, containers and stands for electric lamps, all made of porcelain or earthenware.—Aladdin Industries, Ltd., 118, Southwark Street, S.E 1.

The Embankment Lighting.

Owing to the fact that there would seem to be a wrong impression with regard to the retention of the historic Dolphin lighting standards on the Victoria Embankment, the General Electric Co., Ltd., announces that in the new scheme of illumination which is being carried out the Dolphin standards along the parapet are definitely to remain, and will still function as they have done since the Embankment was opened in 1870. The fact that workmen have been busily engaged in carrying out certain necessary reconstructional wiring details incidental to relamping these units is probably responsible for the wrong impression. There is also some slight misconception concerning the new system of twin overhead suspended lighting along the roadway, which is to be done at each span by means of two 1,500-watt lamps, housed in Wembley lanterns suspended 30 ft. over the roadway. In all there are to be 50 spans, spaced at intervals of 140 ft., each span carrying two lamps. The existing standards alongside the kerb-edge of the Embankment are being removed with a view to their ornamental bases being respaced and augmented to accommodate the new steel suspension poles, which will be mounted in such of the existing bases as are at present fixed along the Embankment, and which, bearing the small Dolphin design and the old coat of arms, will be retained to accommodate the new poles. As, however, there will not be enough of the old bases, new ones are being supplied of similar design, but embodying the new L.C.C. coat of arms in place of that on the old type.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ANDOVER.—School, for Hants. E.C.; director of education, Winchester.

BEXHILL.—Church for St. Peter's, Glassenbury Drive; J. B. Mendham.

BILLINGHAM.—Business stores, for Stockton-on-Tees Co-operative Society; secretary.

BRIGHTON.—Adaptation of Royal York Hotel for municipal offices; Corporation Improvements Committee.

BROMLEY (KENT).—Housing scheme (81), for the R.D.C.; building surveyor, Orpington (returnable deposit of £2 2s.).

BROMSGROVE.—Housing scheme (50) (deposit £2 2s.); R. Thompson, architect, Catshill.

BURNLEY.—School; director of education.

CANE HILL.—Telephone exchange; H.M. Office of Works.

CASTLE-DOUGLAS.—Housing scheme (32), for the T.C.; David Flett, architect, 22, King Street.

CHANDLER'S FORD (HANTS.).—Congregational church (£3,500); Rev. D. Lloyd Jones.

CHARD.—Infirmary block, with nurses' quarters; Lymes and Madge, architects (returnable deposit £2 2s.).

CHATHAM.—Extensions, Glencoe Road schools, for the borough E.C.; R. L. Honey, architect, Town Hall (returnable deposit of £3 3s.).

CHELMSFORD.—Extensions, factory, Goldway Gardens; Mercury Press.

CHORLEY.—38 houses, Harrison Road; borough engineer.

CRAYFORD.—Two central schools, for Kent E.C.; W. H. Robinson, architect, Springfield, Maidstone (returnable deposit of £2 2s.).

CROYDON.—57 houses, Mount Park and Kingsdown Avenue; Morgan, Baines & Clark. Factory and offices, Stafford Road; Harper Automatic Machine Co., Ltd.

DERBY.—Municipal buildings; borough surveyor.

EASTLEIGH.—School, Fair Oak (£8,100), for Hants. E.C.; director of education, Winchester.

FELTHAM.—52 houses, Manor estate; Messrs. W. J. Drinkwater.

GLASGOW.—32 bungalows at Cathcart; McTaggart and Mickel, builders, 65, Bath Street.

GLENGALL (AYR).—Re-erection of mental hospital, electrically equipped, for Ayrshire C.C.; clerk, Ayr (£20,000).

GRIMSBY.—Extensions to Scartho Hospital, for Corporation (£26,845); borough engineer.

HERNE BAY.—Development, Burton Downs estate, for Herne Bay Estates, Ltd.; R. Messenger.

HOUGHTON-LE-SPRING.—Theatre, with electrical and heating work; Percy L. Browne & Son, architects, Pearl Buildings, Newcastle-on-Tyne.

HOVE.—Refuse destructor (£9,771), for the T.C.; borough engineer.

IRISH FREE STATE (CORK).—Houses (30), Friar's Walk, for Irish Sailors' and Soldiers' Land Trust; W. J. Brown, architect, 7, Dawson Street.

(DUBLIN).—New wing, Catholic University School, Lower Leeson Street (deposit £3 3s.); Ashton & Coleman, architects.

KELSALL.—Elementary school (£12,300); Cheshire Education Committee.

KENDAL.—Laundry, for the Lakeland Laundries, Ltd., Hindpool Road, Barrow-in-Furness; W. G. Millican and A. Pickles, directors.

KETTERING.—Municipal offices and council chamber, for the U.D.C.; surveyor.

KINGSLEY.—Elementary school (£11,250); Cheshire Education Committee.

KIRK SANDALL (DONCASTER).—Church, Congregational Trustees; T. H. Johnson, architect, Doncaster.

LANCASHIRE.—Railway colliery and canal bridges on Liverpool-East Lancs. new road; M. Dobell Mott, resident engineer.

LANGPORT.—Housing scheme (38), for the R.D.C.; W. H. C. Waters, architect, 40, Hendford Hill, Yeovil.

LONDON (CHINGFORD, E.).—Telephone exchange, for H.M. Office of Works, King Charles Street, S.W. (returnable deposit of £1 1s.).

(HACKNEY, E.).—40 flats, Kenninghall Road; borough engineer.

(ILFORD, E.).—Stores, flats and offices, Eastern Avenue; K. W. Hammond. Workshops, Metropolitan Cable Works, Grove Road; F. Smith. 32 houses, Eton Road; R. Nash.

(POPLAR, E.).—Nurses' Home, St. Andrew's Hospital, Devons Road; Harley Heckford.

(HORNSEY, N.).—New town hall; Special Committee.

(BERMONDSEY, S.E.).—Extensions, Guy's Hospital; Governors.

(CATFORD, S.E.).—Church, Downham housing estate (£10,000), for the Wesleyan trustees; Rev. W. H. Phipps, secretary.

(ELTHAM, S.E.).—72 houses, Avery Hill estate; J. E. Davies, Ltd.

(LEWISHAM, S.E.).—Factory, Silk Mills, Conington Road; P. A. Coad.

(BATTERSEA, S.W.).—Extensions, Maternity Hospital (£3,736); borough engineer.

(WESTMINSTER, S.W.).—160 tenements, Ebury Bridge (£106,000); Gee, Walker & Slater, Ltd. Offices and shops, Bond Street; E. A. Stone. 35 flats, Vincent Street (£42,403); Humphreys, Ltd.

(ST. MARYLEBONE, W.).—Second section nurses' home, Middlesex Hospital, Ogle Street; Board of Governors. Buildings for B.B.C., Portland Place and Langham Street; Wal Myer & Watson Hart.

(STRAND, W.C.).—Extensions, Savoy Hotel; Savoy Hotel, Ltd. Internal reconstruction, Savoy Theatre; Theatre Co.

MARGATE.—Pavilion, Cliftonville (£20,000), for the T.C., town clerk.

MIRFIELD.—Central warehouse, for the Co-operative Society; Hustler & Taylor, architects, Ropergate, Pontefract.

MORECAMBE.—Factory extension, White Lund; Souplex, Ltd. Extensions printing works, Union Street; A. Caunt.

OLDHAM.—Extension of outpatients' block (two wards), Royal Infirmary (£30,000); secretary.

PORTSLADE.—Factory, Victoria Road; Ronuk, Ltd. Factory, Victoria Road; Fry & Co.

PRESTON.—Church (£5,500), for the trustees of Guttridge Memorial United Methodist Church; Rev. J. Doidge, pastor

RHYL.—Extensions, County School, for Flints. E.C.; R. G. Whitley, county architect, Mold (returnable deposit of £2 2s.).

SALISBURY.—Re-erection of premises, The Canal, for F. Watson. Police station, for the T.C.; W. J. Goodwin, city engineer (returnable deposit of £2 2s.).

SHAW (OLDHAM).—Re-erection of Lyon Mill, for Taylor, Ltd., cotton spinners.

SKEGNESS.—Extensions, including operating theatre and X-ray department, at Skegness and District Cottage Hospital; W. F. Willis, architect, Agatha Road. Reinstatement of the municipal buildings, for U.D.C.; council surveyor.

SLOUGH.—Offices and warehouses, for Horlicks Malted Milk Co. Extensions, Upton Court, for Capt. A. Tickler.

STOCKTON-ON-TEES.—Boys' and girls' secondary school, for Durham E.C.; director of education, Durham.

STOURBRIDGE.—Employment exchange, for H.M. Office of Works, King Charles Street, London, S.W. (returnable deposit of £1 1s.).

SWINDON.—Extensions, Isolation Hospital, for the T.C.; borough surveyor.

TILBURY.—Housing scheme (257), for the U.D.C.; surveyor.

TYNEMOUTH.—Central municipal offices; Special Corporation Committee.

TRENTHAM (STAFFS.).—Development, Mon-Abri estate, Stone Road; E. L. Maddock & Sons, architects.

WARRINGTON.—Additional housing scheme (260), Latchford, with electrical work, for the T.C.; borough surveyor.

WESTON.—Mental institution (£20,000); Warwickshire C.C.

WHITCHURCH.—Housing scheme (52), Talbot Street, surveyor to U.D.C.

WINSFORD.—Housing scheme (28), for the U.D.C.; Peter Heaton, surveyor (returnable deposit of £2 2s.).

WORSBOROUGH (YORKS.).—Additional 40 houses, for the U.D.C.; surveyor.

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The

Electrical Review

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The Training of Apprentices.

WE review elsewhere two pamphlets published by the City and Guilds of London Institute, outlining its revised courses for electrical installation work. The syllabus was drafted in conjunction with the Electrical Contractors' Association, which has officially adopted it as a guide to the technical training of its members' indentured apprentices. Such a standard has long been wanted. The mediæval idea that an apprentice should learn his trade solely by observing and imitating the rule-of-thumb methods of a more or less skilled journeyman still persists in many quarters. It is a method which has turned out good men; but men, for the most part, cleverer with their hands than with their heads. That is not enough in a trade such as electrical contracting, which, with every year, makes increasing demands on the intelligence of its workers. While it is true that no man can learn to wire a building, any more than he can learn to play the violin, from reading a text-book, yet no man can count on rule-of-thumb methods to carry him through all the complexities of modern installation work. If he wants to be more than a mechanical drudge obeying orders blindly, if he aspires to be a competent charge-hand or a foreman, he must somehow or other acquire, in addition to manual skill, a sound theoretical knowledge of the principles which govern his work, from the wiring of a simple bell circuit to the equipment of a three-phase power board. He can only gain that knowledge, systematically and thoroughly, by supplementing the practical experience afforded by the old system by a course of technical training such as that covered by the syllabuses under review.

An interesting feature of the complete scheme is the provision it makes for the elementary training of boys between fourteen and sixteen, in the two difficult years between the school-leaving age and the age when they are old enough to be bound apprentices. The designers of the scheme, recognising that our system of state education utterly fails to turn out boys trained in accurate observation and clear expression, set out, in the two part-time years of the preliminary course, to make good the defects of ten full years of largely wasted schooling It is lamentable that such a programme should be necessary; but that it is, no one with any experience of the average product of our extravagant elementary school

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system will deny. To see clearly, to think clearly, to speak and write clearly—that is the larger ideal of all education; and because our school boards fail to appreciate it, the practical men of the City and Guilds of London Institute and of the Electrical Contractors' Association have been forced to devote a good half of their syllabus to its achievement.

It would be difficult to suggest a syllabus better designed to discipline the muddled, discursive, incoherent mind of the average boy of fourteen or fifteen; that is, if he can be persuaded to embark on it. It will surely be an unusual boy who will look forward two years to the time when he will enter a trade from which, for that time, he is debarred; or who, having done so, will continue steadfast in his training, against the temptation to drift into a chance avenue leading to some other, and perhaps less satisfactory, livelihood. We must rely presumably upon parental authority for the necessary prescience and persistence; but it is a pity that, as things are, no means can be readily devised to secure at once the school-leaving boy to the trade he is to follow, instead of allowing him to waste two years in a blind-alley occupation, and perhaps losing him at the end of them.

The future of the electrical contracting industry depends largely upon the youth we are training now. We want to catch them young and train them long, to a safe, sound, and intelligent standard of workmanship whose average shall be as much higher than to-day's as to-day's is than yesterday's. The very complete scheme of training which the Electrical Contractors' Association has now fathered will go largely to secure that higher standard; and everyone who appreciates the importance to the industry of good installation work must give it the whole-hearted support it deserves. It is to be hoped that not only the members of the Association, but all reputable electrical contractors, will adopt it as an essential part of the training of their indentured apprentices, and will take steps to see that they do not only take up these or similar classes, but remain in them, and work seriously towards the attainment of a certificate. That may mean a little trouble—something more than the perfunctory interest which is all that many employers give to the technical progress of their apprentices—but if it be accorded widely and continuously it will surely result, and very soon, in a definitely better grade of electricians, careful, skilful and intelligent.

Any scheme of training depends, of course, largely on the apprentices themselves. Employers may drive and parents insist, but if the lad himself is indifferent or unwilling, mere attendance at a night school will not teach him anything but scrimshanking. It is not always easy to persuade light-hearted youth that the battle of life is to be won or lost from its beginning in the teens, and the Electrical Contractors' Association has therefore wisely added a concrete incentive to industry and application. It awards each year a gold medal and £20, and a number of other medals and money prizes, to the indentured apprentice who achieves the best results in the final examination of the City and Guilds of London Institute. These are useful spurs to ambition; but worth more than any money prize, however generous, to the young man who has the grit to follow the courses to their certificated end, is the mental equipment he will gain, not only to help him to the higher posts of his trade, but also to open to him the wider horizons of a fuller life.

Pointers and Grouses.

CAN one look at a modern electric cooker without being reminded of a gas cooker? Perhaps the gas people drew their inspiration from the old-fashioned kitchen range, but must we remain so unoriginal and unenterprising?

Will our inventors and manufacturers please hasten to lift electric cooking into the plane of the electric motor, and give it a new design of its very own? They may need high-frequency current and water-cooled coils for the real electric cooker of the future, but the water cooling system might serve to feed the domestic hot-water supply and the oven or saucepan might be nothing but a paper bag which would be dropped into the embrace of a high-frequency coil. In, say, three minutes, the whole meal would be cooked from within, instead of by the long and extravagant process of heat application from without.

When will electric washer manufacturers break away from the mechanical medium? Why not make clothes-washing an entirely electro-chemical process? High-frequency, of course! Violent ebullitions and soap for the washing; then drop out the third rinsing water and dry the clothes within the same coil and container. Nothing mechanical, no wringer. Ozonised laundry!

Makers of electric washers do not even make heat provision a part of their design. The water has to be separately boiled and then transferred to the washer.

Practical men must continue to apply themselves to those ready means of development which are immediately to hand, but who would deny us our flights of fancy? We need decry nothing, neither should we miss any opportunity of trying out new ideas, or experimenting with novel apparatus. In this romantic age development is so rapid and so stimulating that there are few of us who cannot sense a much wider and fuller application of electricity than we know of to-day.

Domestic Electrical Appliances in France.

BEFORE the average Englishman has lived in France for many years, sometimes a few months will suffice, he is impressed with the peculiar way the conditions of French life seem to be out of joint with what are understood to be French ideals. Brilliant discoveries have been made in France in both pure and applied science, in radium and radiology, in the early development of the submarine, the internal-combustion engine, in aeroplanes and hydroplanes, in metallurgy, yet in ordinary living conditions France is behind some European nations which are not regarded as her equals in intellect.

In electricity development progress has been rapid as regards illumination, and the number of villages which are being provided with energy for this purpose is increasing every day; the advantages of electric power are appreciated, alike by industrialists and agriculturalists, but in some respects France is very much behind the times in the application of electricity to modern needs. For domestic purposes, for example, owing to ignorance, electricity is usually regarded as a luxury obtainable only by the wealthy classes. This attitude is being modified by means of exhibitions and other forms of publicity, but progress has been retarded in the past owing to the domestic appliances placed before the French public having been imperfect.

With a view to overcoming defects and avoiding the disfavour which such a state of affairs must necessarily bring to electricity generally, an organisation has been created under the auspices of the electricity suppliers in Paris, and is now supported by practically all the other important electrical authorities in France, which is called the Société AP-EL. This organisation has formulated the conditions which should be observed in the construction and installation of electrical domestic appliances with the object of ensuring that such apparatus shall be capable of giving satisfaction to its users. This preliminary work is really in the nature of standardisation, and covers recommendations and stipulations concerning safety, convenience, economy, strength of construction, durability, and facility of repairs. Those articles which are submitted for approval to the laboratories of the Société AP-EL and are found satisfactory will be certified as being efficient by means of a stamp, or mark, and when the preliminary work has been brought to a satisfactory point of development the organisation proposes to undertake intensive advertising propaganda to encourage the use of electrical appliances for domestic purposes.

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Electricity Supply in Worcester.

An outline of a progressive municipal undertaking's activities, including details of an unusual type of powdered-coal-fired boiler and the methods utilised for supplying electricity in rural districts.

THE Worcester Corporation Electricity Department operates under an Order of 1890, and an extension Special Order of 1925 that enabled it to enter into an agreement with the Shropshire, Worcestershire and Staffordshire Electric Power Co. to enlarge its area of supply beyond the city boundary so as to include

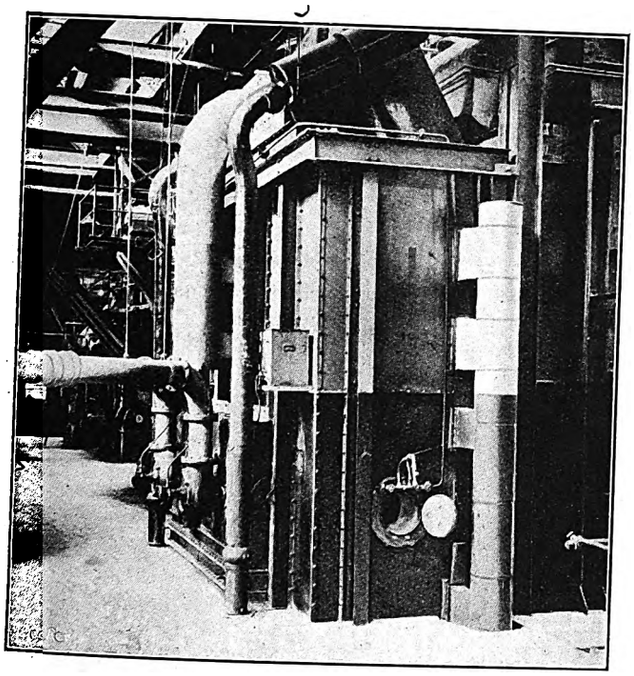

Fig. 1.—Pulverised-coal-fired Boiler.

12 villages. The agreement was approved of by the Electricity Commission and included in the constitution of the South-West Midlands Electricity District.

The Worcester Electric Traction Co., Ltd., purchased energy (305,449 kWh in 1927-28) from the undertaking until the Corporation acquired the tramway system and closed it down in May, 1928, it being superseded by petrol-driven motor omnibuses.

The Malvern Urban District Council commenced to purchase energy in bulk from the Corporation in May, 1924.

Power Stations.—Two generating stations are in use, one hydraulic and the other steam driven, of a total capacity of 13,770 kW. In 1927-28 the energy generated totalled 14,154,931 kWh (of which 695,922 kWh was hydro-electric), the maximum demand reached 6,652 kVA and the load factor 24.22 per cent.

The Powick station houses two water turbines, one driving direct a Westinghouse 250-kW alternator and the other rope-driving a B.P. 70-kW dynamo. A second water-power site has been acquired for possible future development.

The Hylton Road station originally contained Babcock & Wilcox boilers, with Riley retort stokers, which generated steam for the Belliss triple-expansion engines driving Bruce Peebles and E.C.C. alternators (one 250- and three 400-kW sets) and two B.T.H. 1,500-kW turbo-alternator sets.

In 1922 the Corporation acquired from the Government Disposals Board a 3,000-kW B.T.H. turbo-alternator, three Stirling boilers, economiser, boiler-feed pumps, and other accessories. The Department's staff was increased and, with direct labour, the whole of the plant was dismantled at Southampton, transported to Worcester, and re-erected in an extension of the power house, the construction of which was mainly undertaken by direct labour. The turbine was originally designed for 3,300 volts, three-phase, but before re-erection its stator was rebuilt for 6,600 volts, three-phase. While re-erecting one of the boilers, each of which had 6,327 ft. of heating surface, with superheaters, its capacity was increased by the introduction of a greater length of tubes, the heating surface being increased to 8,136 sq. ft., and one boiler was fitted with a Riley 9-retort underfeed type of stoker and longer superheater tubes were fitted; the other two boilers were only erected in skeleton form.

That plant was put in commission during 1923, but the successful introduction of a very low two-part tariff and a growing power load so increased the demand on the system as to necessitate the installation during 1927 of a B.T.H., 3,000-r.p.m., 7,500-kW (m.c.r.) turbo-alternator. It is a modern set of standard design, steam being bled from the turbine and employed in parallel with that used for condenser air ejection for evaporating the boiler feed water; and substantial economies resulted from its operation during the last four months of 1927-28, in conjunction with cheaper fuel, the average cost of generation having been reduced from 1.06d. to 0.71d. per kWh sold.

The newer station switchgear is of the B.T.H. stone-cell pattern with duplicate busbars; the older "home made" gear is to be re-utilised in sub-stations. Auxiliary plant is both steam and motor driven, a feature being the concentration of the steam-driven plant in one room which is insulated to prevent the escape of hot air from it, all of which is conveyed to the boilers by their forced-draught fans.

Pulverised Fuel.—In 1922 when the extension of the generating plant was receiving consideration, the possibility of employing powdered coal in place of stoker

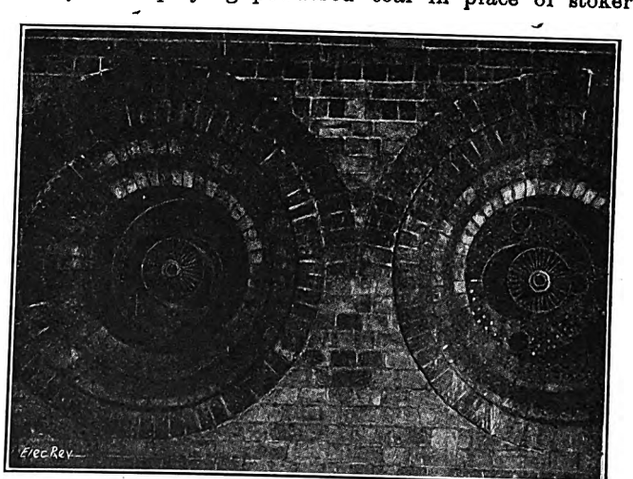

Fig. 2.—Horizontal Turbulent Pulverised-fuel Burners in Front Wall.

firing was investigated; the majority of the then existing plant in England was examined, and in 1925 Mr. C. M. Shaw, M.I.E.E., city electrical engineer, inspected up-to-date plant in several large American stations. Despite contentions to the contrary, especially in the case of small plant, he formed the decided opinion that

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pulverised fuel, if properly handled, offered great possibilities of lowering production costs.

Investigation having shown the cost of the storage bin system to be prohibitive, he adopted "unit" mills,

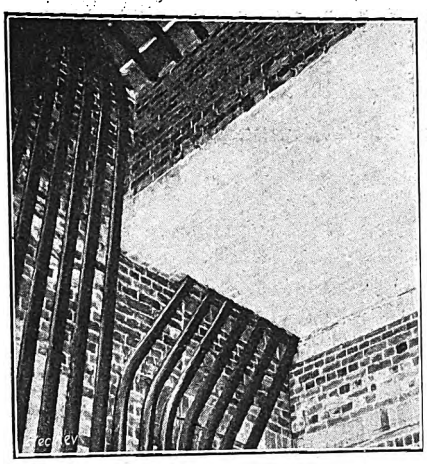


Fig. 3.—Furnace Arch and Brickwork.

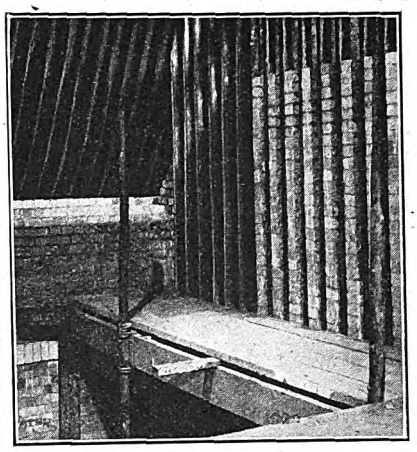
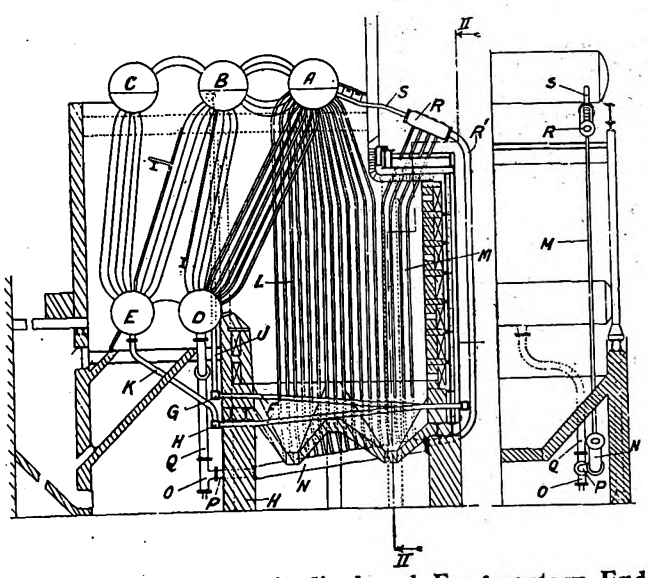


Fig. 4.—Water-tube "Wall" during Construction.

and two "Atritor" 2-ton pulverisers (Alfred Herbert, Ltd.) driven by B.T.H. 50-h.p., 1,465-r.p.m., three-phase, 50-cycle, 440-volt motors have been installed on the boiler-house firing-floor level, their maximum combined capacity being 5.8 tons of powdered coal per hour. Each mill feeds directly one of two Riley turbulent flare burners, each of three tons per hour maximum capacity, which project horizontally through the front of the Stirling boiler opposite, as shown in figs. 1 and 2 (see Table I for details). The burners are lighted by feeding the ignition tubes with paraffin through a 0.25-in. pipe and a flame torch held in the furnace, the pulverisers being started immediately. The operation is usually completed in three minutes, and in about 10 minutes the boiler will commence to raise steam, reaching the full 200 lb. per sq. in. pressure in from 30 to 40 minutes. At present the ash is raked from the furnace hopper into barrows; it is very friable and presents little difficulty.



Figs. 5 and 6.—Longitudinal and Fragmentary End Sectional Elevations of Boiler.

Water-wall Tube Screens.—The novel feature of the boiler is the manner in which the furnace walls are screened with water tubes of a simple form, designed and patented by Mr. C. M. Shaw himself, the nature of the invention, which relates to semi-vertical tube boilers, being declared in British patent specification No. 266,566 to be as follows:—

Table I.—Stirling Boiler Details.

Heating surface	8,136	sq. ft.
Water walls: tube area	988	,, ,,
effective heating surface ...	853	,, ,,
combined effective heating surface of boiler and water walls	8,989	,, ,,
Superheater: surface	1,476	,, ,,
effective surface	1,100	,, ,,
Furnace: volume (15×14×23 ft.)	4,830	cu. ft.
wall surface area	1,532	sq. ft.

The connection of a portion of the tubes constituting the usual water screen of known construction to the front upper steam drum and lower mud drum in such a way as to add those tubes to the boiler's direct water-circulatory system, thus constituting a very extensive steam-generating surface.

Referring to figs. 3, 4, 5 and 6, which illustrate the application of the invention, A, B and C denote the transverse steam drums and D and E the mud drums (the usual water screen denoted by F G H J K is not used in the Worcester plant). At each side of the wall of the combustion chamber is located a water wall composed of rows of upright tubes L, M, connected at their lower ends where they extend outside the ash hoppers to a longitudinal header N, which is connected to a branch piece O by a tube P, branch O being connected with the mud drum D by a tube Q. Tubes L constituting a portion of the water wall are connected at their upper ends with the front upper drum A, certain of them being expanded into holes in the drum which would ordinarily serve for the connection of the tubes of the front bank and for the water-circulating tubes between the front and middle, or rear, upper drums. Thus holes for three of the cross tubes and five of the tubes of the front bank at each side are utilised for the upper ends of the water wall. The second portion of tubes M are connected at their upper ends to a header R, which in turn is connected with the drum A by tube S. The headers N and R may be connected by balancing pipes R^1 as shown, and the tubes constituting the water wall at each side may, in lieu of being extended through the ash hopper, be extended at their lower ends through the side walls and be connected to headers located externally of such side walls.

Air-cooled Walls and Floor.—The boiler is provided with a "Liptak" suspended furnace arch (fig. 3) and hollow walls and floor. In cooling them the air therein reaches a temperature of from 250 to 400 deg. F., and is used for drying the coal, the hot air being then delivered by the pulveriser fans to the burners, thus constituting the primary combustion air. The forced-draught fans drive air through a duct under the boiler-house floor along three paths as follows:—

No. 1 (side-walls) circuit pipe at the left boiler front corner feeds an air box along the top of the furnace

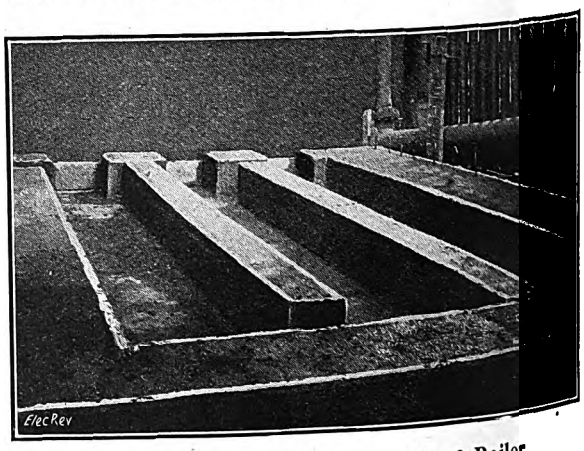


Fig. 7.—Floor Air Ducts, No. 8 Boiler.

(fig. 8, front elevation), whence it passes down between the back two r.s.j. arch supports and over the top of the flat arch, emerging into a pipe (fig. 8, sectional side

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elevation) down the centre of the boiler front; it then enters the two top passages of the hollow wall at the front, immediately dividing to left and right along the front wall and round the side walls, thence down a pipe on each side of the boiler (fig. 8, front elevation) into transfer pipes; it enters the hollow walls again along the side passages until it reaches the front corners, where it joins the final duct of No. 2 path.

No. 2 (back-wall) circuit starts in a pipe along the left-hand side of the boiler, the air passing into the hollow back wall at the firing-floor level (fig. 8, back elevation) and through a series of three ducts (fig. 8, back elevation); it then enters on the right furnace-floor tubes that terminate in a similar duct at the left, where it rises into two ducts in series in the front wall and joins No. 1 path.

No. 3 (floor) circuit starts (fig. 8, front elevation and sectional plan A A) at the back left corner, the air passing towards the front through three ducts in series, ending at the right front corner, where it joins the inlet duct of the furnace-floor tubes.

The hollow walls are of "Liptak" design, but the floor ducts (fig. 7) and tubes are supplementary and experimental (provisionally protected by Mr. C. M. Shaw), the tubes being covered with fire bricks and slabs of cast iron, to determine which has the longer life. When the boiler is started, hot gases may be withdrawn direct from the furnace through the separate fire-brick-lined pipe shown at the side of fig. 8 (sectional side elevation) which supplementary means of heating may also be used occasionally at light load when it is not desirable to cool the brick-work by drawing excessive quantities of air through the hollow walls and floor passages. Thus the temperature of the air employed for coal drying and combustion may be raised to a total of 500 deg. F. if necessary.

Boiler Performance.—Originally designed for the Stirling standard rating of 27,000 lb. per hour, after having been adapted for burning powdered coal by enlarging the combustion chamber, adding the water walls, and 3 ft. longer tubes, the steaming capacity has reached 60,000 lb. evaporation per hour, the superheat obtained ranging from 200 to 250 deg. F. At that rating the water level remains quite steady, and the boiler shows no signs of being forced; CO_2 readings indicate from 14 to 16 per cent. The above rating equals 18,350 B.th.u. per cu. ft. of furnace space per hour; the furnace loading with four tons of fuel per hour would equal 19,800 B.th.u. per cu. ft. per hour for 62,000 lb. evaporation per hour (in American practice the figure reaches 27,000 B.th.u. per cu. ft. per hour). The calculation is based on an average net fuel calorific value of 10,000 B.th.u. per lb. as received, with 10 per cent. moisture content; but is by no means the limit, for the original damper has restricted the loading. The furnace volume being ample for a much higher rate of combustion, the provision of a larger damper should enable the maximum capacity of the pulverisers (*i.e.*, 5.8 tons per hour) to be utilised, which is hoped to increase the rating to nearly 75,000 lb. evaporation per hour in case of emergency.

Modifications contemplated in the case of other boilers, together with details of the modernisation of the undertaking's electricity distribution system, will be referred to next week; as will also the efforts that are being made to stimulate the use of electrical energy in the rural area surrounding the City of Worcester, and the means by which it is being successfully distributed for domestic and farming purposes in country districts with the aid of overhead copper transmission and distribution lines of comparatively large dimensions.

(*To be concluded.*)

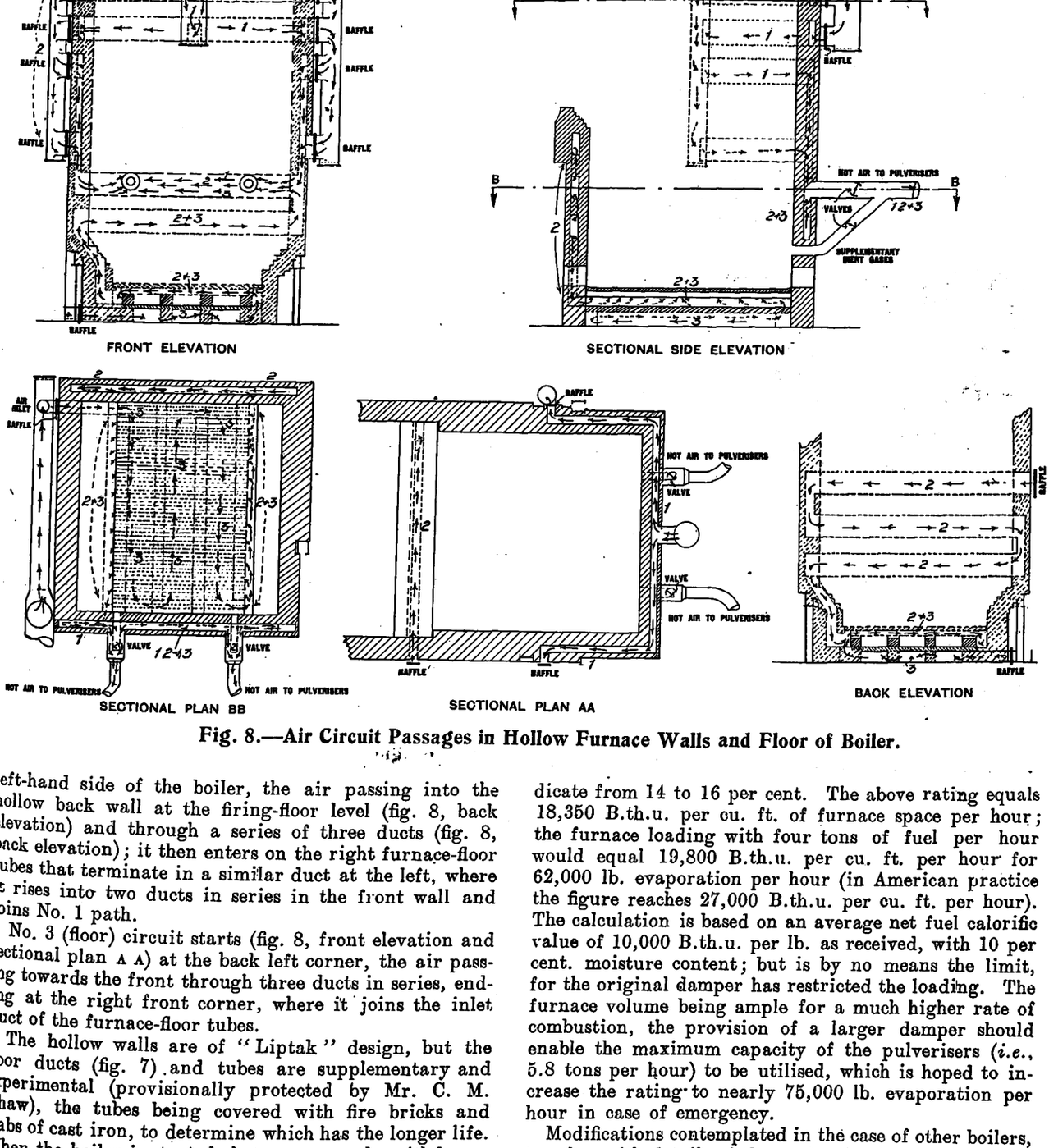

Fig. 8.—Air Circuit Passages in Hollow Furnace Walls and Floor of Boiler.

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High-Voltage Transformers.

Brief details of 132-kV "Metrovick" transformers and switchgear for the Central Scotland section of the national "grid" System.

WHILE the construction of 132,000-volt equipment in this country is not new, such apparatus having been supplied by the Metropolitan-Vickers Electrical Co., Ltd., for service in South Africa, the British "grid" equipment will be the first of its kind to be seen in operation in the British Isles.

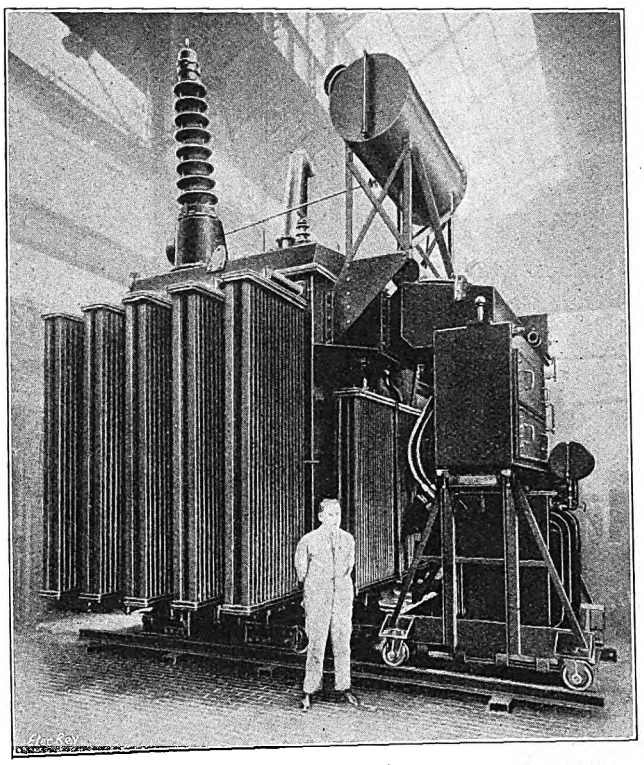

Fig. 1.—A 15,000-kVA, 20/132-kV, Single-phase Transformer.

The accompanying photographs show some Metropolitan-Vickers transformers and switchgear for the Central Scotland section of the "grid," which section was the first to be undertaken and has made rapid progress; much of the structural work of the transmission towers and the sub-stations has been completed, or is well advanced, and a considerable amount of the apparatus is on site. The equipment being supplied by the above-named company for this section includes large-capacity transformers, *viz.*, two of 60,000 kVA and three of 45,000 kVA capacity, arranged in each case in three single-phase units, together with two 15,000-kVA three-phase units, and the whole of the 132,000-volt switchgear for the seven main sub-stations of the western part of the section.

Fig. 1 shows a 15,000-kVA single-phase transformer of one of the 45,000-kVA groups and fig. 2 shows a group of three similar units removed from their tanks. The transformers are for step-up or step-down service; they have a voltage ratio of 20/132 kV and are arranged for delta-star connection. Large detachable radiators are fitted, so that with natural cooling the transformers will deliver 60 per cent. of their full rating, *i.e.*, 27,000 kVA in the case of the 45,000-kVA group illustrated. The radiators are bolted to the tank at the top and bottom and valves are provided in both connections, enabling the radiators to be detached for shipment without removing the oil from the tank body. Each transformer is also provided with an external air-blast oil-cooler, complete with fan and oil-circulating pump. The cooling plant will be brought into commission automatically by means of a temperature device on the transformer when the temperature exceeds a predetermined value, and will be automatically shut down when the temperature falls below that value.

On-load voltage-regulating gear is provided on each unit to give plus and minus 10 per cent. variation in steps of 1.43 per cent. The regulating gear can be seen in the foreground of fig. 1. It is of the contactor type, operating on tappings situated near the high-voltage neutral point of the transformer, which will be solidly and permanently earthed. A reactor, having a mid-point running position, is situated in its own tank below the contactor gear, and will be used to bridge the sections of the transformer winding while changing from one tapping to another, and also to obtain a mid-point running position between each pair of tappings, thus reducing the number of tappings and contactors required. The regulating gear and the reactor are mounted on a separate under carriage, which is bolted to the transformer tank, adjusting screws being provided underneath the regulating gear to facilitate lining up.

Two temperature indicators of the capillary type with dial indicators are provided on each transformer: one shows the oil temperature and the other shows the temperature of the winding. The latter device is fitted with two sets of contacts, one set operating lamp and "Klaxon" horn alarms in the event of the winding reaching a predetermined temperature, the other set being arranged to close the trip circuit of the oil switch in the event of the temperature increasing a further 10 deg. C.

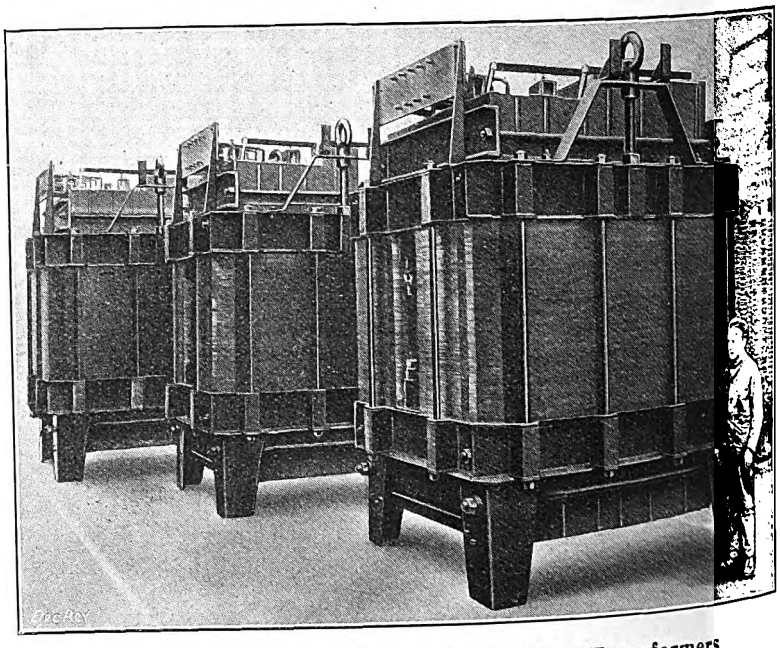

Fig. 2.—Group of Three 15,000-kVA Transformers Removed from their Tanks.

Accessories, including inspection covers, relief pipes,

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oil conservators, filter valves, oil-sampling valves, drain valves, &c., are provided according to requirements on the various pieces of apparatus. The undercarriages of both the transformers and the regulating gear are fitted with rollers which can be turned through 90 deg. and locked in position, and are suitable for running on rails of the standard 4 ft. 8½ in. gauge in either direction.

One of the main problems that had to be solved in the design of these large transformers was that of keeping their dimensions within such limits that the transformers, in their tanks and complete with oil, could be accommodated for transport in railway trucks within the rather restricted loading gauge of the British railways. By co-operation between the engineers of the Central Electricity Board, the railway companies, and the transformer manufacturers, specially designed trucks have been evolved for the work of transport. Fig. 3 shows one of them, built by the London and North Eastern Railway Co., with two "Metrovick" single-phase transformers of a 60,000-kVA group loaded for dispatch to the Dalmarnock sub-station. The truck has detachable girder sides between which the transformers are slung and supported with their bases only a few inches above the level of the rail face. On arrival at the site the detachable side girders allow the truck to be taken apart and drawn away from the transformers, the latter being jacked up from the truck meanwhile and then moved sideways off the track. The truck is then reassembled and dispatched, the whole operation involving a minimum of delay.

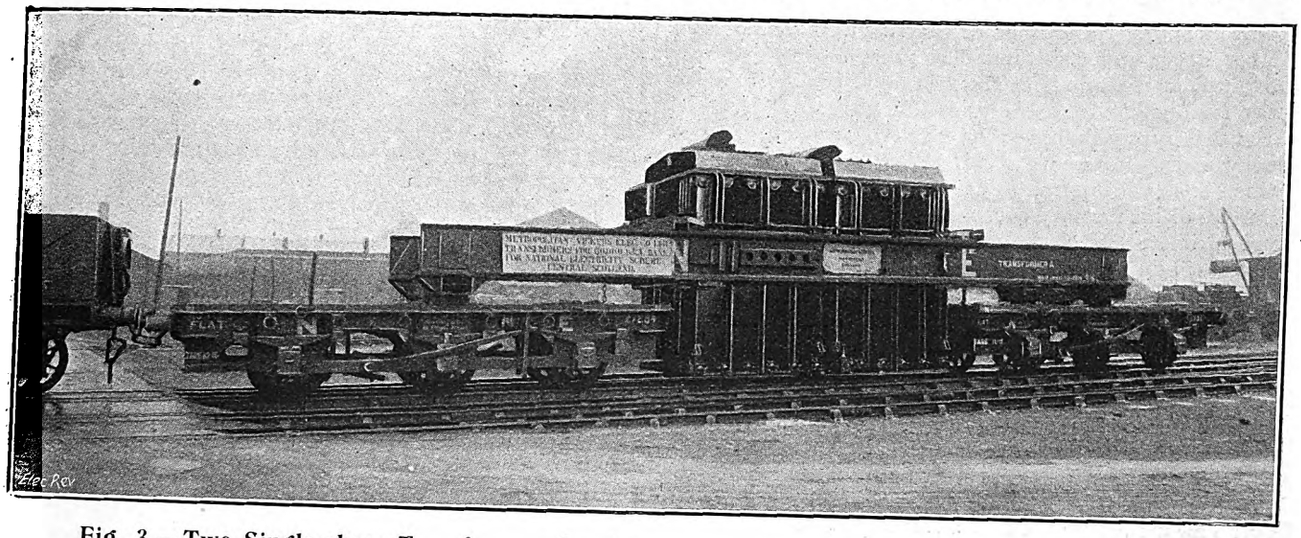

Fig. 3.—Two Single-phase Transformers Loaded on a Specially-designed L.N.E. Railway Truck.

An Old Problem—from a New Point of View.

It is suggested that by bringing all sources of technical education under one disinterested control, these, applied correctly and therefore used efficiently, would help a great deal to reduce unemployment in the future.

By RIC.

THE Institution of Electrical Engineers proposes to alter the conditions of membership and to revise the system according to which its members are classified. This seems to reveal another attempt to state more definitely still what a man should be and know before he can rightly call himself an engineer: "leaders" in the technical Press, also, recall a subject that has had, perhaps, too much written around it. But possibly one particular problem has attracted so little attention as to arouse useful interest still.

We may safely let the experts on education decide whether the straight college-and-works course, an inversion of it, or the so-called "sandwich" course is the best way of training those who can afford it. We grant that an engineering student should learn in a laboratory what a steam-gauge looks like and how it works: he should learn in a boiler-house not to trust blindly in a gauge when intuition tells him otherwise; and he should discover for himself in the shops how to work *with* men who are under his control, when that times comes. But, having assumed all this is true, what is to be done with the precocious youth who has only the usual supply of brains, no money at all, and an immovable determination to become an engineer? It is useless to tell him the idea is impossible, because he is likely to be of the age when we believe nothing is impossible: you dare not argue that a college training is absolutely necessary, because some of the greatest men have contrived to "get there" without that advantage, and he will remind you of it, believing firmly that he can do the same.

That is the problem; but, for a moment, consider something else that throws light upon it from a different angle. In England, at any rate, the usual method adopted when a firm seeks to fill a vacancy, is to advertise the post, giving very cursorily the nature of the work and delving very, very deeply into the past sins of the applicant. He is required to possess the B.Sc. degree or its equivalent, to have had at least two years' experience in a similar position, and to possess three testimonials. The type of man to whom the job most appeals is often one who is seeking just the experience the firm demands as a preliminary, and the need of which would make him keen, while testimonials will be difficult for him to obtain, unless those of the family lawyer and

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Sunday-school teacher are included. But there is more in it than this. In far too many cases if the man who fits the advertisement does get the job, he finds that the only qualifications he needs are common-sense and the aptitude for "picking-up" things which should be a part of every would-be engineer's make-up. Once he is used to the firm's peculiarities and has got into the running of things he begins to feel that his job is too easy, not through conceit or over-confidence, but because it is so. He becomes discontented, naturally, and either slacks and does himself as much harm as he does his firm, or clears out at the first opportunity, to make way for another like him, and so it goes on. Is it not true that rarely indeed is the man with a science degree lucky enough to secure a job which is above him, and which is a continuation of his studies and not merely an exercise of his memory over a few things to the exclusion and ultimate loss of the greater part of the knowledge that cost him so much to acquire?

Presumably, those who advertise these posts either over-rate the value of them, or under-rate the possibilities in those who have not already proved their worth. The latter, after all, is reasonable: no employer can be expected to provide a free training-ground for an untried man who has not even an examination to show that he is capable of learning.

Now, we have come to the point from which the problem can be examined more clearly. While we by no means ignore the real advantages of a degree, nor attempt to bring it within reach of less fortunate students outside the college by making it easier to obtain—a worthless concession—while, too, we do our utmost for the universities and for those who work in them, may we not also attempt to weed out, from those who cannot enter by any known means of scholarship or grant, those who *will* be engineers at heart, however much we try to make them mechanics in the work they actually do? The universities will admit their failures; cannot those outside help to compensate for these by making a few successes?

At the present time the accepted alternative to college training is a course of evening classes. These institutions have been in existence for a long time and have enlarged their scope until they embrace, or are trying to embrace, the professions as well as cater for the trade. With the deliberate intention of calling forth all the evidence, for and against, which the experiences of teachers and students can give, I want to query whether this is being done in the wisest, most efficient way.

About a couple of years ago someone suggested during a discussion at the I.E.E. that these evening classes are over-reaching themselves; that they are attempting too much in trying to offer the equivalent of a day course, and should revert to their original plan and concentrate on the engineering trade. The same speaker stipulated that engineers should be college-trained; many will disagree, but most will accept these two points: first, that the same training, and method of training, will not serve both fitter and engineer; secondly, that both types of men are necessary to the community, and equally to be considered, for, although a prince may use a golden key when he opens a town-hall, the key must fit the lock. I suggest, then, that these institutions would do a far greater work were they to turn many of their lecture theatres into classrooms; extend their workshops, and produce good workmen, taught to be proud of what they can do with their hands and in nowise inferior or superior to those whose equal pride is in their directive abilities; at the same time opening their laboratories and offering a few specialised short courses of lectures *only* to those who have qualified themselves, by study, as keen to do the work and use those laboratories in the right way. For instance, if fitter's mates were taught that to become fitters is something worth doing and does not merely mean "picking up the tools" when the chance comes, and taught to treat their jobs as something above them, and not an insecure stepping-stone to that vague "something better" that steals away all thoughts of hard work in the present and leaves only dreams of an office and a "cushy" job in the future, a great end would be achieved. In the days of Michael Angelo the workers in stone were artists; today, the novice in engineering workmanship seems to be brought up as a speed-merchant. Give him, instead, for ambition the ability to work well, quickly if necessary, but at all costs well, and teach him *that* at evening classes.

All very nice; it is reasonable to suppose that if, each year, a certain number of lads are taught all they can learn about their job, and are then told to develop their experience, to always try to do their work a little better than it has been done before, and not expand their brains to understand what they will never apply, these people will become much more valuable as experts in a restricted sphere, than as smatterers who have not the faintest notion of the aim of half their studies and only an imperfect idea of how to do the simplest work; without a glimmering of light as to what they really are, only a sickly hope that somehow, somewhere, "something will turn up."

The solution of the rest of the problem seems so obvious that there must be a snag somewhere: it is hoped that someone will be tempted to reveal that snag, and be sufficiently interested to try to straighten it out.

An engineer must have a thorough grounding in about half-a-dozen subjects: mathematics, English, drawing, and others; and I seriously believe all but drawing can be taught, up to a certain stage, without the aid of a lecturer and the hindrance of overcrowded lecture rooms, the dragging effect of those who do not work on those who would, and the waste of time occupied in travelling. The thing can be done by private study, but—a tutor of some sort is necessary. A fellow of seventeen cannot see the boundaries of his job with the eyes of an experienced man and so decide what he should study, and how much he can profitably reject. Moreover, a student, however keen at the start, if left to himself is liable to work in furious spasms; to ignore the idea of system, and study only when he feels like it—and the temptation to work is quite easy to overcome. So that the problem is to find a tutor at reasonable cost, and to systemise a course of study which will not only lead to a worthwhile examination, but will qualify the student to attend evening classes of an advanced character (such that really do need a lecturer's personal contact) at the time when he is best able to appreciate and use them.

It is the easiest thing in the world to obtain a diploma, complete with a metal case to keep it in, from a correspondence school. There are, perhaps, four of these schools that attempt to carry out the promises in their advertisements, but they all fail in this respect, that the final examination, like those which precede it, is taken in the student's home, and such an examination is worthless as a recommendation to anyone who does not know him inside out. If you are known to be studying and one day turn up with such a diploma, you may secure promotion in your own firm, among your own crowd, but you cannot expect a stranger to accept such dubious evidence. He may like the look of you and wish to believe you earned that certificate honestly, but that is not enough: he must know or fail in his duty to his firm. To get over the difficulty, why not make the final examination in engineering (or any other course offered by the schools, if it comes to that) a public one? There seems to me absolutely no reason at all why such an examination should not be held, say, twice a year in a dozen centres, under an accepted examining body. Candidates would have to contribute towards the expenses, of course, but surely the cost of hiring a building, of stationery, and the examiner's charges could be covered by an examination fee, which need not be unreasonable and which the diploma would then make worth while!

This would mean the co-operation of the leading correspondence schools with representatives of the engineering institutions to form a central Board of Technical Education, and it would be the work of this body to produce a scheme under which the various schools, while continuing with their individual methods of teaching, provided the Board accepted these, would, under its control, then co-operate instead of compete, as at present. Apart from test-papers set at their own discretion, the schools would set no examinations and would not be

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permitted to offer diplomas. That would be solely the business of this Advisory Board, which, by taking over the responsibility for the subjects studied by candidates, and by offering them a public examination accepted by the people in the profession who really matter—employers and engineers—would, at least, remove the stigma which is at present attached to "tuition by post."

Without doubt, these problems do require an immediate solution. We need skilled, clever workmen who are not ashamed of the fact; we do need skilled, clever engineers. But, above all, employers in particular want some means of recognising the "goods" when they are put before them to avoid accepting, in their stead, half-keen, easily satisfied men who merely seek an opportunity to "settle down" into a fairly comfortable post, doing in a mediocre, or frankly bad, manner, what they have neither brain nor energy to do well. At present, the employers' sole safeguard is to demand a high examination, and experience, for nearly every little vacancy that occurs. That again, as I have already suggested, gives the same result, because such a man, tied to a job that is far beneath him, is not encouraged, or even enabled, to show his abilities. We need, as well, to cut down the large percentage of would-be engineers who will never stick it long enough to "arrive," and to do that we must go right to the root of the matter. It cannot be done while many and various institutions of the correspondence type offer cheap, and easily acquired, education, and place fast promotion and lucrative posts before the eyes of uninitiated "fond parents." Success cannot be attained that way: moreover, the profession needs, not men of that type, but those who are prepared to win dearly every step of the way and who will consider, within reason, the services they can render, before the personal ends they hope to achieve.

All the above is admittedly but a brief lightning sketch of an idea: even on paper it seems so simple that to go into details at such a stage would be ridiculous. But it is suggested that any scheme which attempts to solve a problem such as this, at times such as these, is worthy of criticism.

Rectifier Instruments for A.C.

An Account of the Application of Copper-oxide Rectifiers to Moving Instruments.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P. (Chief Instrument Designer, Messrs. Ferranti, Ltd.).

THE d.c. moving-coil measuring instrument can be made to give full-scale deflection for a smaller consumption of power than can any comparable type, the electrostatic voltmeter being excluded. It is easily possible to produce suspended-coil instruments of moderate resistance requiring much less than a microampere for full-scale deflection, and even with double pivots microammeters are practicable.

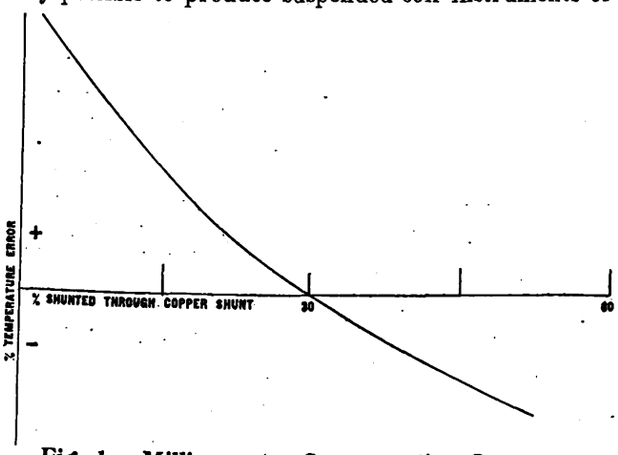

Fig. 1.—Milliammeter Compensation Curve.

The sensitive moving-coil instruments have been applied to a.c. measurements in two distinct forms. One uses a thermo-junction, which may actually be a part of the movement, such as the Boys' radiomicrometer, and the later Duddell thermogalvanometer, or externally by means of separate vacuum, or air, thermo-junctions. In this case the low range of a.c. is possible only by using a sensitive, and usually delicate, instrument. When using robust switchboard instruments the lowest range is usually an appreciable fraction of an ampere. The other method is to use one, two, or four rectifiers with the moving-coil instrument, so that although a.c. exists in the line, only a rectified current passes through the instrument, which is necessary on account of the type of instrument.

The simplest, and one of the earliest, forms of rectifier used with an instrument is a crystal, such as was used for wireless-signal rectification some years ago. In general it gave some comparative indication, although it was not usually stable enough to withstand any movement, and could not maintain its calibration for more than very short periods.

The thermionic valve which displaced the crystal for wireless rectification also displaced the crystal for instrument use, and as the constants of a valve are much more lasting and definite, it was quite easy to calibrate such an instrument and to obtain reasonable accuracy when the valve was made to function under given conditions. A.c. instruments utilising moving-coil movements and thermionic valve rectifiers are usually assembled and calibrated as required, as they are somewhat bulky on account of their associated batteries; they are not usually built up and supplied as complete instruments, entirely owing to the non-portability of the

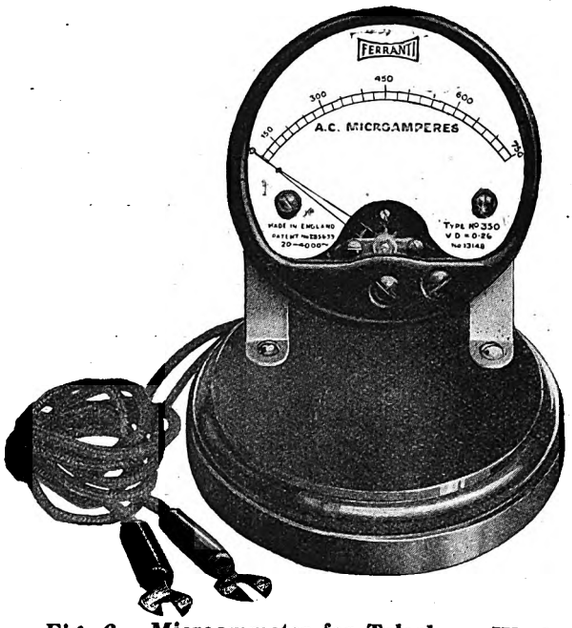

Fig. 2.—Microammeter for Telephone Work.

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rectifying unit. Notes on the use of valve rectifiers with instruments have been published from time to time.*

The copper-oxide rectifier introduced by the Westinghouse Brake & Saxby Signal Co., Ltd., some few years ago has met the demand for a small self-contained, portable, and reasonably constant rectifier; a detailed paper on the characteristics of this rectifier has been published by L. O. Grondahl and P. H. Geiger.†.

Messrs. Ferranti, Ltd., realised its possibilities, and some years ago commenced experimental work with a view to its inclusion in an instrument, particularly for a series of 2½-in. dial movements, in which case the moving-iron instrument, the only practicable alternative, is not as satisfactory as can be desired in so far as energy consumption and applicability to very low ranges are concerned. Considerable experimental work,

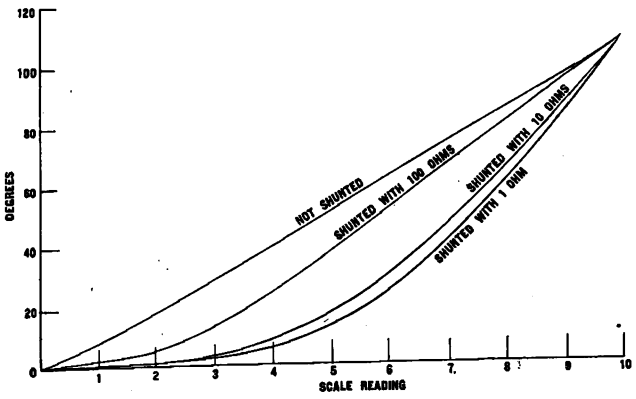

Fig. 3.—Effect of Shunting at Input Terminals.

some of which is outlined below, has resulted, and it has been found that it is possible to make a satisfactory a.c. instrument with the aid of a copper-oxide rectifier, with certain limitations.

The desiderata for a satisfactory rectifier are (1) high ratio of "reverse" to "forward" resistance, (2) a linear characteristic, (3) constancy with time, (4) constancy with varying temperature, and such numerous minor requirements as robustness and portability, overload capacity, and independence of frequency and wave form. The copper-oxide rectifier possesses them to a greater or lesser extent, the results being as follows:—

(1) *and* (2) *Resistance and Characteristics.*—Under the best conditions the reverse resistance may be as much as one thousand times the forward resistance, but the second consideration (linearity of characteristic) has to be considered. A conductor obeying Ohm's law has a linear characteristic, or the current is proportional to the voltage, but the copper-oxide rectifier does not obey Ohm's law, as its characteristic is curved, and although in certain circumstances this is a useful feature, it is in general a drawback to its use in measuring instruments. It is manifest in the scale shape, which, instead of being truly linear like that of the ideal moving-coil movement, is somewhat contracted at the beginning. The contraction is not consistent with all ranges, and in the case of high-range voltmeters and milliammeters is nearly absent, with the result that the scale becomes very nearly linear. Whilst considering the ratio of reverse to forward resistance, it is necessary to decide how many rectifier elements are to be used. If one only is used, the circuit will be broken, in effect, every half cycle, so that one is only applicable to voltmeters. With two elements, the measuring instrument being in series with one, a circuit can be maintained throughout, and the voltage across the rectifier will be limited by the resistance of the movement, but it is only possible to connect the instrument in one side. Provided that the supply is symmetrical about the zero axis, which implies no d.c. component, multiplying the reading (in r.m.s. value) by 2 will give the total line current, but if the wave form is not symmetrical about the zero axis, instruments connected in series with each rectifier will not read similarly. This fact is often of use, but for straightforward measuring circuits when the r.m.s. value of current or voltage is required four rectifier elements are necessary. In this instance the true r.m.s. calibration is not obtained directly from the d.c. reading and an assumed form factor (which, for sinusoidal waves, equals 1.11) on account of the considerations (1) and (2) above. If, however, the calibration is performed with a.c., using true r.m.s. instruments for comparison, a correct scale will be obtained, for the particular wave form used.

In practice, if such an instrument is tested with a true mean voltmeter (say, of the thermionic, or mechanical rectifier, types) mean readings are obtained in very close agreement, thus showing that if calibrated in r.m.s. units the instrument is dependent on wave form. As, however, modern supplies are all very nearly sinusoidal, no serious discrepancies are found between readings on different supply mains, but if a small saturated transformer, or other apparatus which distorts the wave-form, be used, the readings obtained will not be true r.m.s. readings.

(3) *Constancy with Time.*—It is yet too early to state finally if this form of rectifier is really permanent in its characteristics. Rectifier instruments have been under observation for some years, and with the designs that have been adopted they have been found sufficiently reliable to justify them being placed on the market. A period of very many years must elapse, however, before it will be possible to state the probable reliable life of such a rectifier, and at present it can be considered to be quite satisfactory if properly made up and calibrated initially, and not subjected to serious overloads, or very high temperatures; it is essential that the rectifier elements should not be dismantled after calibration.

(4) *Constancy with Temperature.*—The resistance per disk of a copper-oxide rectifier varies appreciably with temperature, decreasing as the temperature increases. As the resistance, either forward (the low-resistance direction) or reverse, varies with the current passing, so will the temperature effect vary too; in general the higher the current the smaller the change due to temperature. In the forward direction the curves connecting resistance with temperature are very approximately linear, but those for the reverse direction are decidedly not linear, and have usually two points of inflexion, giving a definite maximum and minimum on each curve, which fact shows that the temperature effect is by no means negligible and needs compensation. A plain uncompensated rectifier instrument will be in error, depending in each case on the range and size of rectifier, up to as much as, or more than, 0.5 per cent. per deg. C. Such an error is intolerable, and a suitable means of compensation has had to be sought; in general the type of compensation required depends on whether the instrument is a voltmeter or a milliammeter. The latter, when correctly compensated, still varies in impedance with temperature, and so a varying voltage drop results which, in the case of a milliammeter, is of no consequence, but in that of a voltmeter is still unsatisfactory. When the voltage range is high and the applied voltage is mainly across the series resistance, the rectifier error is swamped entirely, but for ranges below about 10 volts this is not the case, and the compensation required depends on each individual range; in some cases the error is not quite negligible, but of the order of 0.1 per cent. per deg. C.

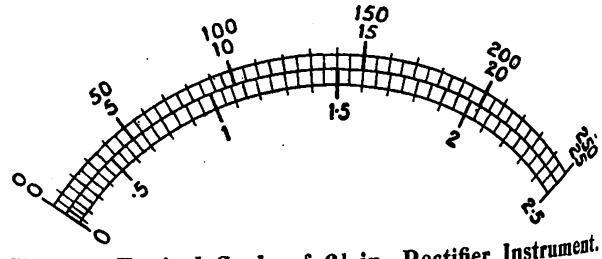

Fig. 4.—Typical Scale of 2½-in. Rectifier Instrument.

* "Measuring Small Alternating Currents," *Electrician*, August 20th, 1926, p. 202.

† "A New Electronic Rectifier," *Journal A.I.E.E.*, Vol. XLVI, No. 3, pp. 215-222.

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Milliammeter compensation consists in applying a copper shunt across the a.c. terminals of the rectifier network, so that less current is shunted as the temperature rises. Fig. 1 shows the type of curve which is obtained, and it will be apparent that when about 30 per cent. of the line current passes through the shunt, at calibration temperature, the error will be negligible, and that by increasing the shunted current the sign of the error can even be reversed. Such shunting increases the current consumption somewhat, so that with a particular movement requiring 5 milliamperes d.c. for full-scale deflection, the line current being more than this on account of the form factor, the total line current, including both rectified and shunted, becomes about 7.5 milliamperes; this value is actually used in some voltmeters. With other movements a factor of 1.5 still holds, so that the resistance in ohms per volt can be stated for any given design of movement. The curve shown is not general, but is typical of a particular movement only; others give curves of similar shape, but of altered values.

Frequency.—There seems to be no reason why rectifier characteristics should alter with frequency, except at extreme limits, which is in general the case. The d.c. reading of a rectifier instrument is definitely not the same as the r.m.s. calibration; hence it may be said that at zero frequency the error is appreciable. Similarly, at radio frequencies the reading is useless, as the capacitance between the disks of the rectifier is such that practically all the current is shunted straight through the rectifier. Ferranti instruments have over the power-frequency range of 25-100 cycles no readable error, and at telephonic frequencies their error is still small; at a frequency of about 6,000 cycles it is difficult to be sure of any current readings to within a fraction of one per cent., but, so far as various and independent tests have shown, the error is then still within two per cent.

Impedance.—The impedance of a milliammeter varies with the scale reading, and is due to a change of capacitance with reading, as well as with frequency, which is approximately linear, and a change of resistance with both reading and frequency, resulting in a decrease of impedance with reading and an increase with frequency. As variation of the impedance of a milliammeter is usually of no account and voltmeters are sufficiently swamped by the series resistance, this is by no means the undesirable feature that is presented at first sight. This fact is of enormous importance, as, in addition to the use of this type of instrument for power work, where there is usually sufficient power to operate a moving-iron instrument, it is also suitable for telephone work in which small currents are usual and the available power very small also. The instrument illustrated in fig. 2 has numerous applications to telephone investigations, as it will actually follow the fluctuations of speech current passing through a telephone receiver.

Shunting for Higher Ranges.—A shunt across the input terminals distorts the scale shape from an approximately linear to an approximately parabolic form as the proportion of shunted current increases (fig. 3), which is serious, and so plain shunts across the a.c. terminals of the instrument do not find much application. There is no reason why there should not be a shunt across the d.c. movement, however, and so current ranges up to the limit of the rectifiers are possible, with nearly linear scales. In the case of the 2½-in. instruments mentioned at the commencement of this article, it is only possible to accommodate a small (60 milliampere) rectifier, so that the maximum range used is 50 milliamperes). Ammeters are then only possible with current transformers, but there are two important differences between such transformers and those usual for moving iron instruments. The secondary current has to be 50 milliamperes, or less, instead of 5 amperes, and the volt-ampere consumption is considerably reduced, owing to the presence of the permanent magnet. With this exception (small volt-ampere consumption) the scope of rectifier ammeters and milliammeters is definitely for low ranges, where the resistance of a moving-iron instrument is prohibitively high.

The following figures of volt-ampere consumption, as they vary with different movements, merely give an idea of the general magnitude, which is definitely lower than corresponding figures for moving-iron or dynamometer types:—

2½-in. dial, 1 mA movement, uncompensated, 0.0004 VA, a.c.

4-in. dial, 5 mA movement, uncompensated, 0.0035 VA, a.c.

Wave-form error is about the most serious limitation of this type of instrument, as has been detailed above. Any number of ranges of a.c. may be incorporated in an instrument: ranges of above 10 volts follow the same law, so that two ranges of, say, 10 and 100, or 25 and 250, volts will be accommodated on one scale by a multiplying factor. Below about 10 volts individual scales are necessary, so that for those ranges the total number is limited to the number of scales that can be drawn on the instrument dial; two, or at the most three, is the maximum. Fig. 4 shows a typical scale of a 2½-in. self-contained rectifier instrument for 2.5, 25 and 250 volts, alternating current.

A voltmeter-ammeter test set is possible when compactness is the first consideration, using a movement of a few milliamperes with series resistances for the voltmeter and a multi-range transformer for the current readings.

Acknowledgment with thanks is made to Messrs. Ferranti, Ltd., for permission to publish the information referring to their instruments.

School Lighting.

Some notes on a subject that does not as a rule receive the attention it deserves, considering its influence on defective vision.

By H. E. HUGHES.

JUDGING by the active interest that is being taken to-day in the correct lighting of schools, it would appear that there is every reason to hope that this previously neglected branch of the art of illumination will be receiving much more attention in the immediate future, and that modern lighting installations will become the rule rather than the exception. Inadequate lighting in schools, it has been proved, has been the cause of a great deal of eye trouble amongst the children, and this becomes plainly evident when it is realised that very few children are born with defective vision, yet an increasing percentage, with increase in age, have disabilities of this kind.

In the London schools it has been found that only 3 per cent. of children under six years of age have seriously defective vision, but that 11 per cent. of those over eleven years of age showed bad defects, and in subsequent years this percentage steadily increased. We are not perhaps in this country in such an unfortunate position as in some Continental towns, where in bad cases as many as

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60 or 70 per cent. of the pupils have defective vision.

An interesting point in this connection is the fact that while there is always a general increase in the acuity of vision with increased illumination intensities, it has been proved experimentally that those children most affected by the improvement are the sufferers from astigmatism and other defects. Conversely, bad lighting is more of a disadvantage, in proportion, to those that have already poor visual powers, and there are other influences to be considered; for example, children who cannot see easily soon acquire the habit of stooping, and cramped positions due to improperly placed lights even lead to such ill-effects as curvature of the spine.

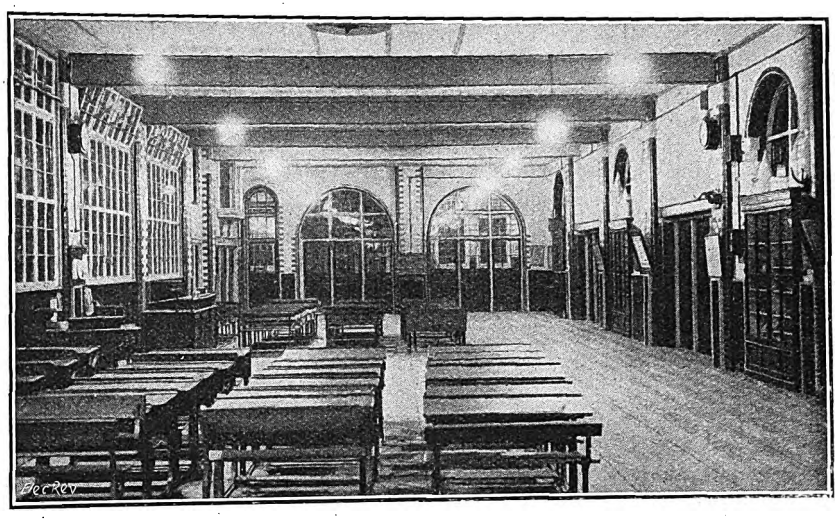

Fig. 1.—An Assembly Hall at West Ham.

The seriousness of this matter of school lighting has only recently commenced to dawn on the public conscience and to be investigated by specialists. The cost of providing good lighting, it would almost seem, is the chief factor in the minds of those responsible, though there are naturally other considerations that have some weight. In this connection it is interesting to note that at a recent meeting of the Education Committee of the London County Council, it was reported, on the one hand, that the cost of electric lighting at present prices was about the same as the cost of gas lighting. The cost of installing electric lighting, on the other hand, was usually much greater than that of modernising existing gas services and providing the latest type of super-heated inverted gas burners. To offset this, however, it was anticipated that the facility with which electric lighting can be turned on and off would tend towards economy, and that the cost of energy and maintenance would be less.

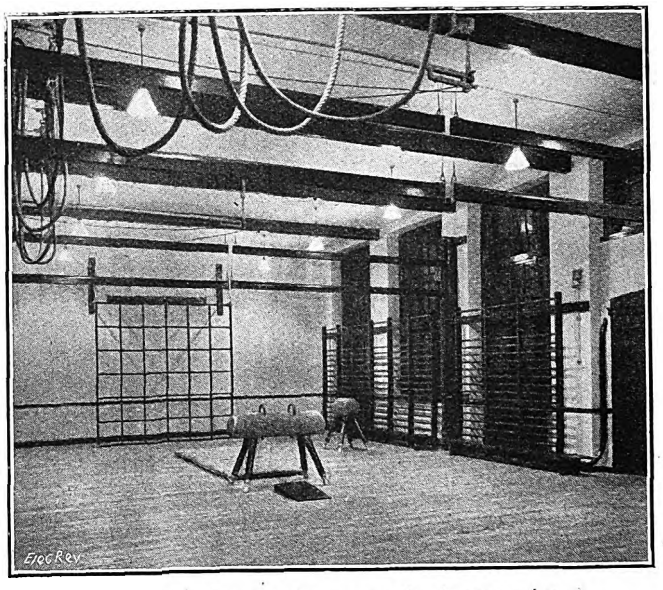

Fig. 2.—A School Gymnasium at Edmonton.

The Sub-Committee considered that the benefits to be derived from electric lighting, such as increased cleanliness, convenience, and improved health conditions, justified electric lighting wherever it could be installed economically in new and remodelled schools. Fig. 1 shows an assembly hall in a West Ham elementary school, equipped with "Holophane" No. 2120 reflector refractors and 100-watt gasfilled lamps; fig. 3 is a view of a class room in the same school, equipped with No. 2110 reflectors and 60-watt lamps; while fig. 2 shows the gymnasium at the Latymer school, Edmonton, wherein F150 reflectors and 150-watt lamps are used.

Another interesting and instructive reference to the same subject was made at a recent meeting of the Illuminating Engineering Society by Mr. H. T. Tizzard, C.B., F.R.S., secretary of the Department of Scientific and Industrial Research. His attention had recently been directed to the problem of school lighting, and from a conversation with an ophthalmologist he gathered that inadequate lighting was one reason for the tendency towards the deterioration of vision during school life. He said he had interested himself in the lighting of a school where special efforts had been made to ensure the correct placing of light sources with regard to the desks and blackboard, for the purpose of eliminating conditions that might cause eyestrain. The results of his efforts were quite encouraging, and, so far, there was no evidence of further deterioration of the eyesight of the pupils.

At the Merchant Taylors School, Charterhouse Square, the great hall, which at one time was lit by gasoliers, is now served by diffused electric lighting. This is effected by a number of unobtrusive bronze octagonal units with white rippled glare-eliminating glassware. Each unit is installed some 30 ft. above the desks, and is equipped with a special form of silvered-glass distributing reflector which permits of the light emitted from 200-watt lamps being directed downwards, so as to provide ample light without shadow or glare.

In producing the successful scheme referred to, the General Electric Co., Ltd., collaborated with Messrs. Maxwell Butcher & Co., Ltd., the electrical contractors responsible for the scheme.

Fig. 3.—An Elementary School Class Room.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Marking of Imported Glassware.

A Board of Trade Committee under the Merchandise Marks Act, 1926, began an inquiry last week into an application for the marking with an indication of origin of: Domestic, fancy, and illuminating blown glassware of all descriptions (other than electric lamp bulbs); pressed glassware of all descriptions; and bottles, jars, and other containers of glass. The original application included lamp-blown ware and scientific glassware of all descriptions, including tubing and rod, but this is to be considered as a separate application. The applicants were the Glass Manufacturers' Federation, the British Flint Glass Manufacturers' Association, and the Northern Association of Pressed Glass Manufacturers, supported by other trade associations and the trade unions concerned, as well as a number of individual firms.

Mr. Wethered appeared for the applicants. The principal opponents were the China and Glassware Section of the London Chamber of Commerce and some groups of British manufacturers. Mr. Wethered, for the appellants, dealing with domestic, fancy, and illuminating blown glassware—other than electric lamp bulbs—said that imports of that class had increased from £1,768,985 in 1921 to £2,247,939 in 1927, and it was complained that foreign makers had copied British designs and trade names so that it was practically impossible for anyone to distinguish the foreign from the British. Foreign articles were often mixed with British articles and sold at prices equal to the best English glass; there was no doubt that many purchasers bought foreign glass under the impression that they were buying English ware. It was suggested that an indication of origin could be given by means of an acid transfer or sand blasting; indeed, some British firms had been doing that for years. The cost would be exceedingly small. British firms made 25 per cent. of the lighting glass required in this country. Answering the chairman, Mr. Wethered said that lighting glassware included shades for electroliers and chandeliers, glass globes for gas or electric lighting, bowls, lamp chimneys, and any form of glassware used for lighting purposes.

Some evidence was given on April 30th with regard to illuminating glassware. Cross-examining one witness, Mr Macaskie (for the opponents) suggested that if a globe or shade were prominently marked, the impression would be given that the whole fitting was foreign, but the witness did not agree. Another witness objected to the use of adhesive labels which were too easily removed; he said that permanent marking should be employed.

The Chloride Electrical Storage Co., Ltd., has lodged an objection to the marking of glass bottles, jars, and containers It maintains that it finds it difficult to obtain suitable accumulator containers from British manufacturers, and therefore imports them. If the foreign containers were marked to indicate their origin, there would be a grave danger that the marking would be taken to apply to the whole of the accumulator.

At the resumption of the hearing on Monday last and on succeeding days evidence of a general nature, for and against marking, was given by a number of prominent glass manufacturers and buyers.

General Rise in Australian Wages.

Owing to a sharp rise in the cost-of-living figures in Australia during the first quarter of this year there have been large increases in the basic wages in various States. As a result it is calculated that the Victorian Government Railways will have to pay £200,000 per annum more in wages, while the Melbourne Tramways' wages bill will rise by £30,000.

An ex-Siemens Association.

At an enthusiastic meeting held at the Hotel Cecil on April 27th it was decided to form an Association of Ex-Siemens' Men, and a portion of the committee and the officers were elected. The qualification for membership is that applicants should be ex-members of the Siemens' organisation who have served at least one year on the staff. A dinner is to be held at the Hotel Cecil on Wednesday, May 29th, and it is hoped that there will be a good muster. Mr. J Snow Huddleston has been appointed hon. secretary and treasurer, and will be pleased to forward full particulars of the Association and also of the dinner to any intending members. Inquiries should be addressed to the hon. secretary, c/o The Union Cable Co., Ltd., Dagenham Dock, Essex.

"The Eight Markets of the World."

This is the sub-title of a "salemanship" article which appeared in last week's *Times Trade and Engineering* Supplement, and it is designed to remind British firms that the world market is not a single entity with the same characteristics throughout. There are really a number of quite distinct markets, each with its individuality, which can conveniently be classified under eight heads:—Western Europe; the Near East, including Eastern Europe, Asia Minor and the north coast of Africa; Africa, roughly south of the Equator; India. Burma, the Malay States, the East Indies and Afghanistan; Eastern Asia; Australia and New Zealand; Canada and the United States; and Central and South America, and the West Indies. Several important British firms have already divided up the world into these or similar areas and as a result their sales organisations have been simplified, costs have been reduced, and sales increased. Each district is under the control of a sales supervisor who is responsible to headquarters for the sales throughout his district, and each district is of such a size that he can visit each branch or agency at least twice a year if necessary. The interests of the districts are looked after at headquarters by eight district advisory managers who work in close co-operation with the district sales supervisors; indeed, it would probably be a good thing if the two changed places every two years, thus ensuring that each is up to date in his knowledge of affairs both at home and in his district.

A Hire-purchase Financing Company.

The United Dominions Trust, Ltd., a banking concern which specialises in hire-purchase transactions, has sent us an illustrated brochure outlining its ten years' history. It has made tremendous progress, which may, perhaps, be looked upon as an index to the growth of the hire-purchase system in this country. The booklet sets out the various classes of trade for which the Trust caters, special reference being made to the engineering, electrical and allied industries.

United States Electrical Exports.

The total value of electrical machinery and equipment exported by the United States during February last was $10,625,444, as compared with $7,891,786 in the corresponding month of 1928. The increase was general, but the following items made notable advances:—Radio apparatus from $563,352 to $1,120,309; refrigerators up to one-ton capacity from $368,513 to $598,542; insulated copper wire and cable from $368,918 to $605,897; bare copper wire from $190,753 to $385,376; stationary motors from $193,919 to $349,374; vacuum cleaners from $68,785 to $135,217; sparking plugs from $75,958 to $259,472; and unspecified apparatus from $557,970 to $904,545. There were very few important decreases: a.c. motors fell from $51,957 to $8,920; telephone apparatus from $432,556 to $363,132; and furnace electrodes from $231,316 to $167,145. Canada, as usual the principal market, took American goods valued at $2,826,498. The United Kingdom ($775,857) was second, and Argentina ($636,814) third. Other leading customers were:—Australia ($519,974), Brazil ($464,776), Italy ($407,079), and Mexico ($401,740). United States electrical imports during February had a value of only $163,555.

Electric Pumps for Brazil.

A brief confidential report on the market for electrically-driven water pumps in Brazil has been prepared by the Department of Overseas Trade from information forwarded by the Commercial Secretary at Rio de Janeiro (Mr. Stanley G. Irving). United Kingdom firms desirous of receiving a copy of this report should communicate with the D.O.T., 35, Old Queen Street, London, S.W.1. (Reference A.X. 7886.)

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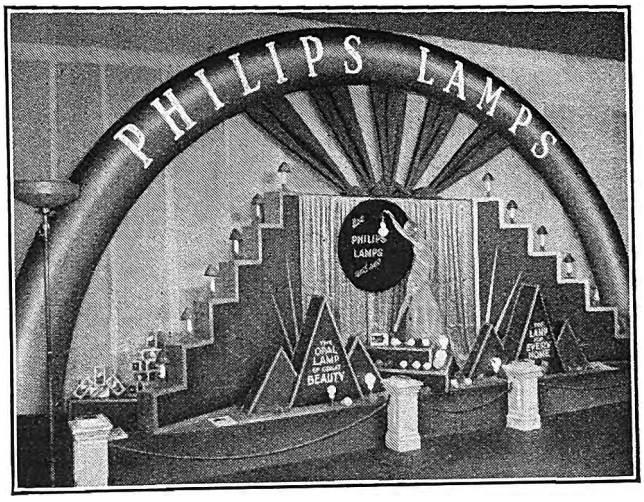
Unemployment.

The registers of the Employment Exchanges at April 22nd showed a decrease of 12,840 in the number of unemployed during the week. At that date the total was 1,140,700, as compared with 1,153,540 on April 15th and 1,062,285 on April 23rd, 1928.

A Philips' Lamp Display.

The picture which accompanies this note shows one of the windows of the premises of Messrs. Lewis's, Ltd., Liverpool, as arranged by the display staff of Philips Lamps, Ltd. It is an example of the effectiveness of simplicity, no effort being needed to take in the whole of the window and its message at a glance. The most striking feature is the "rainbow" in natural colours which arches over the display.



A Philips Display at Liverpool.

Estonian Electrical Imports and Exports.

During February last the imports into Estonia of electrical machines, apparatus and implements were valued at 187,730 kr. (about £10,000), while exports of the same class were valued at 14,041 kr. (£770).

Price Reductions.

The EDISON SWAN ELECTRIC CO., LTD., announces reductions in the prices of its vacuum grid leaks and anode resistances.

Book Notices.

"The Henley Telegraph," Vol. III, No. 24 (56 pp.). London: W. T. Henley's Telegraph Works Co., Ltd. Price 6d. net.—The latest number of this well-produced house organ includes some notes on the origin of the company, a report of the annual staff dinner, and a sketch of the career of Mr. P. Dunsheath, O.B.E., who has been appointed Research and Technical Manager to the company, as well as other illustrated articles and notes.

"Some Notes on the Stroboscope; with particular reference to the Ashdown 'Rotoscope.'" (Pp. 48, 21 figs.). Published by A. J. Ashdown, Ltd., 119, Victoria Street, S.W.1. Price 1s. 6d.—A number of prominent engineers have assisted in the compilation of this brochure, which explains the principles and construction of stroboscopes and the company's "Rotoscope." The many applications of the apparatus are dealt with in an interesting way.

"Kempe's Engineer's Year Book for 1929." Pp. lxxvii+3289. London: Crosby, Lockwood & Son. Price 30s. net.

"Bulletin of the British Cast Iron Research Association." No. 24. April, 1929.

Babcock & Wilcox in Spain.

A message from Bilbao says that the Compañía Euskalduna and Babcock & Wilcox are negotiating for the joint erection of a works near Bilbao for the manufacture of Diesel-electric engines and accessory material, chiefly for the railways.—*Reuter's Trade Service* (Madrid).

Income Tax and Hire Purchase.

Upon representations from the Hire Traders' Protection Association the Commissioners of Inland Revenue have approved an optional alternative method of computing the assessable profits of hire-purchase traders. This involves the treatment in accounts of unpaid balances under hire-purchase agreements as "Stock out under hire-purchase agreements," such stock to be valued by deducting from the outstanding balances the proportion of gross profit included therein. It is not proposed that the method shall be applied to each individual transaction, but that the whole of the hire-purchase business of a trader shall be considered and an average percentage of gross profit employed for calculation purposes. The Commissioners' decision, in effect, is that in future they will not treat hire-purchase contracts as actual sales on instalments, but as the hiring of articles, which does not involve the payment of income tax when the agreement is signed, the tax being spread over the period of hiring. Further details of the scheme can be obtained from the Secretary of the Association, 27, Chancery Lane, W.C.2.

Recent Contracts.

The ELECTRIC FURNACE CO., LTD., has recently received a number of orders for furnaces in foreign countries, in some cases in spite of heavy import duties. These include two Héroult furnaces for India and Brazil, four Ajax-Wyatt furnaces, each of 600 lb. capacity, and four Ajax-Northrup high-frequency furnaces, varying from 15 cwt. to 2 cwt. capacity, for France. The company will also shortly be putting into operation a one-ton Ajax-Northrup furnace in France. This furnace, of which the output is equivalent to a four-ton arc furnace or an eight-ton open-hearth furnace, is claimed to be the largest h.f. furnace yet constructed, and has been designed and built in Great Britain. The company will shortly be starting three 5-cwt. Ajax-Northrup furnaces in France, which were ordered last year.

Among the orders recently received by the AIREDALE ELECTRICAL & MFG. CO., LTD., are a year's contract from Liverpool Corporation for air- and oil-break motor starters; Marconi's Wireless Telegraph Co., Ltd., special control panel; South African Railways and Harbours Board (per Messrs. Rice and Diethelm, Ltd., Johannesburg), six-panel unit type ironclad l.p. switchboard.

The IRON & NICKEL BATTERY CO., LTD., informs us that "Ionic" batteries have been supplied for emergency lighting in the *Ulster Monarch*, *Ulster Queen*, and the *Ulster Prince*. The *Ulster Monarch* is the first oil-engined passenger vessel to be placed in service on the Liverpool-Belfast route.

Messrs. DARWINS, LTD., Sheffield, have received an order from the Philips Co., Eindhoven, Holland, for magnet steel valued at £100,000.

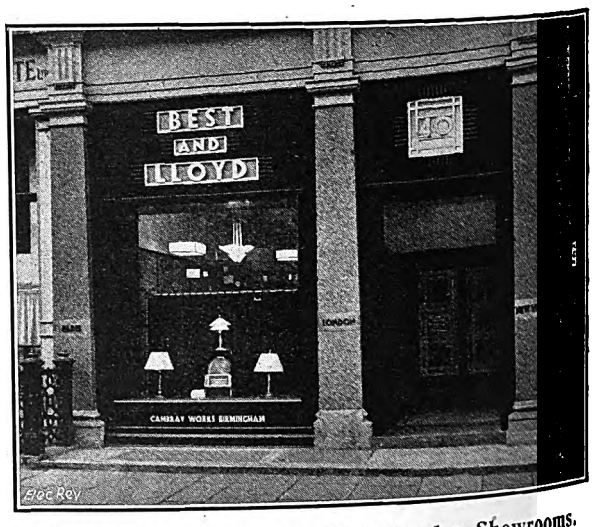
Cardiff Corporation has placed a further order with the EQUIPMENT & ENGINEERING CO., LTD., for two miles of phono-electric trolley wire. The company has also received another order from the Manchester Corporation Tramways for an "E.L.1," two-operator welding plant.

The Radio Wholesalers' Federation.

At a meeting of the new Council of the Radio Wholesalers' Federation on May 1st, Messrs. C. H. G. Hobday (Hobday Bros., Ltd.) and W. A. Hunt (London Electric Stores, Ltd.) were co-opted members. The officers for the year were elected as follows:—Chairman, Mr. E. W. Houghton (Houghton-Butcher (G.B.), Ltd.); vice-chairman, Mr. B. R. Banks (Brown Bros., Ltd.); hon. treasurer, Mr. A. G. Beaver (Sun Electrical Co., Ltd.). The above gentlemen, with Mr. T. Beadle (T. Beadle & Co., Ltd.), again constitute the Federation's Liaison Committee.

New London Showrooms.

Messrs. Best & Lloyd's new offices and showrooms in Great Marlborough Street, W., are noteworthy for the attractive front (illustrated herewith). The colour scheme is black and red, well calculated to set off the fittings, and the lights in the window. The architect was Mr. V. O. Rees. The advent of such firms into the heart of the West End may be taken as a sign of the growing importance of the electrical trade. Among the many articles shown are "Firelight" glass fittings, and the "Rippleray" electric fire. These are only two examples of modern well-designed fittings to be seen at the new premises. Recent lighting contracts carried out by Best & Lloyd include the Royal Horticultural Hall, Westminster; the Co-operative Permanent Building Society's new headquarters in London; the Ritz Palais de Danse, Manchester; and the Manchester Ship Canal offices.



Messrs. Best & Lloyd's New London Showrooms.

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Trade Announcements.

In addition to existing branches in London, Birmingham, Bristol, Dublin, Glasgow, Manchester, and South Wales, Messrs. BLACKSTONE & CO., LTD., have opened a further branch at Groat House, Collingwood Street, Newcastle-on-Tyne.

Messrs. T. BEADLE & CO., LTD., Hull, in addition to their branches at Grimsby, Leicester and Liverpool, have now opened a branch at 96, Hamilton Street, Birkenhead, for the sale to the trade only of radio and electrical material.

The Ipswich branch of the GENERAL ELECTRIC CO., LTD., is being moved, as from May 13th, to larger premises in Westgate Chambers, 40b, Westgate Street, Ipswich. The telephone number and telegraphic address will remain as at present, *viz.*: Ipswich 2379 and "Electricity, Ipswich."

Mr. G. J. PAYNE has been appointed London sales manager of the Electrical Power Engineering Co. (Birmingham), Ltd. His offices are at Fetter House, Fetter Lane, E.C.4.

Messrs. ALBERT E. SUDLOW & CO. have removed to new premises at 60, George Street, Manchester.

Glasgow and a German Tender.

At its meeting on May 1st the Glasgow Tramways Committee decided to recommend the Corporation to accept a tender for copper trolley wire submitted by Messrs. Dennis & Co. for material made by Felten & Guilleaume, Germany. An amendment that the order should be divided between two British companies was rejected. It was stated that the price tendered for the German wire was £1,260, and the lowest British offer £1,372.

German Foreign Electrical Trade.

The exports of electrical plant, apparatus, and fittings from Germany attained a value during January last of £2,518,850, as compared with £1,864,950 in the corresponding month of 1928. The German imports of similar material advanced from £176,600 to £229,300.

Cycle Traders as Electrical Retailers.

In the course of a recent article on "Electrical Fittings as Selling Lines" a writer in the *Motor Cycle and Cycle Trader* urges that "the cycle dealer who is on the look out for additional means of augmenting his income would do well to consider selling electrical fittings in his own district."

A New Cable Works at Derby.

In our "New Companies" section particulars are given of Derby Cables, Ltd., which is being formed with a capital of £100,000. A factory of considerable size is being built for the company in Alfreton Road, Derby, for the manufacture of electric cables. The directors are: Mr. C. A. Newton, A.M.I.E.E. (chairman), Mr. J. H. Lord, Lt.-Col. H. Newton, C.B.E., D.S.O., Mr. H. B. Potter, and Mr. F. Newton (managing director). Mr. H. E. Sewell, who until recently was works manager for the Macintosh Cable Co., is the general manager. The directorate is practically the same as that of Haslam and Newton, Ltd., who hold a controlling interest in the new company. The factory is progressing rapidly, and will be equipped with the latest type of plant for the production of paper-insulated and armoured cable, all types of v.i.r. cables, compound-insulated cables of all types, mains, shaft and trailing cables for collieries, dynamo and other flexible cables and cords, switchboard cables, railway signal cables, and ship wiring cables.

Bankruptcy Proceedings.

L. N. BENNETT, 113, Croydon Road, Caterham Valley, late of Herne Bay, radio engineer.—The receiving order herein was made on the debtor's own petition, and, according to the statement of affairs filed, there are liabilities of £315 and no assets. The debtor attributes his position to the failure of a company to discharge his liabilities under an agreement. He traded with another from August, 1924, until June, 1926, as "The Efficiency Wireless Service." The partner retired, and received £225, part of which the debtor had borrowed, for his outgoing interest. The debtor carried on alone until July, 1927, when he transferred the concern to a company which he registered, with a nominal capital of £100. The company acquired his assets, estimated at about £300, and agreed to discharge his liabilities amounting to about £250, and the debtor received as consideration 99 fully paid £1 shares, and was appointed a director. Heavy losses were incurred, and the company has been unable to discharge his liabilities. In June, 1928, the debtor resigned his directorship and disposed of his shares for £400, which he immediately lent to the company, and now regards as a bad debt. At the first meeting of creditors the case remained in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Court Bros.	35	Reynolds, D.	160
Latimer, H. H.	63	Hobday Bros., Ltd. ...	28

W. R. BALL and J. H. LEACH, trading as R. Ball & Co., electrical engineers, 187, Upper Street, Islington.—This firm failed in March, 1925, and on April 30th the debtor Ball applied to Mr. Registrar Mellor at the London Bankruptcy Court for an order of discharge. The Official Receiver reported that the liabilities amounted to £2,389, and the assets had realised £20. The applicant began business in January, 1922, with £100 capital as an electrical and mechanical engineer, and in March, 1923, was joined by Leach, who provided cash £100 and machinery £100 in return for a one-half share of the business. In September, 1924, they entered into an agreement to supply the X.L.O. Company with 15,000 pairs of headphones. Owing to delay on the part of the manufacturers of certain materials, the delivery of the first consignment was late, and in consequence the contract was cancelled. In February, 1925, they were sued for breach of contract, and judgment was given against them for £369, of which only £70 was paid at the date of the receiving order. They continued business until March, 1925, when their stock, machinery and effects were sold under an execution levied by another creditor. The discharge was suspended for three months.

H. N. SHORROCK, electrical engineer, Hollings Yard, Heysham Road, Morecambe.—Trustee, Mr. H. Parker, Official Receiver, 9, Cannon Street, Preston, released April 19th.

A. H. CRUMP (Selwyn Electrical Engineering Co.), electrical engineer, late of 184, 202 & 220, Walworth Road, S.E.—Last day for proofs for dividend, May 18th. Trustee, Mr. W. Boyle, Senior Official Receiver, Carey Street, W.C.

M. J. SCOTT (M. J. Scott & Co.), electrical engineer and contractor, 100, Jermyn Street, S.W.—Supplemental dividend of 2s. 1½d. in the £, payable at Carey Street, W.C.

H. B. POWELL, wireless dealer, 6, Chandos Street, and 10, Union Street, Hereford.—Second and final dividend of 1½d. in the £, payable May 10th at the Official Receiver's Office, 133, St. Owen Street, Hereford.

E. TEMPLE and J. E. BURKETT (Westoe Electrical Co.), wireless dealers and electrical contractors, 105, Canterbury Street, South Shields.—First and final dividend of 2s. 8d. in the £, payable May 8th, at the Trustee's Office, 48, Pilgrim Street, Newcastle-on-Tyne.

E. R. MILLWARD (West of England Radio), wireless engineer, 67, High Street, Barnstaple.—Receiving order made April 29th on debtor's own petition.

A. B. GREGORY, wireless expert, 29, St. Albans Road, Seven Kings.—Bankrupt's discharge suspended for six months until September 18th, 1929.

K. P. J. JOLWARD.—CORRECTION.—In the list of creditors in this matter which appeared in our last issue p. 787, the name "P. W. Rawes" should have been P. W. Rands.

Company Liquidations.

KEYSTONE INVESTMENT TRUST, LTD., Bank Chambers, Kingston-on-Thames.—Under the compulsory liquidation of this company, the report of the Official Receiver and Liquidator shows that the trust was registered as a public company in April, 1923, with a nominal capital of £30,000, subsequently increased to £100,000, and was formed to undertake all kinds of financial and commercial business. It was promoted by W. H. Butler, whose real name was Brown, and who was found drowned in the Thames last October. According to the returns, 81,134 shares had been issued for cash, and practically the whole of the capital had been utilised in financing companies promoted and controlled by Butler. Among these were the Tidal Power Syndicate, Ltd. (£11,874); and Pinnacle Switchgear, Ltd. (£6,899). In July, 1924, Butler registered a company under the title of "Weaver Tidal Power Syndicate, Ltd.," with a nominal capital of £30,000. The name was altered to "Tidal Power Syndicate, Ltd.," in 1925. The object was to acquire certain land at West Mersea, Essex, in order to develop a project for utilising the rise and fall of the tides for the production of electric power. According to information furnished by Syminton, a director of the Syndicate, an option of the land had been acquired by a third party from one of the Loewenstein group of companies. Sums amounting to about £6,000 are said to have been paid in respect of the option. It appears, however, that the purchase was not completed. The Syndicate then purchased the land direct from the owners for £37,228, which was satisfied in part by a mortgage on the property for £16,000 and cash payments amounting to £17,758. Loans were made by the Trust from time to time, and at the end of 1924 there was a sum of £12,117 due to the Trust. This was satisfied to the extent of £12,065 by the issue to the Trust of debentures of the Syndicate of the nominal value of £12,700, which were subsequently disposed of to various persons stated to have been shareholders in the Trust. Further moneys were advanced by the Trust to the Syndicate and, according to the books of the Trust, there was at the end of 1926 a sum of £10,375 outstanding, which was wholly unsecured. To enable these advances to be made, the Trust appears to have borrowed sums amounting to £9,420 from shareholders during 1925, but no security was given. The Trust was also the registered holder of 15,000 of the Syndicate's shares, which were shown in the books at a cost price of £1,499. Syminton has informed the Official Receiver that it was intended that the Syndicate should promote a large public company in order to carry through the original scheme for the development of tidal power; that for this purpose it was essential that the assistance of the Trade Facilities Committee should be obtained, and that it was contemplated that a loan of at least £300,000 would be made, which, in view of the national importance of the project, it was understood would be forthcoming. Owing to lack of funds it was impossible to obtain the necessary reports from expert engineers, and the Trade Facilities Act

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Committee thereupon refused the application for a loan. In August, 1927, the funds of the Syndicate were exhausted and, the interest on the mortgage being in arrear, the mortgagees commenced proceedings for payment of both principal and interest. The action came before the High Court early in 1928, but numerous adjournments were obtained by Butler on account of ill-health, and the case was in the list for hearing at or about the time of his death. According to Syminton, the Syndicate is without any funds or assets of any kind, and its operations have been suspended. Pinnacle Switchgear, Ltd., was promoted by Butler as a public company in April, 1925, with a nominal capital of £21,000; it was formed to carry on business as manufacturers of electric switches and fuses to be supplied principally to the Admiralty. According to information furnished by Easterfield (a former director), the company was a reconstruction of the Wholesale Electric Co., Ltd., which carried on business at Weybridge. The Trust acquired 250 shares of the Wholesale Electric Company in 1924, and subsequently took up debentures to the nominal value of £2,800. The company went into voluntary liquidation, and a reconstruction scheme was carried through under which the Trust, in exchange for its debentures and shares, was allotted 4,720 £1 preference shares and 19,993 1s. deferred shares in Pinnacle Switchgear, Ltd. Further shares were acquired by the Trust, some of which were subsequently sold. On December 31st, 1926, the Trust held 3,110 preference shares and 19,283 deferred shares, the cost of which was brought into the books at £3,839. Loans amounting to £3,060 were also made by the Trust which are still unsatisfied. It appears that the Switchgear Company created debentures for £3,000 in March, 1927, and that in the following August the debenture holder appointed a receiver, who carried on the business for a short time, and subsequently disposed of it for an amount which was insufficient to discharge the sum due under the debentures.

The Official Receiver further reports that, so far as can be ascertained, the assets of the Trust have no realisable value, and there is no probability of any assets becoming available in the liquidation for the benefit of the creditors or shareholders. The directors state that they are unable to express any opinion as to the cause of the failure. In the opinion of the Official Receiver the failure is directly attributable to reckless and extravagant mismanagement on the part of Butler. The conduct of the other directors calls for serious criticism, as they apparently allowed themselves to be entirely dominated by Butler.

Helikon Wireless Co., Ltd., 6, Park Royal, North Acton.—The winding up order herein was made recently. According to the statement of affairs there are liabilities amounting to £1,188 against net assets of £24, leaving a deficiency of £1,164. The issued capital of the company was £197, and as regards contributories there is a total deficiency of £1,361. The company was registered as a private company in November, 1925, for the purpose of carrying on business as merchants and dealers in wireless accessories with a nominal capital of £300. It commenced business with an office and warehouse in Camomile Street, E.C. In May, 1928, a factory was acquired, and the company began to manufacture electric lamps. Balance sheets and trading and profit and loss accounts for the year ended November 30th, 1926, showed a trading loss of £392, and for the year ended November 30th, 1928, there was a further loss of £393.

Super Electric Heaters, Ltd.—Winding up voluntarily. Liquidator, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Birmingham. A meeting of creditors is called for May 13th, at the liquidator's offices. Particulars of claims by May 27th.

Private Arrangements.

International Electric Co., Ltd., Ashley Road, Tottenham, N., telephone manufacturers.—A meeting of creditors, convened by Messrs. Stoneham & Sons, solicitors, 108a, Cannon Street, E.C., was held at the Midland Hotel, St. Pancras, on April 23rd. The chair was occupied by Col. Simpson (a director), who was stated to be the largest shareholder. Mr. Stoneham said that the company was registered in 1911, and at the outbreak of war the question arose whether the business could continue. It had been carried on with varying success until 1927, and in that year Col. Simpson, the chairman, took a hand in the management. He (Mr. Stoneham) was called in in the autumn of 1927, and he found that Col. Simpson had advanced without any security a sum of £10,000. He was called in to advise Col. Simpson as to what should be done, and he found that there was registered in 1923 an issue of debentures for £70,500. Even in 1927 the arrears of interest on these debentures were very considerable, and they now amounted to upwards of £20,000. Therefore there was a prior charge on the company's assets of not less than £90,000, and the amount might ultimately be found to be nearer £100,000. In 1927 it was considered that there was some prospect of success, and Col. Simpson thought that it would be worth his while to find further money for the company. Accordingly, an arrangement was made, the debenture holders were interviewed, and they expressed themselves as being willing to stand aside so far as their interests were concerned, and, moreover, that they would not take any immediate steps for the protection of their interests. An agreement was entered into under which Col. Simpson was given a certain amount of authority with regard to the affairs of the company, but he was given no security whatever. He was, in fact, to rank as an ordinary creditor. In addition to this, in the event of liquidation, he was to rank even behind the ordinary trade creditors. The object aimed at was to pull the company round and then make terms with the debenture holders. Col. Simpson would then have been satisfied to take his interest in shares. In the spring of 1928 it seemed as if the company were being pulled round. The business was becoming active and orders were being carried out, but great difficulty was experienced with orders which had been on the books for a considerable time and had to be cleared. Balance sheets were made up on November 30th in each year, and it appeared that at November 30th, 1927, the amount due to trade creditors was £8,746. A year later the balance due to creditors was £8,526, and during this period the purchases had amounted to between £30,000 and £40,000. The debenture holders could not be expected to let things remain as they were, and Col. Simpson felt that he could offer no more financial support; he had already provided £44,800. After many discussions they had come to the conclusion that the only alternative was a reorganisation scheme. Certain negotiations had taken place recently, and he thought there was a possibility of a reconstruction on sound lines, and that the company would then attain a new lease of life. It was quite evident that on the basis of the figures which he had submitted there was not the slightest chance of the trade creditors receiving a penny if a liquidation were to ensue. He appealed to the creditors to grant a moratorium, because under this scheme there was a prospect of some kind. If they would do this for six months the debenture holders would give their support, and creditors would, he hoped, support the company to the extent of supplying raw material and goods at competitive prices, against cash or guaranteed payment. It was also undertaken that if a receiver were appointed and this resulted in a realisation, then the creditors would be guaranteed to be paid 10 per cent. on the amount of their present debts. Mr. Stoneham said that three creditors had taken action, but it was hoped that these would fall in with the scheme. The total unsecured claims at the present time so far as trade creditors were concerned were £10,251. In reply to a question, Mr. Stoneham said that the holders of the debenture were William Deacon's Bank. Asked as to the value of the stock, it was stated that this amounted to about £23,000. Mr. Houston observed that the offer of the 10 per cent. to the creditors was really equivalent to a sum of about £1,000, which did not seem a very large amount. A long discussion ensued, in the course of which many creditors expressed their views, and the representative of Messrs. Mansell, Booth & Co., the second largest creditors, who had taken proceedings, stated that he could not at present undertake to fall in with the proposal made. He said that he had given the company four or five months' credit and felt rather perturbed about the present position. Other creditors said they thought it would be wise to accept the moratorium. Eventually a resolution was passed that the trade creditors should agree to grant a moratorium for six months from April 18th on such terms, being not less than 10 per cent., as the committee representing three of the principal creditors agreed to.

Receiver Appointed.

Hendon Electric Lamp Co., Ltd.—Mr. Harold Bell, 22, Bedford Row, W.C., informs us that he has been appointed receiver and manager for the debenture holder of this company.

Dissolution of Partnership.

Crofts & Smith, electrical, mechanical and radio engineers, Queen Street, Deal.—Mr. J. F. Crofts and Mr. E. W. Smith have dissolved partnership. Mr. Smith will continue the business.

An American "Trust" Inquiry.

The *Daily Mail* states that the Federal Trade Commission of the United States is inquiring into the propagandist activities of the American light and power industry. Mr. A. R. Graustein, president of the International Paper & Power Co., giving evidence, said that his company had acquired £2,000,000 of stock in 13 newspapers, but denied that his company had attempted to influence the editorial policies of those papers. Senator Norris, of Nebraska, described the light and power industry as "the greatest trust ever known," and accused it of seeking with money subscribed by the public to gain control of schools, churches, civic organisations, legislative bodies, the Press, and broadcasting systems.

Lamp Standardisation in Holland.

The Dutch main committee on standardisation has appointed a sub-committee for studying the standardisation of electric glow lamps, under the chairmanship of Prof. H. S. Hallo, of the Technical High School, Delft, and a meeting was recently held to consider the working programme. It is proposed to deal with both gasfilled and vacuum lamps; and the questions of voltage, energy consumption, the form of the lamp, shape of the wire, &c., are to be considered for ordinary and special types.

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The National Radio Exhibition.

We have received from the Radio Manufacturers' Association some particulars of this year's National Radio Exhibition which is to be held in the New Hall, Olympia, from September 23rd to October 3rd. These include plans of the "lay-out" of the ground floor and the gallery, together with a schedule of charges for space; the Board of Trade requirements with regard to the provisional protection of inventions; and a formal contract for space. Space is to be allotted by ballot to firms whose applications are received by May 31st.

New Catalogues and Lists.

THE LANCASHIRE DYNAMO & MOTOR CO., LTD., AND THE CRYPTO ELECTRICAL CO., LTD.—A folder outlining the history of the companies, with illustrations showing the "Lancashire" and "Crypto" works.

THE WHOLESALE FITTINGS CO., LTD.—List No. W.233, dealing with radio receiving sets, including portable outfits and radio components.

PHILIPS LAMPS, LTD.—Publication No. 404, a priced and illustrated folder showing industrial lighting fittings, outdoor lanterns, and a foot-candle meter.

THE ZENITH ELECTRIC CO., LTD., Villiers Road, Willesden Green, N.W.2.—A priced and illustrated catalogue of various types of regulating resistances, and a pamphlet describing the company's choke coils with adjustable air gaps, &c.

THE MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Denmark Street, W.C.2.—"Radio for the Million," Vol. 3, No. 1, describing the "S.G.P. Master Three" set incorporating screened grid and "Pentone" valves.

"Z" ELECTRIC LAMPS & SUPPLIES, LTD., 73, Newman Street, Oxford Street, W.1.—A well-illustrated price list of electrical accessories—switches, adapters, plugs and sockets, brackets, &c. Also a comprehensive catalogue of "Association" lamps, including a discount chart.

THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—An illustrated price list of "Ediswan" dry-charged automobile lighting and starting batteries and accessories.

ELECTRIC NEWS PANELS, LTD., 14-17, Wells Street, W.1.—A well-produced brochure, illustrated in colour, advertising the company's animated electric letter signs.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The May "Osram-G.E.C. Bulletin," containing illustrated articles on the lighting of roads and buildings with the company's fittings and lamps; radio valves and sets; "Magnet" domestic appliances, &c. Also a series of revision sheets for the company's large blue catalogue of "Everything Electrical."

Calendar-blotters for May have been received from POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, W.C.2; MAVOR and COULSON, LTD., 47, Broad Street, Mile End, Glasgow; S. ROGERS & CO., LTD., 15, Fitzroy Street, W.1; the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1; and WARREN BROS. (MIDDLESBROUGH), LTD.

MESSRS. HENRY WALLWORK & CO. (1920), LTD., Roger Street, Manchester.—A series of illustrated pamphlets containing particulars of the company's worm and spur gears.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—An illustrated leaflet (E.1538) describing the "A.E.G." phantom load for calibrating a.c. watthour meters. Also a leaflet describing a two-part tariff prepayment meter. Illustrated and priced.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, W.C.1.—A 40-page booklet containing illustrated details and prices of the company's receiving sets, battery eliminators, chokes, transformers and other radio apparatus; and a folder giving particulars and performance curves of the "Hypermu" transformer.

Fire.

The *Liverpool Post* reports that damage estimated at £25,000 was caused by a fire which occurred on May 1st at the premises of Messrs. H. T. Boothroyd, Ltd., Akenside Street, Bootle, electrical and mechanical engineers.

Prices of Raw Materials.

Messrs. F. SMITH & CO. and Messrs. JAMES & SHAKESPEARE, report, May 7th.: No change in copper and lead prices.

Messrs. EDWARD TILL & CO., report, May 7th: India rubber, para fine 11½d., 1½d. inc.

Reporting on May 4th, Messrs. James Forster & Co. stated that a firmer tone was apparent in the lead market last week. Prices opened steady on Monday, and slightly advanced until Friday, when there was a small setback. Conditions in the market are very quiet. A little more business has been passing this week with consumers, chiefly for prompt lead, although the aggregate does not amount to much. However, with arrivals scarce, and consequently no selling pressure, it is not surprising that prices have kept up in the face of the small demand. If consumers can hold off buying until further supplies from Mexico arrive, lower prices seem to be indicated. On the other hand, if they are forced to enter the market under the present conditions of short supplies, higher prices will result.

Lighting and Power Notes.

Australia.—PERTH (W.A.).—According to the *Electrical Engineer of Australia and New Zealand*, tenders are to be called shortly for plant for extending the West Australian Government power station at East Perth. The station provides bulk supplies to the Perth and Fremantle Municipal Councils, the Perth tramways and other authorities, and retail supplies in the area around Perth. An extension of plant bringing the total capacity up to 32,000 kW was completed last year, but owing to the increasing demand, further plant will be required by 1932. The Government, therefore, is preparing to call for tenders for an additional 12,500-kW turbo-alternator and two 65,000-lb. boilers, with all necessary auxiliary plant. The estimated cost of the extensions is £216,845.

VICTORIA.—The Sugarloaf hydro-electric power station was formally inaugurated by the Premier (Sir William McPherson) on March 20th. The plant consists of two 9,000-h.p. turbines direct-coupled to 7,200-kVA alternators. During the winter months when the reservoir is being filled there will not be sufficient outflow to operate the turbines, and the load will be taken up by the stations on the Rubicon river, which have been in operation for some time. In the summer there is not sufficient water to fully operate the Rubicon stations, and the main load will be carried by the Sugarloaf plant.

Bicester.—ELECTRICITY SCHEME.—At a recent public meeting, Mr. A. J. Bridge, of the Western Electricity Supply Co., Ltd., which is carrying out the electricity scheme for the district, explained the system of charges for electricity supply in the town, and other details of the scheme.

Birkenhead.—LOANS.—The Corporation Electricity Committee has received sanction to a loan of £2,200 for laying an e.h.p. main from Upton to Greasby and £1,360 in connection with the extension of h.p. mains and additional switchgear at the Singleton Avenue sub-station.

The Committee is applying for sanction to a further loan of £1,754 for h.p. mains.

Burnley.—LOANS SANCTIONED.—The Corporation has received sanction to loans of £6,260 for the construction of stores for the Electricity Department, and £35,000 to meet anticipated expenditure on mains during the next three years.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Resumption of work on the Ontario Hydro-Electric Power Commission's 54,000-h.p. development at Alexander Landing, on the Nipigon river, is to take place immediately. This undertaking, which is scheduled for completion in 1931, is stated to involve an expenditure of approximately $6,000,000, and is required to meet the growing demand for power on the Thunder Bay system.

The Provincial Water Board of British Columbia is shortly to take evidence in support of three competing applications for water power licences in connection with the Campbell River Falls, at which it is believed that 40,000 h.p. could be developed. This figure could be increased to 75,000 h.p. by the use of Buttles Lake as a reservoir. The three companies which have applied for the licences are the British Columbia Power Corporation, the Campbell River Power Company, and the Crown Willamette Company.

Cardiff.—YEAR'S WORKING.—Mr. E. Morley New, borough electrical engineer, reported to a recent meeting of the Electricity Committee that in the past year 5,527 consumers were added, an increase greater than the total number of consumers connected during the first 25 years of the undertaking. The electrical energy sold was estimated at 40,250,000 kWh, an increase over the previous year of nearly 2,000,000 kWh.

Chester.—LOAN.—The City Council has received sanction to a loan of £18,000 for overhead mains and £2,000 for outdoor sub-stations and equipment in connection with a supply of electricity to Kelsall in the area of the Northwich Rural District Council.

Chesterfield.—ELECTRICITY SUPPLY PROGRESS.—We are informed by Mr. D. H. Davies, borough electrical engineer, that during the past two years the Electricity Department has spent £55,311 on 62 miles of new mains, and has connected 4,100 new consumers. So great is the demand on the department that an application for a loan of £43,355 is to be made for further extensions of e.h.p. and l.p. feeders, l.p. distributors, &c. There are now 14,000 houses in the borough, over 8,500 of which are supplied with electricity, and it is anticipated that during the next three years practically the whole of the houses in the borough will be using electricity at least for lighting purposes.

China.—SHANGHAI.—*Year's Working.*—We have received from Mr. T. H. U. Aldridge, engineer-in-chief and manager of the Municipal Electricity Department, a copy of his report for the year ended December 31st, 1928. The electrical energy generated totalled 527,779,842 kWh, as compared with 470,195,088 kWh in 1927, and the total sales were 458,360,215 kWh, as against 400,343,385 kWh. The year's trading resulted

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in a net surplus of Tls. 3,165,300 (£395,662), and the estimated net profit for 1929 is Tls. 3,517,550 (£414,694). The total revenue amounted to Tls. 12,846,604, as compared with Tls. 11,431,130 in the preceding year. The capacity of the plant installed and in actual service remained at 121,000 kW. The section of the power station in which this plant is installed will in future be known as Riverside "A," and the section in which the two new 20,000 kW turbo-alternators and four boilers equipped for pulverised coal firing are now being completed will be known as Riverside "B." Importance is attached to the future performance of Riverside "B" in comparison with "A" so that the net decrease in cost of production under the new conditions may be carefully ascertained. The highest maximum peak load recorded was 99,000 kW, the maximum sustained load for 30 min. was 98,500 kW, and the maximum load delivered to the feeders was 95,250 kW. The maximum load for 1928 was exceeded in January this year, when it rose to 104,500 kW. The load factor was 61 per cent. as compared with 59.91 per cent. in the previous year, and the overall efficiency was 17.6 per cent. as against 17.41 per cent. There was an increase in the number of premises connected of 4,564, bringing the total to 63,927, and the consumers supplied totalled 50,532, an increase of 3,514. The connected load was 193,895 kW, additional connections during the year amounting to 18,976 kW. The record of work carried out by the distribution section indicates development over the whole system. The capacity of transformers installed increased by 25,400 kVA, bringing the total capacity to 394,291 kVA, and additional cables laid totalled 45 miles, making 488 miles in addition to overhead lines. At December 31st there were 8,494 motors, aggregating 147,074 h.p. connected to the mains, showing a net increase of 1,154 (11,461 h.p.) during the year. The heating and cooking load connected represented 34,141 kW, an increase of 7,352 kW on the figure for the previous year. The *personnel* of the undertaking at the end of the period under review consisted of 305 "foreigners" and 3,140 Chinese.

Colchester.—LOAN.—The Corporation Electricity Committee has obtained sanction to a loan of £4,776 for a main transmission line to Wivenhoe, and switchgear, &c., and £28,670 for the provision of further generating plant at Hythe generating station.

Continental.—BULGARIA.—The new steam-operated power station at Kourilo, near Sofia, was recently inaugurated in the presence of the King of Bulgaria. So far two turbo-generator sets, each of 6,400 kW capacity, have been installed, but a third set of similar capacity is on order, and is expected to be ready by October next. A second 35,000 V double-transmission line is to be erected between Kourilo and Sofia.

ITALY.—A new hydro-electric power station has recently been completed and put in operation at Isollaz by the Società Idroelettrica dell' Evancon. The plant, which utilises the power of the River Evancon in the Austa Valley, comprises two 24,000-h.p. turbines and generators. Electricity is generated at 6,000 V and stepped up to 135,000 V for transmission to the province of Piedmont and the city of Turin.

GERMANY.—A return recently issued by the German Government Statistical Department shows that the output during last year of 122 leading electricity supply undertakings in the country amounted to approximately 14,400,000,000 kWh, as against 12,410,000,000 kWh in 1927. The department estimates that the returns cover only half the total output in Germany, which for 1928 it estimates at 29,000 million kWh, an increase of 4,000 million kWh, or 16 per cent. over 1927.

BELGIUM.—On the occasion of submitting his annual budget to Parliament, the Belgian Minister of Agriculture referred to the rapid progress which was being made in providing electricity supplies in the agricultural districts and villages of Belgium. He stated that whereas in 1914 there were only 500 villages so supplied, the number is now 1,998, or approximately 71 per cent. of the total.

Coventry.—LOAN.—The City Council is applying for sanction to a loan of £7,621 for extensions to mains and sub-stations.

Halifax.—LOAN.—The Town Council has applied for sanction to a loan of £30,000 for mains.

Holbeach.—STREET LIGHTING.—The Urban District Council has accepted the tender of the Boston and District Electric Supply Co. for public lighting with 76 standards at £263 per annum.

Hull.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of a further sum of £73,618, made up as follows:—£49,339 for the conversion of boilers and boiler house building, and £24,279 for buildings, &c., and cooling tower super-structures. Approval has also been received to a balance in hand of £90,973 in respect of the £200,000 for plant sanctioned in 1925 being applied towards expenditure incurred or to be incurred on plant provided for under the £481,500 scheme, making a total (including the £250,000 previously sanctioned) of £340,973 available for plant. The Electricity Commissioners state that they will be prepared to consider sanctioning the borrowing of further amounts in respect of the application for £481,500 upon receipt of a revised detailed estimate of the final cost of the works.

Irish Free State.—LIMERICK.—The Mayor, the city surveyor, and the law adviser to the Corporation recently interviewed Dr. T. McLoughlin, managing director of the Electricity Supply Board, and Mr. P. J. Tierney relative to the proposed distribution system for the city and district, when it was explained that the h.p. cables would be underground. A commencement with the work, which will cost £32,000, will be made during the present month, and a supply of electricity will be available from the temporary power station at Ardnacrusha by September next, and from the hydro-electric station in March.

Ilford.—LOANS.—The Corporation Electricity Committee has obtained sanction to a loan of £50,000 for mains and services and £5,000 for house wiring installations.

The Committee is applying for sanction to a further loan of £5,000 for domestic apparatus to be let out on hire.

London.—TWO-PART TARIFFS.—The South Metropolitan Electric Light & Power Co. announces the introduction of the following two-part tariffs for both domestic and business purposes. Domestic "All-in" rate: Standing charge based on dimensions of premises plus 1d. per kWh. Business "All-in" rate: Standing charge of 6s. 3d. per quarter per 100 watts of installed lighting capacity plus 1d. per kWh consumed.

A similar tariff has been introduced by the South London Electric Supply Corporation, Ltd.

Maidstone.—INQUIRY.—Mr. F. Gordon Tucker, for the Ministry of Transport, held an inquiry on May 1st into the application of the Town Council to erect an overhead 6,000-V cable to Aylesford, Ditton, and East Malling. There were objections by four landowners and one occupier. The borough electrical engineer (Mr. E. E. Hoadley) said that the Corporation wanted to supply the Empire Marketing Board fruit preservation station, and the East Malling Research Station, and continue to West Malling, where it had already contracted for street lighting. One objector asserted that land would be wasted round each pole, and he also protested against the disfigurement of the countryside by the poles. The inspector said that if electricity was to be supplied in the rural districts, overhead lines would have to be used.

New Zealand.—DUNEDIN.—Negotiations are in progress between the Government and the Dunedin City Council for the purchase by the Government of the Council's hydro-electric plant at Waipori Falls. The Government has offered to buy the works for the sum spent on construction by the Council (about £500,000), and to sell energy in bulk to the Council for the price at which it now generates. Extensions to the Waipori undertaking have been authorised by the Council, but it is considered that the Government, if it took over, would not proceed with the full programme of works, as the Waitaki development will be in operation in a few years.

Price Reductions.—Reductions in the charges for electricity have been made or are recommended in the following districts:—

LLANFAIRFECHAN.—Heating and cooking: 2d. per kWh for the first 200 kWh, and 1½d. per kWh in excess of this amount.

RUTHIN.—*Electric Supply Company.*—Lighting: from 10d. to 9d. per kWh.

LIVERPOOL.—For Liverpool, Bootle and Litherland: Flat rate varying from 3¾d. to 2¾d. per kWh, according to the quantity consumed. For Little Crosby: flat rate for lighting 6d. per kWh, power 2d. per kWh. The city electrical engineer, Mr. P. J. Robinson, has recommended that the ratable charges applicable in the city should be extended to various areas outside the city.

Ripon.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £530 for a sub-station building, £14,715 for mains and services, £2,468 for plant (switchgear and transformers), and £600 for meters.

ELECTRICITY IN BULK.—The Electricity Commissioners have approved the agreement between the Corporations of Harrogate and Ripon for a bulk supply of electricity.

Shipley.—LOAN SANCTIONED.—The Urban District Council Electricity Committee has obtained sanction to a loan of £9,861 for mains.

South-East Lancs. Electricity Advisory Board.—GENERATING STATISTICS.—The electrical energy generated by authorities in the area covered by the Board for the year ended December 31st last totalled 1,047,372,951 kWh, of which 465,951,930 kWh was generated at the Manchester Corporation power station, and 119,190,721 kWh by the Lancashire Electric Power Co.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by Lancaster Corporation authorising it to supply electricity in the rural district of Lunesdale and parts of the rural district of Lancaster.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Bournemouth and Poole Electricity Supply Co., Ltd., to supply electricity in the urban district of Wimborne Minster and parts of the rural districts of Poole and Wimborne and Cranborne.

The following Special Orders made by the Commissioners have been confirmed by the Minister of Transport.—Dulverton Rural District; Exe Valley; Macclesfield Electricity (Extension); Withernsea and Patrington; and Wiveliscombe and Wellington Rural.

Uttoxeter.—ELECTRICITY SCHEME.—In connection with the electricity scheme, the Urban District Council has decided to carry out the compulsory work, and to prepare a scheme for the wiring of houses.

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Tramway and Railway Notes.

Blackpool.—YEAR'S WORKING.—Over 52½ million passengers were carried on the Corporation tramcars and 'buses during last year. Tramway passengers numbered 42,456,648 (a reduction of 68,208). The receipts were £309,855 (a reduction of £3,403). The number of car-miles run totalled 3,476,753.

Halifax. — LOAN SANCTIONED. — The Town Council has received from the Ministry of Transport sanction to a loan of £8,576 for the reconstruction of portions of the tramway.

Lanarkshire.—TRAMWAY ABANDONMENT.—The Lanarkshire Tramways Company has been granted permission to run 'buses over the route at present served by its tramway. This is the result of a recent inquiry into a Provisional Order sought by the company.

Liverpool.—NEW TRAMCARS.—The Corporation will shortly put into service a fleet of 14 new tramcars which will embody many new features. In addition to mechanical improvements, the cars will be entirely enclosed, the conductor and driver being protected from the weather. On the top decks upholstered seats will be introduced in place of the wooden seats in use on the existing cars.

London.—L.C.C. TRAMWAY ESTIMATES.—The Highways Committee of the L.C.C. has submitted a report on the annual estimates in respect of the tramway undertaking for the year 1929-30. The estimated total revenue is £4,387,900, and working expenditure £3,616,335, leaving a gross surplus of £771,565. After payment of debt charges, the estimated net surplus is £40,899. The amount to be voted on capital account is £415,920, the principal items being the deepening of the tramway subway from the Victoria Embankment to Southampton Row, and the consequent reconstruction of single-deck cars, new plant at the Greenwich power station, and the improvement of cars. In addition, a provisional sum of £269,200 has been included to cover expenditure which may be incurred on the construction of new tramways from a point near Grove Park Station to Well Hall Road, Eltham, the provision of new cars, improvement of cars, and sundry works, making a total estimate of £685,120.

ALL-NIGHT TRAMWAY SERVICES.—It has been recommended to the L.C.C. that it be referred to the Finance and Highways Committees to consider and report as to the submission of a supplemental maintenance estimate of £1,000 for the development and improvement of all-night services, especially in the east and north-east districts of London.

Manchester.—TRAMWAY ABANDONMENT.—The Tramways Committee has decided to discontinue the tramway service from Stretford Road to Cheetham Hill Road and to substitute 'buses.

Oldham.—TRACK RENEWAL.—The Corporation Tramways Committee is to relay the tramway track in Copster Hill Road at an estimated cost of £4,000.

South Africa.—ELECTRICITY CHARGES FOR RAILWAYS.—The Durban correspondent of *The Times Trade and Engineering Supplement* reports that the Railway Administration is so dissatisfied with the charges for electricity for the railways made by the Electricity Supply Commission that it has declined to consider the electrification of the Durban-Maritzburg line, with the result that the Durban Municipality will be the only big purchaser of electricity from the Commission's new power station, and will have to bear the whole cost of this undertaking alone. In giving evidence before the Select Committee on Railways and Harbours, Mr. J. R. More, the general manager of railways, stated that they were losing £300,000 on the Capetown-Simonstown line compared with £100,000 under steam. He stated that the price of electricity (1.3d. per kWh) was far too high. They were paying the Commission more for their power to-day than they paid the Cape Municipality before the Commission erected the station. The charge for power supplied from the Colenso station was 0.8d. per kWh, and it was contended that electricity was being produced at a cheaper rate on the Rand. The consulting engineers had estimated that the annual working expenses on the Simonstown line would be £169,000 per annum; actually to-day they were £488,000. The Select Committee reported that the reasonableness of the Commission's charges under the heading of administration and general charges would appear to be in question, and recommended that the whole matter should be referred to the Electricity Control Board, which is under the Minister of Mines.

United States.—NEW YORK.—A collision which occurred between a Lexington Avenue subway train and a Ninth Avenue "elevated" train near 167th street station on April 29th, resulted in the death of four passengers and serious injuries to 25 more. The accident took place during the morning "rush" hours, and the two trains were carrying over 3,000 passengers. Several coaches of each train were badly smashed.

York.—TRAFFIC RECEIPTS.—Since the introduction this year of a 1d. service on the Corporation tramways and 'buses instead of the universal 2d. fare, the receipts have been considerably below expectations. It will be proposed at the next meeting of the Tramways Committee that the Committee revert to the old fares with the provision of 1d. on all routes from the centre of the city.

Telegraph and Telephone Notes.

International Telephony.—FRANCE—FINLAND.—A telephone service between France and Finland was to be inaugurated on May 1st.—*Reuter* (Paris).

SWEDEN-SPAIN.—Telephone communication between Sweden and Spain was inaugurated on April 15th.

Irish Free State.—SHANNON TELEPHONE SYSTEM.—At a meeting of the Wireless Society of Ireland in Dublin last week, Mr. J. Mendelson, on behalf of Messrs. Siemens Schuckert (Ireland), read a paper on telephone communication for electric power systems as applied to the Shannon scheme, explaining the working of the system. The system will be independent of the public system and the high-voltage power lines will be used, thus saving the cost of paying for a public system. So strong will these lines be that they will be able to resist the heaviest storms and snowfalls. The lines will run only between the transforming stations and power station.

The Telephone Service.—NEW INSTRUMENTS.—The Postmaster-General announces that 60,000 new telephone transmitters and receivers, all of British make, have been ordered. In contrast to the candlestick pattern, the new instruments are of the cradle pattern, combining mouthpiece and earpiece in one unit for greater convenience in handling.

Transatlantic Telephony.—PROPOSED CABLE.—The London *Evening News* learns that the American Telephone and Telegraph Co. is to make an immediate request for a licence to land a telephone-telegraph cable in England, or in Ireland, within the next few months. It is understood that only a few more trial tests need be undertaken. The cable will carry one telephone message each way simultaneously with eight or ten telegraph channels worked on the same principle as that of existing loaded cables across the Atlantic. The new cable will take about three months to make and about two months to lay. The A.T.T. is now only waiting to place the order. Three American engineers have just returned to New York after looking for the most suitable landing place in this country. They also had interviews with the Irish Free State Government on the subject, but, under the Irish settlement, no agreement can be reached without the sanction of the British Government.

Radio Notes.

Common Wavelength.—SWANSEA.—The B.B.C. announces that the Swansea station has been included among those stations transmitting on the national common wavelength of 288.5 metres (1,040 kilohertz); the change took place on May 7th. The Swansea station formerly transmitted on a frequency of 1,020 kilohertz (294.1 metres).

Manchuria.—NEW STATION.—A wireless station was opened on May 1st at Khabarovsk, on the Manchurian frontier, by the Soviet authorities, to cater for the "cultural needs of the Chinese peoples." The programme was in the Chinese, English, and Korean languages, but the regular daily programme will be chiefly in Chinese.—*Reuter's* (Riga).

New Zealand.—LICENCES.—At the middle of March, 1929, some 44,084 listeners', 1,490 dealers', and 184 transmitting licences were in force in the Dominion. The Postmaster-General decided not to accede to the request made recently by radio dealers to allow the establishment of four "B Grade" stations. The proposal was to form a company to run the stations and to provide continuous programmes from early morning till midnight. No subsidy from the Government or any share of the licence fees was asked for, it being proposed to obtain the necessary revenue by using 10 per cent. of the total broadcasting hours for publicity purposes. The stations would not interfere with the Radio Broadcasting Company, as the new company would be prepared to use the present silent hours and to keep "off the air" when the YA stations were broadcasting. There will, however, be one "B" station, says *World-Radio*, namely, 2YB, New Plymouth, which is shortly to begin broadcasting under the combined control of the R.B. Company and the North Taranaki Radio Society, on a wavelength of 244 metres.

South Africa.—LICENCES.—Broadcasting has not attained the success which was anticipated when the African Broadcasting Co. was formed. About two years ago there were 12,872 listening licences in the Union; to-day the number is 16,764, so there has thus been an increase of 3,892, but it is not considered sufficient. The Johannesburg area leads with 7,120 licences, compared to 5,638 two years ago. Next comes the Cape area with 5,335, as against 3,894, an advance of 1,441. Durban can only show an increase of 969. "Pirates," says *World-Radio*, still flourish, notwithstanding prosecutions. Johannesburg again leads with 204 convictions, as against 61 in Cape Town and 19 in Durban. Therefore the practice, which has always had a serious retarding effect upon broadcasting in South Africa, has by no means ceased.

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United States.—VALVE LICENCES.—A change in the thermionic valve-licensing policy of the Radio Corporation of America, which is interpreted by radio engineers as the first step toward making R.C.A. valve licences available to a number of independent radio manufacturers of the country, is announced by General James G. Harbord, president of the Corporation. Thirty radio concerns are now licensed under the radio set, power amplifier, and speaker patents of the R.C.A. and its associates, but none has been authorised until now to manufacture under its valve patents.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aughton.—May 23rd. West Lancashire R.D.C. Electric lighting scheme for the parish. Specifications (£2 2s.) and form of tender from Mr. James Scott, 358, Royal Liver Building, Liverpool.

Australia.—MELBOURNE.—June 4th. State Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 5216.)*

June 26th (extended from May 15th). Victorian Railways. One geared three-phase electric winding engine. (A.7650 and A.7853.)*

June 18th. Posts and Telegraphs Department. Switchboard cable. (B.X. 5228.)*

June 25th. Telephone cable terminal boxes of the protected type. (B.X. 5231.)*

SYDNEY.—June 22nd. Public Works Department. Transformers and spares for Burrinjuck hydro-electric development sub-stations. (B.X. 5230.)*

June 4th. 18 electrically-operated water level indicators. (B.X. 5233.)*

July 10th. New South Wales Government Railways. One 750-kW turbo-alternator for Ultimo Power Station. (Specification No. 847, 5s.) 2,200-V ironclad switchgear for Argyle sub-station. (Specification No. 852, 2s. 6d.) Two switch operating batteries. (Specification No. 850, 2s. 6d.) Two motor-generator sets. (Specification No. 851, 2s. 6d.) Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

Belfast.—May 21st. Electricity Department. Supply, delivery and erection of h.p. armour-clad switchgear, air preheaters, 22,000-V 3-phase transformers, and cable drum trailer and tractor. (May 3rd.)

May 21st. Supply, delivery and erection of a 22,000-V 3-phase overhead transmission line. (See this issue.)

Chile.—VALPARAISO.—June 1st. Port Administration. Four three-metric-ton electric travelling cranes.

Colchester.—May 18th. Electricity Department. Supply and delivery of four miles of e.h.p. and seven miles of l.p. underground cable. (See this issue.)

Croydon.—June 3rd. Electricity Department. Supply, delivery, and erection of one 20/25,000-kW turbo-alternator, with auxiliaries, boiler-house extensions with two 100,000-lb. boilers, coal handling plant, &c., engine room extension, switchhouse, bridges, and pump house, and 6,600-V switchgear, transformers, &c. (See this issue.)

Cullingworth.—Installation of electric lighting at Conservative Club. Secretary, Conservative Club, Cullingworth, near Keighley.

Edinburgh.—May 21st. District Board of Control. Electrical work for the two higher grade blocks and mortuary at Gogarburn. Schedules from S. Kaye, architect, 14, Hill Street, Edinburgh.

May 30th. Electrical installation at George Heriot's School, Edinburgh. Specifications from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

Epsom.—May 25th. Electricity Department. Supply, delivery and erection of a l.p. d.c. switchboard. (See this issue.)

Glasgow.—May 16th. Electricity Department. Supply of cables, cookers, meters, arc lamp carbons, and kettles for 12 months. (May 3rd.)

Hastings.—June 3rd. Boiler fuel for period commencing July 1st, 1929. (See this issue.)

India.—May 21st. India Stores Department. One 400-kW, 6-phase rotary convertor set and accessories for H.M. Mint, Calcutta. (B.X. 5255.)*

May 27th. 500-kW, 6-phase rotary convertor, starting panel, &c. (B.X. 5279.)*

Kearsley.—May 20th. U.D.C. Electric wiring of 80 houses, Tasker's Lane Estate. Specifications from Mr. E. Shaw, surveyor.

Larne.—May 22nd. Board of Guardians. Installation of electric light at the District Hospital. Forms of tender from Mr. W. Pleasance, 44, Wellington Place, Belfast.

London.—BETHNAL GREEN.—May 22nd. Borough Council. Electric lighting installation at two blocks of tenement dwellings. (May 3rd.)

CENTRAL ELECTRICITY BOARD. May 25th. Supply, delivery and erection of 33,000-V metal-clad switchgear for South-East England Electricity Scheme, 1927. (May 3rd.)

WOOLWICH.—May 15th. Union Guardians. Supply of electrical refrigerator. (May 3rd.)

ST. PANCRAS.—Supply and fixing of an electric motor-driven centrifugal pump. (See this issue.)

Manchester.—May 14th. Tramways Committee. Trolley wire (cadmium copper), and copper bonds for tramway rails. Specification from General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

Melton Mowbray.—Urban District Council. Wiring Egerton Lodge, Melton Mowbray. Forms of tender from Mr. W. H. Jarvis, surveyor, Corn Exchange, Melton Mowbray.

New Zealand.—AUCKLAND.—June 3rd. Auckland Electric Power Board. Pilot cable and accessories. (B.X. 5244.)*

WELLINGTON.—June 18th. Posts and Telegraph Department. Telephone cords. (B.X. 5251.)*

July 16th. Telephone bells. (B.X. 5272.)*

August 6th. Public Works Department. One 120-ton four-motor overhead travelling crane and runway. (A.X. 7810.)*

August 13th. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

Ogmore and Garw.—May 31st. Electricity Department. A short length of 11-kV transmission line, and l.p. overhead and underground mains. (See this issue.)

Richmond.—May 22nd. Board of Guardians. Re-wiring, &c., for electric light buildings at the Grove Road Institution, Richmond. (Deposit £1). Particulars from Mr. C. L. Fenn, clerk, Guardians' Offices, Parkshot, Richmond, Surrey.

Rothwell.—May 14th. West Riding Education Committee. Installation of electric light at Robin Hood Council School. Mr. Beaumont, West Riding Education Offices, 8, St. John's North, Wakefield.

South Africa.—JOHANNESBURG.—June 20th. South African Railways and Harbours. One 10-ton and three 4-ton electric level luffing cranes. (A.X. 7828.)*

PRETORIA.—May 23rd. Posts and Telegraphs Department. Rubber-covered wire and telephone cables. (B.X. 5229.)*

June 27th. Automatic wall and table-pattern telephones. (B.X. 5273.)*

May 30th. Telegraph materials, &c. (A.X. 7767.)

May 20th. Town Council. Cables, switchgear, and transformers. (B.X. 5245.)*

May 27th. Transformers. (B.X. 5258.)*

Uruguay.—MONTEVIDEO.—May 22nd. National Administration of the Ports. Four electric cranes (to lift 3 metric tons) mounted on trucks. (A.X. 7814.)*

Wrexham.—Borough Council. Wiring of 36 houses on Huntroyd estate. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Billingham.—Durham County Education Committee. Recommended:—

Electric lighting at new Council School (£404).—F. Reid Ferens & Co.

Bournemouth.—Pavilion Committee. Accepted:—

Electric wiring and lamps for canopy lighting at Pavilion. —Aish & Co.

Dartford.—Electricity Committee. Recommended:—

L.p. switchgear for Lowfield Street sub-station (£108), and feeder pillar in Miskin Road (£71).—Johnson and Phillips, Ltd.

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Eastbourne.—Electricity Committee. Accepted:—
Transformers (£2,307).—British Electric Transformer Co., Ltd.

Glasgow.—Tramways Committee. Accepted:—
Insulated bolts.—British Insulated Cables, Ltd.
Lighting Committee. Recommended:—
Cables.—Greenwich Cable Works, Ltd.; Metropolitan Electrical Cable & Construction Co., Ltd.
350 steel poles.—Bromford Tube Co., Ltd.
Watch Committee. Recommended:—
Electrical work at new police station at Millerston (£275).—A. A. M. Turnbull & Co.

Halifax.—Corporation Electricity Committee.
Two steel boilers, buildings, and auxiliaries, at the power station (£83,411).—Babcock & Wilcox, Ltd.
Switchgear for new turbo-alternator (£720).—British Thomson-Houston Co., Ltd.

Hull.—Health Committee. Accepted:—
Electric light and bell installation at Maternity Home, Hedon Road (£2,080).—A. Shaw & Sons.

Irish Free State.—Electricity Supply Board. Distribution system for the city of Limerick:—
H.p. cables.—Siemens-Schuckert.
Transformer kiosks.—Metropolitan-Vickers Electrical Co., Ltd.
L.p. distribution network.—Callender's Cable & Construction Co., Ltd.
The total value of the contract is approximately £32,000.

Leeds.—Electricity Committee. Accepted:—
Cables.—(£867), W. T. Henley's Telegraph Works Co., Ltd.; (£1,146), Enfield Cable Works, Ltd.; (£215), Macintosh Cable Co., Ltd.; and (£1,171), Hackbridge Cable Co., Ltd.
24 circuit breakers.—(£396), Park Royal Engineering Co., Ltd.
30 fuse panels.—(£350), Parmiter, Hope and Sugden.
Transformers.—Ten 100 kVA, 2,000 V, single-phase and 10 200 kVA (£2,760), British Electric Transformer Co., Ltd.; 6 100 kVA, 6,600 V (£498), English Electric Co., Ltd.; 10 100 kVA, 6,600 V, and 20 200 kVA (£3,010).—Hackbridge Electric Construction Co., Ltd.
Switch house crane (£698).—Isles, Ltd.
Sub-station switchgear (£7,235).—General Electric Co., Ltd.
Four circulating water screens (£2,703).—F. W. Brackett and Co., Ltd.

London.—LONDON COUNTY COUNCIL.—Education Committee.
Electric goods lift at Trade School, Hammersmith:—

PICKERINGS, LTD. (Accepted.)	£523
E. A. Foulds	550
R. A. Evans	599
John Bennie, Ltd.	695
Smith, Major & Stevens, Ltd.	698
Marryat & Scott, Ltd.	700
Rawlinsons, Ltd.	702
Herbert Morris, Ltd.	734
Medway's Safety Lift Co., Ltd.	791

SOUTHWARK.—Electricity Committee Accepted:—
Boiler alterations (£355).—Vickers Boiler Co., Ltd.
ADMIRALTY.
W./t. combined switch and plug, switches, non w./t., steel springs, and gangway reflectors.—Edison Swan Electric Co., Ltd.
GENERAL POST OFFICE.
Charging tablets.—Edison Swan Electric Co., Ltd.

Manchester.—Tramways Committee. Accepted:—
Automatic point controllers.—Forest City Electric Co., Ltd.
Sub-contractors for electrical switchgear, cables and lighting in connection with extension of Hyde Road car works.—A. E. Sudlow & Co.
Tramcar trucks.—Brush Electrical Engineering Co., Ltd.
Electric rail-welding equipment.—Equipment & Engineering Co., Ltd.
Electricity Committee. Accepted:—
One 10,000-kVA air-cooled static transformer for Oldham Road sub-station.—Metropolitan-Vickers Electrical Co., Ltd.
33,000-V switchgear for sub-stations and Barton power station.—Ferguson, Pailin, Ltd.; British Thomson-Houston Co., Ltd.
Education Committee. Accepted:—
School electrical installations: at Hough Road school.—Sudlow & Co. At Kingsway school and School Lane school.—John Adams, Ltd.

Oldham.—Buildings Committee. Accepted:—
Electric light installation at 200 houses on the Limeside Estate.—Hall & Stinson.

York.—Education Committee. Recommended:—
Electric lighting installation at Fulford Road special and open-air schools.—H. Mandefield.
Tramways Committee. Recommended:—
Welding joints.—Scholey Construction Co., Ltd.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, May 10th. Institution, Storey's Gate, S.W. 6 p.m. Special general meeting. To consider and, if thought fit, pass resolutions relative to a petition for a Royal Charter.
Tuesday, May 14th. 6 p.m. Annual general meeting.

Physical Society.—Friday, May 10th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

North-East Coast Exhibition.—Newcastle-on-Tyne. May 14th to October.

Illuminating Engineering Society.—Tuesday, May 14th. Home Office Industrial Museum, Horseferry Road, S.W. 6.45 p.m. Review of the proceedings of the International Commission on Illumination and on the International Congress held in the United States in 1928.

Physical Society and the Society of Glass Technology.—Tuesday, May 14th. Research Laboratories of the General Electric Co., Ltd., Wembley. 4 p.m. Special meeting.

World Power Conference.—Barcelona International Exhibition. May 15th to 23rd.

Royal Society of Arts.—Wednesday, May 15th. John Street, Adelphi, W.C. 8 p.m. "The Reform of the British Patent System." Mr. R. Burrell.

Overhead Lines Association.—Wednesday, May 15th. Institution of Electrical Engineers. 5.30 p.m. "Getting Consumers in Rural Areas." Lieut.-Col. W. A. Vignoles.

British Institute of Radiology incorporated with the Röntgen Society.—Thursday, May 16th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

Institution of Electrical Engineers, Irish Centre (Dublin).—Thursday, May 16th. Trinity College, Dublin. 7.45 p.m. Annual general meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 18th. South Wales Institute of Engineers, Cardiff. 6 p.m. Annual meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

SOLARAY floodlights.
BLITZ pear switches (name of importer required).
Electrically-operated horses and camels for gymnasium use.
Lamp caps or bases.

Notes.

Extended Steam Tables.

With the assistance of the British Electrical and Allied Industries Research Association, it recently became possible to make direct measurements of the total heat of both water and steam at pressures up to 4,000 lb. per sq. in., and temperatures up to 750 deg. F. They included the whole of the critical region, in which no heat measurements had previously been made, and proved that the objection to the Joule-Thomson equation (namely, that it was incapable of representing the complex phenomena of the critical state) had no foundation in fact. The new experimental data proved to be quite inconsistent with the van der Waals theory, which had been universally accepted for more than fifty years, but fell naturally into line with the fundamental basis of the Joule-Thomson equation, as first applied to steam by Prof. H. L. Callendar in 1900. This fatal objection having been removed, a general account of the theory and equations, as applied to the critical state, was communicated to the Royal Society in 1928 and a set of skeleton steam tables, calculated from the modified equation, was forwarded to the Research Association at the same time. The tables have now been published with some additional details and explanations by the Institution of Mechanical Engineers. They are not intended to be final, but are reproduced as a basis for discussion and comparison, with the object of inviting criticism and suggestions from other workers.

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The Battersea Power Station.

The general secretary, Mr. W. Arthur Jones, A.M.I.E.E., of the Electrical Power Engineers' Association, has issued a statement relative to some of the London daily newspapers' support of the objection that is being raised to the proposal of the London Power Company to erect a new power station at Battersea, which received, not only the consent of the Electricity Commissioners, but also that of the Office of Works, and the station has been adopted as a "selected" station by the Central Electricity Board. The objection is based on the fact that the combustion of coal at the proposed station will be on a large scale and "experience . . . indicates the emission of large quantities of sulphurous acids causing serious damage"; reference is further made to the discharge of large quantities of fine dust and grit. The latter complaint, the E.P.E.A. statement points out, certainly would not be relevant in the case of the installation suggested at Battersea. The emission of sulphurous fumes is a possibility no one would deny. At the same time, it should be appreciated that in a modern power station coal is consumed by scientific methods which aim, not only at getting the utmost heat value out of the coal, but of also dealing with the residue in the most efficient manner. The inaccuracy of the premise underlying the objection rests, however, not upon the method of coal combustion, but upon the assumption which appears to underlie the whole of the agitation, *viz.*, that the coal which is to be consumed at Battersea and in other power stations will be additional to the present consumption in the particular district. The consumption of the proposed station has been given as being an ultimate maximum of 2,000 tons daily, or an annual consumption of three-quarters of a million tons, which is probably overstated. The objectors appear to have completely overlooked the fact that the energy it represents will replace and abolish the hundreds of thousands of domestic coal fires which are daily emitting smoke, sulphurous acids, and various other detrimental products, into the atmosphere of London. The amount of coal being burnt in Greater London at the present time is of such proportions that the maximum rate of combustion at the proposed Battersea station becomes in comparison almost a mere bagatelle. During 1928 the amount of coal consumed in the Greater London area for domestic purposes, that is, excluding the amount used for semi-domestic purposes, such as bakeries, nurseries, &c., and also excluding that used for industrial purposes, was eight million tons. That coal, consumed as it is in a most inefficient manner, is at present emitting more than ten times the amount of sulphurous fumes alleged to be the maximum possible from the Battersea station. Looked at from this point of view, the compulsory abolition of the domestic coal fire becomes an urgent necessity. Pending, however, a Government sufficiently courageous to enact and enforce the necessary legislation, the concentration of combustion at the Battersea station, with scientific and efficient methods of operation, is a big step forward to this desirable end.

According to the latest returns of the Electricity Commissioners, the total amount of coal used by the Electricity supply industry throughout the United Kingdom for the year ended March 31st, 1928, was nine and a quarter million tons only. This one fact alone should convince the objectors and their supporters that their well-meant efforts are somewhat misdirected.

It is suggested by the objectors that, because of the prevailing winds, the proposed station should be placed in an eastern district of London, but it may be imagined that the military authorities would prefer that such generating stations, whose continued existence and operation would be so vital under circumstances of war, should not be placed in apparently close proximity, even though the width of the river may be between them. A further difficulty would arise in the necessity to bring the power trunk mains from the generating station placed lower down the river to the centre of distribution through streets and highways already congested with such impedimenta underground, and with an ever-increasing volume of traffic on the surface. It will be appreciated that whatever may be done on the Continent may, or may not, be suitable for the conditions which obtain in London. Does the opposition to the scheme realise that the solution proposed would not be in the national interests, however beneficial it may be to the south-western area of London? Electrical energy is not a luxury, but a necessity to all walks of life, and it is in the national interests that such energy should be generated and distributed in the most efficient manner possible. Even if the total emission of sulphur is unpreventable, which cannot for one moment be admitted, it is suggested that the advantages on the other side of the account would outweigh that particular defect, apart from the fact that such emission would be less than that obtaining at the present time. The elimination of sulphur is a problem which is not beyond the acumen of engineers and chemists to solve, and it contains the added incentive that by solving it they would not only meet the objections that have been made, but would also continue the process of taking us a step further towards the creation of a cleaner and healthier atmosphere. In the meantime, the man in the street should realise that the proposed station at Battersea, and the additional proposals to extend existing stations, will be a step in the same direction, by the provision of energy on an efficient and economic basis which will be in substitution of the present wasteful and air-polluting domestic coal fires.

Glasgow Royal Technical College Exhibition.

The triennial exhibition and reunion of students was held within the College on April 27th. The opening ceremony was performed by Mr. Robert Robertson, B.Sc., M.Inst.C.E., Lord Dean of Guild, vice-chairman of the Board of Governors of the College, in the presence of an audience of over 1,000. A unique opportunity was offered to the public to inspect the Institution under working conditions, special exhibits and demonstrations having been arranged by the students in all departments. In all, over 4,000 people attended the exhibition, the results being highly gratifying to the organisers. The profits will be devoted to the furtherance of sport and other student activities in the College.

Torquay Extensions.

At a cost of practically £120,000, the Torquay Corporation has made extensions to its electricity works situated at Newton Abbot, which were officially opened on May 1st by the Mayoress of Torquay (Mrs. C. Geen). Those present included representatives of local authorities who are served by the undertaking. The extensions comprise a 7,500-kW turbo-alternator with surface condensing plant; a 50-ton electrically-driven engine-room crane; two high-pressure boilers with economisers, induced draught and other auxiliary plant; additional riverside works for the provision of circulating water for the condensers, a new railway siding for receiving supplies of coal from the G.W. Railway, and a system of coal-handling and conveying plant.

By means of the travelling engine-room crane the Mayoress was handed a bouquet at the outset of the proceedings.

Mr. John Taylor, chairman of the Electricity Committee of the Corporation, who extended a welcome to the assembly, said that since the opening of the plant at Newton Abbot there had been big development. Some four and a half years ago they sold four million kWh and their price at that time was an average of 4¼d., he added. To-day they were selling sixteen million kWh and the price was 1½d. all in. The Committee decided not to appoint consulting engineers for the job, but to employ its own engineer. The station had been equipped at a cost of £10 per kilowatt, which was a price lower than anything in the West of England. The average price per kilowatt was about £14. The equipment was a costly business and the skill and experience which had been put into it was of a high order. On one side they could give their engineer (Mr. H. F. G. Woods) 50 per cent. full marks for administration and generation, and on the side of getting new business and pushing new business he gave him another 50 per cent. full marks; the Committee had trusted him in every way.

For many years, he continued, they had been reducing price all the time, and they were now told they were to be taken over at the end of the year by the Central Electricity Board. "They have promised the country cheaper electricity and we have given them a job that will take them all their time to give cheaper electricity than we are giving at the present time." In rural districts they had had a great deal to contend with, but they had got over most of the difficulties.

The Mayoress was presented with a cut-glass vase as a memento of the occasion, after she had set in motion the new turbo-alternator.

The Mayor (Mr. C. Geen) acknowledged the presentation to the Mayoress and, congratulating those who had brought the undertaking to so successful an issue, said it was an example of co-operation in municipal and local government such as might be of great advantage to them in the future. They had Torquay and Newton Abbot, their near neighbour Paignton, their other neighbour Teignmouth, and the other outlying districts all uniting together to make the undertaking a success, and it was a matter on which they could heartily congratulate themselves.

Those politicians who promised electricity for nothing, he concluded, had better provide it before the election, because the cost of distribution was such as to make it a speculative proposition as to what it would cost. They did not know what the Government would do with their station, but they believed it would further develop it in order to supply a larger area.

During the afternoon the party was conducted over the works by a number of guides, and tea was served.

The Electrical Association for Women.

The summer fixtures of the Electrical Association for Women (London) include the following: May 29th, lecture-demonstration with a thermal-storage electric cooker, by Mrs. H. Dover, B.Sc. (London), at 46, Kensington Court, W.8; June 6th, Women's Day at the Incorporated Municipal Electrical Association Convention at Torquay; June 12th, summer outing to Ashford (Kent) by invitation of the Ashford District Branch (motor coach will leave the Embankment, opposite Charing Cross Underground Station, where members are asked to meet at 10 a.m. prompt, and will return to London approximately at 10 p.m.); July 10th, 11th and 12th, E.A.W. Conference and annual general meeting at Newcastle-on-Tyne, by invitation of the North-East Coast Branch.

On April 25th, nearly 70 members of the Birmingham and Midlands Branch of the Association paid a visit to the needle factory of Messrs. Henry Milward & Sons, at Redditch. The factory is entirely electrically equipped, and the members marvelled at the great number of processes which a needle goes through before it is fit to be used.

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I.E.E. Benevolent Fund Golf Competition.

The committee of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers has in the past organised two very successful golf competitions, and by that means has been able to hand over a substantial amount to the benevolent fund. This year, in place of the usual reunion, the committees of the Manchester and Liverpool Centres have decided that it should take the form of a golf competition and a reunion dinner. The competition, including the play for the G. P. Dennis trophy, will be held on May 29th, on the links of the Hesketh Golf Club, Southport, and that the dinner, to which ladies are invited, will be held at the Prince of Wales Hotel, Southport, and will be quite informal.

North-East Coast Exhibition.

Some fears have been expressed that inadequate arrangements have been made for the accommodation of the many thousands of visitors to the North-East Coast Exhibition at Newcastle-upon-Tyne, which is being formally opened by H.R.H. the Prince of Wales on Tuesday, May 14th. We are informed that this is not so; not only have very extensive arrangements been made in the city of Newcastle itself, but the Exhibition is situated within extremely easy reach of a large number of the attractive seaside and inland resorts, where excellent and extensive accommodation for an enormous number of visitors is available. There is a well-organised accommodation bureau at 31, Westgate Road, Newcastle-on-Tyne.

Radio at Sea.

Since the general adoption of wireless apparatus on board foreign trawlers frequenting the waters round Iceland, the number of vessels arrested for fishing in forbidden areas has become almost nil. It appears that the trawlers keep up constant communication with each other, but as the Icelandic authorities are never able to interpret the messages, which are frequently tapped, the conclusion arrived at is that the trawlers use a secret code, and that they would not do so if everything was fair and above board. The Iceland Minister of Justice has therefore brought a Bill before the Althing to compel all Icelandic trawlers to carry wireless apparatus. The sets will be under Government control, and all telegraphists will be obliged to record messages they succeed in taking; in addition, they will not be allowed to use codes that are not officially approved. The idea is apparently that trawlers are to keep an eye on each other, and so prevent any co-operation between Icelandic and foreign boats. Correspondence in an unknown code will be made an offence, and the Bill provides for fines up to 30,000 kroner.—*Reuters* (Copenhagen).

Reports received by the Marconi International Marine Communication Company from a number of steam trawlers on which its apparatus is installed indicate that its value is considerable. Units of fishing fleets have been enabled to communicate throughout their operations and, by exchanging reports of fishing conditions, to concentrate on the grounds found to be most profitable. In addition, by keeping in touch with the owners, trawler skippers have been enabled to obtain last-minute market reports and to land their catches at the ports where prices were most favourable. A very complete service of weather reports, independent fishing reports, and time signals, is made available by wireless, and these auxiliary services have on occasion proved of great value. Practically all Marconi-equipped trawlers carry ¼-kW transmitters of the quenched-gap type, with two-valve receivers (type M.R.4C.) having a wave range of 200 to 3,000 metres, and so are able to communicate with other trawlers and with land stations over distances of from 200 to 300 miles and more. A number of trawlers are also fitted with direction finders and direction indicators, which are an invaluable aid to navigation and, in addition, enable a vessel, when called to any particular fishing ground by a sister-ship, to proceed directly there by following the bearing of the calling transmitter.

Radio Picture Transmission.

Owners of Fultographs will very soon be able to receive pictures from many countries in Europe. Captain Fulton has returned from an European tour during which he concluded arrangements with the German authorities for regular transmissions during programme hours to take place from many radio broadcasting stations in that country. The new German transmissions began on May 1st and the service will be rapidly increased. In Central Europe the big stations at Prague and Budapest are also installing photo-electric Fultograph transmitters; their transmissions are to begin on May 15th. Southern Europe is also to send us still pictures, for Rome, Madrid, and Barcelona are inaugurating services almost immediately. Brussels, whose new 10-kilowatt transmitter provides such good reception in this country, is acquiring still-picture transmitting plant, whilst both Hilversum and Radio-Paris will soon have their regular services in operation; 5XX, Hilversum, and Radio-Paris are "daylight" stations, and 5GB, 2LO, and Vienna provide after-dark picture services.

On April 23rd an unusual service for ships was inaugurated. Messages were sent and received, not by means of morse dots and dashes, but also in facsimile typewriting. At the Rugby station of the G.P.O. lists of Stock Exchange quotations typewritten on thin paper were mounted one by one upon the transmitting apparatus. Three ships, the *Orvieto*, the *Avilla* and the *Minnewaska*, have been fitted with picture-receiving apparatus and with special wireless sets designed for the purpose by the Marconi International Marine Communication Co., Ltd. Aboard them, on the high seas, the typewritten lists were received, ready to be pinned to the bulletin board. Experiments have shown that at ranges of thousands of miles ordinary typescript is received by means of the Fultograph with clearness and legibility. The Wireless Press, Ltd., supplies news to ships at sea, and Wireless Pictures, Ltd., are responsible for the transmitting and receiving apparatus.

C.E.B. Report.

On going to press we learned of the publication of the first annual report of the Central Electricity Board. Copies are obtainable (price 2s. 6d. each, 3s. post free) from Messrs. Whitehead Morris, Ltd., Tower House, Holland Street, London, S.E.1, or through any bookseller.

B.B.S. for Mining-type Transformers.

The British Engineering Standards Association has just issued a British Standard Specification for mining-type transformers (No. 355-1929), this being the first of a series of specifications that are in the course of preparation for mining electrical apparatus by the colliery section. This specification applies to oil-immersed naturally-cooled transformers primarily for use underground in collieries, and, whilst no stipulation is made on flameproofness as an essential requirement, it includes the necessary constructional provisions to satisfy the requirements of the Coal Mines Acts underground in collieries. The provisions of B.S. Specification No. 171, Electrical Performance of Transformers for Power and Lighting, are embodied. Maximum overall dimensions for three sizes of transformers, 100 kVA, 200 kVA and 300 kVA, have been included in order to assist colliery managers and engineers in the installation of transformers underground. The Colliery Electrical Section has also in the course of preparation specifications for mining-type motors and generators, flameproof switches and circuit breakers, miners', hand-lamp bulbs, underground lighting fittings and cable glands and sealing boxes. Copies of the new Specification can be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free

Appointments Vacant.

Teachers of electrical drawing and electrical wiring for the L.C.C. junior technical officer in the Admiralty Technical Pool at Portsmouth. Examiner at Aeronautical Inspection Department, Kidbrooke, S.E., for the Air Ministry. Resident engineer (£750) for Government of Nigeria. Commercial assistant (£350) for Scarborough Corporation Electricity Department. Chief electrical engineer for Nigerian Electricity Supply Corporation, Ltd. Mains assistant (£300) for Horsham Urban District Council. Electrical engineer (£200) for the Newcastle Emlyn and District Electric Supply Co., Ltd. (See our advertisement pages to-day.)

Large Telephone Cables.

One of the most noteworthy of recent developments in telephony is the 1,800-pair cable, containing 3,636 separate wires, now coming into regular use in the Bell system. The new cable is the result of the use of smaller wire, No. 26, which is 0.0159 in. in diameter, or approximately half the diameter of an ordinary pin. Other factors are the "multiple-unit" arrangement of the wires and the use of thinner paper for insulation, the latter necessitating the perfection of machines that would apply the thinner paper without breaking it, says *The Times Trade and Engineering Supplement*. In the 1,212-pair cable, which was the previous holder of the title for the largest number of pairs, as well as in the smaller sizes, the wires were spiraled on in layers until the proper number was reached. A cross-section of this type therefore resembles a cross-section of a tree with circular rings. The multiple-unit structure, however, is made up of a number of component units. The 1,818-pair cable consists of eighteen such units, or groups of wires, each having 101 pairs, which are twisted together to form the cable. A new colour scheme has been worked out for the paper used in wrapping the individual wires, so that each of the eighteen units can be definitely identified at any point along a cable route. In each of the units in the new cable 100 pairs are the same colour and one pair, which is called a "tracer" and is for special use of the cable service, is red-blue. Each unit receives its name from the colour of the 100 pairs, being known as a blue-green, a red-white, or a red-green unit. Of the eighteen units in this cable nine are blue-white, six are red-white, and three are red-green, one of the last being placed in each of the three layers of units in the cable. Thus the identity of every unit can be indicated by giving its relation to the red-green unit in the same layer. By placing the three red-green units in a line with each other from the centre to the edge of the cable and arranging the other units symmetically on both sides of this line, it becomes possible always to join units of the same colour without interweaving among each other at the splice. Further, with this colour scheme, one end of a length of cable can be spliced to either end of another length, thus retaining the desired "flexibility" of the previous type of cable.

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Educational.

The summer evening classes of the Manchester Municipal College of Technology will begin on June 3rd and 4th and continue till July 23rd. The subjects to be dealt with by the Electrical Engineering Department (head: Prof. Miles Walker) are the improvement of power factor, electricity meter testing, a.c. wave shapes and harmonic analysis, switchgear for mines, electrical laboratories and wireless laboratory.

Institution Notes.

Institution of Electrical Engineers.

WESTERN CENTRE.—Following a peculiar windstorm at the end of October, 1927, which caused much trouble on overhead lines, Dr. G. C. Simpson, F.R.S., of the Meteorological Office, London, lectured on atmospheric electricity in March of last year. Arising out of that lecture he was invited to deliver the Kelvin Lecture before the Western Centre on April 29th at Cardiff, an unusual procedure. The audience over-filled the theatre and many had to stand. A vote of thanks was proposed by the chairman, Mr. W. J. Bache, and seconded by Mr. W. O'Connor, F.G.S., first past-president, South Wales Institute of Engineers.

The Physical Society.

A joint meeting of the Physical Society and the Society of Glass Technology will be held on May 14th, 1929, by permission of the company and of the director of its laboratories, Mr. C. C. Paterson, at the Research Laboratories of the General Electric Co., Ltd., at Wembley. Visits to the laboratories and to the neighbouring glass works of the General Electric Co. are being arranged.

Royal Institution.

The annual meeting was held on May 1st, Sir Arthur Keith, treasurer and vice-president, being in the chair. The annual report of the Committee of Visitors for 1928, testifying to the continued prosperity and efficient management of the Institution, was read and adopted. The report of the Davy-Faraday Research Laboratory Committee was also read; 60 new members were elected in 1928, and 64 lectures and 19 evening discourses were delivered. The books and pamphlets presented amounted to about 181 volumes, making, with the 712 volumes (including periodicals bound) purchased by the managers, a total of 893 volumes added to the library in the year. The following gentlemen were unanimously elected officers for the ensuing year—*President:* the Duke of Northumberland; *treasurer:* Sir Robert Robertson; *secretary:* Major Charles E. S. Phillips; *managers:* Lord Blanesburgh, Ernest Clarke, Sir James Crichton-Browne, Frederick G. Dennan, W. H. Eccles, W. Vaux Ginham, J. S. Highfield, Sir Arthur Keith, V. Warren Low, Charles H. Merz, Robert Mond, Sir Richard Paget, C. C. Paterson, George C. Simpson and W. J. Tennant. *Visitors:* M. Atkinson Adam, Edward N. da C. Andrade, James H. Batty, Frederick H. Berryman, Montague Ellis, Kenneth R. Hay, David Heron, G. W. C. Kaye, William Macnab, Emile S. Mond, Hugh Munro Ross, Walter S. Rowntree, Sidney Skinner, Harold R. D. Spitta and Alfred E. Western.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. A. C. MORGAN, secretary to the Technical Management at the Belvedere works of Callender's Cable & Construction Co., Ltd., who is taking up an important position in London, has been presented by his colleagues with an inscribed gold watch. Mr. Morgan has been on Callender's staff for 22 years.

Mr. D. WILLIAMS, of the Leicester Corporation Electricity Department, has been appointed consumers' engineer at the Rugby electricity works, at a salary of £5 5s. per week. He succeeds Mr. B. M. Butler, who has resigned.

Mr. A. W. MAKOVSKI, of Tamplin & Makovski, Ltd., Redhill, has been re-elected president of the Reigate and Redhill Chamber of Commerce.

Mr. A. H. DARKER, chief electrical engineer of Messrs. J. Stone & Co., Ltd., who has been making a world tour, is returning to London from Australia and New Zealand by the *Orama* on June 6th.

SIR JAMES A. COOPER has been appointed a director of Vickers-Armstrongs, Ltd.

Mr. R. LOMAX informs us that his recent resignation from the position of borough electrical engineer of Stockport was prompted by a suggestion that he should agree to a heavy reduction of salary. A public statement has been made on behalf of a member of the Town Council that remarks made at a Council meeting were not in any way intended to reflect upon Mr. Lomax's skill or ability.

At the April meeting of the Council of the E.C.A. Allied Associations, Mr. H. WILLOUGHBY ELLIS, A.M.I.E.E. (Messrs. Ellis & Ward, Ltd.), was nominated as president of the Association for the year 1929-30. Mr. H. C. HAZEL, M.I.E.E. (Messrs. Lindsay & Co., Liverpool), was nominated vice-president.

Mr. P. E. JOHNSON, who has been appointed assistant mains engineer at Leamington, was recently presented with an oak writing desk by the staff of the Aylesbury electricity works.

Mr. GEORGE A. GAHAN has been appointed, at £2,000 per annum, to succeed Mr. N. G. Bell as Commonwealth Railways Commissioner. Mr. Gahan is at present chief engineer to the Commonwealth Railways, a member of the Australian Institute of Engineers, and senior officer in the Commonwealth Railways Service. He was sent abroad by the Australian Government in 1926 to obtain information on engineering and general railway matters. He studied modern railway practice in the United States, Great Britain, and the Continent. According to the *Industrial Australian*, he will be acting commissioner from May till November, during the period that Mr. Bell will be on furlough, and thereafter will be appointed as commissioner for a term of five years.

At last week's meeting of the Sheffield City Council, regret was expressed at Mr. FEDDEN'S resignation from the post of city electrical engineer, but the chairmen of the Electricity and Tramways Committees extended their congratulations to him upon his appointment as district engineer for the Mid-East England Electricity Scheme. At the same meeting a letter from the Associated Municipal Electrical Engineers was read in which it was maintained that the salary offered to Mr. Fedden's successor (£1,250) was far too low. According to the A.M.E.E. scale the salary for the engineer of an undertaking with an output of 100 million kWh was £2,255; Sheffield's output was now 198 million kWh. The letter was referred to the Electricity Committee for consideration.

A proposal to increase the salary of the Prestatyn electrical engineer (Mr. W. R. KELLEY) from £325 to £400 a year was referred back at a recent meeting of the Urban District Council.

The Lord President of the Council has appointed Sir JAMES A. EWING, K.C.B., LL.D., &c., to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research, to fill the vacancy occasioned by the death of Mr. R. W. Reid, C.B.E. Sir Alfred Ewing was recently elected an honorary member of the Institution of Civil Engineers.

Mr. A. F. STEVENSON, Glasgow, has taken up a position as representative with Derby Cables, Ltd. He is to continue the technical associations with which he has been connected for many years in Scotland.

Mr. H. E. SEWELL, who was for 26 years works manager of the Macintosh Cable Co., Ltd., is now the general manager of Derby Cables, Ltd., referred to in another part of this issue.

Mr. L. J. RANSOM was presented recently with a gold watch by his colleagues on relinquishing his position as production manager with the Liverpool Electric Cable Co., Ltd., to become works manager with Derby Cables, Ltd. Mr. Ransom was previously, for a number of years, with the Hackbridge Cable Co., Ltd.

The Torquay Electricity Committee recommends the payment of 500 guineas to the engineer, Mr. H. F. G. WOODS, for the special services which he has rendered as consulting engineer in connection with the extension of the generating station at Newton Abbot and the installation of additional plant.

Mr. ANDREW BAILES has resigned his position as secretary and sales manager to Omega Lampworks, Ltd., to take up other employment.

Last week Mr. A. E. APPS was presented with an engraved silver cigarette box by the staff and employés of the London and South of England branch of Simplex Conduits, Ltd., on his retiring from the post of sales representative which he has occupied for the last 18 years. Mr. Apps is taking up an engagement in the sales department of Millars Machinery Co., Ltd.

Mr. W. H. SPEEDY has left the Newport (Mon.) Electricity Department upon appointment as shift engineer at the Darwen electricity works.

M. ALBERT CANCE, president of the Syndicat Général des Installateurs Electriciens, has lately been appointed an officer of the French Legion of Honour.

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Obituary.—M. J. BOUSSINESQ.—The death recently occurred in Paris, at the age of 87 years, of M. Joseph Boussinesq, a leading French authority on hydro-dynamics and the utilisation of water power.

PROF. B. DONATH.—The death occurred recently, in Berlin, at the age of 56 years, following an operation, of Prof. Dr. Bruno Donath, the director of the physical and electric rectifier department of the Accumulatoren Fabrik Gesellschaft of that city.

SIR PERCY K. STOTHERT.—We regret to learn of the death at Bath on Monday last of Sir Percy Kendall Stothert, K.B.E., chairman of Stothert & Pitt, Ltd., crane makers. He was 66 years of age.

Wills.—The late Mr. O. C. HAWKES, of O. C. Hawkes, Ltd., of Birmingham, left £257,459 gross and £253,099 net personalty.

The late Dr. CHARLES S. DU RICHE PRELLER, M.I.E.E., left personal estate in Great Britain valued at £71,651.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Derby Cables, Ltd.—Registered as a private company April 30th. Capital, £100,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in cables, insulating materials of all kinds, lifting appliances, &c. The directors are:—C. A. Newton (chairman), Park Lane House, Littleover, Derby; J. H. Lord, address not stated; H. Newton, Mile Ash, Derby; H. B. Potter, address not stated; F. Newton (managing director), The Grange, Old Normanton, Derby. Secretary: E. A. Swindall. Solicitors: Flint, Marsden & Bishop, Derby.

Young Accumulator Co. (1929), Ltd.—Registered as a public company May 1st. Capital, £225,000 in 10s. shares. Objects: To acquire the undertaking and all or part of the assets of the Young Accumulator Co., Ltd. (including its rights in respect of the British Empire, excluding Canada) in a process used in connection with the manufacture of electrical accumulators, and to carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, &c. The directors are:—E. H. F. Reeves, Field House, Friern Park, N.12 (director Crompton Parkinson, Ltd., and Electric Supply Corporation, Ltd.); J. L. Wilson, 68, Vineyard Hill Road, S.W.19; L. Roney, 24, Gerald Road, Eaton Square, S.W.1; T. E. Eachus, O.B.E., Fox Rock, Hertford; A. W. Bullivant, 78, Campden Hill Court, W.8. Registered office: 4, Drapers Gardens, E.C.2.

Tri-Signs, Ltd.—Private company. Registered May 1st. Capital, £600 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical illuminated and other devices, signs and signals, for advertising or otherwise, &c. The subscribers (each with one share) are:—R. E. Haykin, 64, Lower Hastings Street, Leicester, advertising specialist; F. Simkin, 16, New Street, Leicester, incorporated accountant. R. E. Haykin is permanent managing director and chairman. Qualification, £100. Secretary: F. Simkin.

Chesham and District Electrical Installation Co., Ltd.—Private company. Registered May 1st. Capital, £100 in £1 shares. Objects: To carry on the business indicated by the title. The directors are:—G. A. Wilkinson, Yer Cot, Bois Moor, Chesham Bois, Bucks; A. Mayger, Ferndale Villas, Severalls Avenue, Chesham Bois. Secretary: F. W. E. King. Registered office: 111, High Street, Chesham, Bucks.

Carlton Radio Co., Ltd.—Private company. Registered April 27th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus, gramophones, pianos, &c. The subscribers (each with one share) are:—H. R. Bettinson, 36, Cannon Street, Birmingham, solicitor; G. M. Butts, 36, Cannon Street, Birmingham, solicitor's managing clerk. Solicitors: Forsyth, Bettinson & Co., 36, Cannon Street, Birmingham.

United Africa Co., Ltd.—Registered as a private company April 29th. Capital, £13,000,000 in £1 shares. Objects: To acquire and amalgamate all or part of the undertakings, businesses, properties, and assets of the African and Eastern Trade Corporation, Ltd., and the Niger Company, Ltd.; to enter into two agreements with those companies; to acquire concessions, territories, lands, rights, &c.; to build, maintain and work roads, railways, tramways, telegraph lines, telephones, electricity works, wharves, docks, ships, &c. The subscribers are the African and Eastern Trade Corporation, Ltd., Liverpool (A. Stephenson, secretary), and the Niger Co., Ltd. Registered office: Africa House, Kingsway, W.C.2.

Gould, Harper & Co., Ltd.—Private company. Registered April 26th. Capital, £2,000 in 5s. shares. Objects: To acquire the business of manufacturers of wireless and electrical apparatus now carried on by C. H. Gould and T. Harper at Tatnam Road, Poole, Dorset, as "Gould, Harper & Co." The permanent directors are:—C. H. Gould, "La Estancia," Tatnam Road, Poole; T. Harper, 5, Pine Avenue, West Southbourne, Hants; J. P. Wills, 34, St. Margaret's Road, Poole. Solicitor: W. Hatton, Budge, Poole.

Bushing Co., Ltd.—Registered as a private company April 27th. Capital, £60,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in insulating materials and articles and products, electrical, mechanical or general engineers, &c. The subscribers (each with one share) are:—H. W. Miller, 1, Windsor Crescent, Newcastle-on-Tyne, engineer; H. M. Towns, Kenilworth, Kenton Avenue, Gosforth, Newcastle-on-Tyne, company secretary. Solicitors: Watson, Burton, Booth & Robinson, Pilgrim House, Newcastle-on-Tyne.

Thornbury and District Electricity Co., Ltd.—Public company. Registered April 27th. Capital, £15,000 in £1 shares. Objects: To acquire the business of an electricity undertaking carried on by F. H. Grace at Thornbury, Glos., and his rights and privileges under the Thornbury and District Electricity Special Order, and to carry on the business of an electric light company in all its branches. Purchase consideration £4,400 in shares. Minimum cash subscription, £4,000. The first directors are:—E. Cullimore, Shen, Gloucester Road, Thornbury, timber merchant; F. H. Grace, West Shen, Gloucester Road, Thornbury, electrical engineer; Helen G. Grace, West Shen, Gloucester Road, Thornbury (director of Thornbury Gas Light & Coke Co., Ltd.). Solicitors: Crossman & Co., Thornbury, Glos.

Stone Manufacturing Co., Ltd.—Private company. Registered April 22nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electric batteries, electric lamps and torches, hand, cycle, and other lamps, electrical instruments and novelties, &c. The directors are:—G. F. A. Stone (permanent managing director), 422, Pinner Road, Harrow; Miss Ethel Payne, 204, The Grove, Hammersmith, W.6. Registered office: 108-109, Great Saffron Hill, E.C.1.

Supra Electra Motors, Ltd.—Private company. Registered April 27th. Capital, £10,000 in £1 shares. Objects: To carry on business as manufacturers and distributors of and dealers in electric motors and all kinds of machinery and apparatus, &c. The first directors are:—J. Sinclair-Ross, 1, Morpeth Terrace, Westminster, S.W.1, engineer; C. V. Berggren, Woodlands, St. John's Road, Orpington, cargo superintendent (life directors).

Multiple Frequencies, Ltd.—Private company. Registered May 2nd. Capital, £100 in 1s. shares. Objects:—To develop inventions, patents, rights, processes and businesses in connection with the gramophone and radio and sound reproduction machines and industries, &c. The directors are:—W. C. Bailey, 30a, Woodcote Grove Road, Coulsdon, Surrey, inventor; J. Keefe, Eastney, Buckhurst Hill, Essex (director of Steel Grip Fittings, Ltd.). Registered office: 10, St. Christopher Place, Wigmore Street, W.1.

Official Returns of Electrical Companies.

E. A. Manufacturing Co., Ltd.—P. H. Stone, 47, Temple Row, Birmingham, was appointed receiver and manager on April 19th, 1929, under powers contained in debentures dated September 16th, 1927.

L. Jacobs (London), Ltd.—W. S. Warren, 8-9, Martin Lane, E.C.4, ceased to act as receiver or manager on April 12th, 1929.

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Lincoln Wireless Co., Ltd.—Capital, £1,200 in £1 shares. Return dated December 19th, 1928. 700 shares taken up. £700 paid. Mortgages and charges, nil.

Ferryside Electric Supply Co., Ltd.—Capital, £1,200 in £1 shares. Return dated December 31st, 1928. 1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Leamington and Warwick Electrical Co., Ltd.—Capital, £100,000 in 2,500 preference and 7,500 ordinary shares of £10 each. Return dated March 5th, 1929. All shares taken up. £100,000 paid. Mortgages and charges, £35,000.

Detex Distributors, Ltd.—Capital, £2,000 in £1 shares. Return dated July 25th, 1928. 881 shares taken up. £631 paid. £250 considered as paid. Mortgages and charges, nil.

Pan-Electric, Ltd.—Capital, £200 in £1 shares. Return dated January 1st, 1929. All shares taken up. £196 paid. £4 considered as paid. Mortgages and charges, nil.

Aland & Co., Ltd.—Capital, £3,500 in £1 shares. Return dated December 31st, 1928. 3,246 shares taken up. £752 paid. £2,494 considered as paid. Mortgages and charges, nil.

Ashley Wireless Telephone Co. (1925), Ltd.—Capital, £2,500 in £1 shares. Return dated December 31st, 1928. All shares taken up. £2,500 paid. Mortgages and charges, nil.

Forest City Electric Co., Ltd.—Capital, £5,000 in £1 shares. Return dated March 13th, 1929. All shares taken up. £2,210 paid. £2,790 considered as paid. Mortgages and charges, nil.

Walter Denis Manufacturing Co., Ltd.—Capital, £500 in £1 shares. Return dated December 28th, 1928. 261 shares taken up. £2 paid. £259 considered as paid. Mortgages and charges, £1,850.

Berry, Wiggins & Co., Ltd.—Satisfaction in full on February 25th, 1929, of mortgage dated February 1st, 1924, securing all moneys due or to become due from the company to the Midland Bank, Ltd. (Notice filed April 26th.)

Ross, Courtney & Co., Ltd.—Deposit on April 16th, 1929, of deeds of 25, Ashbrook Road, and 62-4-6-8, Elthorne Road, Upper Holloway, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Radio Electric Co. (Bournemouth), Ltd.—Debenture dated April 6th, 1929, to secure £400, charged on the company's property, present and future, including uncalled capital. Holders: A. G. Smith, 16, Rushton Crescent, Bournemouth, and G. T. Smith, 67, Abbey Road, St. John's Wood, N.W.8.

Thermionics, Ltd. (formerly G.W.I. Valves, Ltd.).—L. A. Bartlett, 639-643, Salisbury House, London Wall, E.C.2, ceased to act as receiver or manager on April 12th, 1929.

Banting & Tresilian, Ltd.—Capital, £1,000 in £1 shares. Return dated January 2nd, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

E. P. Allam & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated March 6th, 1929. 5,000 shares taken up. £2 paid. £4,998 considered as paid. Mortgages and charges, nil.

Westminster Electric Supply Corporation, Ltd.—Capital, £2,000,000 in 1,450,000 ordinary and 550,000 preference shares of £1 each. Return dated March 13th, 1929. 1,259,366 ordinary and 550,000 preference shares taken up. £1,305,620 paid on 755,620 ordinary and 550,000 preference shares. £503,746 considered as paid on 503,746 ordinary shares. Mortgages and charges, nil.

Perfect Burglar Alarm Co., Ltd.—Capital, £4,000 in 1,000 preference and 3,000 ordinary shares of £1 each. Return dated November 26th, 1928. 230 preference and 1,710 ordinary shares taken up. £1,382 paid (being £1 per share on 1,210 ordinary and 15s. per share on 230 preference shares). £500 considered as paid on 500 ordinary shares. Mortgages and charges, nil.

Lancashire United Transport & Power Co., Ltd.—Capital, £200,000 in £1 shares. Return dated March 14th, 1929. 192,878 shares taken up. £7 paid. £192,871 considered as paid. Mortgages and charges, £541,150*; £83,330 deferred debenture stock issued having no charge over the assets of the company. (* A further £50,000 of this stock has been deposited as security for possible advance.)

Electro-Mechanical Brake Co., Ltd.—Capital, £30,000 in 2,500 preference and 27,500 ordinary shares of £1 each. Return dated November 5th, 1928 (filed March 4th, 1929). 1,500 preference and 26,500 ordinary shares taken up. £21,965 paid on 1,500 preference and 20,465 ordinary shares. £6,035 considered as paid on the remainder. Mortgages and charges, £7,500.

Morley Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares. Return dated February 18th, 1929. All shares taken up. £3,980 paid. £1,020 considered as paid. Mortgages and charges, £1,266 6s. 2d.

Lamp Manufacturing Co., Ltd.—Capital, £10,000 in £1 shares. Return dated February 14th, 1929. 5,400 shares taken up. £5,400 paid. Mortgages and charges, £2,500 debentures.

Electric Art Shades (1928), Ltd.—Satisfaction to the extent of £50 on March 29th, 1929, of debenture dated August 22nd, 1928, securing £250.

J. T. Kemp, Ltd.—R. B. Baggaley, C.A., Commerce Chambers, Parliament Street, Nottingham, was appointed receiver on April 23rd, 1929, under powers contained in debentures authorised September 23rd, 1927.

City Notes.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.

The annual meeting was held on April 30th, Mr. E. Garcke (chairman) presiding. In presenting the report and accounts, the chairman said that it was natural to expect that the general development of the company's business would cause an increase in expenses, but he must draw attention to the large increase in the amount paid in rates. In 1928 it paid £24,156, as against £16,178 in the previous year and £14,103 the year before. The position would not be eased by the De-Rating Act, as public utilities were debarred from obtaining any advantage from its provisions. Arrangements for inter-connection of supply had been made with the City of Birmingham on the east of the area and with the West Gloucestershire Power Co. and Wessex Electricity Co. on the south. Negotiations with similar objects were proceeding with the Hereford Corporation on the west and with the West Midlands Joint Electricity Authority on the north. The company was also supplying electricity in bulk to the Corporation of Cheltenham. Its distribution area covered nearly the whole of the County of Worcestershire, considerable portions of Staffordshire, Shropshire, Gloucestershire, Warwickshire, Herefordshire, and Oxfordshire, giving a total area of approximately 1,800 square miles in parts of seven counties. Within that area it had a number of separate electricity undertakings. In addition to those previously reported there were Banbury, Ledbury, Stratford-on-Avon, Shipston-on-Stour, and Church Stretton. The company had established an estates department, which was in a position to provide information concerning sites and availability of labour to industrialists in search of the most economic conditions for enterprise, including the supply of cheap electricity. The report and accounts were adopted and a resolution was passed creating 350,000 new shares of £1 each, to be called 6 per cent. cumulative preference shares.

Anglo-Portuguese Telephone Co., Ltd.

This company's report for 1928 was reviewed in our issue of April 26th (p. 753). The annual meeting took place on April 30th, when Sir Alexander Roger, the chairman, said that they had added substantially to the reserves, having created a general reserve of £25,000 and placed £14,580 to the renewals reserve. The capital expenditure had increased by £117,097, which reflected the fact that a telephone company could only progress by the continued expansion of its services and the addition of new equipment. The profit had shown a substantial improvement, for operating and other charges had materially decreased. The number of stations increased by about 9 per cent. during the year, but they hoped to improve upon that rate of progress. They had been able to borrow money on favourable terms from an associated company. When the loans reached a substantial sum it was their intention to issue fresh capital on terms favourable to the shareholders. The Government had granted them a new concession, and had asked them to consider an alternative basis of charging to the message rate system. They had agreed to this, and new rates were put into force in September last. The plant was modern and in good condition, but it was intended to replace it by automatic equipment when it was economic to do so. Upon a recent visit to Portugal he (the chairman) was favourably impressed with the possibilities of development. The telephone business in the country undoubtedly had a prosperous future. The company's relations with the Government and with the Municipalities of Lisbon and Oporto had continued on a very friendly basis. The chairman concluded by thanking the general manager and his staff for the heavy work which they had done during the past year.

Brush Electrical Engineering Co., Ltd.

The accounts for the year ended December 31st last show a net profit of £67,406 (against £65,510), after making provision for general charges, debenture interest, depreciation, &c. This is allocated as follows: To general reserve, £6,010; dividend of 10 per cent. on the shares, £47,640 (the same); further 4 per cent. interest on the participating second debenture stock, £2,045 (as for 1927); and surplus for apportionment between shareholders and co-partners, £11,711. The last sum has been allocated under the co-partnership deed in the following way: Co-partners, £9,839; shareholders, £1,873. The latter amount has been added to the undivided profits account, which now stands at £82,817. The total surplus included in this account is £6,626, and it is proposed to distribute from this 1 per cent., free of tax, in shares or cash, to the shareholders. In order to make this distribution in the most appropriate way it is proposed to convert the issued shares into stock and to alter the articles of association to enable the directors to deal with any future distribution of surplus in a similar manner. The issued share capital of the company now stands at £476,401, having been increased during the year by the allotment of 6,950 shares at par to

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co-partners in respect of the 1927 surplus. The report says that the severe competition in the engineering industry shows no signs yet of diminishing. The company was fortunate, however, in having most of its shops well occupied during the year. Meeting: May 13th.

Oriental Telephone and Electric Co., Ltd.

The net revenue for the year ended December 31st, 1928, was £89,551, as compared with £72,119 in 1927. With £25,243 brought forward, and deducting interim dividends, there is an available balance of £91,029. The final ordinary dividend is 8 per cent., free of tax, making 12 per cent. for the year. For 1927 the dividend was 10 per cent., and there was a bonus of 2 per cent. The reserve receives £15,680, and £34,425 is carried forward. The report says that the installation of the new automatic exchanges in Singapore is well in hand, and should be completed early next year. A new scale of rates was instituted in Mauritius; some subscribers gave up their lines, but it is expected that they will return when they realise the equity of the new rates. The Bombay Telephone Co. reports further progress; the directors propose a dividend of 4 per cent. for 1928. The Bengal Telephone Corporation also shows satisfactory progress, and has again declared a dividend of 7½ per cent., free of Indian income tax. The Madras Telephone Co. reports marked improvement, and has maintained its dividend at 8 per cent., free of Indian tax. The Rangoon Telephone Co. has raised its dividend from 5 to 6 per cent. (free of Indian tax), and 8 per cent. has been paid on the shares of the Hongkong Telephone Co. The China and Japan Telephone & Electric Co. has again been able to declare a dividend of 15 per cent., free of income tax. Meeting: May 14th.

Calcutta Electric Supply Corporation, Ltd.

The report for the year ended December 31st, 1928, records the death of two directors—Mr. P. V. Luke and Maj.-Gen. R. H. Mahon. The sale of energy rose from 129,090,227 to 147,957,366 kWh, and the gross revenue from £930,291 to £955,129. After providing for depreciation there is a net profit of £401,803, as compared with £398,588 in 1927. The addition of £47,683 brought forward makes available £449,486. The allocations include £75,000 to reserve (against £70,000) and £22,551 "reserved for distribution to consumers." The report says that the latter sum is intended to enable the domestic consumers to participate in the profits of a successful year; details of the scheme are to be laid before the shareholders. The amount is equal to the bonus of 4d. per share which is being paid on the ordinary shares, in addition to the 12 per cent. dividend (final 7 per cent.). A balance of £41,130 is carried forward. The ordinary shareholders continue to receive the benefit of the relief in respect of Indian taxation, the deduction for income tax from the dividend and bonus for the past year being at the rate of 2s. in the £. The preference dividend is paid free of both Indian and British income tax. Sir James Donald, C.S.I., C.I.E., has joined the board. The meeting was to be held on Wednesday last.

At the meeting it was to be proposed that the capital should be raised to £4,000,000 by the creation of 1,000,000 shares of £1 each to be issued at the discretion of the directors.

Shanghai Electric Construction Co., Ltd.

The annual meeting of this company was held on May 1st. Mr. J. S. Haskell, the chairman, presided and in moving the adoption of the report and accounts (*vide* our last issue, p. 798), he said that it showed a remarkable recovery from the difficult and uncertain conditions which prevailed during the Chinese disturbances. This stage had been reached by the slow recovery of traffic and the company's policy of providing for wear and tear out of profits. They had spent a sum largely in excess of the issued capital of £500,000 and to bring the capitalisation more nearly into harmony with the value and extent of the undertaking the directors proposed to increase the capital and pay it up from the reserve. After referring to the improvement in the business of the Singapore Traction Co., the chairman said that they were adding £25,000 to reserve, and they proposed to continue, as profits permitted, the policy of adding to their financial resources from within rather than by raising fresh capital. It was proposed to capitalise £100,000 of the reserve and distribute it in the proportion of one new share for each five shares already held. The new shares would rank *pari passu* with the old ones, except as regarded the dividend to be declared that day. The increase of the capital to £700,000 would leave 100,000 shares to be issued if and when required.

The report and accounts were adopted and the capitalisation proposals approved.

Prospectus.

Young Accumulator Co. (1929), *Ltd.*—The registration of this company is recorded in the "New Companies" section of this issue. On Tuesday last the company published a prospectus offering for subscription 300,000 ordinary shares of 10s. each at par. The company is acquiring the business of the Young Accumulator Co., Ltd., including the rights for the British Empire (excluding Canada) in a process for making non-sulphating paste for electric batteries. It is also acquiring from Mr. Horace de Martis the rights in the process for the rest of the world. The consideration is the balance of the shares (150,000), and £10,000 in cash, and the company also undertakes to discharge the vendor company's liabilities surplus to assets up to £26,000. The prospectus stated that the Young accumulator possesses a number of qualities which render it superior to other makes. No figures relating to the past working of the vendor company were included in the prospectus, as "in view of the experimental stage through which it has been passing, these would be of little value." The company expects to spend £20,000 upon additional plant and machinery, and to have £68,000 available as working capital.

Bournemouth and Poole Electricity Supply Co., Ltd.

The annual meeting was held on May 3rd, and Lord Erskine, who presided in the absence of Sir Harry Renwick (chairman), read the chairman's speech. The chairman said that there was an increase in the electrical energy sold of 1,128,753 kWh, making the total 13,366,746 kWh for the year. Negotiations had been opened with the local authorities for extension of tenure of the company's undertaking, but settlement had not yet been reached. Controlling interests had been acquired in other supply undertakings, and two Orders were pending for Wimborne and district. A site had been purchased at Hamworthy, in the Poole area, and application was being made for sanction to erect a new generating station on that site. Meanwhile extensions were being made to the power station at Bourne Valley. Bulk supplies were being given to New Milton and Burton-on-Sea. For the first three months of the current year there was an increase in the electricity sold of over 18 per cent. The report and accounts were adopted.

Madras Electric Tramways (1904), Ltd.

The gross profit for 1928 was £29,099, as compared with £15,197 in the preceding year. After meeting interest and London office expenses, and transferring £7,500 to depreciation and renewal account, there was a balance of £12,212 (£1,025), plus £2,191 brought forward. The preference dividend, less tax, absorbed £6,000, and it is recommended that the balance of the cost of the issue of the 5½ per cent. (registered) debentures (£6,700) be written off, leaving £1,703 to be carried forward. In consequence of lower fares and the introduction of season tickets, the number of passengers carried showed a large increase on 1927, with a resultant increase in traffic receipts and net revenue.

John Thompson, Ltd.

The annual meetings of the associated companies of John Thompson, Ltd., of Wolverhampton, comprising John Thompson (Wolverhampton), Ltd., John Thompson Water Tube Boilers, Ltd., John Thompson Motor Pressings, Ltd., John Thompson (Dudley), Ltd., John Thompson Beacon Windows, Ltd., and Kennicott Water Softener Co., Ltd., were held on April 26th, when a dividend of 15 per cent. was declared on the preference "B" and ordinary shares of the companies, as for 1927. There were present at the meetings Mr. James Thompson, Mr. A. E. Thompson, and Major S. J. Thompson, D.S.O., governing directors, and about 450 employé shareholders. The chairman said that it had been decided to put down a works in Australia to develop the companies' manufactures.

Associated Gas and Electric Co.

Last week this company published (for information only), in compliance with Stock Exchange regulations, a statement of its capitalisation, objects, &c. This showed that the share capital issued was in no-par-value stock of various classes, the total consideration received being $80,480,846. On October 31st the principal amount of funded debt outstanding was $45,760,500. The company was incorporated under the laws of New York State in 1906. It is a holding company for the securities of other corporations and has powers to assist, financially or otherwise, the corporations in which it is interested. The operating companies within the Associated Gas and Electric System own 290,500 kW of electric generating plant (46,128 kW hydro-electric), 3,124 miles of h.p. transmission lines, and large gas undertakings.

Urban Electric Supply Co., Ltd.

The net profit for the year ended December 31st, 1928, after providing for interest, income tax, &c., is £100,832, as compared with £98,749 in 1927. To this is added £22,219 brought forward, making £123,051. Deducting the interim dividends and a small sum devoted to the purchase of funded dividend certificates, there remains £99,993. From this £30,000 is put to depreciation reserve, £15,000 to general reserve, £1,740 to writing off expenses of increased capital, and £2,000 to the staff benevolent fund. The final ordinary dividend is 4 per cent., making 7 per cent. for the year (as for 1927), and £22,953 is carried forward.

Craigpark Electric Cable Co., Ltd.

The directors report a profit of £17,703 for the year ended March 30th last (against £15,594 in 1927-28), and to this is added £1,222 brought forward, making £18,925. The allocations include £9,000 to reserve (against £7,607), and the ordinary dividend is 5 per cent., as compared with 4 per cent. for 1927-28, and 7½ per cent. for 1926-27; a balance of £2,200 is carried forward, subject to directors' fees. There was a considerable increase in the factory's output during the year and the business generally continues to expand. Mr. D. A. Matheson is recommended for appointment to the board. Meeting: To-day (Friday).

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Johnson & Phillips, Ltd.

After providing for bad debts and charging about £15,000 to revenue for maintenance of plant, buildings, &c., the profit for the year ended December 31st, 1928, was £106,417 as compared with £108,858 for 1927. A net balance of £85,072 is added, making available £191,489. From this debenture interest, &c., is met and it is proposed to pay a final dividend of 5 per cent., again making 10 per cent. for the year, leaving £80,903 to be carried forward. The annual meeting was to be held yesterday (Thursday).

Marconi's Wireless Telegraph Co., Ltd.

The directors have decided to pay an interim dividend of 20 per cent. on the ordinary shares and an additional 10 per cent. on the 7 per cent. cumulative participating preference shares. They state that after the payment of these dividends the available profits will not permit of any further distribution in respect of the year 1928. Meetings of the cable companies and the Marconi Company are to be held on May 29th to consider certain alterations in the articles of association in connection with the merger scheme. At the Marconi Company's meeting the directors will submit the 1927 accounts for approval.

Richmond (Surrey) Electric Light and Power Co., Ltd.

Presiding at the annual meeting on May 3rd, Sir Thomas Bethell, in the absence of Sir Harry Renwick, read the chairman's speech. The chairman said that the company was changing over from d.c. to a.c. Since the close of the year 591 kW of new business had been obtained, and the output of electricity had increased by 20 per cent. over the corresponding period of last year, while the number of consumers had increased accordingly. The report and accounts were adopted.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved :—

Bastian Electric Co., Ltd.
Carey Transmission, Ltd.
East Lancashire Electrical Co. (Accrington), Ltd.
Radio Photographic, Ltd.
Wireless Association of Great Britain, Ltd.

Cawnpore Electric Supply Corporation, Ltd.

The accounts for 1928 show that the surplus on the year's working was £86,861, as compared with £67,637 in 1927. After deducting debenture interest and adding £3,150 brought forward, the amount available is £78,214. From this £27,500 is transferred to depreciation and renewals account, £4,002 is written off issue expenses, and income tax and sinking fund instalments are paid. A final ordinary dividend of 7 per cent. is recommended, again making 10 per cent., and £3,824 is to be carried forward. The sales of energy rose from 24,741,660 to 26,804,762 kWh. Meeting: May 14th.

Provincial Electric Tramways Co., Ltd.

The balance on the 1928 revenue account is £16,749, against £15,233 in 1927. There is added £3,139 brought forward, making £19,888. After providing for debenture interest, &c., and transferring £5,000 to reserve, the directors propose to pay a year's dividend on the preference shares, leaving two years' arrears, and to carry forward £3,679. The Portsmouth Street Tramways Co. is seeking Parliamentary sanction to the abandonment of tramways between Gosport and Fareham and to substitute omnibuses.

Weston-super-Mare and District Electric Supply Co., Ltd.

The net revenue for the past year rose from £39,755 to £42,685, and the addition of £4,959 brought forward makes £47,644. After meeting expenses, debenture interest, &c., £17,800 (against £7,000) is transferred to reserve. The ordinary dividend is maintained at 10 per cent., and £6,149 is carried forward. During the year 50,000 £1 ordinary shares were issued, raising the capital to £150,000.

Anglo-American Telegraph Co., Ltd.

The rent received from the Western Union Telegraph Co. in respect of 1928 was £262,500; to this is added £65,625 brought forward, making £328,125. Four dividends totalling £3 15s. per cent. have been paid on the ordinary stock, and one of £1 10s. per cent. on the deferred stock. The balance carried forward remains at £65,625. Major R. L. Benson, D.S.O., has been appointed to the vacancy on the board caused by the death of Mr. R. H. Benson.

Anchor Cable Co., Ltd.

The profit for the year ended December 31st, 1928, amounted to £84,974 (against £64,748). After meeting debenture interest (£2,250) and adding £113,836 brought forward, there is an available balance of £196,560. The reserve for income tax receives £10,000 (against £15,000) and it is proposed to pay a final dividend of 15 per cent., making 20 per cent. for the year as compared with 15 per cent. for 1927 and 10 per cent. for 1926. The report records the recent death of Mr. E. G. Buxton, who joined the board in August, 1927.

Greenwich Cable Works, Ltd.

The net profit for the past year amounted to £3,008. The dividend in respect of the year 1926 is paid on the 7 per cent. first preference shares and £3,976 is carried forward. The bulk of the machinery has been transferred to the new works and the name of the company has been changed to "Croydon Cable Works, Ltd." Since the close of the year a further year's dividend has been paid on the 7 per cent. first preference shares.

Penarth Electric Lighting Co., Ltd.

The net revenue for 1928 amounted to £11,341, as compared with £12,217 in 1927, and after deducting administration and general expenses, income tax, debenture and other interest, and providing £2,000 for renewals, there was a net surplus of £4,027 (£4,942) to which was added £3,200 brought forward, making £7,247. A dividend of 7½ per cent. for the year, and the placing of £2,000 to reserve are proposed, leaving £3,022 to be carried forward.

Merthyr Electric Traction and Lighting Co., Ltd.

There was a reduction in the revenue for the past year from £25,896 to £23,868; with the balance of £3,706 brought forward the available balance is £27,574. Debenture interest is paid and £7,000 is allocated to renewals. A dividend of 2½ per cent. is again to be paid on the ordinary shares, and £3,653 remains to be carried forward.

West Gloucestershire Power Co., Ltd.

The report for the year ended December 31st, 1928, records an increase in the revenue from £50,339 to £60,322; after meeting expenses, debenture interest and other charges, there was an adverse balance of £1,631 which is deducted from the amount brought forward, leaving £40,640 to go to the next account.

American Telephone and Telegraph Co.

The largest bond issue of recent years was made on April 30th by the directors of this company who offered stockholders the right to purchase approximately $219,000,000 in convertible 4½ per cent. bonds in the ratio of $100 at par value for each six shares of stock held.—*Reuter* (New York).

Rushden and District Electric Supply Co., Ltd.

The directors are offering the shareholders 10,000 £1 shares at the price of 24s. each in proportion to their present holdings. The allotment letter includes a renunciation form for the use of shareholders who do not desire to take up the new shares. The list is to close on May 21st.

Birkdale District Electric Supply Co., Ltd.

The balance of the net revenue account for 1928, after providing for income tax, &c., and adding £6,232 brought forward, is £12,204. A sum of £3,500 is transferred to reserve, and after paying a dividend on the ordinary shares of 6 per cent. £5,944 is carried forward.

Associated Electrical Industries, Ltd.

Mr. H. C. Levis (chairman) presided at the annual meeting on Tuesday last and in the course of his address said that this year had so far shown increased business (mainly for smaller apparatus) although prices still tended to be on a lower basis. A report of the meeting will appear in our next issue.

Richardsons, Westgarth & Co., Ltd.

The accounts for the year ended October 31st last show a profit of £30,089 (against £28,253). The ordinary dividend is reduced from 5 to 2½ per cent.

Cable, Telephone and General Trust, Ltd.

The directors report a net revenue of £26,202 for the past year, and recommend a dividend of 4 per cent. on the ordinary shares.

Coventry Chain Co., Ltd.

An interim ordinary dividend of 3 per cent. has been declared, as last year.

Tyneside Electrical Development Co., Ltd.

The title of this company has been altered to "The Tyneside Investment Trust, Ltd."

Dubilier Condenser Co. (1925), Ltd.

The half-yearly dividend has been declared on the 7½ per cent. cumulative preference shares.

Glenfield & Kennedy, Ltd.

The ordinary dividend is maintained at 10 per cent. for the last year by a final distribution of 6 per cent.

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Chloride Electrical Storage Co., Ltd.

A final dividend of 5 per cent., and a bonus of 15 per cent., both free of tax, are to be paid on the ordinary shares. The total distribution for the year is thus again 25 per cent. tax free.

British Power and Light Co., Ltd.

According to the financial Press, a company bearing this title has been formed with a capital of £1,600,000 for the purpose of holding securities of electricity distribution undertakings.

Dutch Company.

Philips Glowlampworks.—This week the company was to make an issue of about £1,160,000 in ordinary shares at 250 per cent. and £440,000 in 6 per cent. preference shares at 130 per cent. Shareholders were to receive prior rights while an additional £200,000 of ordinary shares was reserved for subscription on the same terms by the General Electric Co. of America, which already has a large holding in the company. The proceeds of the issue are to be used primarily for the extension of the company's factories.

The report for 1928 states that the works were operated at full capacity and the turnover substantially increased. The works and plant were considerably extended and plans are in hand for further extensions both in Holland and abroad. The trials of the company's short-wave transmitter proved very successful. At Eindhoven 20,000 persons are now employed; a further 5,000 are engaged in undertakings controlled by the company in Holland and a still further 10,000 are employed abroad, making a total of 35,000. The future is looked forward to with confidence as a result of the increase in the use of electric light and in the sale of radio apparatus. After providing for depreciation the accounts show net profits of 18,710,000 fl. as compared with 11,559,000 fl. in the previous year, and the dividend on the ordinary shares remains at 21 per cent.

German Companies.

The *Felten and Guilleaume Co.* of Cologne-Mulheim, intends to pay a dividend of 7½ per cent. for 1928, as compared with 6 per cent. in the previous year.

The *Dr. Paul Meyer Co.*, Berlin, which belongs to the A.E.G. group, reports net profits of 361,000 marks for 1928, as against 345,000 marks in the previous year. The dividend is 8 per cent., as in 1927.

Swedish Company.

The report for 1928 of the *A.B. L.M. Ericsson* states that the value of the deliveries from the telephone works amounted to 25.90 million kr. and from the cable works to 5.24 millions, the corresponding figures for 1927 being 20.37 millions and 4.11 millions, respectively. The foreign subsidiary works and sales companies were able to increase their turnover, and the foreign concession undertakings co-operating with the company showed progress and produced improved results. The reconstruction of the Southern Italian telephone system was practically completed, and the new automatic network in Naples and Messines was inaugurated at the end of October. During the year investments were made in works in Norway, Estonia and Czecho-Slovakia, as well as in Polish and South American concession undertakings. The accounts show that the net profits increased from 2,490,000 kr. in 1927 to 3,770,000 kr. last year, and the dividend is raised from 6 to 7 per cent.

Spanish Company.

The accounts of the *Compania Hispano-Americana de Electricidad*, Madrid, show net profits of 50.88 million pesetas for 1928, as compared with 43.20 millions in the previous year. It is proposed to pay a supplementary dividend of 9 per cent. in gold on the A to D shares and 4½ per cent. in gold on the E shares, so that including the interim rate of 6 per cent. paid in December, a total rate of 15 per cent. net will be distributed.

French Company.

The *Compagnie Générale d'Electricité*, Paris, reports net profits of 20.99 million fr. for 1928, as compared with 25.33 millions in the 18 months forming the previous financial year. It is intended to pay a dividend of 17 per cent., against 14 per cent.

Stocks and Shares.

MONDAY EVENING.

THE Stock Exchange has entered upon the three weeks' settlement which embraces the Whitsun holidays, and concludes, by coincidence, on the day of the General Election. Therefore holidays and politics have joined forces to lay a further check upon business in stocks and shares—business that has now fallen away to a low ebb pending a settlement, more particularly, of the coming contest between the parties. It is difficult to discover any market in the Stock Exchange where animation prevails, but the American buying of shares in electrical manufacturing companies is certainly one of the features of the day. The books of the Eastern Telegraph, Eastern Extension and Western Telegraph Companies, together with those of the Marconi Company, are closed for three weeks. This places no impediment in the way of dealing with the stocks and shares. In practice, however, the result is that interest has become less than of late. No little curiosity is felt as to the time within which the Bank of England will receive the 60 per cent. assent to the merger proposals needful to render the latter operative.

The Hand of New York.

Associated Electrical Industries ordinary shares are a particularly lively market on American dealing. The fluctuations are governed almost entirely by orders from the other side. The price has been up to 57s.—this happened on a Saturday morning when the London Stock Exchange was closed—and down to 49s. At the time of writing, on Monday evening in this week, the quotation is 52s. 6d. Visitors lately landed from New York speak of the buying movement as being largely a matter of speculation. The company has declared a dividend of 6 per cent., so that, from the yield point of view, for the price to stand at anything like 50s. is clear evidence of motives for buying that take no account of immediate return on money invested. The profit for the past year, given in last week's ELECTRICAL REVIEW, is £258,772, about £4,000 more than that of the preceding twelvemonth. Nothing is included in this total from the company's new interests.

American Influences.

In view of the manner in which American demand has clamoured for General Electrics, Associated Electricals, and, earlier, for some of the electricity supply companies' shares, an impression is current that the desire exists on the part of American interests to obtain a firm foothold in the industry, through the acquisition of shares in British companies. No doubt can be felt as to the feelers put forth from American quarters in regard to the possibility of obtaining a substantial measure of control over companies whose shares fall within this particular area. It might be misleading, and perhaps cause loss, if mention were made here of the companies around which rumour is weaving its web of possibilities. But holders of shares in good-class electrical manufacturing and supply concerns are naturally paying marked attention to the position. Rumours come from various parts of the country as to what undertakings are likely to be the subject of American attention. The atmosphere is charged with what may be called a mild tension of excitement, very different from the placid air in which these companies' shares are accustomed to move.

Cable and Wireless.

Reference has been made above to the closing of transfer books in the Eastern Cable group and the wireless companies included in the merger. This closure has had the effect of checking business, but the tendency is hard as regards the cable stocks, while Marconi maintain their level at 85s. with firmness. Were it not for the disputes that encircle the Marconi Company's shares, it is not unlikely that the price of Marconis would be standing higher than it does to-day. With regard to the cable stocks, the expectation is that about £300 for Eastern ordinary, and, say, £30 for the shares of the two other companies, will represent the levels to which the prices may be expected to attain when the merger is complete. The Bank of England will send out notices on May 17th, asking whether proprietors desire to assent or not to the proposals. After the transfer books reopen, we understand that the Bank of England will renew, to new proprietors then to be registered, the chance of assenting to the scheme. Canadian Marconis have risen to £2; Burndept Wireless are a little better at 5s. The chairman of the Columbia Graphophone Company is credited with the statement that fusion of this company with the Radio Corporation of America would seem both logical and practical.

Home Electricity Supply.

In the list of home electricity supply companies St. James' and Pall Mall are 1s. better at 27s. 6d., while County of London slipped back a similar amount to 54s., the latter on a little profit-taking. A demand has sprung up for Shropshire, Worcestershire and Staffordshire shares, with the result that prices are better at 46s. 3d. for the "A" ordinary, and 44s. for the "B" ordinary. The suggestion was made that the Americans were buying. Whether this is so or not, the advance in price is sufficiently explained by the speech by Mr. Garcke, the chairman, at the recent meeting. A resolution was passed creating 350,000 new 6 per cent. cumulative preference shares of £1 each. The price of the existing preference is 22s. 6d. Dividends are payable in March and September. Midland Counties rose a florin to 30s., the advance being linked to that in Shropshire shares. Bournemouth and Poole at 65s. 9d. are 1/16 higher, responding rather tardily to the statements made at the recent meeting. Lancashire Electric new ordinary are 6d. premium, and the new Clyde Valley 11s. 6d. premium.

Home and Foreign Traction.

British Electric Traction deferred ordinary stock has regained the loss of a few weeks ago, and is 50 points up at 900. Brazilian Tractions at 58½ have shed a point, but the market

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for dollar stocks as a whole is not bad. It is said by those who should be in a position to know, that the monetary situation in New York and Montreal is gradually clearing. Montreal seems to have been even more afflicted with financial indigestion than New York was, and time will probably be yet required before matters are fully straightened out in that centre. Consolidated Gas of Baltimore 4½ per cent. gold bonds are 4 up, at 100. The Mexican group is inclined to sag, there being small falls in the bonds of the Mexico Tramways and the Mexican Light and Power Companies. Power Corporation of Canada shares at 110 are 3 points higher. Of the London undertakings, London United Tramway 4 per cent. debenture stock is nominally a point higher at 62, but stock changed hands the other day up to 65. The preference shares are quoted at 8s. 6d. and the ordinary at about 1s. 6d. Metropolitan Electric Tramways ordinary were last done a couple of months ago at 5s. 6d.; the 5 per cent. preference changed hands the other day at half-a-guinea. London and Suburban Traction ordinary are 4s. 6d., and the preference hold their advance to 12s. 6d.

Undergrounds.

In the Home Railway market Metropolitan consolidated has fallen a point to 59½, and Districts weakened to 75½, Home Railway stocks as a whole being dull. Underground Electric income bonds, however, rallied to 113. The ordinary shares are regarded as a good lock-up investment of speculative order paying, as they do at the present time, £5 13s. 10d. per cent. on the money, though some people contend that District ordinary stock, yielding 6⅝ per cent. on the money, is the cheaper purchase.

Indian Shares.

The Calcutta Electric Supply Corporation is about to increase the capital to four million pounds by the creation of an issue of one million additional shares of £1 each. The price of the existing shares is 53s. 9d., and the company's 5 per cent. cumulative preference stand at 22s. 3d., the dividends on the latter being paid free of income tax. The Cawnpore Electricity Supply Corporation is paying 10 per cent. for the year, the report showing very good figures. The dividend is at the same rate as in the previous twelve months; the price of the ordinary shares is quoted at 33s. 9d., and that of the 7 per cent. preference at 22s. 6d. Madras Electric Tramways gross profit for 1928 of £29,000 is nearly double that of the previous year. The company's 6 per cent. preference shares stand at 13s. The large increase in traffic receipts and in revenue are attributed to lower fares and the introduction of season tickets.

Manufacturing Companies' Shares.

General Electrics have reacted to 3, and the 6½ per cent. preference at 23s. 6d. are 6d. lower. The market is no longer the scene, as it was a month ago, of violent excitement and price variations. Johnson & Phillips at 36s. 3d. show no change on the issue of the report, which gives the 1928 profits at £106,416, or about £2,400 under those for 1927. In their ex rights guise, British Insulated at 3⅜ have attracted a little buying. Brush shares are firm on a satisfactory report. The new issue of Imperial Chemicals ordinary shares at 33s. 6d. commanded a premium of 1s. 6d. when dealings began in them three weeks ago, but the premium ran right off. This Monday was the latest time for making application for the new shares. A further advance of 1s. 9d. carried British Aluminium to 51s. 3d., making a rise of 4s. within a fortnight. Philips Glow Lamp shares, in which Amsterdam has a free market, have been favourably affected by a good report. The shareholders are offered new capital on bonus terms.

Telephone and Telegraph.

The Oriental Telephone & Electric Company repeats its previously-paid final dividend of 8 per cent., free of tax, and the price of the shares is unchanged at 2⅞. American Telephone and Telegraph stock has eased off to 238, and International Telephone to 260, declines of 2 and 5 points, respectively. Business was marked last week in Constantinople Telephone ordinary at 61s. 3d.; this is ex the recently-paid dividend of 3s. 6d. Bogota Telephones are 9d. higher at 29s. 3d. A fair amount of investment business in Anglo-American Telegraph 6 per cent. preferred ordinary has left the price at 102½. Atlas Light & Power ordinary at 25s. 6d. are somewhat heavy on sales by speculators disappointed at the failure of the expectations that American buying would put the price much higher before the beginning of the current month.

Miscellaneous.

Shares affected by the prices of tin and of rubber have been depressed as a consequence of the weakness in both materials. The engineering, iron and steel group displays a dull disposition, public interest in the shares being very tepid. Babcock & Wilcox at 3½ have shed 1/16. The common answer given in reply to inquiries as to why the price of any shares is heavy at the present time, refers to the General Election as the main cause.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Approx. Dividend. 1927,	1928.	Price May 6 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	65/9	+1/16	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/-	—	5 7 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	32/6	—	... ...
County of London	1	7½	10	54/-	—1/-	3 14 1
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	+6d.	5 12 0
Elec. Supply Corporation	1	11	—	56/3	—	3 18 3
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	27/-	—	5 3 8
Metropolitan	1	9	9	2 1/16	—	4 7 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	30/-	+2/-	4 6 8
Mid. Elec. Power	1	15	8	35/9	—	4 9 6
Newcastle-on-Tyne Ordinary ...	1	6	6	1¼	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6xd	+1/-	5 1 10
Scottish Power	1	8	8	30/6	—6d.	5 0 9
South London	1	8½	8½	26/6xd	—	5 5 8
Urban Ordinary	1	7	—	43/3	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	3	3½	59½	—1	5 17 8
do. District	,,	4	5	75½	—½	6 12 5
Underground Electric	£1	5	7	23/6	—	5 13 10
do. do. Income ...	Bonds	6	6	113	+1	5 6 2

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	2⅜	—	5 18 0
Eastern Extension	10	10	10	28	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	280	—	*3 11 5
Globe Tel. and T. Ord.	10	10	10	28½	—	*3 11 0
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	—	33	—	... ...
Indo-European	25	10	10	54½	—1	*4 11 9
Marconi	10/-	10	—	4¼	—	... ...
Marconi-Marine	1	12½	15	3¼	—	4 12 4
Oriental Telephone Ord.	1	12	12	2⅞	—	... ...
Western Telegraph	10	10	10	27½	—	3 12 9

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	8 13/16	—	7 18 0
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	,,	5	—	900	+50	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	58½	—1	3 8 5
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/6	—	... ...
London United Tram Deb. ...	Stock	4	4	62	+1	6 9 1
Mexico Trams, 5% Bonds	—	5	5	71½	—	6 19 10
Mexican Light Common	100	Nil	Nil	77½	—	... ...
do. 7% Pref.	100	7	7	75½xd	—	9 5 6
do. 1st Bonds	—	5	5	76½	—1	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	52/6	—½	2 5 9
Babcock & Wilcox	1	13	15	3½	—1/16	*4 12 4
British Aluminium Ord.	1	10	10	2 1/16	+½	*3 18 2
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	3⅜xr	—	4 8 9
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	4⅜	—	3 9 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4 1/16	—	4 19 0
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	8/8	—6d.	5 10 3
Gen. Elec. Pref.	1	6½	6½	23/6	—½	3 6 8
do. Ord.	1	7½	10	3	—	4 1 8
Henley...	1	25	25	6	—	5 6 0
do. 4½% Pref.	5	4½	4½	4¼	—	... ...
India-Rubber	1	Nil	Nil	18/9	—	5 10 6
Johnson & Phillips	1	12½	10	36/3	—	5 9 1
Siemens Ord.	1	7½	7½	1⅜	—	*4 19 8
Telegraph Construction	12	10	10	24½	—	... ...

* Dividends paid free of Income Tax.

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The Training of Apprentices for Electrical Contracting Work.

The outcome of a scheme of certification in electrical installation work which has the approval of the Electrical Contractors' Association.

By H. R. T.

TWO pamphlets* which were recently published by the City and Guilds of London Institute, Department of Technology, with the approval of the Electrical Contractors' Association (Inc.), are the outcome of the deliberations of an Advisory Committee jointly formed in 1928 by the Institute and the E.C.A. to consider a scheme of certification in electrical installation work; and it has now been adopted by the Institute for the purposes of its examinations and by the Association in connection with its apprenticeship scheme.

Course A, for junior electricians, is designed to cover the two critical years between the time a boy leaves the elementary school and the time he is old enough to be bound an apprentice, and serves to prepare him for the more specialised courses described in the other pamphlet. Its objects are to develop in him observation, initiative, accuracy, and facility of expression, and to familiarise him with the materials and tools used in installation work. Its syllabus is admirably adapted to achieve those objects.

The first year's course is of a general nature, and in the workshop is mainly concerned with the properties of the commoner metals and building materials, and with the more familiar phenomena of liquids and of heat. In the second year the course becomes more definitely electrical, and introduces the student to the elementary laws which govern a simple circuit. Six pages of the pamphlet are devoted to the guidance of teachers, with suggestions for short talks, demonstrations, and easy experiments. Particular stress is laid on the practical nature of the course; and it is certainly well calculated to accustom the student to active doing and constructing, and to develop his ingenuity and his powers of observation. It is insisted that "very little theory is required by the student at this stage; the knowledge which he requires is that of a *user* and not of a designer." This phrase—"the knowledge of a user"—is the keynote not only of this course, but also of the courses B and C intended to follow it. In short, the primary aim of the elementary course is to accustom the boy to handle various materials and the tools with which they are worked, and to teach him their properties, classification and nomenclature by practical demonstration and the use of trade catalogues, rather than by theory and text books.

Workshop practice, however, is only half the course. The other half is intended to be given over to drawing and calculations. "Particular attention should be paid to developing the students' power of description" and, "wherever possible, the 'engineer's language,' *i.e.*, drawing, should be used as an adjunct to verbal description." It is notorious that the average product of the elementary school cannot express himself clearly; too often he cannot write legibly, logically, or even grammatically. He may be intelligent—he generally is—and he may have knowledge—he sometimes has—but he has never been trained to put his ideas and his knowledge on to paper or, for that matter, into words. If the present course succeeds in its aim of transposing those inarticulate lads into young men who can, with clear words and accurate sketches, tell the world what they know, it will have achieved something very much more than the mere manual training of a mechanic which satisfied an earlier generation of technologists.

That this has been the chief objective of the designers of the course is evident. "Training in the power of expression is the main function of the course throughout the two years"; and the workshop practice is intended as a basis for oral and verbal description at least as much as it is designed to familiarise the boy with the facts described.

The syllabus in drawing and calculations is well designed to introduce the boys to the discipline of figures and dimensioned sketches, a discipline neglected in the schools and essential to the clear thinking which must precede clear expression. If the syllabus has a fault it is that, on the "calculations" side, it is somewhat too ambitious; indeed, on a comparison it appears to be in some respects more advanced than the corresponding section of the first two years of the later B course, which was surely not intended. It is doubtful whether it is worth while confusing boys with the metric measure, which, as things are to-day, they may never have to use in practice. In "drawing," too, it is superfluous, from the practical point of view, to ask them to shade and colour their sketches, a thing which no foreman is ever expected to do.

Course B is intended for those who have obtained the needful grounding of course A or its equivalent, and, at the age of 16 or more, are aiming at an "electrician's certificate." It is designed to cover three years of two evenings a week. At the end of that time an examination in theory is set by the City and Guilds of London Institute, and an "Interim Certificate" is awarded on the basis of the result and of the practical work done by the student in the past year. An apprentice employed by an electrical contractor, or a candidate otherwise engaged in electrical installation work, having obtained the "Interim Certificate," may be awarded the "Electrician's Certificate" on the recommendation of an advisory committee guided by a statement of his practical training and work, given on a special form.

The syllabus of course B is, with refreshing novelty, based upon the "Regulations for the Electrical Equipment of Buildings" of the I.E.E., which in effect becomes the official text-book of the course. "The basic idea underlying this is that electrical installation men, if they are to carry out their work properly, must know what the Regulations are, what they mean, and why they have been considered necessary." Moreover, throughout the course, standard wiring tables and the like are used, and the students are taught by the use of catalogues the commercial forms and names of the materials and apparatus they have to handle in their work. This is admirable commonsense. Not only are they acquiring the theory and practice of a normal course of elementary electricity and magnetism, but they are acquiring an essential familiarity with the rules which govern its commercial application to the work for which they are being trained. Again, by the use of catalogues, they are acquiring a knowledge of current materials, fittings, and accessories which will help them later to compare and select those most appropriate to a specific job; and an inkling of their costs which—it is to be hoped—will influence them to avoid waste and extravagance.

By taking the successive clauses of the "Regulations" as text, all the technical equipment of an electrician is thoroughly covered; *e.g.*, regs. 42A (*a*), 6, 86, 87, 70-74 serve as a peg on which to hang the laws governing two-wire supply systems; and regs. 56-58 cover the subject of the functions of a dynamo. Some of the clauses, indeed, might with advantage be passed over. The average wireman has little occasion for knowledge of internal-combustion engines, dynamos, or secondary batteries, and their discussion might well be deferred to the more advanced course, C.

Course C is intended for those who desire to qualify for higher positions, such as that of foreman, and is designed to cover two years of three evenings a week. It leads, by a similar procedure to that in course B, to an "Electrician's *Extra* Certificate." The syllabus covers more advanced electrical and magnetic theory and practice, and the principles of d.c. and a.c. plant. In this syllabus, too, is the only mention of the "general principles of illumination"—which is a pity; for an elementary knowledge of optics would be as useful in course A as the subject of "liquids," and in course B it should be taken as essential, since the modern electrician is expected to be familiar with ever new developments of lighting. In a course intended for foremen, too, something should be expounded of the technicalities of overhead lines; and room should be found for some discussion of the various specialised installations which sooner or later he will be called upon to supervise: theatre work, for example. Another, and from one point of view, the most serious omission from an excellent syllabus, is any mention of what may be called the clerical side of a foreman's job: the writing of reports, the requisitioning and handling of his stores, and the all-important accurate keeping of his day-sheets. No foreman, however knowledgeable and skilful in his trade, will keep his job long who cannot satisfy his head office in these particulars.

* "Electrical Installation Work," Course A, for junior electricians, for boys of 14 to 16 years of age (12 pp. 8vo). "Examinations in Electrical Installation Work," Courses B and C, syllabuses and regulations (16 pp. 8vo).

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The Electrical Imports of Egypt.

Figures for 1927 and 1928 Compared.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1928 is taken from the recently-issued trade statistics. The figures for 1927 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1927. £E	1928. £E	Inc. or dec. £E
Electrical machinery and parts—			
Total	212,000	152,000	− 60,000
From Great Britain ...	62,000	32,000	− 30,000
,, United States ...	14,000	15,000	+ 1,000
,, France	44,000	43,000	− 1,000
,, Italy	18,000	20,000	+ 2,000
,, Switzerland ...	21,000	14,000	− 7,000
,, Germany	24,000	18,000	− 6,000
Internal combustion engines, stationary—			
Total	278,000	452,000	+174,000
From Great Britain ...	141,000	285,000	+144,000
,, France	1,000	3,400	+ 2,400
,, Italy	4,000	9,400	+ 5,400
,, Switzerland ...	48,000	70,000	+ 22,000
,, Germany	52,000	68,000	+ 16,000
Electric lamps—			
Total	44,000	46,000	+ 2,000
From Great Britain ...	3,000	1,400	− 1,600
,, Germany	8,000	7,400	− 600
,, France	600	1,100	+ 500
,, Holland	16,000	18,700	+ 2,700
,, Czecho - Slovakia	400	500	+ 100
,, Austria	8,500	10,400	+ 1,900
Carbon rods for arc lamps—			
Total	500	520	+ 20
Electric cars and wagons—			
Total	26,000	5,000	− 21,000
Telegraph and telephone apparatus, ordinary—			
Total	20,700	8,500	− 12,200
From United Kingdom	6,000	5,200	− 800
,, Sweden	10,000	2,500	− 7,500
Radio apparatus—			
Total	3,000	6,000	+ 3,000
From France	700	900	+ 200
Radio and wireless parts and fittings—			
Total	17,800	17,700	− 100
Telephone and telegraph parts and fittings—			
Total	49,500	19,000	− 30,500
From United Kingdom	31,800	11,600	− 20,200
,, Sweden	13,000	6,000	− 7,000
Batteries, accumulators and parts—			
Total	34,000	35,000	+ 1,000
From United Kingdom	17,700	14,800	− 2,900
,, Germany	4,500	5,600	+ 1,100
Meters, electric, gas and water—			
Total	16,000	23,000	+ 7,000
From Great Britain ...	600	1,000	+ 400
,, France	7,700	13,000	+ 5,300
,, Germany ...	5,300	5,600	+ 300
Electric and gas pendants—			
Total	58,000	56,000	− 2,000
From Great Britain ...	3,000	3,200	+ 200
,, France	33,000	29,000	− 4,000
,, Germany ...	10,000	9,800	− 200
,, Italy	7,000	7,700	+ 700
Electro-medical apparatus—			
Total	11,600	13,900	+ 2,300
From Germany ...	3,700	5,400	+ 1,700
,, Great Britain ...	4,800	2,100	− 2,700
Electric light fittings—			
Total	59,000	77,000	+ 18,000
From Great Britain ...	6,600	10,600	+ 4,000
,, Belgium	6,300	6,800	+ 500
,, France	12,000	14,700	+ 2,700
,, Germany	18,000	22,000	+ 4,000
,, Italy	3,000	11,600	+ 8,600
,, Switzerland ...	4,600	3,700	− 900
,, United States ...	4,000	5,000	+ 1,000
Other electrical appliances and batteries—			
Total	26,000	32,000	+ 6,000
From Great Britain ...	3,000	3,800	+ 800
,, France	4,000	4,300	+ 300
,, Germany ...	7,000	7,400	+ 400
,, Italy	6,000	7,200	+ 1,200
,, United States ...	4,000	7,800	+ 3,800
Electric cables, insulated—			
Total	32,000	35,600	+ 3,600
From Great Britain ...	1,700	3,700	+ 2,000
,, Belgium	8,600	8,100	− 500
,, France	8,400	8,600	+ 200
,, Germany ...	11,000	12,700	+ 1,700
,, Italy	1,700	1,500	− 200
Uninsulated electric copper wire—			
Total	22,000	23,300	+ 1,300
From Great Britain ...	3,300	6,500	+ 3,200
,, France	18,000	12,500	− 5,500
,, Germany	200	1,300	+ 1,100
Electric wire and cable, armoured—			
Total	70,000	146,000	+ 76,000
From United Kingdom	24,000	103,000	+ 79,000
,, Belgium	2,700	5,500	+ 2,800
,, France.	28,000	24,000	− 4,000
,, Germany	12,000	11,000	− 1,000
,, Italy	3,000	1,200	− 1,800

£E = £1 0s. 6½d.

The Federation of British Industries.

Lord Ebbisham's Address.

THE annual general meeting of the Federation of British Industries was held on May 1st when Lord Ebbisham, the retiring president, delivered his address. In the course of this Lord Ebbisham said that although the past year had been disappointing in many ways there were no grounds for pessimism as to our industrial future. The export trade figures were encouraging even if the rate of improvement had been relatively slow. British manufacturers had not lost their ability to adjust themselves to new conditions and the handicap of depreciated foreign currency was disappearing. Since the beginning of the war new industrial countries, protected by high tariff walls, had arisen; the centre of gravity of foreign trade had tended to move away from Europe to the countries bordering on the Pacific; and there had probably been important changes in the relative importance attached by the peoples of the world to the different classes of goods and services entering into foreign trade. Our "invisible" exports had expanded in a marked manner. We should be careful not to slavishly follow American or German practice, for we might find in the long run that such practice was unsuited to British conditions. British energies should be directed to the discovery of the quickest way of exploiting our acknowledged pre-eminence as the producers of high-quality goods and that seemed to depend as much on a revival of our traditional spirit of initiative and adventurous enterprise as on learning the methods of organisation of other countries. Referring to the negotiations with the General Council of the Trades Union Congress, Lord Ebbisham said that the Federation believed that valuable results could be obtained by co-operation; by a mutual exchange of ideas both sides would come to appreciate each other's difficulties and make a united contribution to an increase of national prosperity and employment. The Federation had assisted in the work of the League of Nations and the International Chamber of Commerce, and it had continued its policy of maintaining contact with the national industrial federations in other countries. He had just returned with an F.B.I. delegation from Sweden, where they had discussed important matters with the Federation of Swedish Industries, including the abolition of double taxation and the possibilities of improving the coal trade between the two countries. Lord Ebbisham said that the Federation had expressed its regret at the conclusion of the South African-German commercial treaty, and had also made representations to the Canadian Government in connection with the stipulation that goods must be 50 per cent. British as to raw material and/or labour in order to qualify for preferential tariff treatment. The Spanish Government had agreed to meet a delegation from the Federation to hear its views upon the Spanish Customs tariff. Among other matters to which the president referred were the concessions obtained in respect of companies' super tax, claims for obsolescence allowances, stamp duties on amalgamations, and penny postage. He expressed his belief that the Government's rating relief scheme would prove of definite value to the heavy industries and agriculture and to many other industries indirectly. The Federation had continued to aid in the promotion of efficiency in industry, especially in the direction of practical standardisation. Their existing premises had become too small and they had completed arrangements for the erection of some fine premises in Tothill Street, Westminster, which they hoped would be ready for occupation by the end of next year.

The membership remained at a satisfactory figure and during the last few months many new members had been elected.

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Variable-speed A.C. Commutator Motors.

Notes and Comments on Some of the More Recent Types of Machine.

By C. V. HILL.

(*Extracts from a Paper read before the* ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.)

(*Concluded from p. 783.*)

A.C. Commutator Motors for Power Factor Correction.—It is intended to deal briefly with a motor of very similar construction to the a.c. variable-speed motor, and in which similar principles are involved, but which is designed to give power factor correction instead of speed variation. This machine is known as the "No Lag" motor. To obtain a motor capable of some desired power factor improvement, it is not necessary to have the commutator voltage variable. It can be made constant. This is done by connecting one end only of each phase of the secondary winding to the brushes, the other ends being joined together to form a neutral point. This results in a considerable simplification of the brushgear, only one set of brushes being required, and these can be mounted on a similar type of yoke to that used for direct current machines, since they have only to be capable of a small movement sufficient to allow for small adjustments in the phase of the regulating voltage, to enable the power factor to be set to the desired figure.

Further simplifications can be effected by suitably designing the regulating and secondary windings, whereby it is possible to reduce the number of brushes required, with a considerable gain in simplicity and cheapness. Since the motor runs near its synchronous speed, the commutator is not required to handle any appreciable power, and has simply to carry the wattless kVA used to produce power factor improvement. It can, therefore, be made very small, since the compensating voltage is only 2 or 3 per cent. of the standstill voltage of the secondary.

The arrangement of the windings is shown in diagram, fig. 7. The regulating winding is now referred to as the "compensating" winding, as it is responsible for the power factor correction.

It will be noted that the correction takes place on the secondary side of the motor, and hence an important saving in the kVA required from the compensating winding to produce a desired effect in the primary can be made. A wattless component of one kVA due to the compensating winding will produce an effect in the primary as though a primary leading kVA of full frequency/slip frequency were added to the primary circuit. This principle enables a small regulating winding and commutator to produce large changes in the total power factor of the motor.

In this motor the "compensating" winding is wound in the bottom of the rotor slots, and the primary winding above it. On large machines the compensating winding is placed in the top of the slots, as in the case of the variable-speed machine.

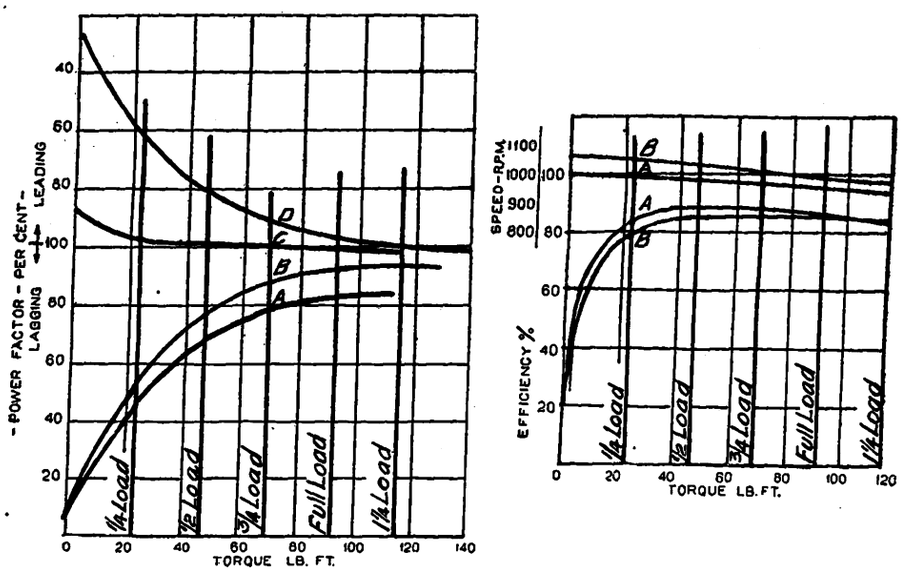
By the use of duplex and open windings for the compensating winding, the volts per segment on the commutator can be kept low, and by running just below synchronism the induced e.m.f. tends to oppose the reactance volts due to commutation, and so the limits in design due to the commutator are raised to such an extent that it is quite possible to build much larger machines than can be utilised as single units for economic reasons. Motors of up to 1,000 h.p. could be built.

Figs. 5 and 6 are typical power factor and efficiency curves for "No Lag" motors, compared with those of an induction motor.

When the "No Lag" motor is adjusted to give unity power factor at full load, the power factor remains at that figure practically down to half load, when it gradually becomes leading. When built to have a leading power factor at full load, the power factor at fractional loads becomes leading much more rapidly. In fact, the motor takes a leading kVA which is nearly independent of changes in load. The efficiency is seen to compare very favourably with that of an induction motor.

As would be expected, its simpler construction enables the "No Lag" motor to be built much more cheaply than a variable-speed a.c. commutator motor, and if used where there is a substantial rebate for good power factor, its additional cost over that of an induction motor can be saved on the power bill in a few months.

It has a better starting performance as regards torque and current than an induction motor, and lends itself readily to the standard forms of enclosure. It can, therefore, be used on most industrial drives with satisfaction.



Three-phase, induction, 17.5-h.p., 1,000-r.p.m., 50-cycle.

Curve A=Power factor of induction motor.
Curve B=Power factor of "no-lag" motor; minimum compensation.
Curve C=Power factor of "no-lag" motor; unity power factor.
Curve D=Power factor of "no-lag" motor; maximum compensation.

Curves A=Efficiency and speed of induction motor.
Curves B=Efficiency and speed of "no-lag" motor at unity P.F.

Figs. 5 and 6.—Power Factor and Efficiency Curves.

Discussion.

Lantern slides were shown of these types of machine in use up to 300 h.p. for the "No Lag" motor. Some diagrams were shown of the rotor windings of the Schrage motor, indicating how they could be arranged for improving the commutation.

Several speakers took part in the discussion, the principal points elicited being that the cost of the Schrage motor was from two to three times that of the slip-ring motor; that, however, it was stated, being due partly to the extreme reduction in price of the latter, due to competition. The "No Lag" motor was stated to cost from 30 to 40 per cent. more than the induction motor.

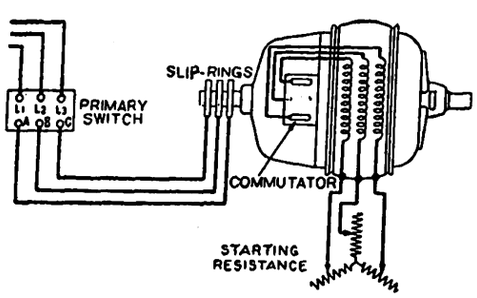


Fig. 7.—"No-Lag" 3-ph. Motor Connections.

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The National Physical Laboratory.

Abstract of the Annual Report of the Executive Committee for the Year 1928.

(*Concluded from p. 806.*)

Among the many matters of interest deserving mention in connection with the work of the electricity department, the most conspicuous are the completion of the high-voltage plant, the progress made with the redetermination of the electrical units, and the international agreement and adjustment reached, as a provisional measure, in the photometry of high-efficiency lamps. The staff in the electrotechnics division has devoted much time to the development of measuring apparatus for use in high-voltage work, and to the provision of the many items of equipment needed to complete the high-voltage installation. It has been possible to make for firms, as well as for investigatory purposes, breakdown tests on strings of insulators up to the full capacity of the plant, and experimental work has been in progress with a view to improvement in methods of measurement of peak voltage in a.c. circuits, by using, after rectification, the current induced in a conductor by the voltage to be measured. A resistor for measurements up to 150,000 volts has been designed and is under construction, as well as a shielded resistor for 40,000 volts for use as a potential divider. The division has also effected a number of improvements in the methods ordinarily employed in tests and investigations for industrial firms. A low-range electrostatic voltmeter has been constructed on the same principle as those in use for the range 50 to 150 volts. The new instrument gives a scale deflection of 5.5 metres at 50 volts, and can be read to one part in a thousand at 10 volts. A set of shielded resistances has been constructed for use in audio-frequency bridge work, ranging from 1 to 50,000 ohms. Air-cooled standard wire resistances for alternating current measurements have been prepared, to replace the water-cooled manganin tubes formerly employed. The resistance for large direct currents has been completed, and will probably serve for measurements up to 15,000 amperes. Some special uses of transformers for measuring purposes have been explored, and the potentiometer electrostatic method for testing voltage transformers has been further tried and found to yield very satisfactory results. The value of "ohmal" for the construction of standard resistances has been confirmed, and 24 such resistances have been under observation; other resistance materials have been studied. The work on the earthing of electric circuits was brought to an end during the year, and a report has been presented to the Wiring Rules Committee of the Institution of Electrical Engineers. A comprehensive investigation has been made into the effective resistance of lead-covered cables when carrying alternating currents, and will be published by the Institution. Researches on the effects of heating and on the dielectric losses in cables at high voltages have been in progress for the British Electrical and Allied Industries Research Association.

In the electrical measurements division very satisfactory progress has been made with the work on the electrical units and standards. The Lorenz machine has been put in order for a redetermination of the ohm in absolute measure, and the experiments will shortly be begun. Much has been done also towards the provision of the necessary equipment for the determination of the ohm by the alternating current method devised by A. Campbell. If good agreement is secured between these two methods, knowledge of the value of the absolute ohm will be established on a very satisfactory basis. An intercomparison of all the standard resistance coils of the Laboratory has also been completed, and a study is in progress of the change in resistance with time of newly constructed standards. The current balance is undergoing reconstruction in an improved form, and it is hoped to reassemble it in the coming year. Measurements showing good agreement with those previously obtained were made with the balance before dismantling it. The results of the work on standard cells, including intercomparisons with other national laboratories, are regarded as satisfactory.

The account given of an international comparison, between the Bureau of Standards (U.S.A.) and the National Physical Laboratory, of measurements on a subdivided mica condenser sent to Teddington from the Bureau, will be found of interest. The results show good agreement in power factor, but a definite difference in the capacity measurements; experiments are proceeding with a view to the explanation of the latter. A number of additions to the equipment for magnetic measurements have been provided to extend the range within which measurements of hysteresis loops and of total loss can be made. Under the heading of research are included some nine investigations of varied interest. The vertical force magnetometer described in previous reports has been set up at the Abinger magnetic observatory. The measurements have shown variations, due, it is believed, to changes in the temperature of the hut in which the magnetometer is housed, which have amounted to several parts in 10,000 in six months. The work on the dielectric constant of benzene has been completed. The method devised for the comparative measurement of input and output voltages on an amplifying system has been brought into operation, and found to give satisfactory results.

A considerable amount of work relating to radio standards has been accomplished for the Radio Research Board. A critical *résumé* of the literature on piezo-electric crystals has been prepared, as well as an account of a mathematical examination into the relationship between the piezo-electric and the dynamical properties of resonators. The interferometer method of examination of vibrating crystal plates has been developed with much skill, and has led to results of great interest.

The photometry division has a considerable programme of work in hand for the Illumination Research Committee of the Department. The main research into the effect of glare on the brightness difference threshold has been completed, and a paper on the results has been presented to the Royal Society.* A series of tests for estimating glare and visibility in lighted streets was organised in July, in connection with the Sheffield meeting of the Association of Public Lighting Engineers, and has yielded interesting information. The study of methods of photo-electric photometry has been continued, and a considerable advance has been made in establishing the use of the photo-electric cell on a reliable basis. For work of the highest precision the original photometer, consisting of a bridge arrangement of two photo-electric cells used with a Compton electrometer, continues to give the best results. Modifications have been made to overcome fatigue effects in the cells. The photo-electric cell is also employed for obtaining continuous daylight records.

In the wireless division good progress has been made with the programme approved by the Radio Research Board. A number of papers have been published during the year giving the results of researches completed. An interesting series of experiments has been carried out on antenna systems for beam transmission. In addition to study of the conditions affecting the "sharpness of directivity" of the system, experiments have been made in an aeroplane to check the calculations of the polar radiation diagrams of antenna systems in a vertical plane. Help has been given by the Air Ministry by the loan of an aeroplane for this work. Differences have been found from the theoretical energy distribution, and the work is being continued with a view to obtaining an explanation of these. For research on wave-lengths below 25 metres, a special oscillator, in which two 250-W valves are used, has been installed at Slough, and a portable loop receiver has been constructed for use at Teddington. It is possible to hold the note in this constant to about 100 cycles per second, corresponding, for 7 metres wave-length, to a constancy of 1 in 100,000. A portable direction-finder for use on wave-lengths between 5 and 10 metres has also been provided. In the continuation of the research on directional wireless, attention has been directed mainly to elucidation of the causes of error in the performance of a rotating loop beacon, and the development of a rotating transmitter free from night errors. The coastal deviation of wireless waves has also been further investigated.

By the desire of the Radio Research Board a critical review has been prepared of the literature from 1916 to 1928 on radio receivers. The investigation of interference has been brought to a conclusion and a report has been prepared for publication.

A large proportion of the research in progress in the engineering department is done to programmes controlled by various boards and committees of the research department, or by outside bodies. The work on lubrication has included the investigation of the limit of pressure under which grease lubrication can be maintained; owing to melting of the grease, the lubrication improves for a slow feed as the temperature rises, and for best results the quantity fed must be made to depend on the temperature. Boundary lubrication for surfaces under relative reciprocating motion has been further studied. The research on "creep" in metals at the high temperatures reached in modern high-efficiency steam turbines and power plant has attained considerable dimensions, the work for the departmental committee having been supplemented by investigations undertaken for firms and outside bodies. The behaviour at high temperatures of a large number of commonly used materials has been investigated, and, in conjunction with the metallurgy department, a programme of work is in hand on new alloys for service at high temperatures.

The experiments on fatigue phenomena exhibited by single metallic crystals of various forms have now reached the point at which prediction of the manner in which failure under stress will occur can be made with confidence when the atomic

* W. S. Stiles, "The Effect of Glare on the Brightness Difference Threshold," presented to the Royal Society, 1929.

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structure, as revealed by X-ray methods, is known. The research is of very great interest, and has been carried through with much ingenuity and technical skill by the staff concerned. A general account of the work was given by Dr. Gough in a series of Cantor lectures delivered before the Royal Society of Arts in February, 1928.

Research in the metallurgy department has been proceeding during the past few years along certain well-defined lines, and has been mainly directed to obtaining information of a fundamental character concerning the manner in which the properties of metals and alloys are dependent upon their constitution and their atomic structure, and the extent to which that structure and the related properties are modified by variation in the proportions of the constituents, by impurities, and by heat and mechanical treatment. The procedure is unavoidably lengthy, and involves much subsidiary work in the study of different types of furnace, of methods of production and purification, of refractories for the lining of furnaces and for the construction of suitable containers which will not contaminate the product, of methods of analysis, chemical, spectroscopic, micrographic and X-ray, and of suitable procedure for correlating the physical structure with the heat and mechanical treatment. Work has been directed of late years to the production of pure iron and pure chromium, and much experience has been gained which is of great importance for other work beyond the immediate problem under attack. In particular, attention has been successfully given to the removal of oxygen. Manganese and silicon have also been produced in a condition of high purity, and in connection with the research on minor metals a considerable amount of time has been spent on the production of pure beryllium, cadmium and titanium. New types and designs of furnace have been devised for this work, especially vacuum furnaces of the valve-controlled high-frequency electrical type.

Concrete Overhead-line Poles.

Their practical uses and tests, based upon a serial report of the Overhead Systems Committee, 1928-1929, of the National Electric Light Association, U.S.A.

(*A report of a meeting of the* OVERHEAD LINES ASSOCIATION.)

AT the meeting of the Association which was held in London on April 24th, Mr. W. Fennell (president) in the chair, an invitation to hold a meeting in the north Midlands to visit the area of the Mid-Cheshire Co. was cordially accepted, and the thanks of the meeting were accorded to the directors of the president's company for the invitation. It is proposed to hold the meeting early in July.

Railway Wayleaves.

As the result of a discussion concerning wayleaves over railway property, it was decided on the motion of Mr. F. Swarbrick, seconded by Mr. R. Borlase Matthews, that the Association should, if possible in conjunction with other interested parties, endeavour to arrange with the railway companies a standard wayleave over their property.

Concrete Poles.

Mr. H. Napier Prentice then took the chair, while the president read his paper on the above subject, pointing out that although they had heard much about concrete poles in France, there was a strange shortage of data. In England, they could not obtain a quotation for poles to resist any particular stress, but a committee had been formed by the British Electrical and Allied Industries Research Association charged with the duty of testing ferro-concrete poles, and Mr. F. Swarbrick was the Association's representative on that committee, but no one seemed to know quite how to commence the British investigation.

The report of the Overhead Systems Committee of the National Electric Light Association commenced by stating that the electric railway companies (U.S.A.) had made considerable use of such poles, but there had been relatively little use of them by power companies; shortage of timber of suitable size had now made the subject a live one. At the present time 33 power companies used concrete poles and 169 did not. Of the 33 companies, 11 made their own, and 5 purchased them for line poles, while the remainder used them for street-lighting standards. All information furnished seemed to indicate a tendency to use concrete poles for fairly low-voltage lines (600 volts), which appeared to be due to the reliance placed in the U.S.A. upon the pole itself to assist the insulator, so that in the U.S.A. the earthing of metal work was not usual, and a conducting pole was avoided for high-pressure work. As they in Britain must earth the insulator pins and must also be prepared to earth the ferro-concrete poles at pressure above 600 volts, its conducting qualities were no disadvantage.

Mr. Fennell dealt with the importance of deterioration and said that twenty users in America reported on deterioration experience with various kinds of concrete poles. Thirteen users reported poles satisfactory, showing no deterioration in from five to seventeen years. Two poles in Schenectady were reported to be thirty years old and in good condition. Seven users reported some deterioration, the causes being as follows:—(1) Steel reinforcing too close to the surface, *i.e.*, less than ¾ in.; (2) porous concrete, due to the use of too much water at the time of mixing; (3) voids in concrete, due to insufficient working, or puddling, of the concrete after placing it in the forms; (4) improper curing, *i.e.*, allowing poles to dry instead of keeping them wet for the first ten days after manufacture; (5) overloading, which was shown up by the appearance of evenly distributed cracks across the pole on the tension side, usually at, or slightly above, the ground line.

The remedies for those causes of deterioration appeared to be:—(1) Steel should be at least ¾ in. below the surface, preferably 1 in.; (2) concrete mixture should be waterproof, by designing the mix for a compressive strength of 3,000 lb. per sq. in.; (3) concrete should be worked and puddled after placing it in the forms, to prevent voids; (4) poles should be cured damp, or wet, for at least ten days; this alone strengthened the concrete 75 per cent. over any unprotected curing; (5) poles should not be loaded beyond the strength for which they were designed.

An investigation conducted by the Power Distribution Committee of the American Electric Railway Engineering Association brought out the following facts in connection with the strength of concrete poles:—(1) Failure of a pole was always due to the stretching of the reinforcing rods on the tension side. (2) A failure was always preceded by the appearance of hairline cracks in the concrete on the tension side, at rather frequent intervals from the ground line up. (3) It was advantageous to use a high grade of reinforcing steel to secure the maximum tensile strength. (4) Plain round reinforcing rods were essentially as satisfactory as twisted, or other rough, rods, because, in general, the rods would elongate before they slipped in the concrete. (5) A large number of small rods was preferable to a small number of large rods, as better distributed reinforcement might be secured for a given amount of steel, and a better bonding contact surface was presented to the concrete. (6) The reinforcement need not be uniform throughout the length of the pole, but might be stepped off as the top of the pole was approached. (7) A pole with uniform reinforcement would break at the ground line, while one with tapered reinforcement would break at some point above the ground, depending upon the taper of the reinforcement. (8) A concrete pole had an element of safety in it, as a failure of the pole would not in general allow it to fall to the ground. It was difficult at times to pull over a pole after failure, even though it was inclined at a large angle from the vertical.

Dealing with cost, the Report indicated that concrete poles appeared to cost from 1½ to 3 times as much as wood poles, and Westinghouse Hollowspun poles are reported to cost approximately the same as tubular steel poles.

The reasons given in the Report for considering concrete poles superior to wood or steel poles were:—(1) Good appearance, (2) durability if properly manufactured and loaded, (3) low maintenance. One user reported that concrete poles were unsuitable for use in city streets because of changing street lines, the poles being unhandy to move. One reply from Fall River, Mass., reported that concrete poles could not be used because of a State law which stated that any type of pole other than wood which carried wires at over 500 volts must be marked "Dangerous." The Report concluded by pointing out that in the design and manufacture of concrete poles the following factors should be considered:—(1) It was an advantage to use high-grade reinforcing steel; (2) poles should be designed so that the maximum load carried would be below the elastic limit; (3) the concrete used gave the pole its enduring properties, and the design and manufacture of the mixture should be carried out carefully. A mixture designed for 3,000 lb. per sq. in. compressive strength would be watertight and would not be affected by the elements. The materials used should be of the best, and the placing and curing of the concrete should be done with the greatest care.

It was apparent, continued the author, that concrete poles properly designed and manufactured were a very satisfactory product with an indefinitely long life. The question was, could they afford the luxury of concrete poles over here? Making full allowance for the slightly higher cost of wood poles over here, as compared with the U.S.A., due chiefly to their more elaborate creosoting, Mr. Fennell expressed the view that they were best for equal strength and height, especially in the smaller sizes. They were not, however, and never would be, allowed to run heavy lines along even medium-sized town streets, the tendency in this country being to reserve overhead work for outer suburbs and rural areas, so that unless a ferro-

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concrete pole were offered at about 1½ times the cost of a similar "medium" wood pole, delivered on site, there was every reason why it should not be used. According to Mr. Fennell's judgment, the ferro-concrete pole would not enter into British rural schemes; its weight and cost of handling must be heavy, and the total cost prohibitive; moreover, its surface weathered in a rather disagreeable way. Its finish was associated with that of "artificial" stone. It did not "melt" into the landscape of England, as did a light brown creosoted pole, nor was it suitable for a country town. It ought to be acceptable in a housing scheme, or at a new seaside watering place, or along a railway, or in a power station, or in the vicinity of concrete fencing posts. In helping the development of overhead lines, it was necessary to cut out everything which added to the present too-high cost of high lines. They were not concerned very much with trunk lines, for which, however, the galvanised-steel structure was an easy first in most climates. There was no doubt, however, that ferro-concrete formed a very suitable medium for combined terminal towers and sub-stations in, or near, towns, and several of the mid-Cheshire sub-stations could have been built of ferro-concrete with advantage, if he had been building twenty structures, instead of three or four.

Discussion.

Major T. Rich considered it unfortunate that the president should have examined the subject of concrete poles in relation to a country—the U.S.A.—which in that respect was now in the position reached by some of the Continental countries about fifteen years ago. If one examined some of the American methods illustrated, one might well come to the conclusion that in connection with the scientific design and construction of concrete poles the Americans were not up to date. The square hollow concrete pole was tried before the war by Mons. Delamarche in Grenoble (who was about the original pioneer of concrete posts on the Continent), but that type was abandoned after some years. A concrete pole, if properly designed, was not necessarily exceedingly heavy; when one bore in mind that there were 750,000 concrete poles in use in France (a country in which a very material amount of timber was available) one would come to the conclusion that there must be something wrong with the president's conclusion that concrete poles were impracticable. The reason why there were so many of those poles in France was that they were properly designed as structures. Centrifugally-made concrete poles as high as 90 ft. had been made; centrifugal posts were used in Italy for 240,000-volt transmission. Messrs. Dyckerhoff & Widmann, of Dresden, were about the earliest makers of centrifugal concrete posts, and they were making such posts from 60 to 70 ft. long, and had transported them by train ferry to Sweden.

The President said the makers of the Kisse poles were making them up to 40 ft. long. They did not want poles 90 ft. long in this country, he believed.

Major Rich, discussing the manufacture of the centrifugally-made concrete poles, said that if the concrete were used in the form of a "pudding" there was no necessity for a core at all. The method of the Westinghouse Co. seemed distinctly crude, as compared with the German method. Some concrete posts were used in France for h.p. light rural lines, having a height of about 10 metres (33 ft.) and weighing about half a ton. If they in this country were allowed to adopt the same factors of safety as had been found satisfactory in other countries, he saw no reason why they should not obtain concrete poles in this country at a cost less than one-and-a-half times that of foreign wooden poles. On the Continent, by the use of special jigs and special methods, they could make a frame for a concrete post about 30 ft. high in a few minutes, and the work was done so quickly that the labour cost was exceedingly low. With regard to factors of safety, he said that in England it was 2½ or 3½, based on the elastic limit, and it was the same for wood as for concrete. Wood had practically no reserve of strength beyond the elastic limit; concrete had a big reserve, but it was given no credit for that in the factor of safety adopted. For climbing concrete poles, the Germans used a climbing iron somewhat like that used for climbing wooden poles. Discussing the question of the development of cracks in concrete, he said he believed it was the policy of some German makers to test every pole before it was despatched from the works. The Continental pole maker did not as a rule pretend that concrete would take any material stress in tension, and did not deny that if a pole were stressed to the ultimate strength specified, hair cracks would develop on the tension side. Immediately the load was taken off, however, the hair cracks would disappear, and as the result of their 25 years experience the makers claimed that the hair cracks did no harm. He was interested to hear from the president that round reinforcing rods were just as good as square, or other shaped, rods, and believed it had been fairly well proved that the provision of notched bars, and so on, in reinforced concrete work represented a waste of money. With regard to curing, he had seen posts made with aluminous cement concrete taken out of the moulds seven hours after casting; in summer time a high-class Portland cement was used, and the poles were taken out regularly once a day. He had seen poles carried on a cross bar on a lorry over roads which were very little better than dirt tracks, and the manufacturers did not consider that the poles would deteriorate as the result of that treatment. Finally, he urged that if concrete poles were properly made they would not spoil the landscape.

Mr. W. A. Turnbull expressed himself as being in agreement with the president throughout. Commenting on his remark that the steel in reinforced-concrete poles did not get a chance of taking the strain, he suggested subjecting the rods to initial stress. When they could get a reinforced-concrete pole, the concrete of which would take the enormous strain that it was capable of taking, so that it would bear its fair portion of the load, they would get lighter and more lasting poles.

Major T. Rich drew attention to the fact that large business was being done in Spain, France, and elsewhere with concrete bases for wooden poles. They were being made in France and sold at a price amounting to a comparatively few shillings each.

Mr. F. Swarbrick, who declared himself to be an enthusiast with regard to concrete poles, said that one important aspect of the development of such poles was the possibility of the establishment of a new industry in this country. In his opinion the Continental concrete pole was of very much better appearance than the creosoted wooden pole. He agreed with the remarks of Major Rich with regard to the light concrete pole he had referred to. The prices mentioned by the president were certainly prohibitive, and not comparable with the prices of French poles. Before the end of the present summer there would be in operation in this country an experimental line constructed on the Continental basis, with concrete poles. As a country, they could not afford so conservative a factor of safety as 3½ when they had evidence that on the Continent a factor of safety of 2½, or less, filled the bill. While they were importing and using wooden poles they were neglecting the possibilities of the utilisation of their own materials.

Mr. H. W. Grimmett said that in South Wales there was a very good double-circuit line on concrete poles, erected in about 1919. The cost of the poles at that time was about five times the cost of wooden poles to-day. The concrete poles used had bevelled corners, there being reinforcing rods at each corner. They were made locally and carted to the points at which they were erected. The carting was very expensive, and the best method of transport was horse transport.

Mr. Molle confirmed Major Rich's remarks about the large number of concrete poles used in France. When he was at Grenoble University about eight years ago a long course of instruction was given on the manufacture of concrete poles. Five or six years ago concrete signal poles were used on the railways in India, but not much pull was imposed upon them for that purpose; they were used extensively on the railways in this country to-day. Had anyone had experience of the Marriott pole, which was invented by a railway engineer in this country? It consisted of a series of hollow sections, each section being cast separately, as drain pipes were cast. In the walls of the pole there were holes running throughout the whole length, at intervals round the circumference, and through those holes reinforcing rods were threaded. Each section of the pole could be carried to the site on a bar held by two men; the reinforcing rods were threaded through the sections to make the complete pole, and were bolted up at each end, so that the complete pole was a hollow tube held together by half a dozen, or so, reinforcing rods.

Mr. Minton asked if consideration had been given to the problem of adding colouring matter to the concrete. Green, he said, was about the cheapest colouring matter, and could be obtained for about one penny per lb. Experiments had shown that 1 lb. would be sufficient for about 2 cwt. of concrete.

Major T. Rich said that several of the Continental firms producing concrete posts were also making a large number of concrete candelabra for the streets. They decorated them with coloured concrete on the outside. Tramway and other posts were made of concrete with colouring material in it.

The Chairman could not help feeling that there was a great future for ferro-concrete poles. This country was not yet electrified; they did not yet know where the loads would be and where the lines were going. They ought to give every consideration to ferro-concrete poles for the future, but ought to develop the country on wooden-pole lines, and build up a load which would enable them to afford the expenditure on the more permanent, and possibly more beautiful, ferro-concrete pole lines which, he hoped, would be designed for future use.

The President, replying to the discussion, wished they could obtain figures and information relative to the French construction methods and the results of tests on the French poles. At heart he agreed with a good deal of what Major Rich had stated, but he had considered the problem from the point of view of a body of Electricity Commissioners, bearing in mind the factors of safety that were specified. The details of proposed schemes had to be "quizzed" by the Commissioners, and stress diagrams had to be produced. It must be shown that on the tension side the loads which would be applied by hypothetical gales and hypothetical ice would be well below the breaking stress, or elastic limit. That was the basis they had to work to; they might discredit that basis by showing that it did not allow them in this country to do what was done in others with apparent safety. With regard to underground lines, leading principles were laid down and the responsibility was left to the engineer concerned, and if that were done with regard to overhead work they would be able to make more progress. In overhead work one was not allowed to be an engineer, notwithstanding one's training, and one had to do what one was told to do. Perhaps it was not fair to blame the Commissioners at the present stage, and one of the principal objects in investigating those matters was to demonstrate that with regard to overhead lines engineers could be treated as they were with regard to underground lines, and that they were men who knew their jobs. While they did not object to

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a factor of safety of 2½ in the case of a steel pole, they could not expect to be allowed a lower factor of safety for a ferro-concrete pole.

Major RICH said that a concrete pole was stronger than a steel pole in compression.

The PRESIDENT replied that one must demonstrate that.

The CHAIRMAN pointed out that in the ferro-concrete pole the steel was protected from corrosion.

The PRESIDENT replied that, under the regulations, the steel-work must be painted regularly. The factor of safety of 2½ was demanded, not merely when the pole was new, but always.

Major RICH said the factor of safety for ferro-concrete was 3½, as compared with 2½ for steel; it should be the other way round.

The PRESIDENT agreed that the higher factor of safety for ferro-concrete was a handicap, and that was what he had wanted to emphasise in the paper. Centrifugally-made poles should be spun so quickly that some real action was exerted by centrifugal force, not merely by compression of the concrete in the early stages of setting. The very light pole, weighing less than half a ton, would not meet the requirements with regard to factor of safety. A 33-ft. pole weighing half a ton would break during the first ordinary gale it experienced, according to the calculations. In the case of the Marriott pole one could put any amount of initial stress on the rods. Where could one get those poles? Pre-stressing was an excellent method. He was not in favour of the argument that all overhead lines were going to be placed underground later on, and looked upon overhead lines as permanent equipment, certainly for the more rural parts of the country, for many years hence. The point made by Mr. Swarbrick with regard to the establishment of a new industry in this country was an important one, and they ought to sacrifice something to that end. If anyone could show him a ferro-concrete pole made in this country, even though it were 50 per cent. more expensive than an imported wooden pole, he would think about it very seriously. With regard to the high cost of the concrete-pole line in South Wales, referred to by Mr. Grimmett, the installation was probably much stronger than it need be and the high cost was due to that fact. Those who had erected the line were pioneers, and no doubt were anxious to ensure that it would not fail. The worst form of engineering in his view, was that which never failed. Colouring matter in concrete would fade when exposed to sunlight.

A Mobile X-Ray Installation.

The equipment described below is believed to be the first of its kind to be specially designed and built for public health purposes.

X-RAYS, LTD., have under construction, and nearing completion, for a public health authority, a mobile X-ray outfit specially designed for use in rural districts, and the installation is believed to be the first of its kind to be built for public health purposes at reasonable cost and for economical operation. The unit consists essentially of a one-ton Morris motor-car chassis and a special body accommodating all the apparatus for the complete production of X-ray negatives at any place to which a motor car can be driven. The chassis is fitted with a four-cylinder 14/28-h.p. engine, and the special body has internal space of 8 ft. by 6 ft. by 6 ft. Two large end doors give complete access to the car. At the foremost part of the body a partition provides the necessary dark room, and the other portion of the body is utilised for carrying the X-ray equipment. A cupboard is provided for taking the various accessories, cassettes, screens, Potter-Bucky diaphragm, &c., and on one side of the top is a drum which carries 50 yd. of cab-tire flexible cable. The cable passes through the roof of the car and is carried over the pavement by means of a swing arm attached on the outside of the car, giving a span of 9 ft. The connection to the cable is provided on the drum, so that it is only necessary to unwind the required amount of wire from the drum. The outside end of the cable is provided with a plug for connection to the control switchboard. The chassis is also fitted with a 2.7-kVA self-exciting alternator, driven from the car engine, for the power supply. The generator is arranged so that it is accessible for inspection and cleaning, but at the same time it is fully protected against the weather. A distribution switchboard is provided inside the car at a convenient position for the driver, so that all wiring is made "dead" while the apparatus is being fitted up or dismantled. A telephone is provided between the operator and the driver.

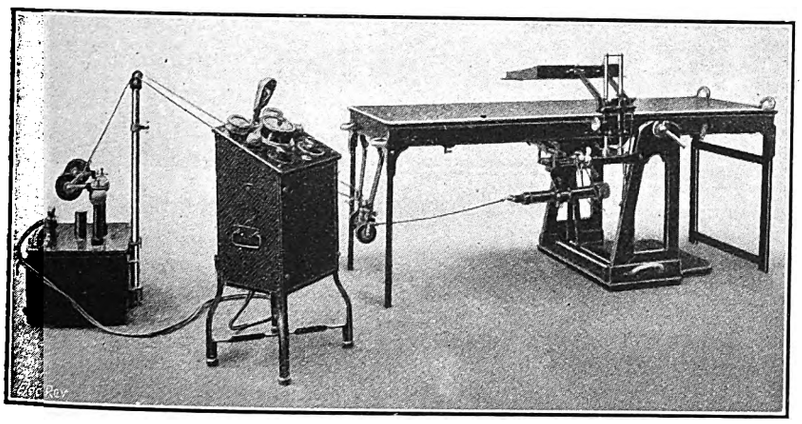

Fig. 1.—X-ray Apparatus for Operation in Horizontal Position.

A step-up high-pressure transformer will give a secondary pressure of 65,000 V (r.m.s.) and is provided with suitable high-pressure pillars for connection to the X-ray tube. The transformer is capable of giving 30 milliamperes output through a hot-cathode type of tube. A separate step-down transformer is fitted in the same tank for heating the filament of the hot-cathode tube. Primary connections to the step-up transformer and the filament current transformer are provided by a multiple-plug connection fitted with a flexible cab-tire lead connecting to the control table. This is fitted with a sloping paxolin top on which the following instruments are mounted: kilovoltmeter for indicating the voltage applied to the X-ray tube; milliammeter for indicating the current passing through the tube; pilot light for showing whether the switchboard is alive; auto-transformer selector switch for varying the voltage applied to the X-ray tube; switch and regulator for varying the filament current and the milliamperage passing through the X-ray tube; and a press-type exposure switch and an automatic time-control switch for giving timed exposures from one-tenth second to ten seconds. A d.p. main control switch is fitted on the side of the switchboard, and the unit is arranged as a separate control table mounted on leg supports.

A combined couch and screening stand is fitted with a travelling framework moving lengthways of the couch or up and down when in the screening stand position, and is provided with counterweights. The cross frame carries a smaller framework on which is mounted a square-leaved diaphragm with handle controls from the front of the stand for adjusting the aperture in either direction—horizontally or vertically. The cross frame carries the fitting to take a "Metalix" tube, and is arranged with a transverse movement in relation to the couch top, controlled from the front of the stand. This travelling framework carries an upright arm on which a fitting is pro-

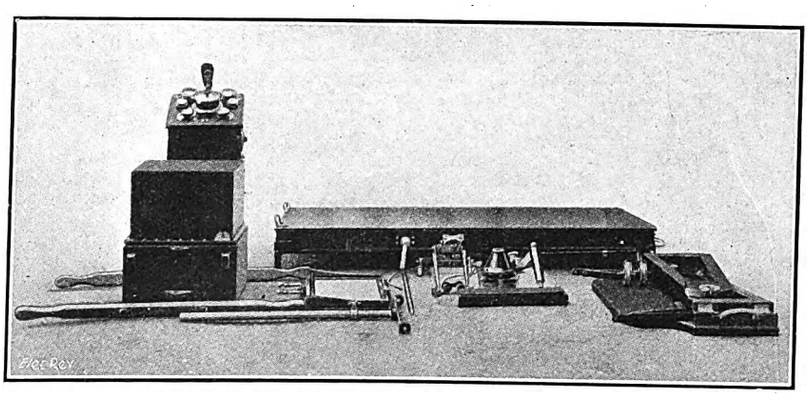

Fig. 2.—X-ray Equipment Dismantled for Repacking into Van.

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vided having an adjustable movement for varying the distance from the tube or couch top. The fitting carries a detachable framework which holds the fluorescent screen. It is provided with an angling movement, and is also arranged to take the

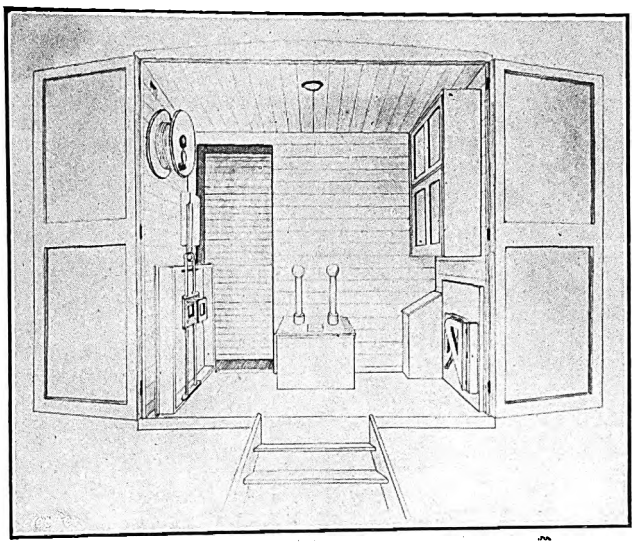

Fig. 3.—Interior of Van of Mobile X-ray Unit.

cassette in place of the fluorescent screen for radiographic work. The screen is fitted with "Super Protex" lead glass giving an equivalent of 2 mm. of metallic lead, and the size is 15 in. by 12 in. An additional fitting is provided for attaching to the upright arm and carries the tube above the patient for radiography from overhead, and has sufficient adjustment for radiography with a Potter-Bucky diaphragm. The framework and base of the combined couch and screening stand is constructed in oak, and is provided with handles for transporting from the car to the room. It is arranged in two units, namely, the base and the couch top, the uprights being hinged to the base for conveniently packing into the car. Suitable handle-type locking clamps are provided for holding the equipment rigid when it is erected. A detachable adjustable upright with a socket fitting is provided for the transformer, and is arranged with deeply-grooved guide wheels for carrying the high-pressure coronaless type spring rheophores conveying the high-pressure current to the X-ray tube, and it is arranged in such a manner that the leads can be connected with the couch and screening stand, either using the tube underneath or overhead, or, alternatively, behind when in use as a screening stand.

The darkroom is provided with a loading bench and a lead-lined sink which accommodates the set of developing, fixing and washing tanks for 15 by 12 films. The tanks are fitted with a removable top which has a clamping device for preventing the fluids from escaping when the car is travelling. An electric darkroom lamp with switch control is fitted in the darkroom. A water tank for carrying a supply of water is provided, together with a hand pump which can be utilised for filling the tank from a low-level supply. Alternatively, there is a filler funnel fitted to the tank which can be filled from outside the car by means of a hose from a high-level supply. A tap is fitted above the sink with a pipe connecting to the water tank. A waste pipe is carried from the sink to underneath the car. A light-tight ventilator is provided in the darkroom and is fitted with an electric fan for extracting the air. Suitable louvres are provided for an inlet of fresh air. There is a plug-switch point off the a.c. mains for a heater.

Fig. 3 depicts the arrangement of the interior of the vehicle; fig. 4 shows the equipment removed from the van and in

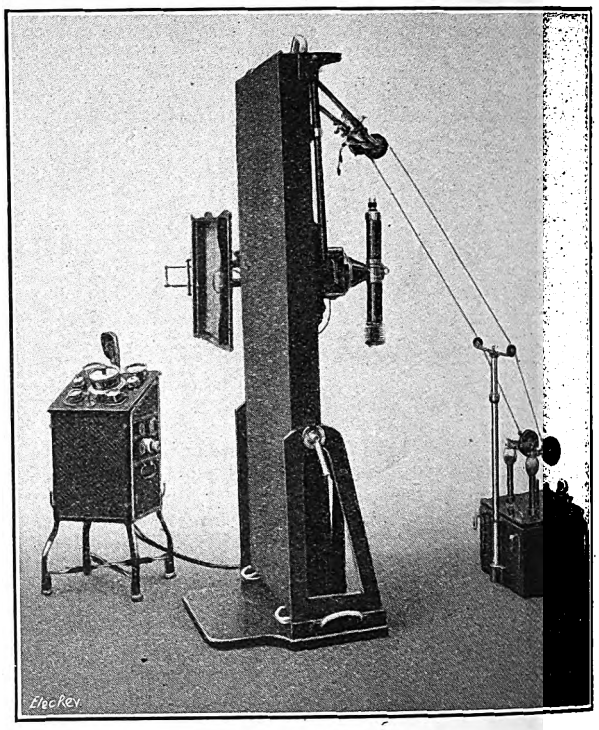

Fig. 4.—X-ray Outfit in Position for Vertical Screening.

position for vertical screening or radiography; in fig. 1 the apparatus is shown for operation in the horizontal position; and fig. 2 shows the outfit dismantled and ready for repacking into the van.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Current Transformers with "Hipernik" Cores.

A new type of current transformer that is suitable for all applications with secondary loadings of up to 50 volt-amperes, at any power factor, and at frequencies of from 25 to 133 cycles per second, for use on pressures up to and including 6,900 volts, has been brought out by the WESTINGHOUSE ELECTRIC & MANUFACTURING CO., of America. Greater accuracy is obtained in this transformer by using "hipernik" instead of silicon-steel for the core. "Hipernik," which is an alloy made of pure nickel and electrolytic iron, specially treated, is non-ageing, and has, it is claimed, three times the permeability of regular silicon-steel and only half the losses. The primary of the transformer is wound with a sufficient number of ampere-turns to assure good and like performance at all ratios. The primary element is almost circular, thus assuring strong mechanical construction. The coils have low current rating and are made of light copper strap, but up to 100 A they are provided with two terminals of sturdy copper strap, ¼ by 1 in., with bolt holes for terminal lugs. The secondary coil is circular, and the leads are brought out to a terminal block. It is properly insulated from the primary coil to withstand a test pressure at 20,000 volts. A secondary terminal block with a suitable cover is provided on which are fixed studs to which the wiring of meters, instruments and relays may be connected. The transformer is claimed to be considerably lighter than similar ones with silicon-steel cores, and it will withstand, mechanically, it is claimed, short-circuit currents of up to 70 times the normal primary rating. The time limit due to thermal capacity of this type of transformer is half-a-second for this current. The transformer is available in sizes ranging from 5 to 1,200 primary amperes.

New Electric Fans.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is introducing this season a new range of induction electric fans for desk and bracket mounting, fig. 1. These are fitted with shaded-pole, squirrel-cage motors with cast shells, the stators being built up of stampings punched from specially selected steel sheets, and carefully insulated to reduce losses. The stampings are riveted together under pressure, thereby eliminating, it is claimed, any humming being set up through magnetic effects. Self-aligning bearings of ample dimensions are provided for the motors, and lubrication is effected by means of a wick held in position by a self-centring spring. In the base of the fan is a choker-type speed regulator. The blades are punched out of sheet brass, and are so shaped as to give maximum volumetric efficiency. They are balanced both statically and dynamically to obviate troubles due to vibration. The fans are made in two types—non-oscillating and oscillating. The former pattern is adapted for desk or bracket use by means of a trunnion attachment,

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and in either position a wide range of adjustment is available. In the oscillating pattern a continuous movement over a wide area is provided by means of special mechanism. Considerable attention has been given to the design and manufacture of ceiling fans for both a.c. and d.c. circuits, and in this respect the G.E.C. has modified its existing range of fans of this type by splitting each type into two patterns, known as the

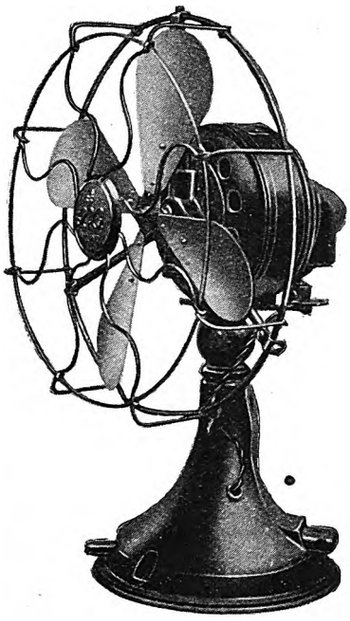

Fig. 1.—" Magnet " Induction-type Desk Fan.

"distribution" and the "velocity" types. The "distribution" type of ceiling fan is fitted with blades on which the contour is designed to give a distributed breeze over a wide area, while the blades of the "velocity" type are arranged to give a concentrated breeze over a relatively restricted area, thus giving the highest possible air speed.

An Electrical Anemometer.

We have received from Messrs. F. A. Wilkinson & Partners, Ltd., Gretton, near Kettering, Northamptonshire, particulars of their latest development, an electrical anemometer. It comprises a small wind dynamo with a directly-coupled propeller and a wind-gauge meter. It is especially suitable for yachts, aerodromes, &c., in connection with which it is necessary to read the velocity of the wind *at any moment*. The dial is graduated in miles per hour. The illustration, fig. 2, shows a portable type which is held in the hand with the propeller facing the wind. Messrs Wilkinson & Partners also supply a

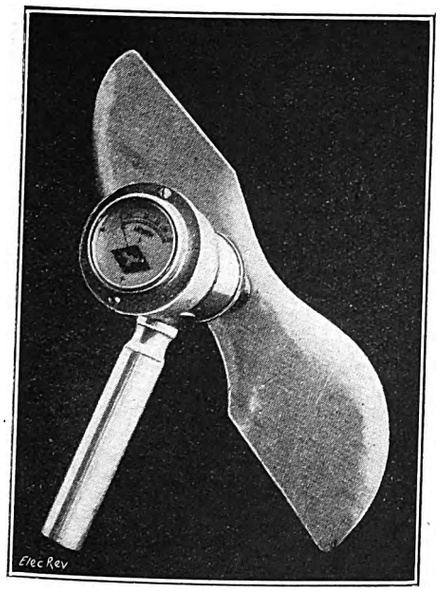

Fig. 2.—A Portable Electrical Anemometer.

stationary type, which comprises the wind dynamo mounted upon a tubular support fitted with a wind direction vane and swivel head, but with the wind-gauge meter installed in any suitable position and connected to the wind dynamo by means of a cable.

Pole-type Transformers.

We have received from Bruce Peebles & Co., Ltd., Edinburgh, an interesting illustrated leaflet dealing with their pole-type transformers, which, they point out, are manufactured in all the usual sizes and voltages. Although this publication only extends to eight pages, it is well illustrated, and a very considerable amount of information is given in a compact form. There are lists of the approximate weights and dimensions of all the sizes manufactured, and also three schedules giving technical particulars of pole-mounting transformers for different ranges and voltages. Fig. 3 shows a "Peebles" 15-kVA, 3-phase, 50-cycle, 11,000/415-

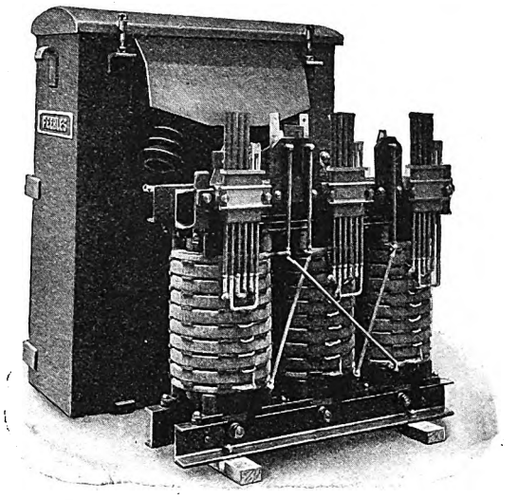

Fig. 3.—Pole-type Transformer; 15 kVA, 3-phase, 11,000/415-240 V.

240-volt pole-mounting transformer fitted with the makers' patent tapping units. It will be noted that the tank is provided with an improved design of h.p. terminal insulator. These transformers are, of course, also manufactured in the platform-mounting type, and they can be fitted with externally-operated tapping switches if required. There are many special features in design and construction fully described in the leaflet, which makes the perusal of a copy wel worth while.

A New Lighting Fitting.

The accompanying illustration, fig. 4, is of an "Essalite" enclosed lighting unit, a recent production of Messrs. Smith and Ansell, Ltd., Stockfield Road, Acocks Green, Birmingham. Its feature is the method of suspension contact at the fitting itself. Instead of the usual metal canopy carrying the globe by means of a lip on the latter and screws, studs, with washers,

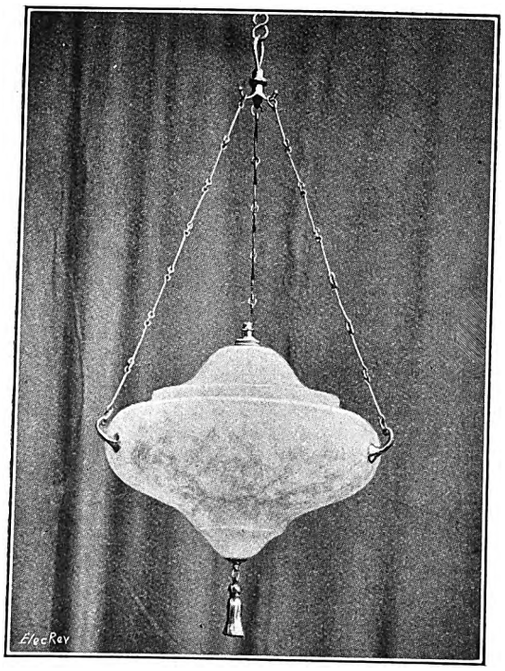

Fig. 4.—" Essalite " Enclosed Lighting Unit.

fitted in the sides of the bowl are hooked by the suspension chains. The bowl is made in two parts, and by simply lifting the top portion the lamp is rendered easily accessible. The fitting is made in two sizes, which may be fitted with "Triply," "Snowflake," "Goldflake" or "Veinflake" glass.

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Legal.

The Gasfilled Lamp Patent.

In the Chancery Division, on May 6th, Mr. Justice Luxmoore had before him an application by the British Thomson-Houston Co., Ltd., for an extension of Patent No. 10,918, dated May 8th, 1913, relating to gasfilled incandescent electric lamps. Applicants asked for an extension for five years on the ground that they had suffered loss or damage owing to the war.

Sir A. Colefax, K.C., for the company, said that the patent had been the subject of litigation in this country, and its validity had been upheld by the House of Lords. The incandescent electric lamp at the date of the invention was a vacuum lamp. Lamps made in accordance with the invention contained a gas of low heat conductivity at a relatively high pressure, the filament being one of large diameter or of concentrated form. The common method was to have the filament in spiral form. The purpose of the invention was to enable the filament to be heated to a higher temperature than would otherwise be obtained without prejudicial evaporation. By reason of the higher temperature of the filament a whiter light was produced, and also, with certain sizes and with certain voltages, one got substantially greater efficiency than was possible with vacuum lamps. The invention was made in the United States by a distinguished man in the employ of the General Electric Co. By the time war broke out considerable work had been done in this country by the B.T.H. Co., who were the grantees and registered owners of the patent, in the application of the invention to large-sized lamps, and progress had been made in establishing their manufacture. A matter which had to be borne in mind was that when the war broke out no tungsten was made in this country, and the applicants had to produce it themselves, which was a difficult matter. Moreover, the essential gas for the smaller lamps was argon, and it was mixed with another gas in the larger lamps. In respect of the large lamps, their manufacture as a commercial operation was seriously interfered with, and the necessary work in connection with the application of the invention to smaller sized lamps was brought to a standstill by the war. The smaller sized lamp was the one in which the invention found the greatest use; to-day it constituted 70 per cent. of the actual sales in this country of lamps made in accordance with the invention. The company's works became a controlled establishment in 1915, and remained so till the middle of 1919. The lamp department was largely occupied in making wireless valves and special lamps required for military use. Their licencees were also a controlled establishment, and were engaged on war work. The invention had had a very large application, and large profits had been made since the war. But his case was that the applicants had lost four years of the life of the patent owing to the war. During the war the few lamps made in this country were supplied to the Government, and in 1918 there was an importation of these lamps for Government purposes from Holland.

Notice of objection had been given by Mr. Claude H. Morrell and by Mr. A. H. Gower. Another objector was Lissen, Ltd., who, he understood, desired to withdraw. There was objection by a union of French lamp manufacturers. The Nox Electric Lamp Co. appeared to want a licence, and applicants were not indisposed to grant this company one on certain terms and subject to royalties. Applicants had not refused a licence, except in one case, for good reasons. The other objectors were Tungstalite, Ltd., the Kye Electric Co., Ltd., and the Nelson Electric Co., Ltd. They said that applicants had suffered no loss by reason of the war, but that if they had they had more than recouped their losses since the war. They also said that they objected to the applicants' methods of trading, stating that the prices were too high. Last year 17 million of these lamps were sold in this country, and that did not look as if the prices were too high or as if the public were suffering. Another objection was that large dealers were granted special discounts if they dealt in other lamps made by the applicants.

The patent had been extended to the principal Continental countries, with the exception of France, where quite recently it had been held invalid on the ground of alleged prior publication. The decision was to the subject of appeal.

Affidavit evidence having been read, Sir Duncan Kerly said he was not there to oppose on behalf of the Nox Co., but his contention was that he had a concluded agreement for the grant of a licence, and he would ask his Lordship not to grant an extension unless he had a licence according to the agreement.

The hearing was adjourned.

The Marconi Company's Royalties Appeal.

The hearing of this appeal by Marconi's Wireless Telegraph Co., Ltd., from an order of the Comptroller-General of Patents was resumed by Mr. Justice Luxmoore in the Chancery Division on May 1st. The opening stages were reported in our last issue (p. 810).

Sir Duncan Kerly, K.C., for the Marconi Co., said the Comptroller's decision in substance was that it was contrary to public policy to refuse to grant the applicants (the Brownie Wireless Co.) a licence. He contended that there was no evidence to support the finding, and the proposition that it was contrary to public policy to refuse a particular applicant a licence must be wrong. It was said that 12s. 6d. per valve-holder was too high a royalty; the evidence to establish that must come from the trade, and there was not a scrap of evidence of the kind. It was said that there was a 50 per cent. margin between the retail selling price and the cost of manufacture, and yet it did not pay English manufacturers already in the business to make a reduction in their profits in order to secure an enormous number of imaginary customers who would not pay £7 5s. for a set, but would pay £4 7s. 6d. He asked his Lordship to brush aside all this. It was impossible for the Comptroller, with the evidence before him, to arrive at a sounder conclusion how the Marconi Co. should carry on its business than it had been able to reach in constant discussions with the trade in a period of five years. The wireless trade in this country had grown up under the protection of the Marconi Co., and so far from the suggestion being true that it would be to the advantage of British manufacturers that there should be importation of cheap foreign sets, he contended that British manufacturers attached great importance to the protection they now enjoyed. There was no evidence from the trade as to what was a reasonable or possible royalty. The Comptroller had acted on the suggestion that a Brownie two-valve set would be sold at a cheap price, and one would think that the licence would have been restricted to cheap sets. If the Brownie two-valve set had to be sold at £2 10s. there was no justification for giving the Brownie Co. a general licence. Another objection to the Comptroller's decision was that there was no minimum royalty fixed. A first condition of the grant of a compulsory licence to them ought to have been the fixing of a minimum royalty of £1,000 a year, or something of the sort.

Mr. Trevor Watson, who followed, argued that it was definitely contrary to public policy that a compulsory licence should be granted in any such circumstances as those which existed in this case.

Mr. Moritz, K.C., on behalf of the Brownie Co., said that there were no novel principles involved. Compulsory licences had been part of the law of the country for nearly 50 years. The assumption underlying Sir Duncan's speech was that unless grave reason could be shown to the contrary, a patentee could still do what he liked with his own, but that was a doctrine which had long been exploded. Patent legislation tended more and more to interfere with any such attitude. His contention was that it was in the public interest that a licence should be granted to the Brownie Co. that there had been a refusal by the Marconi Co. to grant a licence on reasonable terms, and that the trade of the Brownie Co. was prejudiced by that refusal. Wireless broadcasting had become a public utility service of the same nature as the telephones, and was now a matter of vital national interest. As for the argument that if his Lordship upheld the Comptroller's decision it would put the Marconi Co. in a position of great difficulty from which there was no escape, he pointed out that the Marconi Co. had publicly announced that if the Comptroller's decision was upheld it would be prepared to grant licences on the same terms to any other manufacturer. The evidence would show that the Brownie Co. was in a position to supply sets at such a price as to place them within the reach of a large section of the public who had never been catered for. Counsel maintained that there had been concealment of the fact that all licences were not alike. Certain firms who could manufacture on a large scale started with the dice loaded in their favour, being granted special terms.

The hearing was resumed on May 2nd, when Mr. Moritz, K.C., continuing his argument, said that Mr. Shoenberg, of the Marconi Co., in his evidence before the Comptroller, said that the "big six" acquiesced in the "A2" form with regard to paying royalties. He (counsel) had evidence negativing that and to the effect that with regard to the British Thomson-Houston Co.—one of the "big six"—it never had paid more than 2s. 6d. per valve-holder by arrangement. He asked that he should be allowed to cross-examine Mr. Shoenberg and to call further evidence on the matter.

Sir Duncan Kerly, K.C., said that as regarded the B.T.H. Co., he was instructed that it paid 10s. royalty, as Mr. Shoenberg said, and it continued to do so down to the time just before the Comptroller's inquiry. Since that time it had made no payments. The matter stood over, and no doubt would be affected by the result of those proceedings. As regarded all the other licencees, until the Brownie application was made they continued to pay. Since that application, with regard to some of the other licencees the matter had also been allowed to stand over. With certain persons dealing with it the Marconi Co. had made arrangements for the interchange or the purchase of rights from those persons, and in a few cases the considerations had some operation on the royalties they had to pay. Those were exceptional cases. He declined to disclose, unless directed by the Court to do so, what those arrangements were, and he submitted that it could not be right for the Court to require the Marconi Co. to disclose its business arrangements with other persons.

The Judge said if Mr. Moritz accepted Sir Duncan's statement that was sufficient. It would not be right to require the Marconi Co. to disclose its business arrangements.

Mr. Moritz agreed that he had no right to a roving inquiry, but Mr. Shoenberg had stated that they issued a uniform licence to large and small manufacturers alike, but in the

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case of the "big six," they paid only 10s. royalty. The information that had come into his hands was that that evidence was not true. He wanted to ask specific questions with regard to all the "big six."

The JUDGE said he did not think because Mr. Moritz did not accept the evidence that was a reason for recalling Mr. Shoenberg and cross-examining him about what he said at the inquiry. If the answers were untrue, Mr. Moritz had another course open to him.

Mr. MORITZ asked his Lordship to scrutinise the cross-examination of Mr. Shoenberg with great care and to infer that considerable concessions were made to specific firms, and this was concealed from the general body of the licencees.

Sir DUNCAN KERLY protested against the attack on Mr. Shoenberg, and the JUDGE ruled that there was no ground for adjourning the case for the recall of Mr. Shoenberg or for further evidence. Mr. MORITZ acquiesced.

Mr. STAFFORD CROSSMAN, on behalf of the Comptroller-General, said that he had before him certain confidential figures supplied by the Marconi Co. showing the amount received during the preceding five years from the 12s. 6d. royalty. It seemed to him that his Lordship ought also to have those figures before him.

Mr. MORITZ said he could not object. but he would have liked to have seen the figures and to have asked some questions about them.

Sir DUNCAN KERLY handed in a copy of the figures for the use of the Judge, and said he had no objection to counsel for the Brownie Co. seeing the figures, but they were not to be disclosed to anyone else..

The JUDGE said that no comment must be made which would disclose them. If it was necessary a part of the argument could be heard in private. A copy of the figures was then shown to Mr. Moritz, who afterwards proceeded to read the cross-examination of Mr. Shoenberg at the inquiry before the Comptroller. In his concluding argument he suggested that the Comptroller was entitled to judge that the home constructor was a material consideration. Mr. Barber, of the Brownie Co., said that if the royalty was reduced, home constructors would be induced to buy cheap sets on which royalties had been paid. The Comptroller accepted that view. With regard to public interest, the fact was that there were a large number of people in the country whose means were such that they could pay 50s. for a two-valve set without accessories, but could not pay more. If there was a person who was willing and able to satisfy their requirements it was in the public interest that he should be put in the position to do so, and should be granted a licence. That was the conclusion of the Comptroller-General.

On May 3rd Mr. SHELLEY, continuing the argument on behalf of the Brownie Co., said that a manufacturer could not enter the wireless trade except through the Marconi Co., and it was wholly irrelevant to consider the fact that there were 2,300 licences without considering whether the licence was reasonable. Mr. Barber was prepared to put on the market a two-valve receiver at a price which compared with prices previously obtaining was ridiculous. The evidence was that the average price of a two-valve set had been £5 4s. 6d., and Mr. Barber was going to put on the market a set at £2 10s. He could only do that if the royalty was reduced. He was willing to submit to any clause compelling him, so long as there was a demand for them, to put only the cheap sets on the market.

The suggestion that the effect would be to destroy the sanctity of contract and would mean the nullification of the 2,300 existing licences was beside the point; the legislature had frequently interfered with the sanctity of contract, and the only question was whether the interference was in accordance with what the Legislature had laid down. If Mr. Barber was unable to develop his business because the royalties were maintained at 12s. 6d., it was a restriction on the legitimate extension of his trade, and such a restriction was contrary to public policy.

Sir DUNCAN KERLY, K.C., replying on behalf of the Marconi Co., said that the respondents had endeavoured to make a case with unverified assertions. It was maintained that the Comptroller-General was entitled to act without evidence because he had special knowledge enabling him to do justice in the particular case. This was untrue, for the Comptroller knew no more than the proper evidence put before him, and, in fact, he had not purported to act on anything but evidence. Another point was that there was a large body of people who desired to have valve receivers, but could not afford more than 50s. But the Brownie Co. advertised a crystal set with a note magnifier for 32s. 6d. Where was the evidence that that did not satisfy the demand? The notion that there was a large class of people who would rush in to buy if the royalties were reduced was a false assumption. There was nothing in the Act which said that it would be an abuse of the monopoly rights, leading to the grant of a compulsory licence, if licences were granted on different terms by the patentee.

The hearing was adjourned until Wednesday last.

Spurious "Osram" Lamps.

THE General Electric Co., Ltd., prosecuted in a case at Hull Police Court on April 22nd, when Thomas L. Bower, trading as the Oakenshaw Trading Co., Bradford, was summoned for using the company's trade mark "Osram" in connection with electric incandescent lamps not of the company's manufacture. Defendant pleaded "Not guilty."

Counsel for the company said that it had come to his clients' notice that lamps were being sold which were stamped in a way calculated to lead persons to believe that they were genuine "Osram" lamps, when such was not the case; the offending lamps lasted only a very short time. The lamps in this particular case were marked "Osram Gasfilled, Made in France," whereas the General Electric Co.'s lamps were made in England. The evidence showed that the defendant offered to supply Messrs. Miller & Garness, electrical contractors, Hull, with lamps marked "Osram Gasfilled, Made in France," and that he supplied them with 50 lamps against a cheque for which a receipt was given. Within a week or two the purchasing firm received complaints of lamp failure and communicated with the Hull branch of the General Electric Co., Ltd., with the result that inquiries were instituted and the fraud discovered. A certificate of the registered trade mark "Osram" was produced, while a factory superintendent of the Osram Lamp Works at Hammersmith gave evidence that the offending lamps were not made at those works, and were in fact spurious imitations.

Defendant said that he had been in the lamp business since 1922, and admitted the sale of 50 lamps as alleged by the prosecution, but denied that he knew they bore the offending mark.

The Stipendiary found the defendant guilty of selling lamps improperly marked, and said that the public must be protected. He fined the defendant £15 and £15 15s. costs, or 51 days' imprisonment.

Misuse of "Ediswan" Trade Mark.

AT the Norwich Guildhall Police Court on April 23rd, Roger H. Read (18) pleaded guilty to a charge of falsely applying the trade mark "Royal Ediswan" to lamps not made by the Edison Swan Electric Co., Ltd., the owners of the trade mark.

Mr. C. B. HILL, prosecuting for the company, said that the defendant traded as the "East Anglian Electrical Supplies" at Great Yarmouth. He offered some lamps to a customer, who would not take them as they were of Dutch manufacture, when he wanted British-made lamps. The defendant said he would obtain some British lamps for the customer at the same price as the Dutch ones. He returned with some lamps, which he said were "Royal Ediswan," and the customer made him enter that description on the invoice. The customer found out later that the lamps were marked "Made in Austria." Evidence was given on behalf of the company that the lamps differed in construction from "Royal Ediswan" lamps. A solicitor pleaded for leniency as the defendant had been trying to keep the business going during his father's illness. Two other charges of obtaining money by false pretences were mentioned, and the defendant admitted to them.

The magistrates, in view of his youth, bound defendant over for two years under the supervision of probation officers.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

South-West England Scheme.

On May 1st Colonel WOODCOCK asked the Minister of Transport if he could state the date upon which the scheme for South-West England, now being prepared by the Electricity Commissioners, would be transmitted to the Central Electricity Board; and if the report would be made public without any further delay.

Colonel ASHLEY said he understood that the Commissioners hoped to complete their survey of the large area included in the South-West England and South Wales Electricity Scheme in the autumn, and to transmit the Scheme to the Central Electricity Board before the end of the year. The Board would then proceed to publish it.

The Severn Barrage.

On May 1st Colonel ASHLEY informed Colonel WOODCOCK that the expert committee had presented a report which would shortly be considered by the Severn Barrage Sub-Committee of the Committee of Civil Research.

The Grampian Power Bill.

Owing to the death of Lord Younger, who was chairman of the Select Committee of the House of Lords which had this Bill in hand, the Committee has been discharged and the Bill cannot proceed further in the present session of Parliament.

The Metropolitan Railway Bill.

Opposition to this Bill having been withdrawn, the Unopposed Bill Committee of the House of Lords has passed

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it for third reading. The Bill, which empowers the company to raise further capital and to carry out the widening of its lines between Harrow and Wembley Park, has already passed the House of Commons.

The Co-ordination of London Passenger Transport.

On May 1st the Bills designed to secure the co-ordination of the London tramway, Underground and omnibus systems, promoted by the London County Council and the "Underground" group, came before the House of Commons for third reading. Upon consideration of the L.C.C. Bill a number of amendments were moved by Labour members but all were rejected. The amendments were directed at limiting the return on the capital employed; modifying the common fund proposals; and limiting the amount of capital admissible as ranking capital. Sir H. Jackson, who was in charge of the Bill, said that only eleven of the local authorities in the area now opposed the Bill. The promoters had undertaken that after a reasonable return had been paid on the ranking capital the Minister of Transport should have a voice in the disposal of the surplus. Local authorities would be able to appeal to the Minister against any material changes in fares. Immediately upon the passage of the Bills it was intended to promote a Bill for powers to construct an extension of the Piccadilly line northwards from Finsbury Park, as suggested by the London Traffic Advisory Committee. All existing fares and arrangements on the tramways would be continued under the common management, and workmen's fares would be introduced on the omnibuses where this was the sole means of transport. Lord Ashfield had assured the trade unions concerned that none of the "Underground" employés would be prejudiced by the scheme and provision for compensation where necessary had been included in the L.C.C. Bill. A motion for the rejection of the Bill was negatived and the measure was read a third time. The other Bill also received its third reading.

The Bills were read a first time in the House of Lords on May 3rd.

The Underground Railways Bill.

The Bill which has been promoted by the City and South London, London Electric & Metropolitan District Railway Companies has been referred to the Unopposed Bill Committee of the House of Lords, the opposition having been withdrawn upon terms.

A Scottish Case.

On May 2nd, Mr. Westwood asked the Minister of Transport what action, if any, he proposed in connection with the petition from users of electricity in Bonnyrigg, Midlothian, requesting his intervention to determine what fee should be charged for hire of electricity meters in the burgh of Bonnyrigg; and if he was aware that the fee charged was 8s. per year for light meters and 12s. per year for power meters.

Colonel Ashley said that the Electricity Commissioners informed him that they were in communication with the electricity undertakers concerned, and hoped shortly to be in a position to determine the matter.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Telephone Development.

We have been reading with much interest your article on telephone development in your issue dated April 26th.

It is quite true, as you say, that an enormous amount of propaganda work remains to be done. One detects a certain amount of complacency about recent official dicta about the record growth in the actual number of telephones in use, but the fact remains that the percentage rate of growth, the real test, is not going up, the figure for the last four years, ended December 31st, in each case being: 1925, 9.2 per cent.; 1926, 8.7 per cent.; 1927, 8.2 per cent.; 1928, 7.7 per cent.; and a very careful study of the growth figures, both actual and percentage, during the last decade leaves the impression that the results recorded represent the rate at which the Post Office is supplying the demand for telephones rather than the rate at which the demand for telephone service from the public is increasing.

Of course, what the assistant Postmaster-General described as the "shackles put upon the Post Office by the Exchequer" may have a good deal to do with the even flatness of the growth chart which we keep here, though this is difficult to reconcile with the Postmaster-General's more recent statement that he had had all the money he had asked for from the Treasury, the deduction from which is that he did not ask for enough, otherwise we should not find in a district surveyor's annual progress report, compiled for the information of the Telephone Advisory Committee, such a reference as the following: "The restriction of capital expenditure, due to the urgent need for national economy, has curtailed the constructional activities of the Engineering Department."

You point out, further, that political capital is now being made out of this question of intensifying the programme of development of the telephone system as a contribution to the problem of unemployment. We here have very carefully examined the proposals contained in the Liberal Party's publication, "We Can Conquer Unemployment," and we do not think that, speaking generally, there is much fault to be found with them. Indeed, it is significant that no effective criticism of this item in the Liberal Party's programme dealing with unemployment has yet appeared, either from political or economic quarters, in spite of the admission by the Minister of Labour that the proposals had been submitted to Departmental experts for rigorous criticism. In themselves, the proposals are not new; they have been consistently urged by T.D.A. since its inception, and the whole case, in its particular bearing upon the question of unemployment, was submitted in detail by the Association to the Prime Minister in the autumn of last year.

The concessions in the direction of increased facilities in rural areas announced in the Budget speech are certainly welcome, and a definite step in the right direction; but we shall not get really adequate telephone development in this country, not even that degree of development which is justified by the profitable nature of the investment, until there is a radical change in the present attitude of the Treasury towards a nationally-owned enterprise which pays its own way, earns its own keep, and docilely hands over to the Treasury an annual surplus which is applied, not, as might be expected, to extending the business or to the benefit of subscribers, but towards other commitments of the Treasury.

Meanwhile, there are, we believe, several experiments which deserve to be tried out; as, for example, the idea of applying the fashionable instalment system to the telephone system, in other words, monthly accounts for telephones. It is quite true that a certain amount of extra bookkeeping cost would be involved, but experience, in America at any rate, is that this is more than compensated for by a marked increase in the number of subscribers, and consequently in the revenue from rentals and calls.

Telephone Development Association.

H. E. Powell-Jones, *Secretary.*

London, *May 2nd*, 1929.

Proposed Technical Society for Meter Engineers.

With reference to the proposal put forward by your correspondent, Mr. H. F. Hudson, dealing with the proposed formation of a new technical association for meter engineers, may I, as a junior assistant, express my whole-hearted appreciation of his enterprise, and the step he has taken to assist the future generation of meter engineers?

The majority of juniors are finding it extremely difficult to follow the few lectures given dealing with their chosen profession and, moreover, cannot purchase a booklet upon metering to compare in any way with the monthly pamphlet which was published by the old M.E.T.A.

It would seem that many of your correspondents do not pay much heed to the needs of junior meter engineers, who are not in the fortunate position of being able to attend—even if they wish—the lectures given at the I.E.E.

There are many who are confident that such a society as that suggested would do good, and bring both the young and older meter engineers together; and not keep them apart as now is the case.

W. S. B.

April 29th, 1929.

"Bluffing" the Public.

While much has recently been written in the technical Press on educating the public to the dangers of shoddy electrical installations and bogus contractors, an interesting case came before the writer a few weeks ago.

A person called at an electrical shop for some accessories and asked what terms he could have as he was in the trade. On being asked whether he had a card, he produced a card bearing his name, and in rather bold type underneath were the initials M.I.E.E., then followed "Electrical Contractor" and the address, which was a private one.

As there was some doubt as to the person's *bona-fides*, he was asked to pay cash. On referring to the various registers and the I.E.E. list of members, no such person's name appeared. The matter was taken up with the secretary of the I.E.E. in order to verify whether the person was entitled to use the initials M.I.E.E. after his name, and a reply was received stating that the person was not a member and therefore not entitled to use the initials M.I.E.E. The matter was then referred to the legal advisors of the I.E.E., who communicated with the person in question and received from him an apology and a promise that the use of the initials would be discontinued at once.

One learns that in the circumstances it is not proposed to take any further action, but what is to be done to protect the public against such false representation? Should not such persons be compelled to make a public apology through the local and technical Press? If not, under the present ruling it appears that any Tom, Dick or Harry can have cards printed and include the initials M.I.E.E. after his name, distribute

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them throughout a district, and then, when found out, all he needs to do is to write an apology to the I.E.E.

How are the recipients of these cards to learn of such "bluffing"?

A. D.

Hanley, Staffs.
May 4th, 1929.

The Sulphur and Grit Problem.

This is a very serious matter when it is considered that in burning a ton of coal from 50 to 80 lb. of concentrated sulphuric acid is produced: hence consternation *via* Press—*The Times* Technical Publication. The prevailing idea is that this terrible nuisance cannot be feasibly overcome, which is erroneous, simply because it has been tackled in the wrong way, *i.e.*, after combustion, which is courting failure, instead of before. Many factors nullify success after combustion, *viz.*, the very large volume of flue gases, hot condition and the highly diluted state of the sulphurous oxide, which becomes sulphuric acid on mingling with damp atmosphere. A striking instance of the damaging effects is to be plainly seen in the eating away of the top portion of the iron chimneys at the Barton, Manchester, generating station; there are ragged portions from 4 to 7 in. completely eaten away; if it will eat through iron like this in a short time, it requires no undue labour of the mind to gauge the pernicious corrosive effects on property, vegetation, and lungs.

There is an improved process of fuel utilisation that will not only thoroughly eliminate the sulphur and grit nuisance, but will at the same time reduce the fuel account fully 50 per cent. at any generating station.

Chemical Engineer.

May 4th, 1929.

[Congestion of space has necessitated the publication of several letters being deferred until next week.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

26,844. "Electric switch structure and mechanism for actuating the same." A. E. White (Bastian-Morley Co.). October 10th, 1927. (309,415.)

26,845. "Electric liquid heaters." A. E. White (Bastian-Morley Co.). October 10th, 1927. (309,416.)

26,906. "Röntgen-ray photography." K. Meyer. October 11th, 1927. (Convention date not granted.) (286,283.)

29,707. "Electric winding-up mechanism for clock works." B. Krausse. November 7th, 1927. (309,386.)

33,603. "Variable-resistance shunts." G. L. Porter and Ferranti, Ltd. December 12th, 1927. (309,514.)

33,888. "Electrical relays and relay systems." J. Solomon. December 14th, 1927. (309,615.)

35,030. "Electric telegraphic receiving and retransmitting or reproducing apparatus." Creed & Co., Ltd., F. G. Creed, and R. D. Salmon. December 24th, 1927. (309,388.)

1928.

295. "Relays and controlling apparatus energised by alternating electric currents." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. January 4th, 1928. (309,515.)

529. "Device for feeding low-tension measuring instruments from high-tension systems." Trub, Tauber & Co., and A. Imhof. January 6th, 1927. (283,185.)

549. "Electric devices for drying the hands." O. Aldinger. January 7th, 1928. (309,422.)

564. "Electrical fuses." R. Lomax, J. R. Garner, and P. C. Walker. January 7th, 1928. (309,463.)

569. "Lighting units." Thermal Syndicate, Ltd., and Sir R. A. S. Paget. January 7th, 1928. (309,464.)

685. "Manufacture of cores for electromagnets or the like." General Electric Co., Ltd., W. Singleton, and G. C. Marris. January 9th, 1928. (309,394.)

712. "Electric differential drive for drilling." E. E. Greve and Oil Well Supply Co. January 9th, 1928. (309,397.)

732. "Automatic electric current regulators." J. Stone & Co., Ltd., and W. R. Chaplin. January 9th, 1928. (309,398.)

748. "Electric insulators or the like." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 9th, 1928. (309,426.)

752. "Telephone systems." Associated Telephone & Telegraph Co. May 23rd, 1927. (291,045.)

753. "Telephone systems." Associated Telephone & Telegraph Co. May 23rd, 1927. (290,998.)

810. "Ignition spark-plug heating devices of internal-combustion engines." C. D. Groves. January 10th, 1928. (309,428.)

823. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. January 10th, 1928. (309,431.)

824. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. January 10th, 1928. (309,520.)

905. "Process for obtaining steel from electric furnaces." Soc. Anon. Fonderia Milanese Di Acciaio. January 10th, 1927. (283,489.)

908. "Telephonic receivers." W. J. Rickets and A. H. S. MacCallum. January 10th, 1928. (Cognate application, 5,436/28.) (309,469.)

1,009. "Apparatus for amplifying and projecting sound from aircraft." A. E. White (Plane-Speaker Corporation). January 11th, 1928. (309,617.)

1,013. "Lead-through insulators." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 11th, 1928. (309,472.)

1,048. "Lighting of and direction-indicators for motor road vehicles." F. A. Pilkington. January 12th, 1928. (309,521.)

1,078. "Electrical rail connectors." A. A. J. Briois and P. F. R. Betrand. January 12th, 1928. (Convention date not granted.) (284,601.)

1,224. "Electrolytic rectifier." S. D. White and R. J. Jones. January 13th, 1928. (Cognate application, 33,016/28.) (309,622.)

1,310. "Telephone systems." Associated Telephone & Telegraph Co. February 14th, 1927. (285,365.)

1,315. "Light-sensitive discharge devices." Electrical Research Products, Inc. April 6th, 1927. (288,539.)

1,339. "Voltage-regulating devices for supply systems comprising variable-speed dynamos." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 14th, 1928. (309,631.)

2,447. "Automatic telephone systems." Siemens & Halske Akt. Ges. January 29th, 1927. (284,333.)

2,454. "Automatic telephone systems." Siemens & Halske Akt. Ges. January 29th, 1927. (284,334.)

2,458. "Automatic telephone systems." Siemens & Halske Akt. Ges. January 29th, 1927. (284,335.)

2,792. "Doors for electrically-heated ovens." Walker, Hunter & Co., Ltd., and J. Walker. January 28th, 1928. (309,652.)

2,793. "Heating elements, particularly for electrically-heated ovens." Walker, Hunter & Co., Ltd., and J. Walker. October 25th, 1928. (309,653.)

3,466. "Disposal of electrostatic charges on kinematograph films." P. H. Nicollic and M. J. E. Claude. February 3rd, 1928. (309,659.)

4,269. "Luminous reproductions of circuits." Siemens & Halske Akt. Ges. April 6th, 1927. (Addition to 283,893.) (288,246.)

4,513. "Process for manufacturing dynamo brushes." Dr. C. F. Von Siemens, Dr. H. Von Siemens, and Dr. A. Franke (trading as Siemens and Co., Geb.). March 29th, 1927. (Addition to 285,081.) (287,895.)

4,525. "Electric lighting systems of motor-cycles and the like." J. H. Runbaken. October 15th, 1928. (309,669.)

4,879. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. February 16th, 1928. (Cognate application, 17,356/28.) (309,670.)

6,286. "Electric switches." J. A. Crabtree. February 29th, 1928. (309,681.)

6,602. "Electric lamps." A. L. Davis. March 2nd, 1928. (309,688.)

6,679. "Dynamos for use on motor vehicles." Wolseley Motors (1927), Ltd., and O. Boden. March 3rd, 1928. (309,690.)

7,353. "Construction of cathodes for electric discharge devices." De Forest Phonofilms, Ltd. April 27th, 1927. (289,424.)

7,462. "Electric fans." Revo Electric Co., Ltd., and F. H. Reeves. March 10th, 1928. (309,698.)

7,494. "Electromagnetic switches." G. Meikle. March 10th, 1928. (309,699).

7,595. "Electric vacuum tubes." British Thomson-Houston Co., Ltd. March 14th, 1927. (287,089.)

7,948. "Electric relays." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz and Soc. l'Action à Distance. April 8th, 1927. (288,263.)

8,285. "Overload circuit breaker." W. Layhausen. March 19th, 1928. (309,704.)

8,608. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. March 21st, 1928. (309,711.)

8,843. "Electric switches." General Electric Co., Ltd., and W. Manchester. March 23rd, 1928. (309,714.)

9,177. "Protective arrangements for electrical heating apparatus." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. March 26th, 1928. (309,720.)

9,410. "Safety electric lamps." Ceag, Ltd., and R. J. Plummer. March 28th, 1928. (309,721.)

10,613. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). April 10th, 1928. (309,733.)

12,403. "Variable electric condensers." Lissen, Ltd., and R. P. Richardson. April 27th, 1928. (309,748.)

13,676. "Mercury-tube switches." I. E. McCabe. December 5th, 1927. (301,792.)

15,034. "Protective gear for alternating electric current systems." T. W. Ross and Associated Electrical Industries, Ltd. May 22nd, 1928. (309,766.)

15,373. "Photographic recording and reproduction of sound." Westinghouse Electric and Manufacturing Co. May 26th, 1927. (291,105.)

15,433. "Dry cells." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks (deceased)). (National Carbon Co., Inc.). May 25th, 1928. (309,769.)

15,783. "Fastening devices for electrical leads or conductors." J. Andvig. May 30th, 1928. (309,772.)

17,018. "Controllers for electric motors." R. B. Hunter. June 27th, 1927. (292,949.)

17,514. "Tap-changing switches for electric transformers." Siemens-Schuckertwerke Akt. Ges., K. Kurda, W. Wernicke, and C. Oertel. June 16th, 1928. (309,780.)

20,806. "Electric welding." H. D. Fitzpatrick (Maatschappij tot Vervaardiging van Snijmachines Volgens van Berkel's Patent en van Andere Werktuigen). July 18th, 1928. (309,796.)

22,029. "Electric lamp holders." International General Electric Co., Inc. July 30th, 1927. (294,887.)

24,445. "Telephone systems." Associated Telephone & Telegraph Co. March 14th, 1927. (Divided application on 287,079.) (296,069.)

24,447. "Telephone systems." Associated Telephone & Telegraph Co March 14th, 1927. (Divided application on 287,079.) (296,070.)

30,684. "High-tension cables." British Thomson-Houston Co., Ltd. October 25th, 1927. (299,394.)

31,152. "Aerial systems." Marconi's Wireless Telegraph Co., Ltd. October 28th, 1927. (299,472.)

31,858. "Telephone systems." Associated Telephone & Telegraph Co. May 25th, 1927. (Divided application on 291,045.) (299,814.)

36,542. "Television systems." Electrical Research Products, Inc. April 6th, 1927. (Divided application on 288,234.) (302,238.)

36,544. "Television systems." Electrical Research Products, Inc. April 6th, 1927. (Divided application on 288,324.) (302,240.)

36,562. "Electric apparatus for heating liquids." A. E. White (Bastian-Morley Co.). October 10th, 1927. (Divided application on 309,416. (309,436.)

1929.

903. "Röntgen diaphragm." K. Mayer. October 11th, 1927. (Divided application on 286,283.) (309,529.)

1,575. "Device for feeding low-tension measuring instruments from high-tension systems." Trub, Tauber & Co., and A. Imhof. August 10th, 1927. (Addition to 283,185.) (Divided application on 283,185.) (304,218.)

3,769. "Thermionic and the like amplifiers." W. S. Smith and N. W. McLachlan. January 12th, 1928. (Divided application on 1,114/28.) (309,635.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 1st:—

Fulgura. No. 500,613. All goods in Class 6. No. 500,614. All Class 13. No. 500,615. All Class 18.—Bergmann Elektricitätswerke Gesellschaft, Berlin. (British representatives: Abel & Imray, 30, Southampton Buildings, W.C.2.)

Lion. No. 493,863. Class 8. Telephonic loud-speakers.—Graham Amplion, Ltd., 37, Walbrook, E.C.4.

Transonic. No. 500,040. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—F. G. Woodwall, St. Helier, Jersey. (British representatives: Gee & Co., 51, Chancery Lane, W.C.2.)

Keepalite (lettering and design). No. 499,053. Class 18. Emergency lighting installations for buildings.—Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHTON-UNDER-LYNE. — Domestic science department, West End schools, for the Borough E.C.; G. W. Handforth, director of education (returnable deposit of £2 2s.).

BEDFORD.—Block of business premises, for the Co-operative Society; W. H. Guest Hubbard, architect, 35, Manchester Street, Luton.

BEXHILL.—Converting Nos. 29, 52 and 54, Western Road, into shops; J. H. Lye, Chepbourne Road.

BIRKENHEAD.—Rebuilding offices, Catherine Street; Co-operative Society.

BOLTON.—Works extension, Blackhorse Street; Kay & Co. Administrative buildings, for water department, Sweetloves; John Dickinson & Co. (Bolton), Ltd. Extensions, infirmary, Chorley Street; governors. Church and assembly hall, Halliwell Road; Free Church Council. Extensions, Moss Dye Works, Brightmet; T. and H. Twises.

BOURNEMOUTH.—Church, Southbourne Road; Immanuel Congregational Church Building Committee. Additions, National Sanatorium, Bourne Avenue; governors.

BRIGHTON.—Boys' secondary school (£47,366), for the Borough E.C.; F. T. Wilson & Sons, builders.

CARLISLE.—School, for the city E.C.; Percy Dalton, surveyor, 18, Fisher Street (returnable deposit of £1 1s.).

COSHAM.—School, Cowplain, for Hants. E.C.; A. L. Roberts, county architect, The Castle, Winchester (returnable deposit of £1 1s.).

CROYDON.—Extensions, nursing staff accommodation, Mayday Road Hospital (£13,000), for the Board of Guardians; clerk.

DARTFORD.—Extensions, King Edward Avenue Hospital, for the Board of Guardians; G. E. Burgess, architect, Station Approach (returnable deposit of £2 2s.).

DERBY.—Cinema (£120,000), for the Majestic Cinema (Derby), Ltd., with electrical and heating work; Naylor, Sale & Woore, architects, Market Place. Extensions, Babington Lane Picture House, for the Midland Electric Theatres, Ltd.; B. Dent, manager.

DEWSBURY.—Cinema, arcade of shops, &c., for the Palatine Amusement Syndicate (£70,000); C. F. Mallinson, architect.

DONCASTER.—Extensions, administrative block, for the Joint Hospital Board; Allen & Hickson, architects, 51, Hallgate.

DUNDEE.—Tramway depôt, for Corporation; George Baxter, city engineer.

DUNFERMLINE.—Police buildings (£16,000); R. H. Motion, architect.

EDINBURGH.—52 houses at Corstorphine, for Corporation; city architect.

FOLKESTONE.—Works, for the Reliance Motor Body Works Co., Park Road.

GLASGOW.—Police station, Millerston; city engineer and trade contractors.

GLOUCESTER.—Business stores, Eastgate Street, for the Co-operative Society, Ltd.; secretary.

GREAT WARLEY (Essex).—Works extensions, Woodman Road, for Selo, Ltd.

GUILDFORD.—Technical college, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

HAMPTON.—School (360 places), for Surrey Education Committee.

HIGH WYCOMBE.—Factory extensions, Newland, for W. Barrett.

HOUNSLOW.—Factory at Great West Road; Wallis, Gilbert and Partners, architects.

HULL.—96 houses, Derrington estate; Holliday & Barker. 32 houses, Eastfield Road; G. T. Rignall. Orthopædic hospital at sanatorium; city architect.

HUTTON.—Extensions, Grammar School (£31,500), for Lancs. E.C.; director of education, Preston.

KIDDERMINSTER.—Re-erection of portion of The Elms, Abberley, with electrical work, residence of Sir Richard Brooke.

KNUTFORD.—Housing scheme (140), for the U.D.C.; H. Caldecut, clerk (returnable deposit of £1 1s.).

LEEDS.—300 houses and flats, Dewsbury Road and Southfield estates; city engineer. Development, Roundhay Park estate; C. H. & F. Lax and H. Arnold & Sons, Ltd.

LEICESTER.—Houses on Braunstone estate, for Corporation, Harris Bros. (96); Chapman & Sons (110); D. Heggs (38). 114 houses, Braunstone estate; Bodill & Sons, Ltd., Hucknall. Mental hospital, Leicester Frith (£15,240); W. Potter. Elementary school, Braunstone estate; Leicestershire Education Committee. 54 houses, Saffron Lane, for Corporation; S. A. Potter. Estate development, Glenfield Road; Sherriff & Co. Aerodrome, Braunstone estate; city engineer and Air Ministry.

LEYLAND.—Secondary school (£34,350); Lancashire Education Committee.

LONDON (Camberwell, S.E.).—121 tenements and 12 shops, Oliver Goldsmith estate (£45,848); R. J. Rowley, Ltd., Tottenham.

(Stockwell, S.W.).—Additions, Spurgeon's Orphanage, Clapham Road; W. L. Cook & Co., Ltd.

(Wandsworth, S.W.).—Additions, Garrett Lane, for Imperial Chemical Industries, Ltd.; Chesterton & Sons.

(Soho, W.).—Reconstruction Royalty Theatre, Dean Street; Theatre Co.

MANCHESTER.—Technical school and clinic, Gorton (£56,000); Education Committee.

MANSFIELD.—Extensions to grammar school (£32,000), for Notts. E.C.

NEWHAVEN.—Telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W.

NETHERNE.—Extensions for extra 600 patients, sanatorium; Surrey county architect.

NORDEN.—School (£20,000), for Lancs. E.C.; director of education, Preston.

OLDHAM.—Extensions, picture house, Southgate Street; Palladium Pictures, Ltd.

OSWALDTWISTLE.—School (520 places), for Lancs. E.C.; director of education, Preston.

PEMBROKESHIRE.—Reservoir, heating, &c., mental hospital (£10,600); County Council.

ROMSEY (Hants).—Housing scheme (34), for the R.D.C.; C. W. P. Dyson, surveyor (returnable deposit of £2 2s.).

SHEFFIELD.—Library and art gallery (£95,000); city architect. Police station, Attercliffe (£13,500); city architect. Workshops for blind, Sharrow Lane (£27,356); T. Roper & Sons, Ltd.

SHIPLEY.—Warehouse, Dockfield Road; Bowden, Webb and Co., Ltd.

SMETHWICK.—Works extensions, Lewisham Road; Evered and Co., Ltd. Works extension, Cape Hill; Mansill, Booth & Co., Ltd. Transformer house, Wills Street; Wilmot & Breeden.

STAINES.—Cinema, High Street; S. B. Pritlove, London, architect; Kirk & Kirk, Putney, builders.

STOKE-ON-TRENT.—Overhead wiring for 257 houses, for City Electrical Engineer's Department; city electrical engineer, St. George's Chambers, Kingsway. Two hospital pavilions, nurses' home, and dining hall, for the Board of Guardians (£100,000); W. Pendleton, architect. 40 houses, Shelton New Road, &c.; Holloway & Co.

STRATFORD-ON-AVON.—Housing scheme (44), for the R.D.C.; G. E. Boshier, architect, Bridge Street.

SUTTON VALENCE.—School (200 places), for Kent E.C.; E. Salter Davies, director of education, Maidstone.

THORNTON-CLEVELEYS.—School (500 places), for Lancs. E.C.; director of Education, Preston.

TORQUAY.—About 100 houses, Barton; borough engineer.

WEMBLEY.—Elementary school, Kenton site (£14,000); Middlesex Education Committee.

WORSLEY.—Central school; Lancashire Education Committee.

YORK.—50 houses, Burton Lane estate; Flowitt & Gilbert, Doncaster. Housing scheme, Heworth Green; city engineer.

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The

Electrical Review

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The Central Electricity Board.

THE switching in at full pressure of the first 20 miles of the Central Electricity Board's "grid" transmission overhead line system last week marked one more milestone on the road of electrical progress, for it is the first instance of the electrical transmission of power in Great Britain at a working pressure of 132,000 volts.

The section referred to is part of the Central Scotland scheme, between the Dalmarnock sub-station, Glasgow, and Bonnybridge. Another short section of line, forming part of the South-East England scheme, between Bedford and Little Barford, was also made alive last week, but has been commissioned at 33 kV temporarily; that voltage will, however, be raised to 132 kV so soon as the scheme has been completed. It is probably generally known that in framing the district schemes the Electricity Commissioners' choice of 132 kV was influenced to some extent by the possibility that in due time short lengths of underground cable might be deemed to be of sufficient reliability in service at that working pressure where circumstances might warrant the heavy additional capital expenditure that their use would involve. That the choice was a wise one from the economic aspect was conceded at the time it was made, but it was not expected that the hope that underground cables might be used at that pressure in the near future would be fulfilled quite so soon as it apparently will be. Optimism has, however, been justified and we may expect to see such cables being laid in the metropolitan area before very long.

Most appropriately, the inauguration of the first portion of the "grid" coincided with the publication of the Central Electricity Board's first annual report, which is dealt with on another page. It details the accomplishments achieved during one and three-quarter years of the two years that the Board has been in existence. Largely descriptive of the system and methods adopted, it is, notwithstanding I.E.E. papers on the same subject, highly interesting, for the progress of the work undertaken by the Board has been materially more

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rapid than its magnitude allowed one to hope for initially. A substantial share of the credit for this satisfactory state of affairs is rightly attributed to the electrical consultants who carried out preliminary investigations on behalf of the Electricity Commission, and by appointing them to serve as the Board's consultants also the latter has shown its appreciation of their accumulated information and at the same time avoided the collection of a large technical staff to deal afresh with matters that had already been investigated. The preliminary work lightened the Board's task considerably and enabled it to place contracts at an early date, but some of the contractors have, we fear, not been able to keep to their completion dates.

Representations from statutory undertakers and other interested parties have been mainly of the nature of suggestions relative to the practical working out of the schemes rather than criticism of their general provisions, and it is highly satisfactory to be able to record the fact that resort to formal inquiry or arbitration has not been necessary. So far, moreover, it has only been necessary in two cases to apply to the Minister of Transport for compulsory wayleaves (two towers in Scotland and three in south-east England).

That there is considerable scope for the structural designer in connection with the determination of the most suitable form of overhead-line supports will be generally agreed, and it is interesting to learn that although the majority of the towers will be of lattice-steel construction, reinforced-concrete and wood poles are also being used on some sections of the secondary system. Rustless steels are at present considered to be too expensive to allow of their use in tower construction. The most vulnerable component of high-voltage transformers being their terminal insulators, it has been decided to put both the oil-filled and condenser types to the test of practical use. The latter kind has hitherto had to be largely imported, and it is accordingly gratifying to know that satisfactory insulators of this design of British manufacture are now obtainable. Space is being provided at each sub-station for the building of repair sheds, but they are not to be erected until experience dictates the necessity, which decision is contrary to current practice abroad, but it was formed after consultation with the principal transformer makers. Again, it has not been deemed expedient to restrict development by specifying any one of the several methods of voltage regulation favoured by individual manufacturers, which differ in detail. Such instances are examples of the general desire to ascertain by the severest test of practical use the most trustworthy equipment.

Voltage regulation, the metering of interchanged energy, and control of the system, or load dispatching, are likely to be the major operational problems to be solved. There is not much doubt that the "grid" lines will function with a reasonable measure of safety without the need for any elaborate system of protection; in this country the provision of lightning arrestors would be a luxury of doubtful utility, and it seems that most of the high-voltage overhead-line trouble experienced in the British Isles has resulted from the deposition upon the insulators of fouling matter carried by wind and rain. Thus, attention needs to be devoted to insulator design with due respect to field form and equipotential surfaces, as recently outlined in an I.E.E. paper on the subject.

One point is worthy of notice: while most of the equipment is touched upon in the report, there is a total absence of any reference whatever to the switchgear. In recent I.E.E. papers on the Board's work similar reticence was exercised, and it may therefore be assumed that definite experience under working conditions is desired before any statement is made. It is claimed to be feasible to calculate the rupturing capacity of a given circuit breaker with sufficient confidence to allow of upward extrapolation within moderate limits. Such an assumption requires proof and may be dangerous, particularly as to-day the conception of large-capacity circuit breakers implies gear capable of rupturing short-circuit power loads of over 1,000,000 kVA, and one cannot afford to class it in the same category as fuses, to be replaced after it has been called upon to function once, and once only.

The "Associated" Meeting.

THE first annual meeting of Associated Electrical Industries, Ltd., since it changed its name and functions, is an event of outstanding importance, and in the report of Mr. Levis's speech, which appears in this issue, there are many points which indicate the policy of the group and are therefore deserving of particular attention.

In the first place, it is interesting to learn that the company's old title—Metropolitan-Vickers Electrical Co., Ltd.—is to be taken by the subsidiary which, originally "Metro-Vick Supplies, Ltd., was to have been called "Metro-Vick Electrical Products, Ltd." Thus the net result of the arrangements appears to be that the new Metropolitan-Vickers Electrical Co., Ltd., will carry on the business of the old company of the same name, plus that of the selling concern—Metro-Vick Supplies, Ltd., leaving Associated Electrical Industries, Ltd., to act purely as a holding company.

It is very reassuring to hear from Mr. Levis that the policy of the companies of the group will be to continue manufacturing in this country practically everything that they supply. This should eventually lead to the employment of far more than the 30,000 people to whom the companies already give work.

The chairman pointed out, as many other chairmen of electrical manufacturing companies have done, that the profits earned by the industry are incommensurate with the capital invested and work carried out. He said that the low prices prevailing were not entirely due to foreign competition; in many cases they were attributable to competition between English firms. This pointed to the advisability of every effort being made by those in control of the industry in England to secure co-operative arrangements which would tend to produce an adequate return for the investment of money and brains in the industry.

The object of the "Associated" merger was to co-ordinate production, selling, research, and purchasing and to economise efforts in many other directions. In Mr. Levis's opinion the merger "can be regarded only as the beginning of what should be done if the electrical industry in England is to develop successfully and be in a position to render adequate service in this country, and, in addition, to bring to Great Britain its proper share of world business in competition with other countries."

Financial Developments in the Supply Industry.

FURTHER steps towards the grouping of electricity supply companies were announced last week. The first was the proposal by the British Power and Light Corporation, Ltd., to issue £1,600,000 in ordinary shares in this country (the offer actually being made on Monday last) and a similar amount in the United States. The principal acquisition of the company will be the North Wales Power Co. and its associated Distribution Company, but it is also purchasing the share capital of five smaller concerns in various parts of the country. The directors of the Corporation include Messrs. G. W. Partridge and G. V. Twiss.

In the second place, the Greater London & Counties Trust, Ltd., has made an offer to the "A" and "B" shareholders of the Shropshire, Worcester & Staffordshire Electric Power Co. which, if accepted, will give the Trust control of the company. In the Shropshire Co.'s last report it was mentioned that arrangements had been made for the interchange of supplies with the Wessex Electricity Co. As the latter is controlled by the Trust the purchase of the Shropshire Co.'s shares will no doubt bring about a physical as well as a financial interlinking of the two important undertakings which between them cover a very extensive area of the country, mainly of a rural character.

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The Leningrad Sub-station.

Some particulars concerning the equipment of the step-down transformer station of the Volchov hydro-electric undertaking.

By C. J. WEBB, A.I.A.E.

IN a recent issue of the ELECTRICAL REVIEW (February 22nd, p. 320), a full description is given of the 80,000-h.p. hydro-electric station which has been established on the Volchov River for the supply of power to the city of Leningrad, about 83 miles away. We are now able to give some particulars of the main transformer station in Leningrad, fig. 1, which is designed to receive power from the Volchov station through two 120-kV transmission lines, and to step-down the pressure to 35 kV by means of two indoor-type transformers. As a stand-by a third identical transformer is provided, this being so arranged with respect to the 120-kV bus-bar system that by means of two electrically-operated section switches it can easily be connected to either of the two lines. The normal input of the sub-station is about 70,000 kVA. There is no excess-voltage protection, except that the neutral points of the transformers in the generating station are earthed, and the high-pressure neutrals of the step-down transformers in the sub-station are earthed through pressure transformers. The object of the latter is partly to release the line of oil switches on the occurrence of an earth fault, and partly for the purpose of giving a signal to the switchboard attendants.

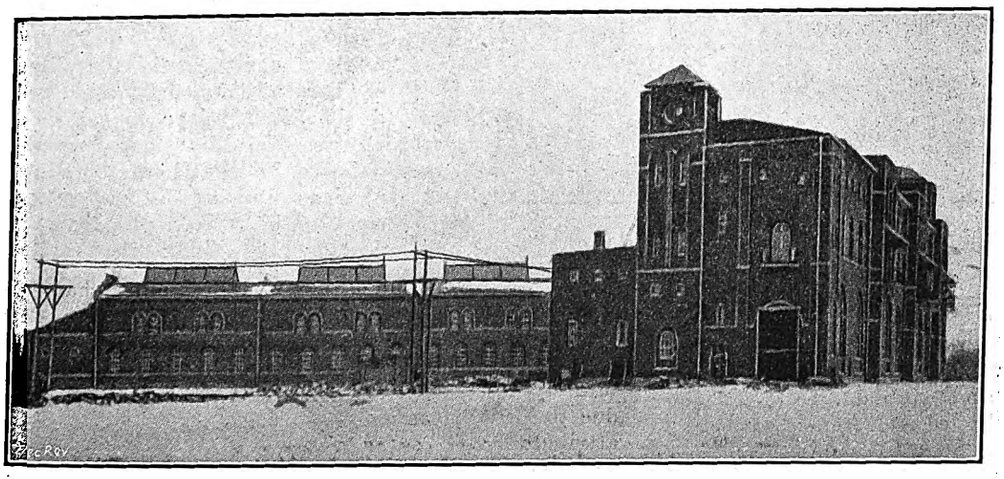

Fig. 1.—The Leningrad Sub-station; Snow-covered Ground.

Energy at 35 kV is transmitted to a duplicate bus-bar system, one half being kept as a stand-by. The system has been arranged so that parallel working between the two transformers can be effected through two sets of reactance coils, whether the normal transformers or the stand-by transformer is in operation. From the 35-kV bus-bar system power is distributed through cables to different load centres in the Leningrad district, arranged on a ring main, where the pressure is further transformed down to 6.3 kV. From the 35-kV bus-bars power is taken to a tertiary station housed in the main sub-station, where the pressure is also stepped down by two indoor transformers to 6.3 kV. On the 6.3-kV system there are five outgoing feeder cables and two circuits to local transformers for the requirements of the sub-station itself. The tertiary system is sectioned by means of oil switches and is normally divided for working into two groups, although the possibility of parallel running exists if the load requirements of the station should demand it. By means of the local transformer power is transformed down for the station requirements to the most suitable voltage, in this case 220 V.

There is also an arrangement for the supply of d.c. for local requirements, two 22-kW, 250-V motor-generators and accumulators being installed. For emergency lighting purposes there are three automatic lighting change-over switches which, in the case of a breakdown of the a.c. system, automatically connect the d.c. system to the lighting circuits, automatically returning to their original position when the a.c. voltage is restored.

One wing of the building is used for the 120-kV equipment, fig. 2, while the other contains the 35-kV, 6.3-kV and 220-V apparatus, the control room, local equipment, &c., being located in the central portion. For earthing the 120-kV incoming lines when any work is to be carried out on them, "disconnecting" switches are placed immediately under the leading-in bushings. The main 120-kV oil switches, fig. 4, are situated on the ground floor, and in the line before these are connected inductance coils which, with the heavy insulation of the trans-

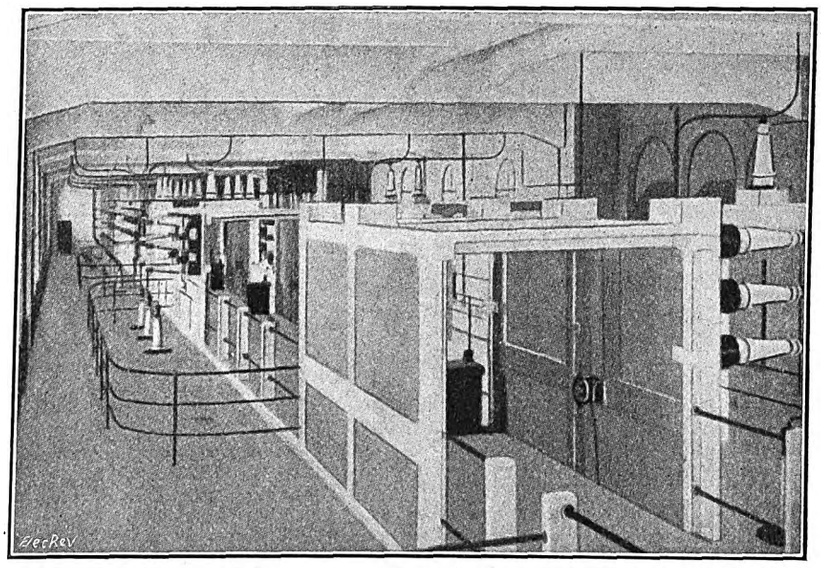

Fig. 2.—View of 120-kV Switchgear.

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formers, are calculated to give adequate protection against surges.

The main transformers are located in special separate fire-proof rooms. Each group of transformers, consisting of three single-phase star/delta connected transformers, constitutes a single unit from the erection point of view. Each is isolated by fireproof partitions from the other units, so that if an explosion should take place in one unit no interruption would be caused on other parts of the system.

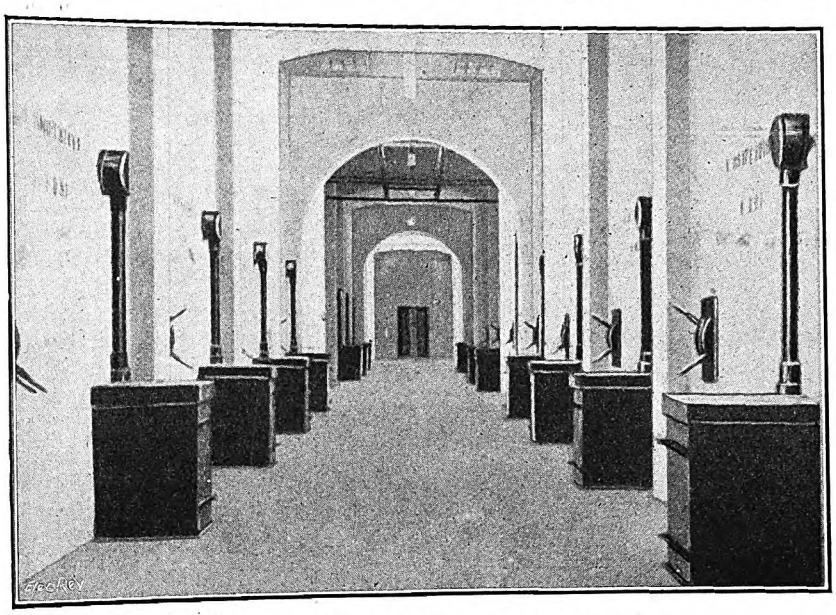

Fig. 3.—35-kV Operating Gangway.

All the h.p. conductors of the 120-kV system consist of hard-drawn copper tubes 38 mm. in outside diameter and 2 mm. thick. On account of the long length of the 120-kV bus-bars the conductors have been furnished with expansion joints and all the free ends of the tubes fitted with spheres to minimise corona losses. The arrangements adopted for the bus-bar system are such that it can be made dead in sections, so that it is possible to carry out thorough inspection of important parts when there is not very much load on the station.

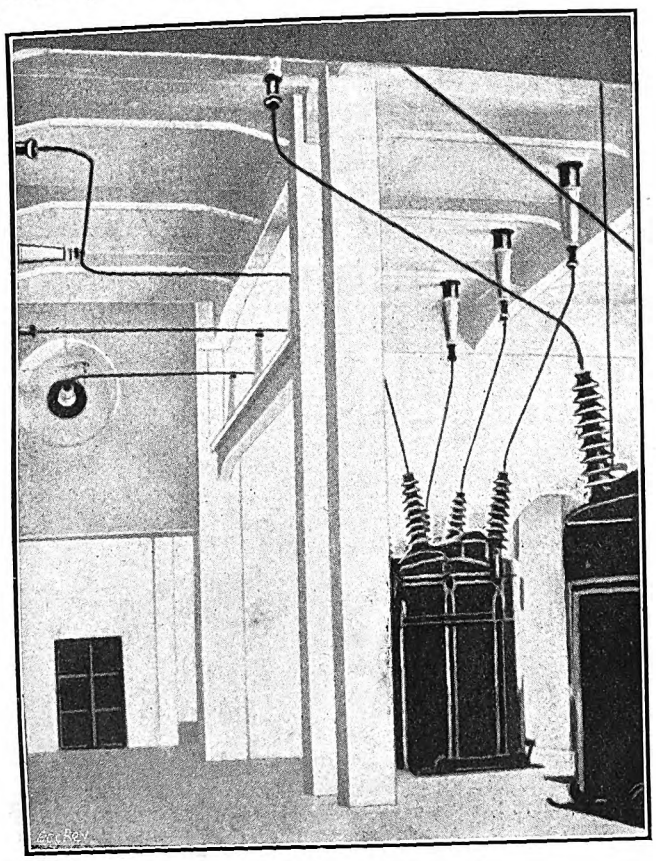

Fig. 4.—120-kV Oil Switches.

There are three main control boards in the sub-station, one for the sub-station proper, one for the tertiary installation in the sub-station, and the switchboard for local distribution. The first two are placed in a control room located on the second floor, while the local board is on the ground floor. In relation to the building in general, these rooms are located between the 120-kV and 35-kV switchgear, and in the most central part. Fig. 3 is a view of the 35-kV operating gangway. Suitable reactance equipment, fig. 5, is arranged in the 35-kV circuits. A diagrammatic indication of the system not only shows the transformer connections, but also the transformation ratio by means of different colours.

The relay protection for the incoming lines has been so devised that completely selective release can be obtained under all conditions. For the two 120-kV lines the relays consist, in the first place, of three-phase differentially-connected overload time-limit relays in combination with three-phase interlocked reverse power relays; in addition, there are locking relays and earth-fault relays. If a short-circuit between phases occurs on either of the lines, the reverse power relay for the line in question operates instantaneously and releases the differentially connected overload time-limit relays belonging to the faulty line. The reverse current then rises to a predetermined maximum value, when the overload relays effect the release of the line oil switch in question. At the same time the tripping device of the other line oil switch is locked for a sufficient length of time to allow of certain selective release of the circuits from the generating station to the point of the fault. Both lines are capable of carrying double their normal power continuously, and each transformer double the

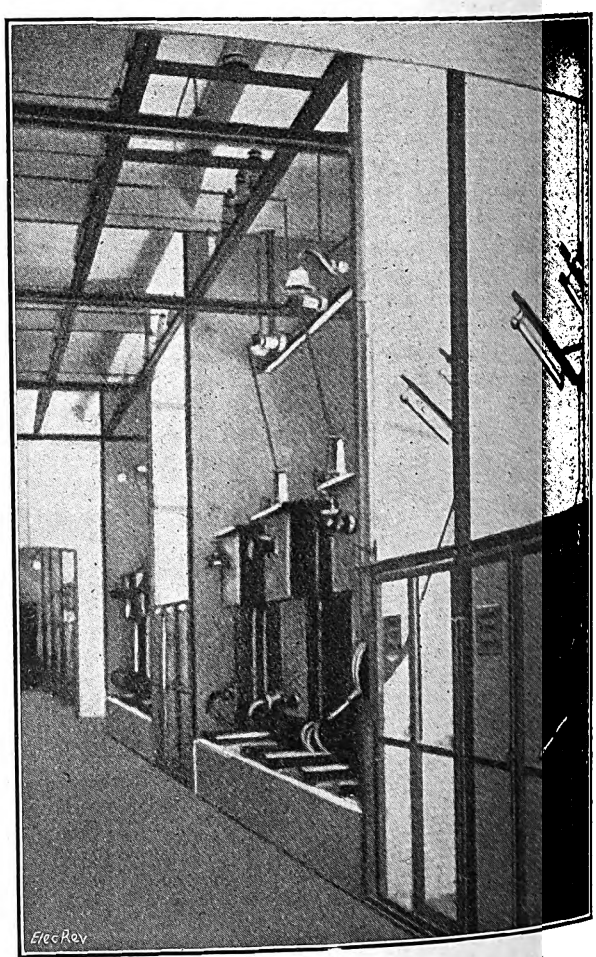

Fig. 5.—35-kV Reactance Equipment.

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normal output for eight minutes, so that the attendants, after receiving the signal of the fault, have sufficient time to switch in the spare transformer without in any way necessitating a reduction in the load handled by the station.

On the occurrence of an earth fault on any of the phases, a voltage relay is closed which releases the line circuit breaker. The transformers are protected by differentially-connected and overload time-limit relays. The differential relays serve only to protect that part of the transformer equipment which lies between the two transformer oil switches.

We are indebted for the accompanying illustrations to the Swedish General Electric Co., of Vesteras, Sweden, which concern was responsible for a large portion of the plant.

Electricity Supply in Worcester.

An outline of a progressive municipal undertaking's activities, including details of an unusual type of powdered-coal-fired boiler and the methods utilised for supplying electricity in rural districts.

(*Concluded from page* 819.)

Other Boiler Modifications.—Another idea that occurred to Mr. C. M. Shaw was to lower the front mud drum A as indicated in fig. 9, which would (i) eliminate the back wall of the combustion chamber, (ii) increase

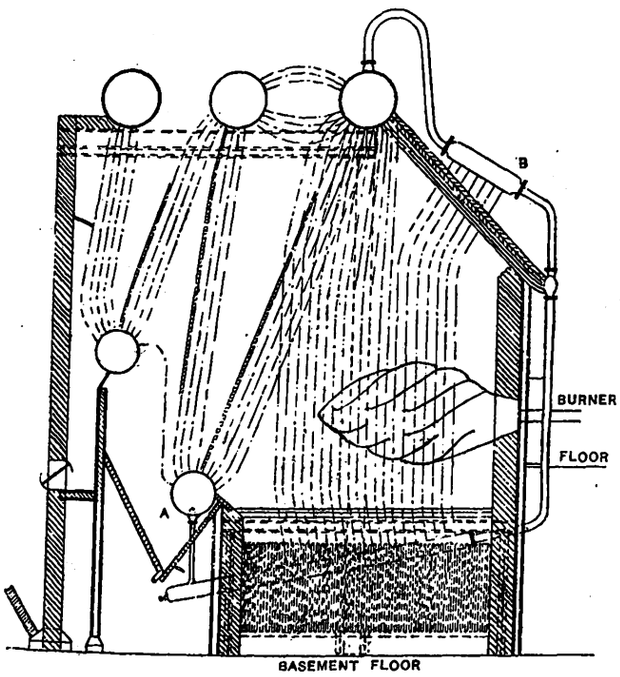

Fig. 9.—Boiler Modification, No. 9.

the heating surface area adjacent to the hottest part of the furnace, and (iii) diminish, or converge, the gas-passage area, thus approximating to a reduced gas volume. His experience of water-tube walls exceeding 26 ft. in length has given him confidence to arrange for the front banks of tubes of another boiler (at present erected in skeleton form) to be extended (minimum length between drums, 25 ft.) and for the flat brick arch of the combustion chamber to be replaced with two or three extra staggered rows of water tubes expanded into a header B that will be supported along the front of the boiler. This addition, with the water walls protecting the sides of the combustion chamber, is hoped to raise the capacity to 90,000 lb. evaporation per hour.

A third boiler (at present kept banked for emergency use) is to be somewhat similarly adapted, but the mechanical stoker is to be retained and supplemented by one p.f. burner as shown in fig. 10. It will be noted that a series of tubes expanded into each end of the top front steam drum will be led down into a circular header to form a water wall; the water will pass through a connecting pipe from the lower front drum to the header, the flow then dividing partly up the water-wall tubes and partly to a horizontal header in front of the boiler above the stoker hoppers, into which header 58 tubes (two rows) in staggered formation will be expanded and carried to the front drum to form a water-tube roof. This method of closing the top of the combustion chamber will make an expensive flat arch unnecessary and add in its stead substantial heating surface; the suggested modification is expected to add about 15,000 lb. per hour to the boiler's capacity (total about 50,000 lb.) and reduce brickwork maintenance.

Electrical System.—The transmission and distribution systems have been reorganised: three-phase 50-cycle energy generated at 6,600 volts is transmitted to decentralising centres where it is fed through Scott-connected transformers into the older 2,200-volt two-phase system, which method is convenient, obviates balancing trouble, suitable switchgear is cheap, and Berry radial transformers can be used on consumers' premises (200 volts). A 3-wire d.c. network (230 and 460 volts) is also in service, fed partly hydro-electrically and partly by motor convertors; the system is in course

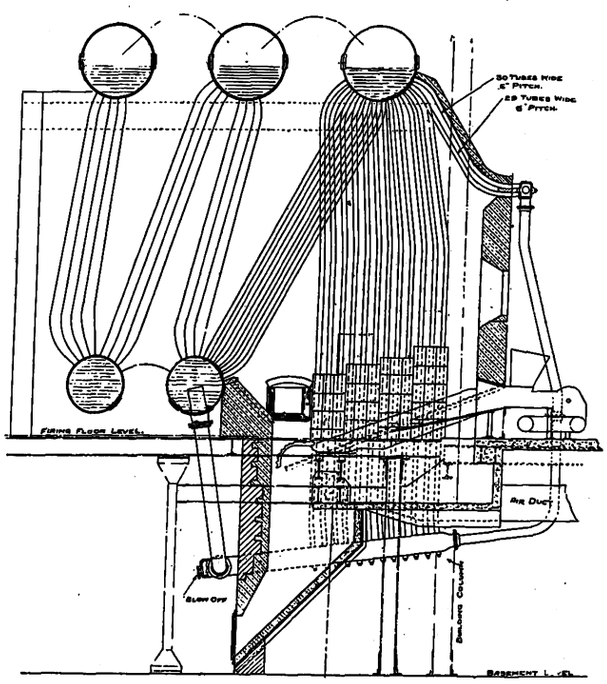

Fig. 10.—Boiler Modification, No. 7.

of being changed over to a.c. and will probably be completed during this year.

During the last few years distribution system extensions have been planned on broad lines and carried

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out to meet the rapidly increasing demand. Some 67.75 miles of overhead mains and 128.5 miles of underground mains are in service, and 108 sub-stations, besides 56 transformers in private houses. During the year 1927-28 the energy sold increased by 2,424,999 kWh to a total of 11,647,783 kWh, the average being 2,721 kWh per consumer, or 228 kWh per head of population; the mean price obtained was 1.6d. and the mean profit 0.26d. per kWh sold. The consumers numbered 4,281, some 653 new ones having been added during the year, and 236 existing installations extended, whilst the following apparatus* was connected to the system: 523 radiators, 73 motors, 69 irons, 41 cookers, 25 kettles, 11 water heaters and boilers, 6 hotplates, 3 convertors, 2 grillers, 2 urns, and one toaster, which aggregated 2,347 h.p., the total connected equalling 16,898 h.p.

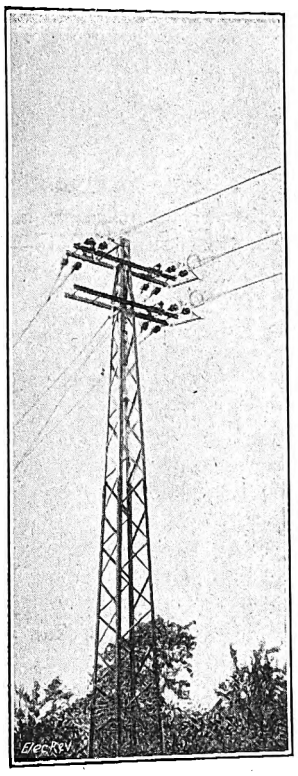

Fig. 11.—Spetchley Road E.H.P. Crossing.

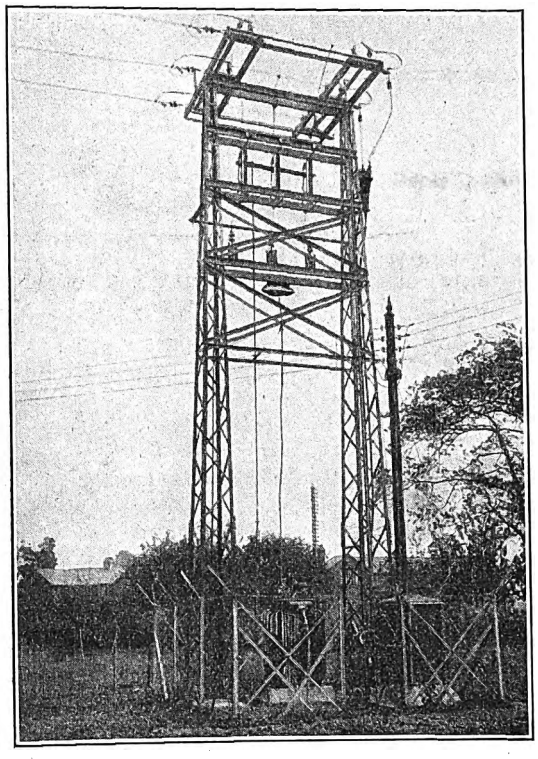

Fig. 12.—Callow End Outdoor Sub-station.

Very satisfactory progress is being maintained in the sale of energy for domestic purposes; during 1927-28 it amounted to 1,345,191 kWh, besides 857,888 kWh sold for heating purposes. Quite recently the Town Council established a showroom, and appointed a lady demonstrator and two junior assistants; also it decided to inaugurate an assisted-wiring scheme for small houses and to undertake the sale of apparatus, both outright and on the hire-purchase system, all of which should tend to place the benefits of domestic electrification within the reach of would-be users who would otherwise be deprived of them by being unable to afford, unassisted, the initial cost of installation.

Rural Electrification.—In what is known as the "extended" district, including the bulk supply purchased by the Malvern District Council, 1,100,265 kWh was sold during 1927-28, double the amount sold in the previous year.

When the original rural scheme was being prepared, it was estimated that the constructional work would cost £33,000, and that at the end of two years' operation the energy sold would amount to 330,000 kWh per annum; the work had not been long in progress, however, before it became evident that greater provision would have to be made to meet a larger demand than had been anticipated. The main scheme has now been completed at a cost of £37,500 and, excluding the Malvern municipality's bulk supply, 842,354 kWh had been sold to private consumers after a complete year's operation.

The greater part of the constructional work was carried out by the Worcester Corporation Electricity Department's staff with direct labour in a very creditable manner, including the erection of the lattice steel towers of the e.h.p. lines, manufacturers' tendered prices having been judged too high; a number of the workmen have been retained, as the services of men thus trained are required for the maintenance of the overhead lines and for carrying out extensions which will become necessary to cope with the constantly increasing demand, in the stimulation of which a pertinent factor is the price charged for energy:—

Lighting: 5.5d. per kWh.

Power: 2.5d. and 1d. per kWh, plus 15 per cent. (Wright indicators).

Heating: 1d. per kWh.

Domestic: 20 per cent. of ratable value of house, plus 0.5d. per kWh.

These prices apply to the city area, those in the "extended area" being subject to 20 per cent. extra, all less 10 per cent. for prompt settlement of accounts.

The rural transmission lines are carried on lattice steel poles, painted dark green. Although operating at 6,600 volts at present, the copper conductors are carried by 11,000-volt insulators, and the cross arms have been suitably spaced for 33,000 volts in anticipation of future requirements, with double-insulator bridle terminals where necessary; for instance, fig. 11 shows the e.h.p. Spetchley Road crossing in 1927. So far as is possible all lines are rings, otherwise being fed from duplicate transformers, looped in and out of the sub-stations. The latter are either brick-built low structures housing Ferranti transformers (all interchangeable, 25, 50, 100 kVA, &c.) and simple George Ellison switchgear of the three-way and straight T-tapping varieties; or of the outdoor types illustrated in figs. 12 and 13, the pole-mounted transformer being associated with a

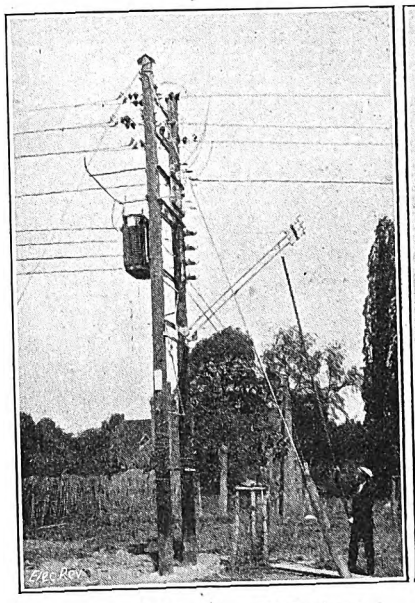

Fig. 13.—Pole-type Transformer and Switch-fuse.

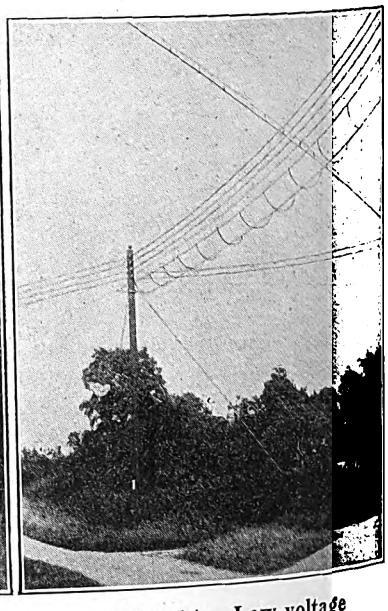

Fig. 14.—Low-voltage Line Guard.

* Based on definite notification to the Corporation Electricity Department by application form; there are no means of ascertaining consumers' unnotified additions.

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Swedish switch-fuse; the method of operating it is indicated in the illustration.

The low-voltage distribution system is more extensive

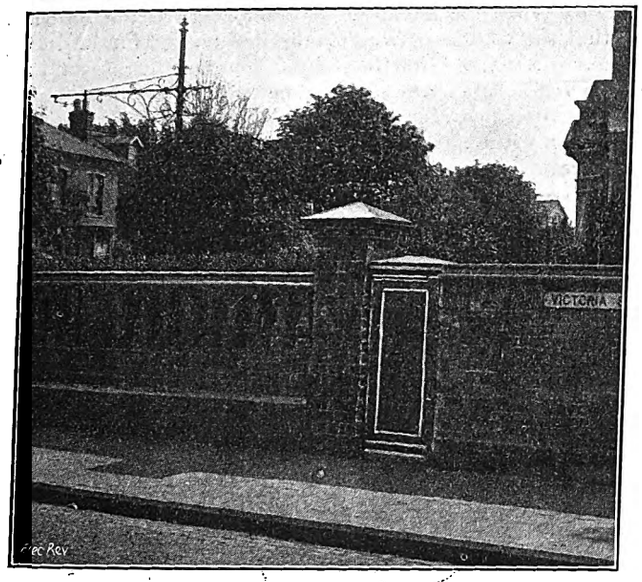

Fig. 15.—A "Hidden" Distribution Pillar.

than is generally realised: carried on wood poles of the Post Office pattern, but shorter and slightly stronger, the smallest copper conductor is of 0.1 sq. in. sectional area, and some are of 0.2 sq. in. The load is growing rapidly, however, and the generous design has been amply justified; indeed, two additional conductors have had to be added to nearly all the single-circuit lines erected, as indicated in fig. 14, which shows a guarded l.p. line crossing a Post Office cable, and all poles have four insulator-pin holes drilled in them as a standard arrangement before erection. Service connection between the lines and consumers' premises is effected with insulated conductors, usually rear or side entry, as poles are never erected in village streets if doing so can be avoided, and attempts to shield the pole lines by locating them behind, rather than in front of, rows of houses have been strikingly successful; in fact, cases are on record of consumers actually paying the Corporation the cost of deviating a line so as to give it a side or back entry, and so preserve the front aspect of the premises. Thus unobtrusiveness is a feature striven for in every case, fig. 15 being an example of a "hidden" Henley distribution pillar in Victoria Street; not only is it less obstructive to pedestrians, but also economical, for one by no means large undertaking has spent over £100 per year on replacing such pillars which are dislodged or fractured by backing vehicles and similar street accidents.

From what has been written it will be apparent that the rural system has been liberally designed and carried out on very comprehensive lines in anticipation of a heavy demand for electricity for domestic and farming uses, which is materialising at a rapid rate.

Our Overseas Electrical Markets.

Economic conditions in Australia, New Zealand, South Africa and India.

BELOW are given, in accordance with our practice every quarter, a series of charts showing the trend of the import trade in electrical machinery and apparatus in Great Britain's principal overseas markets. At the same time general economic conditions in those markets are surveyed. It will be noticed that imports of electrical goods into South Africa, although still considerably below the level of those into Australia, are on the whole maintained at a steadier level than in the latter market. The feature of Indian business, which is much larger on the apparatus side than in machinery and plant, is the fact that Germany's share, while still small, is slowly but appreciably increasing.

Australia.

The labour situation in Australia shows little improvement and the movement to jettison the existing arbitration procedure seems to be gaining strength. At the same time there are a number of promising features in the economic position. Customs revenue has been increasing, the figure for April being nearly £500,000 more than in April, 1928. For the ten months of the financial year, receipts show results £1,600,000 below the estimates. In eastern Australia the weather during the first half of April was favourable to the crops. The total wheat yield of the Commonwealth is estimated at 168,000,000 bushels. Wool has been selling well. For the first half of the current financial year the value of merchandise imports totalled £72,603,000 as compared with £80,659,000 in the corresponding period of the previous year, while that of exports of merchandise totalled £66,906,000 as compared with £69,085,000. The fact that imports have declined to a greater extent than exports, thus reducing the unfavourable trade balance, is a reassuring sign. During the same period the value of electrical machinery and appliances imported totalled £2,968,000 as against £3,852,000 in the corresponding period of 1927-28. The keen nature of American competition in the machinery trade of Australia is shown by some statistics recently got out by the Senior Trade Commissioner at Sydney. Of a total value of machines and machinery imported in the December quarter of 1928 amounting to £3,976,100, no less than

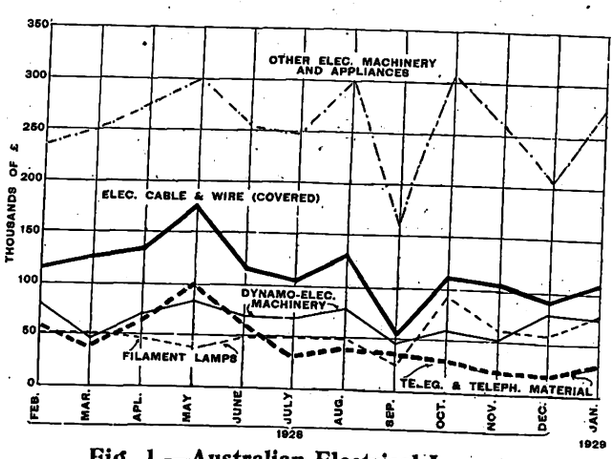

Fig. 1.—Australian Electrical Imports.

£1,576,700 represented United States products. This sum stands very near to that representing British imports of machinery during the same period, viz., £1,768,900.

For the purpose of counteracting the pessimistic views which have been spread abroad regarding the effects of labour troubles in the Commonwealth, the Government has been drawing attention to certain favourable features of the economic life of the country. Evidence of progress

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is found in the returns of the State Savings Banks. Excluding Queensland, where the State institution has been absorbed by the Commonwealth Savings Bank, the excess of deposits over withdrawals from the banks last year was nearly £10,000,000. Adding similar figures relative to the Commonwealth institutions it is estimated that the total savings of Australians last year were approximately £14,000,000. Another Government communication points out that between 1917 and 1927 Australian products to the value of £125,000,000 had been exported annually, that the Commonwealth would eventually produce 600,000,000 bushels of wheat annually, a quantity sufficient for the requirements of 100,000,000 people, and that primary and manufacturing production together between 1901 and 1921 had advanced from £30 per head of the population to £73, while the total value of production had nearly quadrupled during the same period. It is claimed by the Government publicists that although strikes undoubtedly have a depressing influence, their occurrence is less noticeable in the Commonwealth because the progress and prosperity evident everywhere overshadow recurring industrial disturbances. The problem of seasonal unemployment is to be dealt with by the authorities in the separate States by the establishment of committees which will study means for bringing about a greater degree of stability in industrial activities.

New Zealand.

In New Zealand the banking situation shows a very marked improvement compared with, say, six months ago. Then the banks were endeavouring to attract fixed deposits. Now they are not finding it altogether easy to invest the funds in their hands. There are few signs of the bad impressions left by the excessive granting of credit which took place a year or two ago. Expenditure on luxuries has been undoubtedly brought down to reasonable dimensions. In agriculture a favourable symptom is the attention which is being given to the use of machinery and modern implements as well as of fertilisers, instead of the indiscriminate bringing into cultivation of land of doubtful value. From both the sheep and grain farms good reports are forthcoming For dairy produce a record export season is assured. With regard to wool, although prices have fallen, the clip is

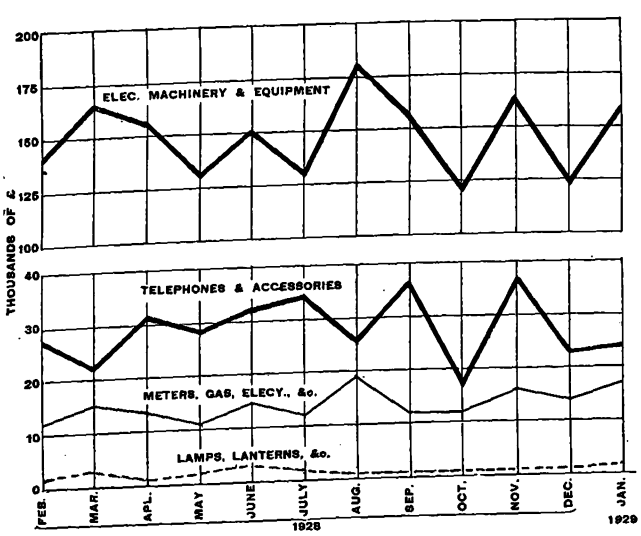

Fig. 2.—New Zealand Electrical Imports.

substantially larger as the number of sheep shows an increase of more than a million, and the results to the producer are expected to be profitable. The demand for beef from the United States continues to expand and the prices of mutton and lamb are very satisfactory. Against these favourable factors, however, it is expected that the wheat yield will be smaller by a million bushels and the barley and oat crops also less than last season. During the twelve months ended March 31st last there was a favourable trade balance of £12,000,000. Judging by the progress of export trade so far this season, the result will be more satisfactory than during the record season of 1924-25. Meanwhile, imports also have been increasing in value and consequently it is hardly to be expected that the balance of trade will be as favourable as it was at the end of June last. In the opinion of the *Auckland Weekly News* the meaning of the foreign trade returns is that the volume of New Zealand's production and the prices prevailing for her chief commodities form the basis for a fuller and more general enjoyment of prosperity than has ever previously been experienced. The Government has shown its confidence in the economic situation by announcing its support of a bold policy of railway development and public works. This should stimulate trade in every branch.

South Africa.

In South Africa one excellent barometer of trade and industrial activity, namely, railway earnings, stands high. Their total during the twelve months ended March

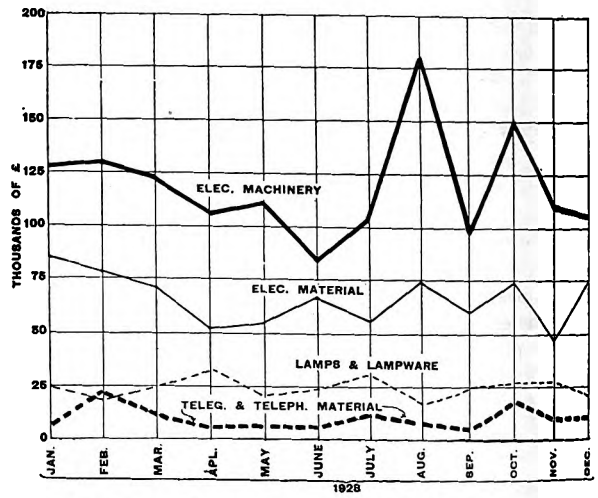

Fig. 3.—South African Electrical Imports.

last was £26,135,400 or £915,400 above the estimate for that period. Farming prospects generally, and for pastoralists in particular, remain good. The total exports of maize and maize products for the season were 7,275,000 bags. February's estimate of the yield of the new crop was 20,548,000 bags, but since then the figure has been lowered. The new sugar crop is expected to be about 315,000 tons, compared with 295,000 tons a year ago. The important position now held in the economic life of the Union by the fruit industry is indicated by certain statistics which have recently been made public. The total citrous exports during the 1929 season are roughly estimated at 1,100,000 standard cases. Exports of deciduous fruit for the season up to March 31st, were 1,332,000 boxes—a decrease of 400,000 boxes on the previous twelve months, owing to a disappointing crop of pears.

Manufacturing activities are for the most part well maintained. The satisfactory state of the building trades indicates a continuance of the demand for many kinds of electrical apparatus and fittings. The trade in motor vehicles has been brisk—which is another sign of prosperity—but that in agricultural plant has been rather below expectations. Business in the latter will probably revive now that weather conditions have begun to help the farmer.

It would be unfortunate if the dispute between the Electricity Supply Commission and the Railway Administration over the charges for energy from the Salt River and Colenso power stations were to check the progress of railway electrification in the Union. The railway manager states that whereas formerly only 0.8d. per kWh was paid for power, the "impossible" price of 1.3d. per kWh is now being charged, and that the annual working expenses of the line were £488,000 against an estimate of £170,000 by the consulting engineers. The matter has been investigated by a committee, which has referred it to the Electricity Control Board. On behalf of the supply undertaking it is pointed out that the railway's figures take no account of the earnings on coal,

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which was formerly carried free for locomotive purposes, and further that an anticipated increase of 25 per cent. in traffic has not materialised, there having actually been a decrease of 25 per cent.

India.

An examination of the foreign trade returns of India shows that in spite of labour troubles monthly imports of machinery and millwork have kept at a very steady level of value, *viz.*, an average of Rs. 150 lakhs or about £1,125,000. From the explanatory memorandum of the Indian railway budget for 1929-30 it appears that in the Bombay area the electrification of suburban lines is practically complete. The proposed extension of the electrically-operated suburban service from Boroli to Virar has been deferred for the present. On the Great Indian Peninsula Railway the suburban scheme which comprises the electrification of the Harbour Branch, of all tracks from Bombay to Kurla and the local lines from Kurla to Kalyan, is virtually complete, and all goods traffic between Bombay and Kalyan is now electrically operated. It is expected that the main line to Poona will be ready for electric traction during the current year and up to Igatpuri by 1930. The work on the Kalyan power house is well in hand and it is expected to be finished during 1929-30. On the South Indian Railway financial provision has been made for the electrification of the Madras suburban area. Altogether Rs. 170 lakhs (£1,275,000) will be expended and the work will take three years to complete. The scheme for the electrification of the Calcutta suburban railways is still under consideration.

By the end of August next it is hoped that the Glen Morgan power scheme on the Pykara River will be completed and power available. The transmission line thence to Coimbatore, about 70 miles distant, will be one of the longest in India. Transformers, switchgear and line materials have been ordered by the Ootacamund and Coonoor Municipalities from the British Thomson-Houston Co., who are also the suppliers of the plant and machinery for the main station.

This continuance of electrification work is a fair assurance that British electrical firms will benefit by the expenditure of £20,000,000 which the Railway Department is undertaking on productive works. Lord Peel, Secretary of State for India, in pointing out recently that Indian purchases in Great Britain stood at 5s. 3d. a head, while those made by New Zealand were £13 5s.,

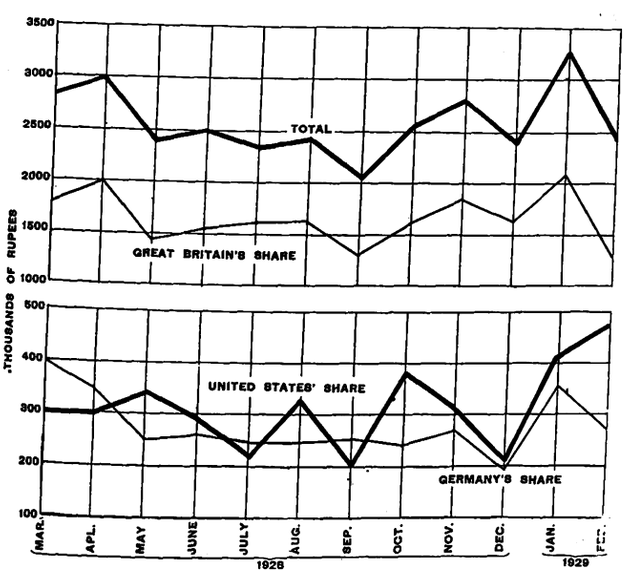

Fig. 4.—Indian Electrical Apparatus Imports.

alluded to the good reception given in India to the report of the Commission of Agriculture, which should result in raising the standard of living in the country and thus increasing its purchasing power. He recommended British commercial interests to keep in touch with the work of the Indian Tariff Board and, in the event of higher import duties being under consideration, to lay their case before that body.

In granting the application of the Indian Cable Co. for the removal of the import duty on electrolytic copper rod and the levy of one of 5 per cent. on certain rubber insulated electric wires and cables, the Tariff Board made it clear that it was considered policy to remedy

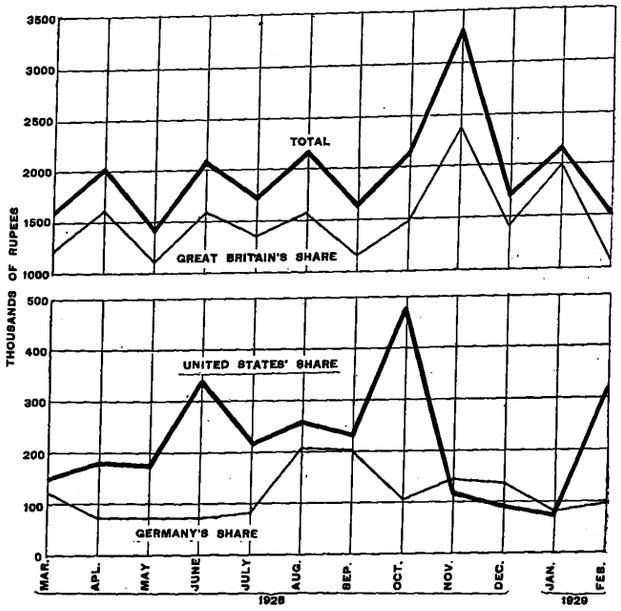

Fig. 5.—Indian Electrical Machinery Imports.

any inequality in tariff treatment between any Indian manufacturing concern and its foreign competitors, particularly when its supplies of imported raw materials were affected.

South African Trade Affairs.

Some time ago the British National Union and the South African National Union planned a business tour of the Union of South Africa, expecting that 50 representative British business men would take part. The proposal was warmly welcomed both in this country and in South Africa, but in spite of this only twelve men expressed a desire to participate in the tour. In view of this poor response, the organisers were compelled to abandon the project. The need for every effort to promote British trade in the Union is apparent when it is remembered that the British share of the total import trade fell continuously from 56.4 per cent. in 1922 to 44.8 per cent. in 1927. In his last report on South African conditions (ELEC. REV., November 2nd, 1928, p. 771), Mr. N. Elmslie, Senior Trade Commissioner in South Africa, attributed this gradual decline to the higher prices of British goods, but he also detailed a number of contributory causes which have had their origin in the Union itself. The Union Government has reduced considerably the proportion of its requirements which it obtains from this country, and its Customs policy has not been such as to give an impetus to British trade. By the Customs Act of 1925 the general preferential rebate of duty on imports of United Kingdom origin was withdrawn. It is only fair to put against this, however, Mr. Elmslie's opinion that there is considerable room for improvement in the manner in which British manufacturers regard the market. More efficient service is said to be necessary, while skilful propaganda emphasing the superior quality of British goods would go a long way towards discounting the adverse effect of higher prices.

It is probable that the recently discussed commercial treaty between South Africa and Germany has created a feeling of uncertainty in this country. This treaty would extend to German goods equal treatment with those of Empire countries in the event of the institution of preferential rates in the future, besides giving them the existing preferences upon their extension to other Empire countries.

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Overhead-line Protection.

For guarding against atmospheric surges the author advocates increasing the factor of safety of machines &c., rather than the provision of lightning arrestors.

By L. F. RATCLIFFE.

SURGES due to atmospheric and other effects have been known to cause the breakdown of electrical apparatus connected directly to overhead-line systems, and it is generally agreed that some form of protection should be provided against them. Opinion is by no means unanimous as to the form this protection should take, although in a broad sense only two alternatives present themselves. The factor of safety of all apparatus directly connected to the system may be increased to cover surges, or the same result may be aimed at by employing so-called lightning, or surge, arrestors.

The contemplated development of rural districts where the load is scattered over a considerable area is only commercially possible by the adoption of an overhead line system of distribution of the very simplest type.

The capital costs of distribution to make the scheme possible will admit of none but the very bare essentials being provided, so that the decision as to what measures should be taken to protect these lines and the apparatus connected to them against atmospheric effects therefore becomes of great importance. The problem is one of economics and can only be solved by a very careful analysis of the capital damage resulting from atmospheric disturbance to existing stations.

Happily the need for this data has come at a time when great advances have been made in our knowledge of atmospheric phenomena and the surges they produce. Largely due to the inventive genius of Du Four, it is now possible to substantiate the theories based upon past experience by actual test results taken in storm areas, so that the subject takes for the first time the nature of a concrete and exact science. It is now possible to design a distribution system and protect it so that it is definitely immune from atmospheric effects of a dangerous magnitude, a claim which certainly could not be justified a few years ago.

A resumé of the work done in the past, and a consideration of the origin, nature, magnitude and frequency of the voltage surges produced by atmospheric effects is necessary before the subject can be got in proper focus and preventive measures decided upon, if necessary.

Origin of Surges.—Electrical systems possess the characteristics of inertia, with the result that a change in the magnetic or electric field from one condition to another requires a definite period of transition while the system acquires or dissipates the energy of momentum. Whenever the amount of energy injected into or withdrawn from a system changes, therefore, a surge is produced, the magnitude of which bears a relation to the change in conditions and characteristics of the circuit. In practice, under normal conditions, the load upon a supply network is continually fluctuating throughout the day, and the system is continually subject to surges. These surges are of a transient character, and continue to flow until they are finally absorbed by the impedance effects of the network. In general, however, surges created in this way are of insufficient magnitude to cause trouble, and can be safely ignored. The sudden injection into, or release of energy from, a system occasioned by atmospheric or fault conditions gives rise to surges of a very serious nature indeed.

These notes deal with surges created by atmospheric effects only, although those resulting from faults are very similar. Such conditions are characterised by a heaping up of potential at a point in the system which travels along in the form of a pressure surge of steep wave front. The pressure between conductors and any of the conductors and earth is as a result greatly increased, and the potential gradient along the line due to the steep wave front rises from a few volts to possibly several thousand volts per yard run. The increase in potential tends to spill over and stress the supporting insulators or dielectric above normal, and the high voltage gradient along the line tends to overstress the intervening dielectric at points of the conductor in close proximity to one another, such as in transformer and machine windings.

Production of a Surge by Atmospheric Effects.—The production of surges by atmospheric effects can be generally explained as follows: If a cloud becomes electrically charged, there is a difference of potential between the cloud and the earth immediately beneath it. Intermediate objects which lie in the static field between the earth and the cloud receive a charge, according to their nearness to the earth and the cloud. An overhead line passing through the static field produced by an electrically-charged cloud will itself become charged in that local area. No strain will exist between the overhead line and the cloud or earth, however, all the time the charge is bound to the cloud. Directly the cloud discharges to earth the static field disappears, leaving a portion of the overhead line in that locality very highly charged. The conductor on both sides of the affected area, being uncharged, is at a lower potential, with the result that a current flows and a surge is set up travelling outwards in both directions from the disturbing centre.

The Nature of Surges.—A knowledge of the nature of the surge, its speed of travel, wave shape and magnitude is obviously necessary before preventive means can be devised. Overhead-line systems possess resistance, inductance and capacity, and therefore form a damped oscillatory circuit, the velocity of surges or travelling waves being given by $v = 1/\sqrt{LC}$ (1), where v = velocity wave in miles/sec., L = inductance in henries/mile, and C = capacity in farads/mile.

By the substitution of average values of inductance and capacity of various pieces of apparatus in the formula given in equation (1), the velocity of travel of waves through various circuits has been calculated and is given in the following table:

VELOCITY OF TRAVEL OF SURGES.

Circuit.	Velocity in Miles per Second.
Overhead lines	186,000
Cables	80,000
Generators	40,000
Transformers	40,000

It can be seen that for overhead lines the velocity of travel approaches that of light, whereas for machines and transformers where the inductances and capacities are much higher the velocity is considerably reduced. The magnitude of the voltage that can be induced upon a given overhead line is limited by the value required to spill over the supporting insulators. By this is meant the impulse spill over-value, not the sustained

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value, which is very much less than the impulse spill over-value, in fact, as a general rule, it will be found that the ratio of impulse spill over-voltage/sustained spill over-voltage = 2 (2).

The current that this voltage produces flows through inductances of the line and into the capacity to earth, and is limited by the distributed inductance and capacity per unit length of circuit. From a number of calculations it has been ascertained that the combined inductance and capacity of overhead-line systems known as the surge impedance falls between the limits of 300-600 ohms. Assuming a value of 400 ohms for surge impedance, a reasonable figure to take, a surge current of 2½ A will flow for every 1,000 V of surge pressure.

Summarising the results obtained immediately above it can be seen that :—

(1) The velocity of the travelling waves or surges will be of the order of 40,000 to 180,000 miles per second.

(2) The maximum voltage surge possible upon an overhead-line system is limited by the impulse flash or spill over-value of the supporting insulators.

(3) The current created by this voltage surge depends upon the surge impedance of the system, which is generally of the order of 400 ohms.

(4) If this figure is adopted the maximum surge current possible is limited to 2½ A for every 1,000 V of surge pressure.

So far the magnitude of the voltage and current surge to be dealt with has been arrived at by theoretical means,

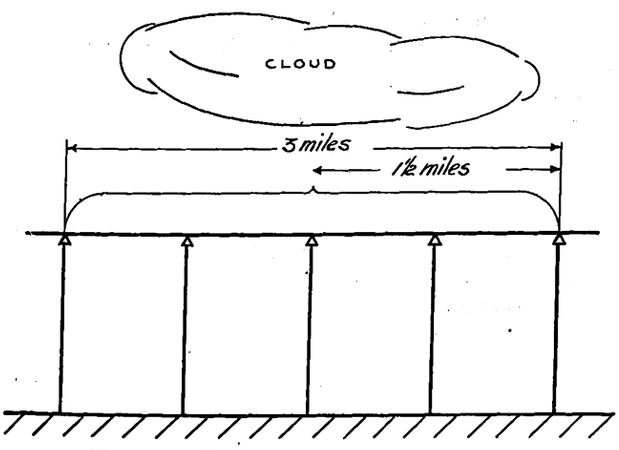

Fig. 1.—Surge Wave in Storm Area.

and its velocity of travel determined. The enormous velocity of the travelling waves will immediately suggest that whatever preventive device is used will have to operate very rapidly, and directs attention to the actual period of time within which the device must function. Theoretically, an idea of the time available can be obtained by considering the area usually affected by storms. Observations indicate that storm areas very rarely exceed 2—3 miles in extent and if it be assumed that the surge wave has its peak in the middle of the affected area, as shown in fig. 1, it must fall from maximum to zero over a distance of about 1½ miles, and as its velocity is of the order of at least 50,000 miles a second it will reach its maximum and pass any given point in an overhead line in about 1.5 micro seconds. From theoretical considerations, therefore, it would appear that any preventive device employed would have to be capable of absorbing or shunting sufficient of the surge current to earth in about 1.5 micro-seconds, so as to leave the remainder a harmless quantity.

It is important to note the behaviour of these travelling waves as they pass through circuits of different characteristics. Whenever the surge impedance increases, it tends to obstruct the passage of the travelling wave, causing it to build up and be reflected back on to parts of the circuit of lower impedance.

Where the surge impedance suddenly becomes very high, such as at the open end of a line, the pressure wave is doubled by this process and reflected back on to the system. If, on the other hand, the surge impedance suddenly becomes zero, as in the case of a short-circuit to earth on the system, the initial surge pressure is reduced to zero at this point, but is replaced by a negative wave of equal magnitude which is reflected back on to the system. The ideal case for a preventive device is, therefore, to possess a low impedance to reduce the pressure wave at that point to a small value and large energy absorbing properties, so that very little energy remains to be reflected back on to the system. Before considering the practical application of the theoretical considerations made above, it is of great interest to review the results of actual observations made in storm areas.

Actual Investigations into the nature of Surges.—It has been possible by means of the cathode-ray oscillograph invented by Du Four to actually record transients which occur upon overhead-line systems as a result of atmospheric disturbances. Although much work remains to be done in this direction, it is interesting to compare the results of actual observations that have been made with the theoretical considerations enunciated above. The practical results obtained may be summarised as follows :—

(1) The travelling waves observed took at least 3 micro-seconds to reach their peak value and pass a given point in the overhead-line system, except in cases of insulator flash-overs, in which the time was much shorter.

(2) High-voltage surges of steep wave front are very quickly damped as they travel along the line, partly by corona losses.

(3) Medium-voltage surges, particularly those below the corona limit, may travel a considerable distance without material change in characteristic, and are the most frequent and dangerous to contend with.

(4) From the overhead lines under observation, it was found that disturbances of sufficient magnitude to be dangerous to the insulation of apparatus were comparatively rare.

The Protection of Overhead-line Systems.—From the investigations made it is now possible to decide in a broad sense upon the measures to be taken to protect overhead-line systems. The magnitude of the charge induced upon the line by atmospheric effects depends upon its position in the static field. The height of overhead lines above the ground does not vary greatly, therefore they can be said to have a definite and constant position in the static field, whatever the system voltage may be. The higher the system voltage, the lower the ratio of maximum induced voltage to line voltage becomes, making the effect of atmospheric disturbances much more serious upon low-voltage lines than upon very-high-voltage lines; *e.g.*, a surge pressure of 200 kV would have very little effect upon a 200-kV system, but would be extremely damaging upon a 33-kV system.

Upon overhead-line systems above 66-kV operating in this country, it is found that the factor of safety of the line insulators, together with the damping effect of the long lines, is sufficient to withstand any likely atmospheric effect without damage. The usual earth wire should, of course, be included, and a double earth wire is an advantage for 66-kV lines. It is for systems operating at pressures below 66-kV that special consideration has to be given to the question of atmospheric disturbances. In this country there are several overhead lines operating at pressures below 66-kV upon which no special precaution is taken to guard against atmospheric effects, and it has not been found necessary to provide any protective devices or increase the factor of safety of the apparatus used at all. On the other hand, there are instances in this country and upon the Continent where dangerous surges have been of frequent occurrence, demanding the use of special protective devices and increased factors of safety. Such effects have, however, been mainly of internal origin, or else

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they have appeared upon lines passing through areas which are subject to heavy storms.

The lightning arrestors available for use upon such systems can be usefully divided into two classes :—

(1) Those that protect against excess pressures between lines and to ground only.

(2) Those that protect against excess pressure and also smooth out the wave shape of surges of comparatively small pressure.

Those in the first class invariably comprise a horn gap with some form of impedance in series to limit the flow of dynamic current when they operate, and can be obtained at very little cost. The second type consists of either a condenser or inductive device permanently connected in circuit, and is very expensive to instal when compared with the cost of a simple overhead-line circuit. The information actually obtained in storm areas confirms the opinion of several authorities and clearly indicates that it is the pressure waves of comparatively small magnitude, but of steep wave front and high frequency, that are most common and destructive, and the second class of arrestor is the only one which can deal with such surges at all sufficiently.

The commercial cost of lightning arrestors of the type capable of smoothing out the shape of a high-frequency surge with a magnitude no more than normal voltage, definitely prevents them being used on small lines where economy is essential. The result of experience and information obtained in the past indicates the following :—

(*a*) Protection against excess pressure between conductors and between any conductor and earth is best obtained by the use of arrestors.

(*b*) Protection against surges of comparatively small magnitude, but steep wave front, is best obtained by increasing the factor of safety of the apparatus installed on the system.

(1) Where overhead lines pass through a district which is not subject to heavy storms, and where the line itself is not in a position to receive directly the operating shocks of the whole system, no precaution against surges is necessary.

(2) When, however, the line is short and liable to receive the switching shocks directly of the whole system, giving rise to excess pressures of a dangerous magnitude, especially at the " dead " end, arrestors should be used.

(3) For lines passing through bad storm areas and of reasonable length that are likely to be subject to surges of steep wave front, but of inconsiderable magnitude, the factor of safety of the apparatus installed should be increased and no arrestors need be used.

The accumulation of experience upon the Continent and in this country has enabled a simple rule to be formed, so that machines and transformers for direct connection to overhead-line systems coming within the scope of grade (3) may be provided with a suitable factor of safety; this is obtained by designing them to meet a test pressure of

$$2E + 10 \text{ kV} \qquad (3)$$

where E is the working voltage per kV.

The result of years of experience upon hundreds of miles of overhead lines clearly indicates that the procedure of increasing the factor of safety of machines and transformers connected directly to overhead lines is, generally speaking, from an economical and technical point of view, better than the provision of lightning arrestor gear.

Hundreds of units have been designed to meet equation (3), and have been in operation upon overhead-line systems operating at pressures from 2,000 to 66,000 volts, and have given every satisfaction without the use of lightning protection.

The Central Electricity Board.

Extracts from the First Annual Report Covering a period of Twenty Months.

THE Central Electricity Board has made its first report* to the Minister of Transport. It covers the period from the appointment of the Board in March, 1927, to December 31st, 1929, and it summarises the circumstances which led up to the passing of the Electricity (Supply) Act, 1926, and the objects for which the Board was constituted. The eight members were appointed for periods varying between five and ten years, and all are still in office. The Board has a regular monthly meeting and, in addition, meets from time to time as occasion requires, and when considering the adoption of a scheme received from the Electricity Commissioners sits in constant session for considerable periods. The Board appointed committees of its members to authorise the acquisi-

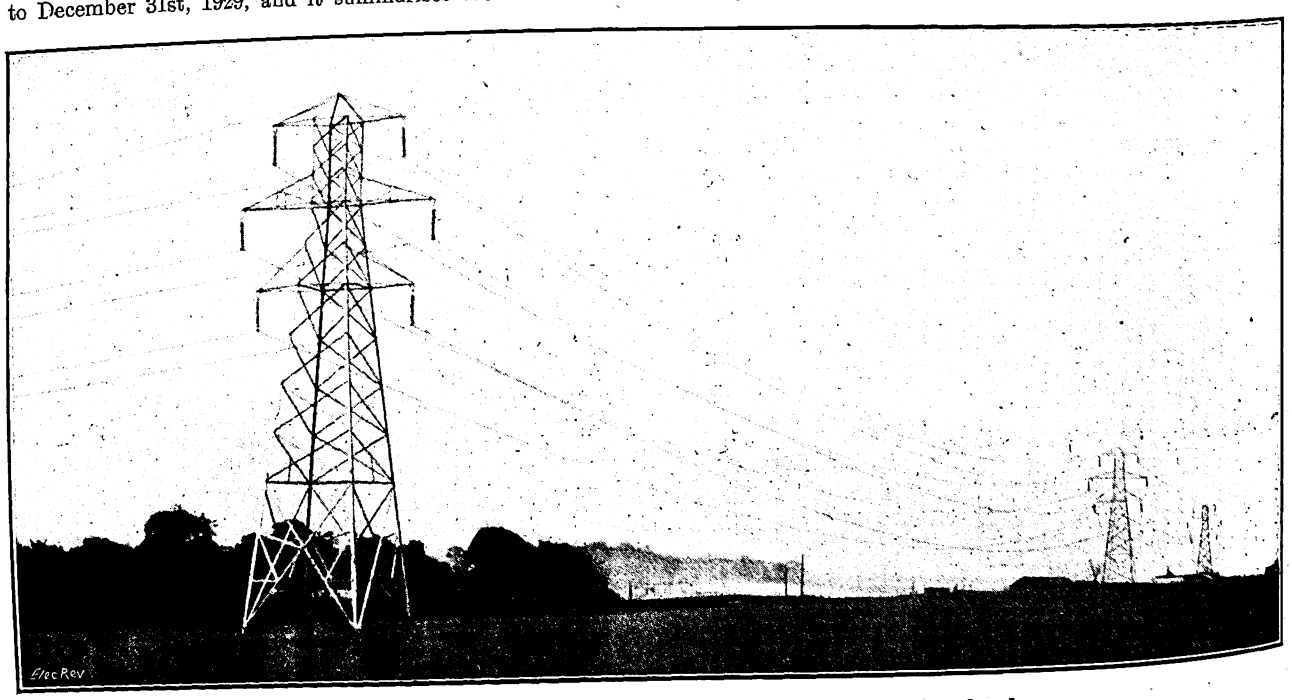

Fig. 1.—Double-circuit Primary " Grid " Line in Scotland.

* Publishers: Messrs. Whitehead Morris, Ltd., Tudor House, Holland Street, London, S.E.1. Price 3s., post free.

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tion of land required for sub-station sites and other purposes, and to deal with all questions in relation to the obtaining of wayleaves not coming within certain guiding principles which the Board laid down; the committees meet at short notice to deal with cases as they arise.

The procedure laid down by the Act for the preparation of schemes and the methods adopted by the Board in considering and adopting schemes are outlined. Up to December 31st, 1928, the Board had considered five schemes, and adopted four; the salient facts relating to them are outlined in Table I.

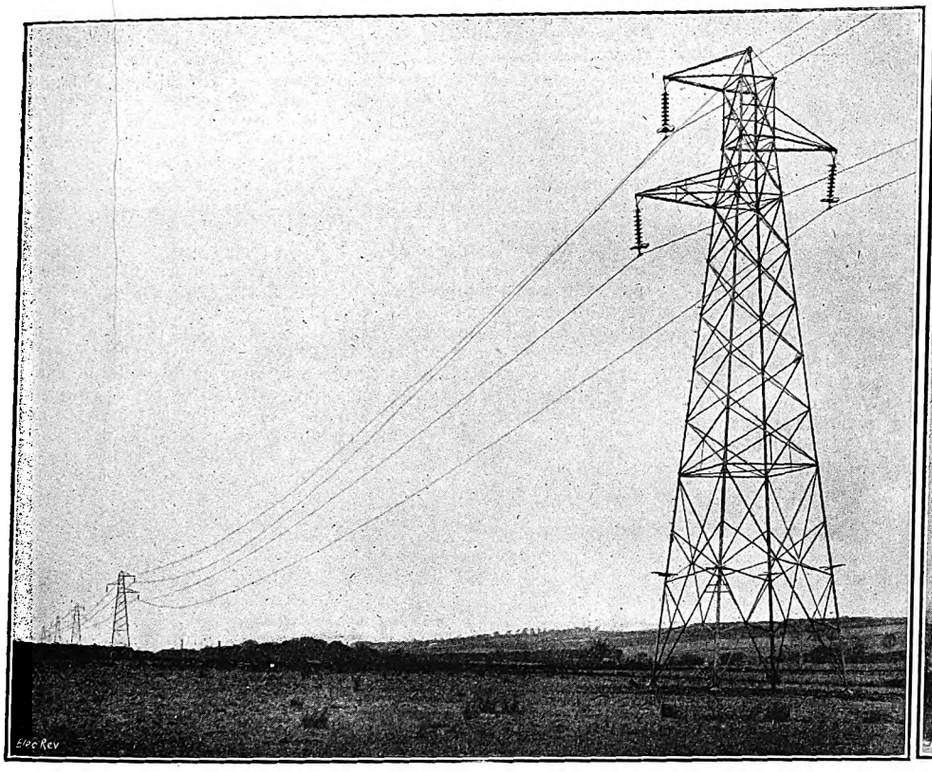

Fig. 2.—First Line in Scotland to be Commissioned at 132-kV, erected by B.I. Cables, Ltd.

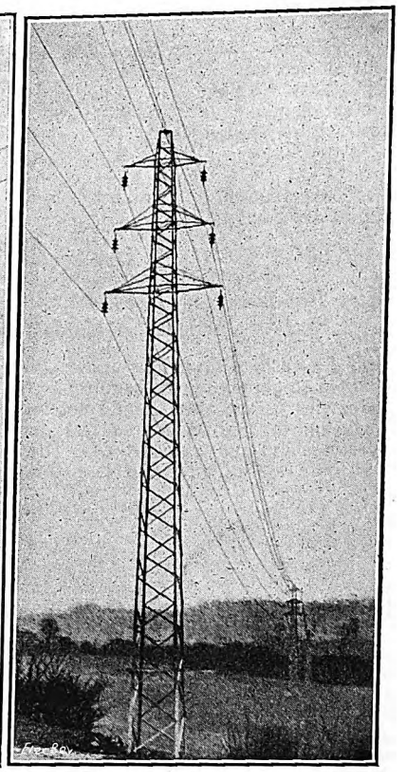

Fig. 3.—Secondary Transmission Line.

The organisation at headquarters consists of the engineering department, the accountant's department, and the secretariat, including the solicitor's branch. The engineering department is sub-divided into the construction, the operating, the research, and the supply sections. Each district engineer has also attached to his staff a wayleave staff whose duty it is to obtain all the wayleaves necessary for the erection of the "grid" in his area. All wayleave questions not coming within the principles laid down by the Board are referred from each district to headquarters for decision by the Wayleave Committee, so that wayleaves may be negotiated on the same principles in all the areas. The staff of the Board at December 31st, 1928, consisted of 59 members in London, and a total of 48 in the four district offices.

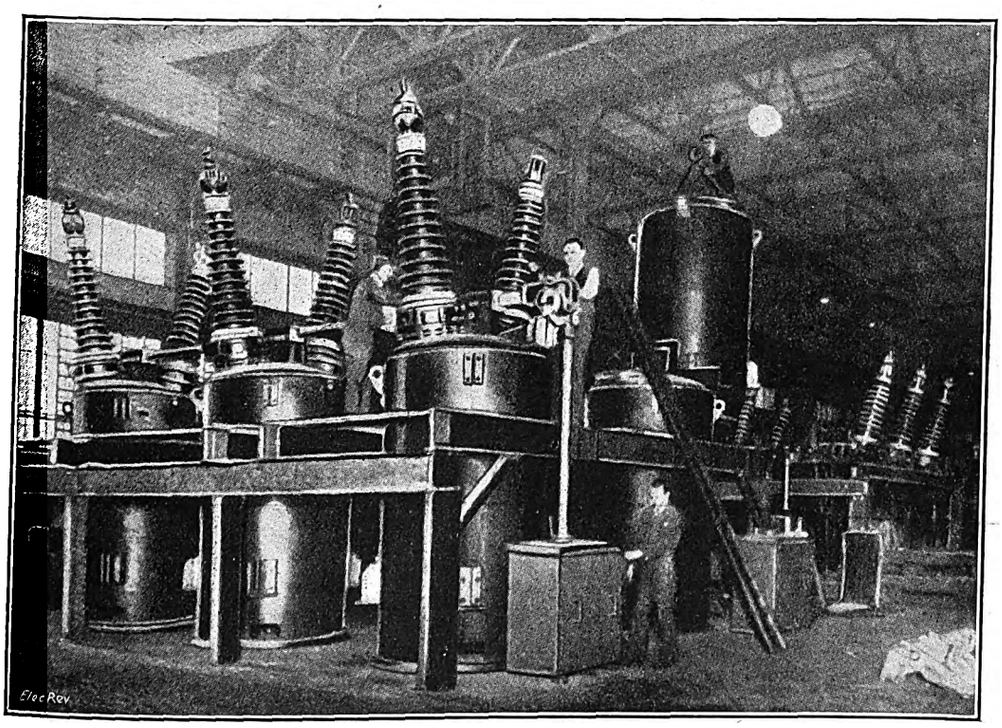

Fig. 4.—"Grid" Circuit Breakers During Assembly in Maker's Works.

Representations were received from the greater number of the undertakers concerned in each area, relative mainly to detail and development at particular stations, rather than to criticism of the general provisions. As a result of them and of conferences and inquiries the schemes as submitted by the Electricity Commissioners were adopted with little modification. In the case of the Central England scheme, both the Birmingham Corporation and the Shropshire, Worcestershire and Staffordshire Electric Power Company questioned whether the anticipated savings under the scheme were sufficient to justify the higher expenditure which they estimated would be necessary to provide for frequency standardisation, although they expressed themselves as ready to co-operate fully with the Board. The estimates adopted by the Electricity Commissioners on the assumption that work would commence in 1928 were that a net expenditure of £2,061,400 would be necessary. The revised estimates on the basis of work commencing in January, 1930, were £4,336,700 gross, which sum includes certain expenditure to be incurred by the undertakers at the time of frequency change, which would in any case have been required by them, but at a somewhat later date; a proportion of this ante-dated expenditure will be recoverable from the undertakers later. After reviewing all the circumstances the Board concluded that, in spite of the heavy increase in the anticipated expenditure on standardisation, it was necessary that this work should not be delayed.

In the case of the North-West England and North Wales scheme, criticism was directed against the rate at which the Commissioners had assumed that the consumption of electricity

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in the area would develop, and there was also some natural anxiety on the part of the important undertakers in South-

TABLE I.—SCHEMES ADOPTED.

Scheme.	Area, Sq. Miles.	Population (1921 Census).	Sale of Electricity 1925-26 Millions of kWh.
Central Scotland	4,980	3,761,200	528
South-East England ...	8,828	11,392,561	1,283
Central England	7,311	5,218,146	715
North-West England and North Wales	9,082	6,980,925	1,214
Total adopted ...	30,201	27,352,832	3,794
†Mid-East England ...	7,455	4,529,880	703
Total	37,656	31,882,712	4,497
Great Britain	88,141	42,769,196	5,606

† Adopted on March 19th, 1929.

East Lancashire that their undertakings, which are so largely devoted to supplying the requirements of the textile and other industries in the area, should not be unduly burdened by the inclusion in the scheme of less densely populated areas of Westmorland and Cumberland. The Board did not feel justified in adopting anything less than the whole of the area contemplated. Future expansion assumes particular importance in this area in view of the fact that the cotton industry and its subsidiaries are largely concentrated within the area of this scheme and are at present in a very depressed condition. After full consideration, the Board came to the conclusion that, with a return to more normal trade conditions, the estimated output might reasonably be reached, although the effect of continued adverse trade conditions might be to postpone the realisation of the estimates to a later date.

The details of the schemes are set out in the report and maps show the area covered by each, the selected stations, the sub-stations, and (diagrammatically) the route of the "grid" lines. There is also included a technical description of the "grid," with diagrams of the towers and layout of the sub-stations, as well as five photographs showing towers actually erected, a tower undergoing a test, and a grid circuit breaker, some of which are reproduced herewith.

The "grid" will consist of some 3,000 miles of 3-phase overhead lines operating at the standard frequency of 50 cycles per second and a pressure of 132,000 volts. This system differs from the systems of the Continent and the U.S.A., which have mainly been developed to *transmit* large blocks of power over long distances from localised water-power or brown-coal areas. In Great Britain, however, the availability of suitable coal over wide areas and without wide variation of price, coupled with the fact that the country has no large water-power resources, calls rather for a system of *interconnection*.

(To be concluded.)

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Marking of Imported Glassware.

Further evidence was heard last week by the Standing Committee under the Merchandise Marks Act, 1926, which is considering an application for an Order-in-Council requiring that certain classes of imported glassware should bear an indication of origin. Mr. E. A. Hailwood (managing director of Hailwood & Ackroyd, Ltd.), spoke in support of the application, stating that buyers were often led into purchasing foreign glass in the belief that it was British. He said that between 75 and 80 per cent. of the illuminating glassware used in this country was imported; his company produced 20 per cent. or more of the British output. Witness considered that the glass could be marked without injuring it in any way and as for the suggestion that it would give the Customs authorities extra work, there were many men who were seeking employment. Another witness said that he had been employed for six years by one of the large manufacturers of electrical apparatus and fittings. Most of the glassware in those fittings was obtained from America and Sweden and the fittings were sold in packages which indicated that the entire contents were British. Similar evidence was given by other witnesses and the inquiry was adjourned until May 13th.

Upon the resumption of the hearing Mr. C. M. MILLS, secretary of the Chloride Electrical Storage Co., Ltd., gave evidence in opposition to the marking of glass containers for accumulators. He said that his company produced about 5,000,000 cells of different sizes per annum. Of these about 66 per cent. were made up in glass boxes or jars; of these, again, about 98 per cent. were in pressed glass boxes. As blown glass was used for the larger types, the actual value of pressed glass was only about 60 per cent. of the total. The company only purchased pressed glass from abroad. The glass represented about 10 per cent. of the cost of a cell. His company knew exactly where its glass came from, and therefore marking was unnecessary so far as it was concerned. The glass was purchased abroad, first because of the difficulty of obtaining suitable material in England, and, secondly, to keep open another channel of supply. At the same time, between 90 or 95 per cent. of the requirements were satisfied by home producers, for the latter had overcome a number of difficulties. It was felt, however, that the stimulus of some rivalry was essential if the British battery industry was to compete with foreign makers. The company was afraid that if the glass container bore an indication of foreign origin the ultimate customer would imagine that the whole of the battery or accumulator had been made abroad. It would be difficult to persuade him that only the container, representing 10 per cent. of the value, was foreign. He maintained that a marking Order would be very detrimental to an important British trade.

In cross-examination, Mr. Mills said that although there was not a great deal of difference between the appearance of British and foreign glass, the trade could distinguish one from the other. Asked if his objection to marking would be met if the words "glass foreign" were used, the witness said that it would be fairer to say that the glass was foreign because there was difficulty in obtaining it from British manufacturers. Later he said that the British battery manufacturers had done their best to encourage British glass makers, and he admitted that the latter had gone a long way to meet requirements. He concluded by saying that if marking were enforced the battery makers might have to consider the elimination of glass in favour of some compound for containers.

Recent Contracts.

Mechanical chain grate stoker equipments for water tube boilers have recently been ordered from Messrs. EDWARD BENNIS & CO., LTD., for the Harrogate Corporation electricity works (per Yarrow & Co., Ltd.) and the India Rubber, Gutta Percha and Telegraph Works Co., Ltd. (per Yarrow & Co.). The latter order covers four forced-draught stokers with coal-handling plant. Mechanical coal- and ash-handling plants are being supplied by the company for the Grimsby Corporation electricity works (per Clarke, Chapman & Co., Ltd.), and the Douglas Corporation electricity works (per Richardsons, Westgarth & Co., Ltd.).

For the signalling of the new terminal station at Auckland, N.Z., the Westinghouse electro-pneumatic system of power operation, together with a.c. track circuits and day colour light signals, has been selected, and the contract has been awarded to the WESTINGHOUSE BRAKE & SAXBY SIGNAL CO., LTD. The plant (including the air compressors) will be supplied from England with the exception of the interlocking frame of 128 levers, which will be built in Melbourne, in the shops of an associated company, McKenzie & Holland (Australia) Pty., Ltd.

The WEST MIDLANDS JOINT ELECTRICITY AUTHORITY has awarded to the MITCHELL CONVEYOR & TRANSPORT CO., LTD., the contract for the building and civil engineering work (excluding steelwork) in connection with the "super power" station to be built at Bedwas, near Ironbridge, Salop. This will be the first section, designed to house two 50,000-kW sets; the ultimate capacity of the station will be 200,000 kW. It is expected that the contractors will complete their portion of the work by the end of next year.

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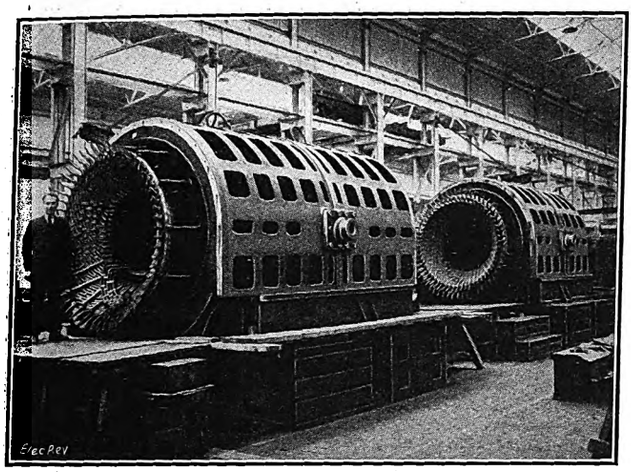
Large "English Electric" Turbo-Alternators.

The accompanying picture provides an interesting indication of present activity in the building of power station units of large size. Both of the alternator stators are for complete 3,000-r.p.m. steam turbine and alternator sets in course of manufacture at the Rugby and Stafford works of the English Electric Co., Ltd. The stator in the foreground is for the 37,500-kVA set which is being constructed for West Ham to the specification of Mr. F. W. Purse, the borough electrical



Two Large "English Electric" Stators.

engineer. The turbine for this set will have a high-pressure cylinder and two low-pressure cylinders exhausting into a single-body "English Electric" condenser, which will be the largest of its type so far produced at Rugby, with a weight of some 100 tons. The second stator is for the 31,250-kVA turbo set under construction for Leicester Corporation, to the specification of the electrical engineer, Mr. J. Mould. An "English Electric" set practically identical with the last-mentioned one was recently ordered by Sheffield Corporation.

Catalogues Wanted.

Messrs. A. J. TARRANT & Co., William Street, Burton Latimer, ask for catalogues of electrical fittings and apparatus.

American Radio-Gramophone Deal Abandoned.

It is reported that the suggested merger of the Radio Corporation of America and the Columbia Graphophone Co. has been abandoned in view of the United States law regarding trusts.

Wages in the Engineering Industry.

At a conference of representatives of trade unions connected with the engineering industry held in London last week, it was decided that an immediate application should be made to the Engineering and Allied Employers' Federation for an early conference to resume consideration of the Unions' application of February 1928, for an increase of 8s. per week for time workers, with a corresponding increase for piece workers.

Central Electricity Board Contracts.

The Central Electricity Board has placed contracts amounting to approximately £300,000 for work in connection with three electricity schemes as follows:—

South-East England Scheme: Secondary transmission lines.—Messrs. Watsham's, Ltd.

Central England Scheme: Secondary transmission lines.—Messrs. Watsham's, Ltd.

North-West England and North Wales Scheme: Secondary transmission lines.—Messrs. Siemens Bros. & Co., Ltd.; Messrs. John Collier & Co., Ltd. Secondary transformers.—English Electric Co., Ltd.

Messrs. SIEMENS BROS. & Co., LTD., inform us that their contract covers approximately 100 miles of double-circuit 33,000-V transmission lines, consisting of steel-cored aluminium conductors carried on fabricated steel towers. The line embraces the districts of Carlisle, Workington, Whitehaven, Egremont and Penrith.

In our advertisement pages to-day the Central Board invites tenders for the supply, delivery and erection of indoor and outdoor switchgear for the North-West England and North Wales Electricity Scheme.

Swedish Installation Material Regulations.

As from January 1st, 1930, all electrical installation equipment used in Sweden must be made in accordance with the standards established by the Swedish Government. After that date only approved material bearing the Government stamp "S" may be used.

Aluminium Prices.

It is stated that, contrary to earlier reports concerning the recent meeting in London of the representatives of the European Aluminium Syndicate of the intention of the Syndicate to raise the price, it was decided to make no change in the price which has remained in force since May, 1928. It was recognised as being advantageous to continue a steady price policy so as to extend the consumption of the metal.

Registered Electrical Contractors.

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Podmore, C. J., Stoke-on-Trent.
Maddocks, E. S., Urmston, nr. Manchester.
Girdler, E., Mitcham, S.W.16.
Shrosbery, Bakewell & Co., Ltd., Colchester.
Bush, E., & Co., Bradford.
Sothers, C. A., Ltd., Birmingham.
Forrest & Webb, Handsworth, Birmingham.
Taylor, P., Taunton.
Burrell, R. C., Harrogate.
Law & Carruthers, Bury.
Troy, F., & Co., Ltd., Hampstead, N.W.3.
Nicholson & Ade, Eastbourne.
York, W. H., Kings Heath, Birmingham.
Collins, C., London, S.W.1.
McMaster, Malcolm, Belfast.
Belshaw & Co., Ltd., London, S.W.1.
Allan Holt Electrical & Sanitary Engineering Co., Belfast.

At the same meeting one application was withdrawn and 10 were declined.

Illumination Design Course.

Although the programme of the 19th Illumination Design Course, which is to be held at the London Lighting Service Bureau from June 10th to 14th, follows the general scheme of its predecessors, it incorporates much that is new. The course will cover a varied and interesting field, and should be considered worth while by all who have to deal with illumination problems. No fee is charged to members of the electrical trade. Inquiries regarding the course should be addressed to the Bureau, 15, Savoy Street, Strand, W.C.2.

Reported Dutch-German Lamp Agreement.

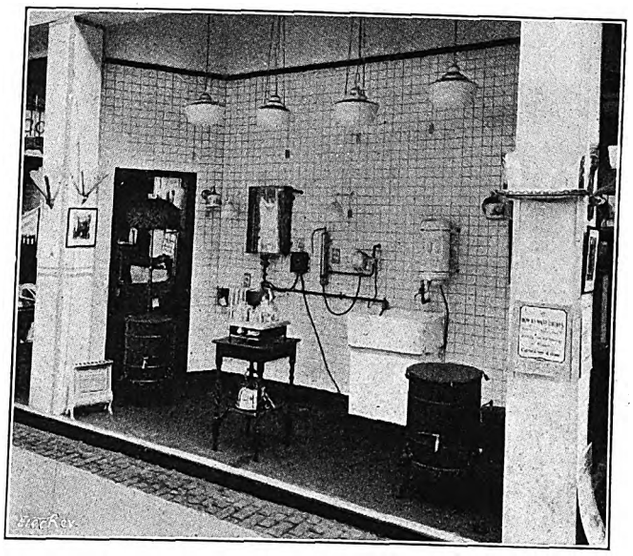
A report is in circulation in Amsterdam financial circles to the effect that the Philips Glow Lamp Company, Eindhoven, has entered into an agreement with the German makers of lamps and radio apparatus under which mutual competition is to be avoided.

The New F.B.I. Headquarters.

The contract has now been signed for the erection of the new building of the Federation of British Industries on a site in Tothill Street, Westminster, upon which work will begin at once. The building will be entirely built by its future owners—in other words, all the firms engaged in the manufacture of materials for the construction of the building are members of the F.B.I., from Messrs. J. Laing, the contractors, down to the firm supplying the smallest article. The building will have a frontage of 90 ft. and a height to the roof of 80 ft.

A "Brighter Homes" Exhibition.

As would be expected from its title, the Brighter Homes Exhibition at the City Hall, Manchester, which concluded yesterday after a fortnight's run, included a great deal of



A Metro-Vick Stand at Manchester.

electrical equipment. Among the exhibitors were the Manchester Corporation Electricity Department, Electrolux, Ltd., the Hurley Machine Co., Frigidaire, Ltd., and Metro-Vick Supplies, Ltd. A part of the stand arranged by the last company is depicted herewith. It displays a number of kitchen and bathroom appliances arranged in a very effective manner. The company also exhibited many examples of lighting fittings, radio apparatus, and domestic equipment, and gave daily demonstrations of electric cooking and other operations.

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New Catalogues and Lists.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A priced and illustrated catalogue of "Magnet" lampholders.

CARRINGTON MANUFACTURING CO., LTD., "Camco" Works, Sanderstead Road, South Croydon.—A booklet containing illustrations, particulars and prices of "Camco" cabinets for wireless sets.

THE ELECTRIC HEATING CO., George Street, Croydon.—Two illustrated leaflets advertising the "Elect" boiling ring and the standard "Junior" iron.

MAWDSLEY'S, LTD., Dursley, Glos.—An illustrated blotter and folder dealing with squirrel cage motors.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—List No. 201, containing illustrations and prices of electric fans of various designs.

THE ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107, 109 and 111, New Oxford Street, W.C.1.—A brochure describing very fully "Devoorde" patent electric scaling equipments. Illustrated.

AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Strowger Works, Liverpool.—A well-produced pamphlet describing and illustrating the A.T.M. Doignon Baudot multiplex apparatus.

KORTING & MATHIESEN ELECTRICAL, LTD., 711 & 715, Fulham Road, S.W.—A copy of the company's house journal, "The Kandem Quarterly Review," dated April, 1929, describing with illustrations, "Kandem" lighting fittings for commercial, industrial and street lighting.

LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Playhouse Yard, Golden Lane, E.C.—A leaflet advertising "Lewcos" wires and cables.

MR. M. BOBIN, 15, Farringdon Avenue, E.C.—Two illustrated and priced pamphlets dealing with "Embob" electric irons, one of which is fitted with a special heat-regulating safety device.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A well-produced brochure, describing with illustrations the company's marine control gear, and showing examples installed in various ships.

ELECTRIC ART SHADES (1928), LTD., Feering Factory, Kelvedon, Essex.—Price list of lampshades in imitation vellum.

MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—An illustrated leaflet describing two types of gate end switches. Priced.

HIGGS MOTORS, Witton, Birmingham.—A leaflet, describing with illustrations, the company's repulsion induction motors.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W. May stock list of motors, dynamos, transformers, &c. Also a "General Booklet" dealing with the company's works and manufactures.

GENT & CO., LTD., Faraday Works, Leicester.—Sheet No. 42F, showing weatherproof, watertight, &c., bells, Morse keys, telephones, and other specialities for mines.

A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.—A stock list of motors of all types and voltages. Priced.

ANGELO BROS. (ENGLAND), LTD., 45, St. Mary Axe, E.C.—Two booklets on shellac, one dealing with the company's products and other with the physical and chemical examination of shellac.

THE MORSE CHAIN CO., LTD., Letchworth, Herts.—A well-illustrated brochure dealing with Morse silent chain drives in the textile industry, and for small power drives.

HENRY WIGGIN & CO., LTD., Wiggin Street, Birmingham.—A descriptive pamphlet giving details of the properties of "Brightray," "Glowray," and "Ferry" resistance alloys.

Sussex Electrical Contractors' Dinner.

The annual dinner of the Sussex branch of the Electrical Contractors' Association was held at the Old Ship Hotel, Brighton, on May 8th. Mr. H. L. Holford (chairman) presided, and the guests included the Mayor of Brighton (Ald. H. J. Galliers, J.P.), the Mayor and Mayoress of Hove, Mr. W. H. Walton (president of the E.C.A.), Mr. J. Christie, the Brighton electrical engineer, and Mr. C. B. Smith, the Hove electrical engineer. Among the toasts was "The Electrical Contractors' Association," proposed by Councillor Chatfield (Eastbourne), and responded to by Mr. Walton, who said that the Government was providing a transmission "grid" and a load had to be found for it, which meant more installation work for many years to come. Mr. L. C. Penwill (secretary of the E.C.A.) proposed the health of "The Sussex Electrical Engineers," and Mr. J. Christie replied.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during March last amounted to £78,968, bringing up the total for the first three months of the year to £150,658, as compared with £119,247 in the corresponding period of 1928.

New French Companies.

Among the concerns recently formed in France are the Société de l'Energie et Lumière, Rouen, capital 105,000 fr.; La Société Télémécanique Electrique, Nanterre, 20,000,000 fr.; La Société l'Union Electrique Coloniale, Paris (48, Rue de Bienfaisance), 100,000 fr.; and La Société des Transformateurs Sol, Paris (116, Rue de Turenne), 117,000 fr.

Bankruptcy Proceedings.

L. J. SMITH, 16, George Street, Berkhampstead, electrical, radio, and cycle engineer. The receiving order herein was made on April 2nd, on the debtor's own petition. The first meeting of creditors was held recently at 37, Cornmarket Street, Oxford. The following are creditors:—

	£		£
Shell-Mex, Ltd. ...	... 83	Giffin, R. A. ...	... 26
Michelin Tyre Co. ...	... 21	Kolster-Brandes, Ltd.	... 31
Arneways Trust ...	... 41	Smith, Gladys ...	... 77

R. BENNETT, wireless dealer, lately carrying on business at 107, Devons Road, Bow, E.—The first meeting of creditors was held on May 6th, at the London Bankruptcy Court. The receiving order was made on April 23rd, upon the petition of Brahams (Houndsditch), Ltd., the act of bankruptcy alleged being non-compliance with the requirements of a bankruptcy notice. It appeared that the debtor had not yet attended under the proceedings, and nothing was known regarding liabilities or assets. The proofs of debt had been lodged, and the case was left in the hands of the Official Receiver to be wound up in the usual manner.

J. G. RITCHIE, 54, Woodsley Road, Leeds, electric lamp dealer.—The adjourned public examination herein was held recently at the County Court House, Leeds. The statement of affairs previously produced showed a deficiency of £81, and the debtor attributed his failure to the cost of an action against him for an injunction with reference to an alleged infringement of patent rights. The Registrar ordered the debtor to file papers referring to the matter by a certain date, and adjourned the examination.

J. STIRZAKER, electrical engineer, Wen Roe, Llanfairfechan.—Receiving order made May 1st, on debtor's own petition.

J. H. MCBEAN, electrical engineer, 29, Bradford Road, Batley Carr.—Receiving order made May 3rd, on debtor's own petition.

E. R. MILLWARD (West of England Radio), wireless engineer), 67, High Street, Barnstaple.—First meeting held May 14th, at the Official Receiver's offices, Exeter Bank Chambers, Broadgate, Exeter; public examination, June 4th, at the Guildhall, Barnstaple.

W. R. J. WHITE, electrical agent, Golden House, 29, Great Pulteney Street, W.—Last day for proofs for dividend, May 28th. Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C.

E. TEMPLE (separate estate) (Westoe Electrical Co.), electrical contractor and wireless dealer, 105, Canterbury Street, South Shields.—Last day for proofs for dividend, May 22nd. Trustee, Mr. A. J. Gray, 48, Pilgrim Street, Newcastle-on-Tyne.

H. PEVVER, electrical apparatus and tool merchant, Market Lane, Newcastle-on-Tyne.—Receiving order made May 6th on debtor's own petition.

E. E. HARRISON, electrician, 27, School Lane, Heaton Chapel.—Receiving order made May 8th, on debtor's own petition.

H. SAVORY, electrical engineer, 7a, Hill Street, Shaw, Lancaster.—Last day for proofs for dividend, May 25th. Trustee, Mr. J. D. Turner, Official Receiver, Byrom Street, Manchester.

Company Liquidations.

EARLSDON RADIO SUPPLIES, LTD.—A petition for the winding up of this company has been presented to the County Court of Nottinghamshire, held at Nottingham, by Burgoyne Wireless, Ltd., of 34a, York Road, King's Cross, N., creditors, and will be heard at Nottingham on June 20th.

YOUNG ACCUMULATOR CO., LTD.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. E. J. Bettson, 274, Gresham House, E.C. Meeting of creditors at the liquidator's offices, May 21st. Particulars of claims by June 14th. (This notice is purely formal; all creditors have been or will be paid in full.)

Private Arrangements.

HERBERT LYONS, trading as J. Lyons, electrical and wireless engineer, 300, Willesden Lane, N.W.2.—In response to a circular letter issued by Messrs. Phillip L. Causley & Co., 70, Hatchard Road, N., a meeting of creditors was held on May 6th in London. The statement of affairs as at April 30th last showed liabilities of £577, and assets of £246, leaving a deficiency of £331. It was stated that the debtor was previously in a partnership, and then started trading on his own account. There were various contracts and other work, and it was thought that the business could be carried on successfully in the future. On May 2nd last, a company, called J. Lyons, Ltd., was formed to take over the assets as a going concern. Certain of the cash creditors were taking shares in the company, which was willing to make arrangements to pay the other creditors in full. The debtor was being allotted fully-paid shares in the company, and the company offered deferred notes to the creditors which would be redeemable over 12 months, with a reasonable rate of interest. A resolution was passed in favour of the matter being dealt with in bankruptcy. The following are creditors:—

	£		£
Tungstalite, Ltd. ...	... 102	Young & Wildsmith ...	39
Supra Electrical Co. ...	39		

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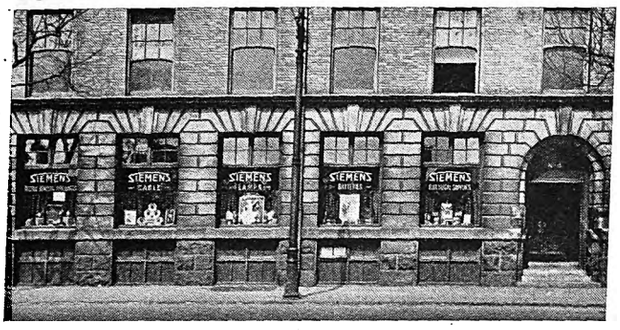
Unemployment.

The Ministry of Labour returns showed an increase of 23,078 in the number of registered unemployed during the week ended April 29th. The total at that date was 1,163,800, as compared with 1,140,722 on April 22nd, and 1,136,003 on April 30th, 1928.

A New Siemens Branch.

In order to cope with increasing business, SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., has opened new branch premises at 4, Castle Boulevard, Nottingham (telephone: Nottingham 3110). The new premises, which are illustrated herewith, will embody a trade counter, showroom facilities, and stores in



New Siemens Branch at Nottingham.

the same building. Adequate stocks will be carried of lamps, fittings, accessories, "Xcel" domestic appliances, 'Zed" fuse material, v.i.r. wires and cables, h.t. batteries, dry cells, telephones, and B.R.V.M.A. radio valves.

Book Notices.

Publication of the Bureau of Information on Nickel, Ltd.: "Nickel Cast-iron," by Prof. D. Hanson, D.Sc.—This paper formed the subject of a lecture to the Institute of British Foundrymen in November last; it describes the technical basis of the applications of nickel in cast-iron, as developed from the research work carried out at Birmingham University.

"Steam Turbines," by T. M. Taylor. Pp. viii+207; figs. 171. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

"Engineering Economics," by T. H. Burnham. Pp. viii+326; figs. 11. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

Lighting on the Mumbles Railway.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., informs us that all the new cars on the recently-electrified Swansea and Mumbles Railway are lighted by means of "Silvalux" gas-filled opal traction lamps.

Trade Announcements.

Messrs. MAYALL & CO., LTD., Birmingham, have opened a branch stores at 5a, Beast Fair, Pontefract.

The HOLLAND HOUSE ELECTRICAL CO., LTD., has removed from 247a to 217, St. Vincent Street, Glasgow, with stores at 128, St. Vincent Lane. The telephone number (Central 7048) is unaltered.

New offices at St. Neots have been opened by the BEDFORDSHIRE, CAMBRIDGESHIRE AND HUNTINGDONSHIRE ELECTRICITY CO.

The address of RADIO INTELLIGENCE, LTD., is now Marconi House, Strand, W.C.2.

Mr. L. VANDERVELDE has removed to larger premises at 35, Minories, E.C.3. (Telephone: Royal 1261; telegrams: "Splittings, Ald, London.")

For Sale.

The Cheadle and Gatley Urban District Council has for sale a quantity of demand indicators. The East Suffolk Electricity Distribution Co., Ltd., has for disposal one 16-kW and one 24-kW generator, meters, motor booster and battery. (See our advertisement pages to-day.)

Local Exhibition.

HOVE.—On May 8th the Mayoress opened an electrical exhibition at the Hove Street showrooms organised jointly by the Hove Electricity Department and local registered contractors. During the exhibition, which ran for a week, daily demonstrations of electric cooking, washing, &c., were given.

An E.D.A. Lecture.

On May 8th, at the Midland Hotel, Manchester, Mr. C. H. Rayner, sales manager, Manchester Corporation Electricity Department, delivered a lecture to the Manchester branch of the Incorporated Sales Managers' Association. This was a repetition of a lecture drawn up in pamphlet form by the British Electrical Development Association. An interesting discussion followed. Several speakers touched upon the all-absorbing topic of price, and the lecturer appealed to his audience not to believe that the "halfpenny unit" was almost within reach throughout the entire kingdom. The Battersea and Barton stations came in for severe criticism on the subject of fumes, but Mr. Rayner appeared to convert many of his hearers to the belief that the domestic chimney was the chief malefactor in creating the smoke pall which hangs over most of our large cities and towns. Mr. Blany, a visitor from New Zealand, and Mr. J. W. Price, chairman of the meeting, contributed to the discussion.

Showroom Site Dispute at Leicester.

At a recent meeting of the Leicester City Council the Electricity Committee put forward a proposal to purchase a site for offices and showrooms at a cost of £28,500. Objections were made that the proposed expenditure was too great and an amendment was moved and carried calling upon the Committee to choose a site already owned by the Corporation.

Our Foreign Electrical Trade.

The following table shows the values of exports and imports of electrical goods and machinery during April, 1929:—

	£	£	£
Exports—			
Electrical goods and apparatus	1,163,890	+235,658	− 14,573
Machinery	4,150,722	+ 7,369	−342,949
(Inc. electrical machinery)	510,344	+ 9,085	− 65,144
Imports—			
Electrical goods and apparatus	397,260	+ 91,573	+220,740
Machinery	1,573,955	+109,500	+324,191
(Inc. electrical machinery)	145,977	− 2,348	− 21,355
Ré-exports—			
Electrical goods and apparatus	14,226	+ 1,768	− 1,383
Machinery	127,271	− 11,843	− 6,747
(Inc. electrical machinery)	11,845	− 2,531	− 8,819

"Hoover" Window Displays.

In a window display competition recently arranged by Hoover, Ltd., the first prize was awarded to Messrs. Edward Dewhurst, Ltd., Preston, the second to Messrs. Lambert Brien and Co., Ltd., Dublin, and the third to Messrs. Parker, Winder and Achurch, Ltd., Birmingham.

Sir Hugo Hirst on Australia.

A further review of Australian conditions and the work of the British Economic Mission was made by Sir Hugo Hirst, Bt., at a British Engineers' Association luncheon last week. He said that the Commonwealth had a national debt of about £1,100 millions, more than half of which was due to Australians themselves. About 75 per cent. of the debt was reproductive and it was ridiculous to doubt the financial stability of the Commonwealth. One matter which needed attention was the lack of knowledge of British industry in Australia, as compared with what was known regarding American industry. It was our duty to see that our scientists and engineers studied Australian conditions and co-operated with Australians. So far as the electrical market was concerned Canada had been lost to the United States, but Australia desired to purchase British goods. A great deal of trade was, however, going to America which should be in British hands and it should be our aim to divert it.

Electrical Education.

The British Electrical Development Association has sent us a reprint of a report by Major E. A. Barker, borough electrical engineer of Barnsley, on the use of electricity in school domestic centres. This matter was referred to in our issue of March 29th (p. 587) when we reproduced the bulk of the report and some of the illustrations.

Departmental Opinions on the Liberal Report.

A White Paper has been issued in which the development proposals put forward by the Liberal Party are considered in detail by the Ministers in charge of the Departments concerned with the various branches. Dealing with the subject of electrical development, Col. Wilfrid Ashley, Minister of Transport, points out that the principal difficulty in speeding up expenditure upon the distribution system is to give undertakers confidence that they will receive a reasonable return upon their investment in a short time. He considers that the Liberal report deals very vaguely with the means by which this is to be achieved. After stating that too rapid extension of distribution might lead to the further development of generation on the wrong lines, Col. Ashley says that the Electricity Act of 1926 adopted the logical sequence of development. That Act provides for a proper main distribution system to enable generation to be conducted in the most efficient way, and then an increase (on the present normal though marked annual expansion) of the distribution systems to dispose of the energy so produced. The Liberals' telephone proposals are dealt with by the Postmaster-General (Sir W. Mitchell-Thomson). In his opinion the finance of the scheme is radically unsound. There is no reason to believe that within the next two or three years such large numbers of people as is suggested will be found willing to rent telephones except at rates below cost. Already about a million pounds a month is being spent on new capital works. If

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considerably more was expended either the new plant would remain idle or its use would have to be offered to subscribers at rates which would not cover the cost. "In either case the telephone service would have to be subsidised by the taxpayer and the excess capital, however it was raised, would in effect be withdrawn from other industries where it might be more usefully employed."

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price May 14th.	Fortnight's inc or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	"	£52	...
a	Bisulphide of Carbon	"	...	...
a	Borax	"	£25	...
a	Copper Sulphate	"	£25 10s.	...
a	Potash, Chlorate	per lb.	8½d. to 4d.	...
a	" Perchlorate	"	5½d.	...
a	Shellac	per cwt.	£18 10s.	...
a	Sulphur, Commercial	"	£11	...
a	" Roll	"	£11	...
a	Soda, Chlorate	per lb.	8d.	...
a	" Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	8½d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£95 to £100	...
b	" Wire	per lb.	1/1 to 1/9	...
b	" Sheet	"	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£182	...
	Grade II	" "	£128	...
	Grade III	" "	£71	...
c	Brass (rolled metal 2" to 12" basis)	per lb.	10⅞d.	...
c	" Tubes (solid drawn)	"	1/1 to 1/1½ d.	...
c	" Wire, basis	"	11⅛	...
c	Copper Tubes (solid drawn) ...	"	1/3¼	...
c	" Bars (best selected) ...	per ton.	£112	...
c	" Sheet	"	£112	...
c	" Rod	"	£112	...
d	" (Electrolytic) Bars ...	"	£84	...
d	" " Sheets ...	"	£148 10s.	...
d	" " Wire Rods	"	£94	...
d	" " H.C. Wire	per lb.	11⅝	...
d	" "	"	2/8 to 2/6	...
f	Ebonite Rod	"	2/8 to 2/6	...
f	" Sheet	"	2/2	...
n	German Silver Wire	"	nom.	...
h	Gutta-percha, fine	"	11½d.	1¾d. inc.
h	India-rubber, Para fine	"	68/6	...
l	Iron Pig (Cleveland No. 3.) ...	per ton.	£21	...
l	" Wire, galv. No. 8, P.O. qual.	"	£25 5s.	15s. dec.
g	Lead, English pig	per bot.	£22 2s 6d. to	...
g	Mercury		£22 5s.	...
e	Mica (in original cases) small ...	per lb.	8d. to 8/-	...
e	" " medium	"	4/- to 8/-	...
e	" " large ...	"	10/- to 20/- & up	...
e	" "	"	1/3½	...
p	Phosphor Bronze, plane castings	"	1/5	½d. dec.
p	" " drawn bars & rods	"	1/3¾	½d. dec.
p	" " rolled strip & sheet	"	1/6¼	1¼d. dec.
p	" " wire...	"	£13 17s. 6d.	...
o	Platinum	per oz.	1/3	...
d	Silicium Bronze Wire	per lb.	7½d.	...
r	Steel, Magnet. in bars	"	£199 5s. to	£1 inc.
n	Tin, Block (English)	per ton.	£199 15s.	
n	" Wire, Nos. 1 to 16	per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on May 11th, Messrs. James Forster & Co. stated that quiet conditions again prevailed in the lead market last week. Prices for forward lead scarcely moved from day to day, but the May position, owing to declarations of American lead, became a trifle easier. Demand, both in this country and on the Continent, shows no signs of reviving, while arrivals are not excessive, but sufficient for requirements. These conditions seem likely to continue, resulting in continued quiet and rather stagnant markets, until some new factor arises to alter the present position of supply and demand.

Lighting and Power Notes.

Aberdeen.—GRAMPIAN BILL OPPOSITION WITHDRAWN.—The Corporation Electricity Committee reports that a sub-committee has adjusted a clause with the promoters of the Grampian Electricity (Supply) Bill, now before Parliament, for the protection of the Corporation, and that, as a result, the Corporation's opposition to the Bill has been withdrawn.

Aldershot.—LOAN.—The Town Council has applied for sanction to a loan of £4,560 for the provision of an additional 1,000-kW set at the electricity works.

Barnstaple.—LOAN.—The Town Council has applied for sanction to a loan of £6,750 in connection with the installation of a 300-kW Diesel generating set.

NEW SHOWROOM.—The Lighting Committee is to prepare a scheme for a showroom for electrical fittings and appliances.

Birmingham.—ELECTRICAL DEVELOPMENT.—In a report to the City Council the Electric Supply Committee has asked for authority to incur an expenditure of £600,000—£300,000 for mains and £300,000 for additions to the sub-station system. The Committee states that the sum of £561,000 sanctioned in December, 1927, to meet extensions to the end of March, 1929, has proved to be sufficient, and the cash balance in hand is required to meet commitments. Further capital is now required to provide for the continued growth in the demand for electricity supplies, both within the city and in the area of the Council's supply beyond the city boundary. The capital expenditure on mains of all classes, including trunk mains, during each of the past five years was:—Year ended 1925, £289,042; 1926, £357,870; 1927, £438,010; 1928, £260,596; 1929 (estimated), £450,000. The number of additional consumers connected during the same period was during the year ended 1925, 5,521; 1926, 8,905; 1927, 10,307; 1928, 9,753; and 1929, 11,076. It is estimated that the expenditure now proposed will meet the requirements for mains and sub-station equipment up to the end of December, 1930. The Committee's proposals were approved at a meeting of the Council on May 7th.

Blackburn.—CHANGE-OVER.—The Town Council has received consent to the change-over from d.c. to a.c. in certain districts of the borough.

Burton-on-Trent.—LOAN.—The Corporation Electricity Committee is seeking sanction to the borrowing of £10,000 in connection with the assisted wiring scheme.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Gatineau Power Co., one of the units of the Canadian Hydro-Electric Corporation, Ltd., controlled by the International Hydro-Electric System, a subsidiary of the International Paper & Power Co., has put into operation the second 25,000-h.p. generator in its Bryson, Quebec, hydro-electric plant which is designed for 75,000 h.p. With the starting of the second generator in the Bryson power-house, the Gatineau Co. now has hydro-electric plants on the Ottawa river and its tributaries with an aggregate installed capacity of 562,600 h.p. Of this, 436,000 h.p. is in the hydro-electric plants on the Gatineau river.

Colchester.—BULK SUPPLY.—The following terms have been offered to the Walton-on-Naze Urban District Council for a supply of electricity in bulk:—Walton to agree to make provision to receive at a pressure of 11,000 V a minimum of 100 kVA and 120,000 kWh per annum. The charge is to be: First 100 kVA and 120,000 kWh in any one year, £5 per kVA and 0.8d. per kWh; next 100 kVA and 120,000 kWh, £4 15s. and 0.75d. per kWh; next 100 kVA and 120,000 kWh, and beyond, £4 10s. and 0.7d. per kWh. The agreement is to be for 25 years, with quinquennial reconsideration of the prices.

Crewe.—LOAN.—The Town Council has applied for sanction to a loan of £15,000 for electricity extensions.

Dewsbury.—LOAN.—The Town Council has applied for sanction to a loan of £10,000, for mains and services.

ASSISTED WIRING SCHEME.—The decision of the Electricity and Tramways Committee to take no action in setting up its own department for the wiring of houses in connection with the assisted wiring scheme has been confirmed.

BULK SUPPLY.—The Yorkshire Electric Power Co. has given notice to terminate, on March 31st next, the existing agreement with the Corporation for a bulk supply of electricity, but offers to withdraw the notice and amend the charges from that date on the basis of the company's prevailing bulk supply tariff. The Corporation Electricity Committee has asked the borough electrical engineer and the borough treasurer to go into the matter and report.

Doncaster.—LOAN.—The Corporation is applying for sanction to a loan of £3,470 for extending the electricity supply to the Intake housing estate.

Eastbourne.—MAINS EXTENSIONS.—The Corporation Electricity Committee has decided to extend mains to Willingdon and Wannock at a cost of £5,832.

East Ham.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £3,500 for buildings, £5,526 for mains and £15,000 for plant.

Exeter.—ELECTRICAL DEVELOPMENT.—At a meeting of the City Council on May 7th, the chairman of the Electricity Committee said that ten years ago the number of consumers was 2,200; last year it was 7,200. Two million kWh was sold in 1919, as compared with six millions last year. The revenue had increased from £22,000 to £73,000, and the station capacity from 2,000 kW to 11,500 kW. He hoped to make an announcement shortly regarding a decision under which the Council would secure business that in a few years would take practically half the present output of its station. The matter, however, was not yet sealed.

India.—CALCUTTA.—To meet the increased demand for electricity anticipated in 1930, the Calcutta Electric Supply Corporation is inviting tenders for a 15,000-kW turbo-alternator. It

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is destined for the southern generating station at Cumberbatchies Point. The mains are being extended further into the country and electricity will shortly be available in the Serampore district where the Municipality is considering the lighting of streets electrically. The supply available at Serampore will be almost doubled by a further scheme on which the Corporation is embarking. This involves carrying another main along the Calcutta side of the river, and linking it up with the new system south of the Municipality. Other important plans include the extension of electricity across the Hooghly.

Isle of Wight.—SPECIAL ORDER.—At a conference of local authorities of the Isle of Wight, it was recommended that they should support an application by the Isle of Wight Electric Light & Power Co., Ltd., for a Special Order to cover that portion of the island now covered by the existing local Orders, subject to the terms of the agreement to be entered into to this effect being approved by the local authorities concerned.

Japan.—ELECTRICAL DEVELOPMENT.—The Tenryugawa Electric Power Co., Ltd., has recently completed a new hydro-electric power station with a capacity of 25,000 kW at Minami-muki. The Great Consolidated Electric Power Co., Ltd., is planning to construct a large reservoir on the Kiso River to increase the generating capacity at the Kiso River plants. When all power plants on the Kiso River are completed the total generating capacity will be 370,000 kW.

Lancaster.—LOAN.—Application is being made by the Corporation Electricity Committee for sanction to the borrowing of £27,000 for two new boilers at the Caton Road generating station.

London.—BERMONDSEY.—The Borough Council Electricity Committee has prepared loan estimates as follows:—Mains and services, £20,000; meters, £2,500; wiring installations, £7,500.

ST. PANCRAS.—The Borough Council has received sanction to the borrowing of £5,000 on account of the £7,549 applied for in respect of the provision of additional condensing water plant, &c., at the King's Road generating station. The Electricity Commissioners have informed the Council that, before sanctioning further amounts, they desire to have particulars of the pump house buildings, &c., and of the tenders which it is proposed to accept.

FULHAM.—The Electricity and Lighting Committee recommends the expenditure of £6,217 for the provision of three sub-stations, (*a*) on the site of Harwood Road School, (*b*) at the corner of Fulham Palace Road and Bishop's Park Road, and (*c*) in Filmer Road, opposite Munster Road School.

Luton.—WAYLEAVES.—In connection with the inquiry held on April 8th into the application of the Corporation for compulsory wayleaves for an overhead line required to supply electricity to the Zoo being established at Whipsnade, the Minister of Transport has granted the Corporation's application on condition that where the line crosses the property of the National Trust it shall be underground.

Newark.—ELECTRICAL DEVELOPMENT.—Owing to the increasing demand for electricity the Town Council has decided to install a new 500-kVA transformer with switchgear, &c., at a cost of £747. The Council also decided to extend the l.p. mains to supply the 116 houses which it is erecting in Bowbridge Road at a cost of £1,155. The houses are to be wired by the Council.

Northern Ireland.—OMAGH (Co. TYRONE).—At a recent meeting of the Urban District Council, Mr. P. A. Spalding, consulting engineer, Dundalk, submitted a report on the proposal to install a municipal electricity supply in the town. He stated that the initial capital cost of a complete scheme for supplying the urban area, using overhead lines, and providing steel poles in the principal streets, should not exceed £10,000. The charge of 9d. per kWh for lighting would ensure a safe margin of profit. The Finance Committee recommended that the Council should engage Mr. Spalding to draw up a scheme for the lighting of the town, and to act generally as the Council's consulting engineer during the proceedings in connection with the application for powers to install the plant and to obtain the necessary loan.

Odiham (Hants.).—OVERHEAD LINES.—Mr. A. D. Erskine, on May 4th, held a Ministry of Transport inquiry into the application of the Aldershot Gas, Water and District Lighting Co., to use overhead lines for the supply of electricity in the rural area. The principal objectors were A. J. Parsons, Ltd., on whose farm it is proposed to erect twenty poles, and Mr. Spencer Charrington, a landowner at Winchfield, whose objections were mainly against the company's agreement. For the company it was stated that the proposed route was from the sub-station at Fleet to a sub-station to be erected at Hook, which would eventually be used by the Central Electricity Board for a switching station. The lines would carry 11,000 V. The County Council and the Fleet Urban District Council had given consent, and the Hartley Wintney Rural District Council would do so providing underground cables were used in Odiham.

Ormskirk.—BULK SUPPLY.—A sub-committee of the Urban District Council has been negotiating with the Central Electricity Board for a bulk supply of electricity to its area. The report of the sub-committee has been approved and the Town Clerk has been instructed to carry out its recommendations.

Peterborough.—WIRING SCHEME.—The Town Council has adopted a scheme of hire purchase for the wiring of the smaller type of houses. A deposit of 2s. 6d. per £1 of the cost will be payable, and the balance will be repaid by quarterly payments of 1s. 2d. per £1.

Preston.—ANNUAL POWER STATION INSPECTION.—Members of the Electricity Committee recently undertook their annual inspection of the Ribble power station and the various distribution plant in the area. It was stated by the chairman that when the Ribble station was completed it would have a capacity of approximately 60,000 kW. On the distribution side the Corporation had spent £250,000, and had laid 155 miles of cable. The expenditure on transmission lines amounted to £200,000 and on miscellaneous administrative details £50,000.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

TORQUAY.—The fixed rate for Council houses from 1s. 3d. to 1s. 1d. per week.

CONNAH'S QUAY.—Lighting: From 8d. to 7d. per kWh. Heating and cooking: From 3d. to 2½d. per kWh.

DARWEN.—Domestic rates for lighting during summer quarters: From 5½d. to 5d. per kWh for less than 30 kWh, and from 5d. to 4¾d. per kWh in excess of this amount. Domestic power, heating and cooking: A reduction of ⅛d. per kWh for over 30 kWh per quarter. Large industrial consumers: Over 100 kWh up to 500 kWh, from 2⅜d. to 2d., second 500 kWh from 1⅝d. to 1 9/16d., second 1,000 kWh from 1¼d. to 1 3/16d., over 4,000 kWh from ¾d. to 13/16d. per kWh. Contracts are subject to 27½ per cent. discount instead of 22½ per cent. Late shop window lighting, 2¾d. per kWh, conditional on paying 10s. per quarter for meter rent and time switch.

Rugby.—COMMERCIAL TARIFF.—The Urban District Council has adopted the following commercial tariff:—Power: l.p. supply, 1½d. per kWh, with a minimum charge for 72 kWh per quarter per h.p. installed; h.p. supply (by agreement), below 50,000 kWh per annum, 1.375d. per kWh; between 50,000 and 250,000 kWh, 1.25d. per kWh; beyond, 1.2d. per kWh. Business premises: lighting, 4½d. per kWh; cooking, 1d. per kWh; heating, controlled by time switch to keep off peak load, 1d. per kWh.

Scarborough.—BULK SUPPLY.—The Town Council is negotiating with the Electricity Commissioners and the Central Electricity Board for a bulk supply to Bridlington.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by the Holderness Trust, Ltd., authorising it to supply electricity in the urban districts of Great Driffield and Pocklington, the rural districts of Bridlington, Driffield, Norton and Sherburn, the rural district of Pocklington (except the township of Cottingwith), and certain parishes in the rural district of Beverley.

The following Special Orders made by the Commissioners have been confirmed by the Minister of Transport: Hope (Derbyshire) and District; and Dumfriesshire (Gretna and Dornock).

Tonbridge.—EXPERIMENTAL TARIFF.—The Urban District Council has introduced the following new tariff for electricity for lighting and power, which is to be tried for a year:—A fixed charge of 20 per cent. per annum of ratable value, with a minimum charge of £2, plus 1d. per kWh.

Torquay.—ELECTRICITY SUPPLY.—In view of the wish expressed by the Totnes Rural District Council that the Corporation should become the electricity undertaker for the whole of that rural district, the Corporation is to oppose the application which is being made by Mr. W. G. Heath for a Special Order authorising him to supply the urban district of Ivybridge and certain parishes in the Kingsbridge and Totnes rural districts in so far as that order affects the last named rural district, and to apply for a Special Order extending the Corporation's area of supply so as to include the whole of the Totnes rural district, instead of part as at present.

PURCHASE OF UNDERTAKING.—An agreement has been arrived at between the Corporation and the Teignmouth Electric Lighting Co., Ltd., for the purchase by the former of the Buckfastleigh electricity undertaking, at a cost of £10,500, subject to the sanction of the Electricity Commissioners.

Worcester.—LOAN.—The City Council is to apply for sanction to a loan of £12,500 for l.p. mains.

Tramway and Railway Notes.

Birmingham.—ABANDONMENT OF TRAMWAY ROUTES.—The City Council has decided to abandon the tramway tracks in Hagley Road and Bolton Road, and to substitute a motor-omnibus service.

Continental.—SWEDEN.—The Minister of Communications has announced in the Riksdag that the main line between Stockholm and Malmoe, 600 km. in length, is the railway that may next be electrified. It has, however, not yet been decided whether the electrification of the Swedish State Rail-

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ways should be continued, nor has it been ascertained whether the estimated cost of Kr. 60,000,000, for the electrification of the Stockholm-Malmoe main line and two small lines with a total length of 152 km. connecting it with the already electrified Stockholm-Gothenburg main line, could be recouped by the reduced cost of running and increase in traffic after electrification.—*Reuter's Trade Service* (Stockholm).

Japan.—RAILWAY ELECTRIFICATION.—The I.G.R. plans electrifying its lines between Ochnomizu and Kamedo, Yonehara and Imasho, Fukushima and Yonezawa, and Toyooka and Tottovi, the work to be carried out during the period 1929 to 1936 at an estimated cost of 203,115,690 yen.

It has been decided to electrify the Hakatanwan railway between Hakata and Fukuoka, a distance of 14 miles. The cost is estimated at 600,000 yen.

The Ujigawa Electric Power Co., Ltd., which operates an electric railway between Kobe and Himeji, is planning to extend the line as far as Okayama, a city in Okayama Prefecture, a distance of 52 miles.

Siam.—RAILWAY ELECTRIFICATION.—According to *L'Industrie Electrique* a proposal is being discussed for the electrification of the Royal railway in Siam. At present the steam locomotives are operated by means of wood fuel, and this is not found satisfactory. The railway authorities, instead of waiting for the execution of the projected hydro-electric works in the north of Siam, will erect a power station in Bangkok with a capacity of 15,000 kW. The boilers will be fired with refuse from the rice fields. The preliminary proposals embody the electrification of 200 km. of railway, and it is possible that the supply of the new plant, and erection of the power house, as well as the conversion of the line, will be entrusted to a single firm by means of international competition. The expenditure is estimated at 80 million fr.

Telegraph and Telephone Notes.

Canada. — RAILWAY TELEPHONY.—Long-distance telephone communication to and from passengers in a Canadian National railway train moving at forty miles an hour has been successfully demonstrated, following experiments in wireless telephony by the company's engineers. The reception was quite distinct at both ends, and the new process eliminated many of the difficulties now experienced with similar voice transmission by the system operating in Germany. The Canadian National Railway proposes the installation of wireless telephone equipment on a number of its trains to enable passengers to keep always in touch with their homes or business offices.—*Reuter's* (Ottawa).

India.—RADIO COMMUNICATION.—Our Indian correspondent states that the latest report of the Indian Posts and Telegraphs Department shows progress in the development of wireless installations. The new receiving and direction-finding station near Malir (Karachi) has been completed and tested under working conditions. In conjunction with the remodelled transmitting station at Karachi, it will be used for civil aviation purposes as well as for communication with ships. For both purposes arrangements have been made for the operation of transmitting sets at Karachi by remote control from Malir. At the inland stations the new continuous-wave transmitting sets at Allahabad, Lahore, Quetta, Peshawar, and Nagpore have been completed, and similar work at Mhow is in progress. At the Peshawar telegraph office a new receiving installation has been installed and tested with satisfactory results. A new wireless station has been constructed at Kumaran Island, in the Red Sea, principally for communication with Aden. The aerial systems at Allahabad, Lahore, and Quetta have been completely remodelled to suit new continuous-wave transmitting sets. Special receiving sets have been installed at various stations.

International Telephony.—ENGLAND-CZECHO-SLOVAKIA.—The Postmaster-General announces that, as from May 11th, a telephone service became available between London and all parts of Czecho-Slovakia. From the provinces telephone service will continue for the present to be restricted to Zones I and II in Czecho-Slovakia (namely, Bohemia, Moravia, Silesia, and Western Slovakia).

The Telegraph Service.—CHANNEL ISLANDS.—The Central Telegraph Office reported last week that telegraph communication with Alderney was interrupted, and telegrams were being sent from the mainland by steamer.

The Telephone Service.—ISLE OF WIGHT CABLE.—The Portsmouth Corporation has reported that a specially-constructed new submarine cable has been laid between Portsmouth and Ryde, which, in conjunction with a new telephone repeater station now being installed at Portsmouth, will afford facilities for direct telephone service between the Isle of Wight and London.

Uruguay.—COMMUNICATION SERVICES.—There are now 6,404 miles of telegraph wires in operation in the South American Republic of Uruguay, or 3.7 miles per 1,000 of the population. The number of telephones in use in the country is 26,915, or 15.7 instruments per 1,000 inhabitants.

Radio Notes.

B.B.C. Balance Sheet.—MORE INCOME.—A balance of £123,181 is recorded in the second annual report of the Governors of the British Broadcasting Corporation, covering the year ended December 31st, 1928. The corresponding figure for the previous year was £128,338. The total income last year was over £1,000,000. Licence income fell short of revenue expenditure by £7,560 in 1928, whereas in 1927 there was a balance on this section of the accounts of £27,669. Licences increased during the year by 233,218 to 2,628,392, exclusive of free licences to the blind, which increased from 11,448 to 14,068. The principal items in the balance sheet are: income from licences, £871,763; from publications, £120,635; total income, £1,002,505. Expenditure on programmes, £538,990; plant, power, &c., £160,455; rent, rates, taxes, &c., £77,999; administration, salaries, and expenses, £56,211; total expenditure, £879,324. Expenditure on programmes was 63 per cent. and 17 per cent. for plant and power, approximately the same as in the previous year. The value placed upon the premises, plant, fittings, &c., taken over without payment by the Corporation from the company is £174,938. Additional appropriation from revenue to cover capital expenditure on regional stations totalled £134,167, compared with £110,108 for 1927. A further £31,150 was put to reserve for depreciation and renewals. Total assets are reduced at slightly below £600,000. In 68,000 hours of transmission the percentage of breakdowns was .035, representing an increase of .005 in comparison with 1927, caused by damage to aerials during the November gales.

Belgium.—BROADCASTING BILL.—Notwithstanding an appeal by the Minister of Railways, the Senate on May 8th voted the adjournment of the debate on the Bill creating a National Broadcasting Institute, which has already passed the Chamber. —*Reuter's* (Brussels).

Canada. — Co-operation between the Dominion Government and all provinces in the creation of a permanent system of broadcasting is forecast in an official memorandum laid before the Federal Radio Commission by the British Columbia Government, and made public by the Hon. R. S. Pooley, acting Premier of British Columbia. The views of the province on the future administration of radio are thus summed up, says *World-Radio*: "The Government of British Columbia is ready and willing to enter into negotiations with the Government of Canada and the Governments of the various Canadian provinces with a view to the organisation of radio broadcasting on a basis of public service, by some method that may be mutually agreed upon by the said Governments."

Research Station.—MOVE FROM KESTON.—The B.B.C. has decided to dismantle its experimental receiving station at Keston, which for more than four years has been the centre of important research work. The need for a more satisfactory site and a more efficient station has long been felt, and it has now been decided to erect another research station two or three miles away, near Tatsfield Village, on Botley Hill, close to the main road from Croydon to Westerham, says the *Daily Telegraph*. In future the station will be known as the Tatsfield receiving station, and it is anticipated that it will be ready for use early in July. The main work carried on at the station will consist of checking the performances of B.B.C. stations, locating areas of interference, and checking British and Continental wavelengths. Occasional relaying of programmes from various countries abroad will also be carried on from the new station.

Switzerland.—PROPOSED REORGANISATION.—According to an official *communiqué* from the Swiss telegraph administration, the technical committee of experts studying the reorganisation of broadcasting has arrived at the following conclusions, says *World-Radio*. Of the two exclusive wave-lengths available for Switzerland within the broadcast band one should be allotted to German Switzerland, and the second to the French-speaking part of the country. Two high-power stations should be suggested, one in the centre of the canton of Vaud, and one near the See valley for the German-speaking regions. As the two stations would serve only part of the country and, especially, preclude certain important towns, secondary transmitters should be suggested in or near the following towns:—Geneva, Sion (Valais), Berne, Basle, Zürich, St. Gall, Coire, and in the canton of Tessin. The topographical condition of the region round Sion and that prevailing in the Tessin are such that the use of the wave-lengths 680 and 760 metres should be assigned to these stations. The other secondary transmitters should use a common international wave-length. The German-Swiss region should pay for the Tessin transmitter to balance the smaller financial resources of the French-Swiss region. It is accepted that the Confederation will build and operate the transmitters. The authorities have not come to a decision regarding the recommendations of the experts. It is hoped that this summer will see the definite acceptance of reorganisation.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aughton.—May 23rd. West Lancashire R.D.C. Electric lighting scheme for the parish. Specifications (£2 2s.) and form of tender from Mr. James Scott, 358, Royal Liver Building, Liverpool.

Australia.—MELBOURNE.—June 4th. State Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 5216.)*

June 26th (extended from May 15th). Victorian Railways. One geared three-phase electric winding engine. (A.7650 and A.7853.)*

June 25th. Posts and Telegraphs Department. Telephone cable terminal boxes of the protected type. (B.X. 5231.)*

July 9th. Resistances and reactances. (B.X. 5281.)*

SYDNEY.—June 4th. Public Works Department. 18 electrically-operated water level indicators. (B.X. 5233.)*

July 10th. New South Wales Government Railways. One 750-kW turbo-alternator for Ultimo Power Station. (Specification No. 847, 5s.) 2,200-V ironclad switchgear for Argyle substation. (Specification No. 852, 2s. 6d.) Two switch operating batteries. (Specification No. 850, 2s. 6d.) Two motor-generator sets. (Specification No. 851, 2s. 6d.) Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

Ayr.—District Committee. Installation of electric wiring in the District Fever Hospital, Old Cumnock. Specifications from Mr. J. MacEwan, consulting engineer, 62, Robertson Street, Glasgow.

Belfast.—May 21st. Electricity Department. Supply, delivery and erection of h.p. armour-clad switchgear, air preheaters, 22,000-V 3-phase transformers, and cable drum trailer and tractor. (May 3rd.) Supply, delivery and erection of a 22,000-V 3-phase overhead transmission line. (May 10th.)

Belgium.—ANTWERP.—June 17th. Municipal Council. 32 electric travelling cranes for the new dock. (Cahier des charges No. 755.) (A.X. 7924.)*

Chile.—VALPARAISO.—June 1st. Port Administration. Four three-metric-ton electric travelling cranes.

Croydon.—June 3rd. Electricity Department. Supply, delivery, and erection of one 20/25,000-kW turbo-alternator, with auxiliaries, boiler-house extensions with two 100,000-lb. boilers, coal handling plant, &c., engine room extension, switchhouse, bridges, and pump house, and 6,600-V switchgear, transformers, &c. (May 10th.)

East Ham.—June 12th. Education Committee. Installation of electric lighting at Salisbury School. Specification 10s., from F. H. Thompson, secretary, Town Hall, East Ham.

Eccles.—May 29th. Health Committee. Installation of electric light wiring and fittings in 68 houses, Westwood Park, Morton. Specification and form of tender from borough electrical engineer, Electricity Works, Cawdor Street, Patricroft. (Deposit £1 1s.)

Edinburgh.—May 21st. District Board of Control. Electrical work for the two higher grade blocks and mortuary at Gogarburn. Schedules from Mr. S. Kaye, architect, 14, Hill Street, Edinburgh.

May 30th. Electrical installation at George Heriot's School, Edinburgh. Specifications from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

Epsom.—May 25th. Electricity Department. Supply, delivery and erection of a l.p. d.c. switchboard. (May 10th.)

Glasgow.—May 21st. Education Authority. Installation of electric lighting in Hyndland new secondary school. Specifications from Education Offices (Property Department), 129, Bath Street (one guinea deposit).

Grimsby.—May 31st. Electricity Department. Electrically-driven boiler feed pump. (See this issue.)

Hastings.—June 3rd. Boiler fuel for period commencing July 1st, 1929. (May 10th.)

India.—May 21st. India Stores Department. One 400-kW, 6-phase rotary convertor set and accessories for H.M. Mint, Calcutta. (B.X. 5255.)*

May 27th. 500-kW, 6-phase, rotary convertor, starting panel, &c. (B.X. 5279.)*

South Indian Railway Co., Ltd. Supply of spare parts for train lighting cells and v.i.r. cotton and silk covered copper and galvanised iron wire. (See this issue.)

Kearsley.—May 20th. U.D.C. Electric wiring of 80 houses, Tasker's Lane Estate. Specifications from Mr. E. Shaw, surveyor.

Larne.—May 22nd. Board of Guardians. Installation of electric light at the District Hospital. Forms of tender from Mr. W. Pleasance, 44, Wellington Place, Belfast.

London.—BETHNAL GREEN.—May 22nd. Borough Council. Electric lighting installation at two blocks of tenement dwellings. (May 3rd.)

CENTRAL ELECTRICITY BOARD.—May 25th. Supply, delivery and erection of 33,000-V metal-clad switchgear for South-East England Electricity Scheme, 1927. (May 3rd.)

June 17th. Supply, delivery and erection of 33-kV and lower voltage switchgear for the North-West England and North Wales Electricity Scheme, 1928. (See this issue.)

ST. PANCRAS.—June 6th. Electricity Department. Supply of one 1,000-kW motor convertor. (See this issue.)

Manchester.—May 28th. Tramways Committee. Electrical equipments, trucks, and air brakes, for tramcars. Specifications and forms of tender from general manager, Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—AUCKLAND.—June 3rd. Auckland Electric Power Board. Pilot cable and accessories. (B.X. 5244.)*

WELLINGTON.—June 18th. Posts and Telegraph Department. Telephone cords. (B.V. 5251.)*

July 16th. Telephone bells. (B.X. 5272.)*

August 6th. Public Works Department. One 120-ton four-motor overhead travelling crane and runway. (A.X. 7810.)*

August 13th. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

Ogmore and Garw.—May 31st. Electricity Department. A short length of 11-kV transmission line, and l.p. overhead and underground mains. (May 10th.)

Renfrewshire.—May 20th. Education Authority. Electric lighting installation and heating work for new clinic at Barrhead. Schedules (deposit £1) from Executive Officer, County Education Offices, Paisley.

Richmond.—May 22nd. Board of Guardians. Re-wiring, &c., for electric light buildings at the Grove Road Institution, Richmond. (Deposit £1.) Particulars from Mr. C. L. Fenn, clerk, Guardians' Offices, Parkshot, Richmond, Surrey.

South Africa.—JOHANNESBURG.—June 20th. South African Railways and Harbours. One 10-ton and three 4-ton electric level luffing cranes. (A.X. 7828.)*

June. 1st. Town Council. Truck type cubicles. (B.X. 5285.)* Oil switches. (B.V. 5283.)*

PRETORIA.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. B.X. 5273.)*

May 27th. Town Council. Transformers. (B.X. 5258.)*

Stoke-on-Trent.—June 22nd. Installation of electric light and power in new buildings proposed to be erected at the North Staffordshire Technical College. (See this issue.)

Uruguay.—MONTEVIDEO.—May 22nd. National Administration of the Ports. Four electric cranes (to lift 3 metric tons) mounted on trucks. (A.X. 7814.)*

Yorks.—May 31st. West Riding Education Committee. Electric light installation for the Malty Craggs and Aston Schools. Mr. A. Adcock, divisional clerk, "Craigmoor," Godstone Road, Rotherham.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

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Contracts Closed.

Colchester.—City Council. Accepted :—
Pipe work for the electricity works (£2,950).—Brightside Foundry & Engineering Co., Ltd.

Dewsbury.—Town Council. Accepted :—
Wiring 37 houses for electric light, at £221.—Beaumont and Blackburn.

Dumfries.—Town Council. The contract for a turbo-alternator was referred back to the Electricity Committee for further consideration.
Cooling tower (£1,792).—Premier Cooler & Engineering Co., Ltd. (Accepted.)

East Ham.—Electricity Committee. Accepted :—
H.p. and l.p. switchgear and remote control gear (£3,938); feeder panel (£416).—Bertram Thomas.
Cable, 5,750 yards, 6,600 volt (£5,635).—Enfield Cable Works, Ltd.

Gillingham (Kent).—Town Council. Accepted :—
Cable and transformers in connection with extensions to Rainham, Wigmore and Hempstead.—Callender's Cable & Construction Co., Ltd.

London.—CENTRAL ELECTRICITY BOARD.—The Central Electricity Board has placed the following contracts in connection with the South-East, Central, and North-West England and North Wales Electricity Schemes; the value of the contracts is approximately £300,000.
South-East England. Secondary transmission lines.—Watshams, Ltd.
Central England. Secondary transmission lines.—Watshams, Ltd.
North-West England and North Wales. Secondary transmission lines.—Siemens Bros. & Co., Ltd., and John Collier, Ltd. Secondary transformers.—English Electric Co., Ltd.

LONDON COUNTY COUNCIL.—Highways Committee. Recommended :—
New special tramway trackwork and replacements. Extension of contract for five years on basis of fluctuating percentage.—Hadfields, Ltd.
Electric incandescent lamps.—Siemens Electric Lamps and Supplies, Ltd.

GENERAL POST OFFICE.
Telephone switchboard lamps.—Edison Swan Electric Co., Ltd.

HAMMERSMITH.—Electricity Committee.
6-in. sludging pump (£240), 15-in. condensing water pump (£446).—Mather & Platt, Ltd.

Wiring of property. The Council is recommended to enter into contracts with the undermentioned local contractors for the execution of electric wiring installations for a period of six months :—
Brooks & White, A. Bantock & Co., F. E. Beltram, W. T. Canning & Co., E. W. Chamberlen, Fenn & Co., A. H. Fisher, G. Goodchild, J. R. Goode, S. Hellyar, Ltd., L. T. Hall, O. E. Jones, W. T. Lofting, C. J. Mount, M.E.D.A.S., Ltd., A. E. Mayhew & Co., J. B. O'Brien, Smith, Owen & Co., H. E. Steer, Thornton & Co., A. H. Verney, and Wilkins Electrical Works.

SHOREDITCH.—Lighting Committee.
Electric lighting installation at No. 7 Block, L.C.C. Whitmore Housing Estate (32 tenements).—City Electrical Co. (£485). (Recommended.)

Cable in connection with the mains extension.

HACKBRIDGE CABLE CO., LTD. (Recommended.)	£4,525
W. T. Glover & Co., Ltd.	4,610
British Insulated Cables, Ltd.	4,666
Pirelli-General Cable Works, Ltd.	4,675
Siemens Bros. & Co., Ltd.	4,725
Union Cable Co., Ltd.	4,745
Macintosh Cable Co., Ltd.	4,752
Standard Telephones & Cables, Ltd.	4,760
W. T. Henley's Telegraph Works Co., Ltd. ...	4,797
Greenwich Cable Works, Ltd.	4,829

Plymouth.—Hospital Committee. Accepted :—
Repairs to storage battery at Mental Hospital (£107).—Tudor Accumulator Co.

Portsmouth.—Electricity Committee. Accepted :—
Supply of transmission lines to Emsworth.

JOHNSON & PHILLIPS, LTD. (Accepted.) ...	£25,268
British Insulated Cables, Ltd.	25,623
W. T. Henley's Telegraph Works Co., Ltd. ...	25,908
Callender's Cable & Construction Co., Ltd. ...	26,373
Siemens Bros. & Co., Ltd.	26,157
Pirelli-General Cable Works, Ltd.	26,800

South Shields.—Tramways Committee. Accepted :—
70 tons of tram rails, curves and points (£671).—Messrs. Dorman, Long & Co., Ltd.

Swansea.—Electricity Committee.
10,000/12,500-kW turbo set (£34,476).—British Thomson-Houston Co., Ltd. (Six tenders were received, ranging from £34,476 to £36,830.)

Forthcoming Events.

North-East Coast Exhibition.—Newcastle-on-Tyne. May 14th to October.

World Power Conference.—Barcelona International Exhibition. May 15th-23rd.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 18th. Porthcawl. Annual meeting.

Faraday Society.—Thursday, May 23rd. Burlington House, Piccadilly, W. 7.45 p.m. Annual general meeting.

Physical Society.—Friday, May 24th. Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Notes.

B.S.S. for Distribution Boards.

British Standard Specification No. 214-1929 is a further addition to the series of British Standard Specifications for electrical accessories and installation materials. The specification relates to two-pole distribution fuse-boards and distribution switchboards for ordinary duty with working currents not exceeding 30 A per way, and for use in circuits the voltage of which does not exceed 250 V. The boards are rated in terms of the largest current per way which can be carried continuously without the temperature rise of any of the parts exceeding a specified amount. There are three standard sizes, namely, 5, 15 and 30 A per way. The specification lays down requirements as to design and construction of wood and metal cases, the performance of the switches (if any) and fusible cut-outs, and details of tests to be carried out on completed distribution boards. Copies of the specification can be obtained on application to the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1. Price 2s. 2d. post free.

Post Office Engineering Appointments.

The Civil Service correspondent of *The Times* states that changes in the mode of filling professional and technical posts in the Engineering Department of the Post Office are to be introduced as the result of an agreement which has been reached on a joint committee of the Post Office Engineering and Stores Department Whitley Council upon the system of recruitment to the supervisory technical grade of inspector, and to the basic professional grade of assistant engineer. In the case of assistant engineers the proportion of vacancies allotted to open competition, limited competition, and promotion which are at present 20, 20, and 60 per cent., respectively, will be varied every two years until 1933-4, when the proportions will be 20, 40, and 40. As regards inspectors, the present proportions of open competition (10 per cent.), limited (10 per cent.), and promotion (80 per cent.) will become 10, 40, and 50 per cent., respectively. The intermediate grades of chief inspector will continue to be recruited solely by promotion.

The Westinghouse Lighting Institute.

At the end of May there will be opened at the Grand Central Palace, New York, the Westinghouse Lighting Institute, which is described as a permanent institute for the advancement of the art of modern lighting. The Institute will occupy the entire seventh floor of the building, with an area of 40,000 sq. ft. In the Institute there will be a typical city street, with fronting on it a modern home, a bank, a theatre, a petrol-filling station, a florist's shop, and two completely-equipped electrical shops, one typifying the average central power station sales department and the other an ideal example of an electrical shop of average size. In the florist's shop there will be an exhibition of plant growth under electric light. Other exhibits will show examples of office lighting in a typical general office, a directors' office, and a board room. A transport and aviation room will show various methods of lighting steam and electric railway trains and road vehicles. There will also be a model airport, with all kinds of airport equipment, hangar and other buildings, built to scale and properly lighted throughout, with model aeroplanes in actual operation. This room will also contain the model of a railway system with stations, tunnel switches, sidings, and train lighting. Another room will be devoted to demonstrations of various methods of industrial lighting, depicting general, local, and special applications to specific needs, such as bench assembly work, heavy press work, and so on. A 60 ft. by 46 ft. auditorium will have fixtures for demonstrating direct, semi-direct, and totally-indirect lighting, and colour lighting of auditorium walls and ceilings. There will be distribution cabinets on each side of the stage for demonstrating shadow and colour. In the art gallery various effects from light-diffusing lenses will be shown. This room will have facilities for the demonstration of high-intensity illumination upon small areas, such as a hospital operating table.

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Horology.

The programme of the National Association of Goldsmiths' annual conference, which was held at Weston-super-Mare from May 6th to 9th, indicates that the outlook of some electrical engineers is not restricted to their profession. The scientific and archæological aspects of horology were dealt with by members of the Institute. "Britain's Supremacy in Time-keeping" was the subject chosen by Mr. F. Hope-Jones, M.I.E.E., F.R.A.S. The interesting country and antiquities visited were talked about by Mr. R. P. Howgrave-Graham, M.I.E.E, F.S.A., who also accompanied the excursion party to Glastonbury and Wells by motor coach and spoke on the unique archæological features of the district, and also on the Wells Cathedral clock.

Electrical Detection of Flaws in Rails.

According to the *Times Trade and Engineering Supplement*, the application of electrical methods to the detection and measurement of hidden fissures in rails, both at the mill and after they have been placed in the track, was recently described by Mr. Elmer A. Sperry before the American Iron and Steel Institute. Direct current is employed to provide the intense energisation required to reveal the internal physical condition of the rail. The main primary energising current is made to traverse the rail, or a section of it, by main brushes in contact with the track. Between these brushes are three searching brushes connected to two coils which constitute the primary of a transformer. These coils are wound to produce opposite magnetic excitation of the transformer. All variations in the primary current will be picked up by the two outer brushes, and thus be completely neutralised as to their influence on the secondary of the transformer. But, in passing along the track, when a fissure occurs between one end brush and the middle brush, the first coil will become excited to a greater extent than the other. The transformer will become active, and in the secondary will be induced half, say, the positive side, of a sine-wave curve. In the next instant the fissure passes between the middle brush and the opposite end brush, giving an opposite excitation in the secondary and completing the alternating wave by adding the negative side. The alternating wave so produced passes to the amplifiers and is examined as to both its magnitude and characteristics. In a sound rail the direction of current flow is axial unless disturbed. The slightest disturbance changes this alignment of flow, and means have been found to utilise this deviation, as to both angle and magnitude of the mean axial departure, for giving an accurate interpretation of the cause, especially when all elements are magnified so as to be recognisable. Thus the size, character, and exact position of the fissure or other flaw are accurately determined.

Neon Light Patents in France.

Mr. Georges Claude is regarded in France as the first to utilise the luminous properties of rare gases, in particular neon, in a practical way. In view of the fact that his patent has been widely utilised, he recently brought an action on his own behalf and on that of the company exploiting his inventions against certain infringers. According to "*l'Industrie Electrique*," after hearing the evidence of experts on both sides, the French Courts have given a verdict in favour of Mr. Claude, who has been awarded damages.

Electrolytic Production of Sheet Copper.

Works have recently been established at Bex, Switzerland, by the Compagnie des Produits Electro-Chimiques for the electrolytical production of sheet copper. The process employed, which is known as the Jullien-Bex, is akin to the well-known Elmore method, but comprises some innovations which enable scrap red copper and bronze and other low-quality primary material to be used. The copper sheeting is formed on a circular mandril, 13 ft. 9 in. in length and 26¼ in. in diameter, sheets measuring approximately 13 ft. by 6 ft. 6 in. (when trimmed) being produced. The works at Bex have a capacity of about 400 tons per year, the product being largely used for roofing purposes.

"Relay" Telephones at Cardiff.

The Cardiff City Council has installed automatic telephones throughout its municipal departments in place of the old manually-operated system. At the luncheon on the occasion of the official opening of the p. a. b. x. installation, which was carried out by the Relay Automatic Telephone Co., Ltd., the Lord Mayor of Cardiff (Alderman W. R. Williams, J.P.) said that the system consisted of four switchboards, namely, one at the City Hall, one at the Law Courts, and one each at the Electricity Departments at The Hayes and at Ninian Park Road. By this means all municipal departments were able to communicate with each other automatically in three seconds, and it was a very well-known axiom that "he who saves time saves money." The services of only one operator at each exchange were required, against two with ordinary manual handling. Mr. B. B. Johnson, chief engineer of the Relay Automatic Telephone Co., Ltd., explained that the new installation for Cardiff, although it would considerably benefit internal communication between the Corporation offices and officers, was also part of the public network, and each telephone connected to the Corporation system was capable of being connected to any one of the public network. The Post Office engineers in this country required to satisfy themselves that all apparatus connected to their system must in every way be of the best, in order to meet the exacting requirements of modern telephone service. The exacting nature of the Post Office demands had been a blessing in disguise to British telephone manufacturers because if their products satisfied the Post Office, they would meet the demands of any other administration. For that reason his company should thank the Post Office engineers for their assistance in their early days when his company undertook the vast research work necessary to meet their demands (which cost £250,000), for it was one of the reasons for the success of the "Relay" system abroad, in India and the Colonies, in South America and Japan, and the Czecho-Slovakian Republic. There were now more than 80 exchanges working there, which was a triumph for British engineering, bearing in mind that Czecho-Slovakia was geographically next to Germany, that country of clever and painstaking technicians and cut prices. Cardiff, although the first in Wales, was the fiftieth municipal body in Britain to adopt the "Relay" automatic telephone system, identical with that serving Manchester, Glasgow, Newcastle, Plymouth, and Bristol.

Junior Institution Dinner.

The annual dinner of the Junior Institution of Engineers at the Monico Restaurant, Piccadilly, on May 10th was well attended by members and their distinguished guests, Mr. W. A. Tookey (vice-president) proving himself as energetic as ever in performing the task of toastmaster. Following the loyal toast, "The Institution" was proposed by Lieut.-Col. K. Edgcumbe (president, I.E.E.), and responded to by Mr. S. H. Hole (chairman, J.I.E.). To the toast of "Pioneers of Progress," proposed by Mr. Frank Hodges, Lieut.-Col. J. T. C. Moore-Brabazon (president, J.I.E.) responded. Mr. S. Dunlop (vice-president, J.I.E.) proposed "Our Guests," on whose behalf Dr. A. E. Dunstan (president, Institution of Petroleum Technologists) and Sir Ernest Moir (president-elect, J.I.E.) responded, while the chairman's health was proposed by Mr. E. D. Gill (vice-chairman, J.I.E.). The Westminster Singers provided the musical programme.

The Institution is now in its 45th year and looks forward to celebrating its jubilee in 1934. The present membership is nearly 1,600, about half of which is in London and the other half divided amongst four local sections, the provinces, and abroad. The Engineers' Register has, particularly since the war, been instrumental in assisting a large number of members to find suitable employment, or improved positions. The personal note is emphasised in the case of members proceeding abroad, who are given introductions by the secretary to members in the locality for which they are bound, so that the bearer can always be sure of a welcome and assistance in becoming acquainted with his new surroundings.

Home Office Industrial Museum.

The Home Office announces that the Home Office Industrial Museum (97, Horseferry Road, Westminster) will in future be open in the afternoon from 2 to 4 on every week-day (instead of only on Saturday as hitherto), as well as in the morning from 10 to 1.

Electrical Standards in Australia.

The Australian Commonwealth Engineering Standards Association recently announced that the following Australian standard specifications, which were issued in tentative form for a period of 12 months, are about to be revised prior to their issue as Australian standards:—

C.38-1927.T.—Electrical performance of alternators of the steam turbine-driven type.

C.42-1927.T.—Indicating ammeters, voltmeters, wattmeters, frequency and power-factor meters.

C.46-1927.T.—Liquid starters for electric motors (d.c. and a.c. 3-phase induction, with slip rings).

C.48-1927.T.—Multiple switch starters for electric motors (d.c.).

C.49-1927.T.—Contractor starters for electric motors (d.c. and a.c., 3-phase induction, with slip-rings).

C.53-1928.T.—Fixed condensers for radio reception purposes.

Humidifying the Vatican Library.

An American firm has constructed an electric steam generator for use in the Vatican Library at Rome. In damp weather the atmosphere in the library becomes so humid that the priceless manuscripts and books show a tendency to decay, which was recently guarded against by the installation of electric heating apparatus. However, during the dry season in Rome the manuscripts become brittle and are in danger of cracking and breaking, and it is the latter contingency that is now to be guarded against by the employment of artificially-produced moisture. The moisture-creating device that is being installed consists of a metal tank filled with water, in which a series of electric heating elements has been immersed. The elements are operated through humidity gauges and thermostats. The apparatus is adjusted for the required humidity, and when the latter drops below the point desired switches are automatically operated, which connects the supply of electricity to the heating elements. These bring the water up to the correct temperature at which it will discharge water vapour into the rooms.

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Institution of Mechanical Engineers.

The Institution of Mechanical Engineers has decided to apply for a Royal Charter. Dr. H. S. Hele-Shaw, who seconded the resolution, said that it would be appropriate if the Charter were granted, as this year was the centenary of their first chairman's invention, namely, George Stevenson's "Rocket."

The Electrical Association for Women.

The North Wales Branch of the Electrical Association for Women, at the invitation of the Cunard Steamship Company, Ltd., recently visited the *Samaria* in Huskisson Dock, Liverpool. Electricity plays an important part in the equipment of the ship, and the appliances were of special interest to members of the E.A.W.

Local Societies.

Mr. P. J. Robinson, M.I.E.E., Liverpool city electrical engineer, was re-elected president of the Liverpool and District Electro-Harmonic Society at the annual meeting of the Society held recently. Mr. B. L. Myer (Power Centre Co.) was elected to succeed Mr. L. F. S. Sington, A.M.I.M.E., as hon. treasurer, Mr. E. G. Pulford, jun., was re-elected hon. secretary, and Mr. W. A. Sloane, assistant hon. secretary.

Appointments Vacant.

Meter tester and repairer for the Bournemouth & Poole Electricity Supply Co., Ltd. Electrical engineer and manager for Felixstowe Urban District Council. Meter mechanic and tester for Harwich Corporation. Storekeeper for Beckenham Urban District Council. Deputy city electrical engineer (£600) for Exeter City Council. Senior switchboard attendant for Darlington Corporation. Assistant lecturer in electrical engineering at Bradford Technical College for the Education Committee. (See our advertisement pages to-day.)

I.E.E. Students Visit All-Electric Farm.

The prominence given to the all-electric farm of Mr. R. Borlase Matthews since the Electricity Commission granted him powers to supply electricity in an area of 1,280 square miles in Lincolnshire, made the recent visit of sixty members of the Students' Section of the Institution of Electrical Engineers a most popular one. The visitors, many of whom were connected with British electrical manufacturing firms, spent some three hours walking round the estate, and were eager to see the type of machinery required for driving the various farm machines. Those specialising in power supply work were particularly interested in a new and inexpensive type of pole for overhead-line work. Mr. R. Borlase Matthews is using this type of pole on a new overhead line now being erected on the estate. By its use constructional costs of the overhead line are reduced, it is claimed, by at least 70 per cent. Among the other items which claimed the interest of the visitors may be mentioned the hay-curing plant, the electric plough, the electrically-operated binder, and the electro-culture apparatus.

Overhead Lines Association.

The summer meeting of the Overhead Lines Association will be held in Mid-Cheshire very early in July, by invitation of the directors of the Mid-Cheshire Electricity Supply Co., Ltd., and of the president, Mr. W. Fennell. The local arrangements will be made by the president as time and circumstances may permit, and will be notified to members later. They will include inspection of the new designs of sub-stations for bulk supplies for small towns, suburbs and villages, from the 33-kV main system, and also representative country lines, some on native timber treated on the Cobra process, single-phase, 3,300-volt, with special guarding and compound lines for 3,300 V and 220 V on the same poles. The route will include some of the beauty spots of Mid-Cheshire, and, by way of contrast, the Salt District near Brunner, Mond's works; also an inspection of subsiding areas. The special type of lifting building will be inspected. High tea will be provided at Waverley Cottage, The Brockhurst, Northwich, by invitation of Mrs. Fennell. It is hoped to assemble at Crewe at about midday and to end at 6 p.m. at the same centre, or at a station nearer Northwich if trains permit. It is hoped that this visit, being held in the North Midlands, within easy reach of North Wales, Lancashire, Yorkshire, and the South Midlands, will be attended by members from all parts, especially those who, by reason of distance, cannot attend all the London meetings. Arrangements will be made for cheap fares from centres where eight or more passengers arrange to book in advance and travel together.

A train, with restaurant car, leaves Euston at 8.30 a.m., reaching Crewe at 11.36. A return train at 6.14 p.m. reaches London at 9.5 p.m. Ladies introduced by members will be welcomed, but it will be necessary to make a charge of 8s. each to cover transport expenses. Applications from visitors to attend may be made to the hon. secretary. In order to complete the arrangements and to fix a date to suit the maximum number, it is requested that members will notify the hon. secretary before June 1st, giving him a list of the dates they have free during the first ten days of July.

The World Engineering Congress in Japan.

As a result of the work of the British Committee on the World Engineering Congress in Japan, which is representative of some 26 engineering institutions and technical societies, 76 papers have been contributed for presentation at the Conference. The following papers are among those contributed by members of the Institution of Civil Engineers: "The Oil-Electric Locomotive in Railway Service," by A. E. L. Chorlton, C.B.E.; "Water Power Developments in Great Britain and Ireland," by W. T. Halcrow, M.Inst.C.E.; "The Water-Tube Boiler Installation at Bankside Power Station, London," by H. E. Yarrow, C.B.E.; "Some Limitations in the Design of Steam Generating Plant for Modern Power Stations," by S. B. Donkin, M.Inst.C.E., and R. W. Mountain, B.Sc. Included in the papers contributed by members of the Institution of Mechanical Engineers are: "Surface Condensing and Feed Heating Plant," by Richard W. Allen, C.B.E.; "Coal- and Ash-Handling Plant in the Modern Boiler House," by Capt. J. D. Troup, M.I.Mech.E.; "Diesel Auxiliary Generating Machinery," by Richard W. Allen, C.B.E.

The following papers will be forthcoming from members of the Institution of Electrical Engineers: "The Administration of Electric Power Supply in Great Britain," by J. M. Kennedy, O.B.E.; "Some Observations Concerning the Determination of the Capacity and Spacing of Sub-stations in High-tension D.C. Electric Railroads," by T. Ferguson, A.M.I.E.E.; "High-tension Underground Cables in Great Britain," by T. N. Riley, D.S.C.; "The Economical Operation of Steam Power Plant—Peak Load Comments," by I. V. Robinson.

Institute of Transport.

Railway and road problems were discussed at the Institute of Transport Congress at Harrogate on May 9th. Air Vice-Marshal Sir W. Sefton Brancker presided over 250 delegates, and replying to a civic welcome from the Mayor, described transport in this country as more safe, more economical, and more efficient than in any other country. Mr. T. Hornsby, divisional general manager of the North Eastern area of the London and North Eastern Railway, presented an interesting paper on the transport facilities of that railway. Replying to the discussion, he said that the question had been asked whether electrification would solve their problems. He would not like to answer that without careful consideration. Evidence obtained at Newcastle, both with regard to passenger and freight traffic, demonstrated that electrification would help very considerably, but it had to be borne in mind that a large capital expenditure had to be faced, and that there would be a double capital on which to earn revenue. It was a very serious problem.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

At the recent opening of the new Mining Laboratory of the Armstrong College, Newcastle-on-Tyne, by the Prince of Wales, a souvenir miner's lamp was presented to His Royal Highness by Mr. E. MAURICE FISHER, eldest son of Mr. H. J. Fisher, M.I.E.E., chief electrical engineer of Lambton and Hetton Collieries, Ltd.

Mr. SAMUEL T. DAVIES, who has been appointed secretary of the Stalybridge, Hyde, Mossley, and Dukinfield Electricity Board, was entertained recently by his colleagues at Accrington and was presented with a pewter tea service and gold albert. During his service with the Accrington Corporation, Mr. Davies had charge of the electricity and tramway accounts.

The marriage took place last week at Beetham, of Mr. JOHN FAWCETT, of Fawcett & Sons, electrical engineers, Milnthorpe, and Miss L. BURCH, of Overthwaite, Beetham.

It was stated at last week's meeting of the Exeter City Council that the development of the electricity undertaking necessitated the appointment of an assistant electrical engineer. The salary, based on the size of the station, would be between £500 and £600 per annum. The Electricity Committee was authorised to advertise the post.

At last week's meeting of the Lowestoft Town Council the Mayor moved the adoption of the report of the Electricity and Transport Committee which contained a recommendation that the salary of the general manager of the electricity and tramway undertakings (Mr. H. H. SAUNDERS) should be increased

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from £600 to £700 per annum. His Worship pointed out that Mr. Saunders had converted the tramways from a losing to a paying undertaking. There was opposition to the proposal, which was eventually referred back to the Committee.

The Bury (Lancs.) Electricity Committee recommends that the salary of the borough electrical engineer (Mr. J. G. POTTS) be increased from £850 to £950 per annum.

Councillor H. E. DULCKEN has been elected chairman of the Willesden District Council Electricity Committee.

Mr. E. KILBURN SCOTT is the Liberal candidate for South Leeds.

Mr. E. JACKSON, who for the last 9½ years has been manager of the London office of Messrs. Erskine, Heap & Co., Ltd., has been appointed a director of the company.

Lt.-Commander HAYDN T. HARRISON informs us that his telephone number at 14, Victoria Street, Westminster, has been changed to "Victoria 2943." Commander Harrison is occupied in research and testing work in the Benjamin Research Laboratory (telephone: Tottenham 3600).

Mr. S. H. CHATTERLEY has resigned his position as manager of Cantie Switches, Ltd., Nottingham, and is shortly taking up duties with Messrs. Dorman & Smith, Ltd.

The Shoeburyness Urban Council has appointed Mr. R. H. HOLMES, of Pembroke, as electrical engineer and manager at a salary of £230 per annum.

Mr. JAMES L. GUNN, at present general manager of the Greenock and Port Glasgow Tramways Co., has been appointed manager of the Aberdeen Corporation Tramways Department, in succession to Mr. William Forbes. The salary is £750 a year, rising by annual increments of £50 to £900. The vacancy was caused by the appointment of Mr. W. Forbes to the managership of the Cardiff tramways. Mr. Gunn started his career in the Leith Corporation Tramways in 1911, and became assistant to the general manager. He was appointed manager of the Greenock and Port Glasgow Tramways Co. three years ago.

Obituary.—MR. H. JONES.—The death has taken place suddenly of Mr. Henry Jones, who was in business as an electrical engineer at Colnbrook, Bucks.

MR. J. E. BRADY.—The funeral took place at Walthamstow Cemetery on May 8th of Mr. John Eugene Brady, who was for many years with the Electrical Power Storage Co., Ltd., and its successor, Pritchett & Gold & E.P.S. Co., Ltd. The company was represented at the funeral.

MR. A. TAYLOR.—The death took place on May 5th, after a long illness, of Mr. A. Taylor, who was chief electrician at the Markham Main Colliery, Armthorpe.

MR. R. R. DOUGLAS.—The *Electrical World* reports the death, on April 18th, of Mr. Roydon R. Douglas, who founded the Douglas Electric Construction Co. of New Orleans. Mr. Douglas was a native of Manchester, and went to the United States some forty years ago.

The *Australasian Electrical Times* reports that the death took place on March 5th of Mr. W. CORIN, M.Inst.C.E., M.I.E.E., M.I.E.Aust., who was in charge of electricity supply in Launceston, Tasmania, from its inception in 1895 till 1907. He was then appointed chief electrical engineer to the Department of Public Works, N.S.W. For the past few years he had been engaged in private consulting practice.

Wills.—The late Mr. SYDNEY MORSE, J.P., A.I.E.E., left £63,941 gross (£55,533 net personalty).

Dr. LIONEL SELLS, a well-known X-ray worker, left estate of the gross value of £4,259 (£4,185 net).

Mr. ALFRED COOPER, electrical engineer, late of Blackheath, left £14,857 gross (£7,971 net personalty).

The late Mr. T. B. CALLARD, a director of James Keith and Blackman, Ltd., left £25,851 gross and £17,594 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Hydro Thermal Power, Ltd.—Registered as a public company May 6th. Capital, £50,000 in 2s. shares. Objects:—To acquire patents, licences, secret processes or inventions relating to a system of hydro-electric practice of generating power and a combined boiler and accumulator, to erect hydro-electric power stations and machinery, and to carry on the business of hydro-electric and general engineers and suppliers of electric power; to make experiments in and public exhibitions of electric and hydro-electric lighting and power, to manufacture, put up and use telephones, telegraphs (wireless or otherwise), phonographs, dynamos, accumulators, lamps and apparatus, &c. The subscribers are:—R. H. Wheeler, "Rookwood," Hampstead, N.W.3, insurance broker; F. W. Hallewell, 3, Victoria Street, S.W.1, engineer; V. V. Romanoff, 35, rue Cambon, Paris, metallurgical engineer; Brig.-Gen. E. L. Speare, 8, Little College Street, S.W.1; Granville (?), St. Stephen's House, S.W.1, engineer; H. Stokes Waite, 37, Eaton Place, S.W.1, civil engineer; Sir Geo. C. Buchanan, K.C.I.E., 16, Victoria Street, S.W.1, consulting engineer. The first directors are to be appointed by the subscribers. Solicitors: Cohn, Seligman & Bax, 52, New Broad Street, E.C.2.

Peerless Productions, Ltd.—Private company. Registered May 8th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of sellers and purchasing agents for manufacturers of wireless apparatus, motor cars and cycles, gramophones, electrical, scientific and optical instruments, &c. The directors are:—C. G. Fox, Whitedown Cottage, Chobham, Surrey; E. C. Roderick, 53, Bushmead Avenue, Bedford. Registered office: 92, Victoria Street, S.W.

Mains Radio Gramophones, Ltd.—Private company. Registered May 4th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of, agents for, and dealers in gramophones and records; wireless and general electrical and mechanical engineers, &c. The directors are:—F. Riddiough, "Lyndhurst," Queen's Drive, Bare, Morecambe; J. W. Riddiough (managing director), West Point, St. John's Park, Menston, Yorks. Registered office: 8, Vaughan Street, Bradford.

Robinson & Rex, Ltd.—Private company. Registered May 4th. Capital, £500 in £1 shares. Objects:—To acquire the business of an electrical and gas heating engineer and manufacturer of, and dealer in "Blighty" automatic washers and boilers and other industrial and domestic electric and gas appliances now carried on by H. Robinson at Hampton Wick as "Robinson & Rex." The permanent directors are:—R. J. Mott (chairman), 12, York Buildings, Adelphi, W.C.; H. Robinson, "Rio Vista," Riversdale Road, Thames Ditton. Registered office: Old Castle Wharf, Lower Teddington Road, Hampton Wick, Middlesex.

Lighting Research, Ltd.—Private company. Registered May 4th. Capital, £1,000 in 1s. shares. Objects:—To carry on the business of manufacturers of, and dealers in glass of all kinds, lighting engineers and experts, electrical and chemical engineers, &c. The subscribers are:—G. H. Glover, 187, Camberwell New Road, S.E.5, incorporated secretary; F. T. J. Firminger, 1, Probend Mansions, W.4, glass manufacturer. G. H. Glover is the first director. Registered office: 10, Lancaster Place, W.C.2.

J. Lyons (Electrical & Wireless), Ltd.—Private company. Registered May 4th. Capital, £200 in £1 shares (100 7 per cent. cumulative preference and 100 ordinary). Objects:—To acquire the business of an electrical engineer and wireless dealer carried on by H. Lyons, trading as "I. Lyons" at Willesden Lane, Willesden Green, N.W. The directors are:—H. Lyons, 8, Streatley Road, N.W.6; I. Karet, 16, Elmcroft Avenue, N.W.11. Secretary: P. L. Courcey. Registered office: Willesden Lane, N.W.2.

Allom Brothers, Ltd.—Private company. Registered May 8th. Capital, £3,000 in £1 shares. Objects:—To acquire the business now carried on at 15, George Street, Hanover Square, W., and elsewhere, as "Allom Brothers," and to carry on the business of electricians, mechanical, electrical, motor, wireless, and general engineers and contractors, &c. The subscribers (each with one share) are:—D. V. Turner, "Ketner," Woodfield Road, Hounslow West, secretary; R. M. Stanton, 1, Arundel Street, Strand, W.C.2, clerk. The directors are: G. F. Allom (permanent managing director and chairman)

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and others to be appointed by the subscribers. Solicitors: Amery, Parkes & Co., 1, Arundel Street, Strand, W.C.2.

Wynsor Electric Range Co., Ltd.—Private company. Registered May 6th. Capital, £1,000 in £1 shares. Objects: To acquire the business carried on by the Windsor Electric Range Co., to adopt an agreement with L. Burn, carrying on business as the Windsor Range Co. and W. D. Stevens, and to carry on the business of manufacturers of and dealers in electrical cookers, radiators, stoves, lamps, flashing signs, electrical and mechanical engineers, &c. The subscribers (each with one share) are:—H. C. Holman, 6, Alexandra Park Road, Muswell Hill, N.10, chartered secretary; H. F. H. Base, 8, Madeley Road, Ealing, W.5, chartered secretary. The first directors are W. D. Stevens and L. Burn. Registered office: 1, Broad Street Place, E.C.2.

District Supplies, Ltd.—Private company. Registered May 10th. Capital, £10,000 in £1 shares. Objects: To acquire the business of a dealer in gas and electrical fittings, wireless instruments and accessories, gramophones, &c., carried on by B. Usick, at 43, High Road, Wood Green. The first directors are:—B. Usick, S. Usick, and Mrs. Sarah Usick, all of 32a, Woodberry Down, Finsbury Park, N. Registered office: 43, High Road, Wood Green.

Official Returns of Electrical Companies.

Radioservice (London), Ltd.—Satisfaction to the extent of £125 on April 15th, 1929, of debenture dated July 25th, 1927, securing £2,750.

Thompson, Ritchie & Co., Ltd.—Issue on April 29th, 1929, of £500 debentures, part of a series already registered.

Stone Manufacturing Co., Ltd.—Debenture dated April 29th, 1929, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. M. N. Stone, 422, Pinner Road, Harrow.

Allen West & Co., Ltd.—Return dated December 31st, 1928. Capital at date of return, £150,000 in £1 shares (increased February 8th, 1929, to £180,000 in £1 shares). 141,724 shares taken up. £141,724 paid. Mortgages and charges, £100,000. Return of allotments made February 21st, 1929, shows a further 27,443 shares allotted as fully paid.

Asea Electric, Ltd. (formerly Swedish General Electric, Ltd.).—Capital, £5,000 in £1 shares. Return dated March 8th, 1929. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Sturge & Baker, Ltd.—Capital, £8,000 in £1 shares (1,500 preference and 6,500 ordinary). Return dated March 27th, 1929. 1,500 preference and 5,896 ordinary shares taken up. £7,396 considered as paid. Mortgages and charges, nil.

White & Mantle, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1928 (filed April 4th, 1929). 551 shares taken up. £301 paid. £250 considered as paid. Mortgages and charges, nil.

Britain's Best Crystal, Ltd.—Capital, £100 in £1 shares. Return dated October 26th (filed December 13th), 1928. All shares taken up. £100 paid. Mortgages and charges, nil.

Midget Lamp Co. (1924), Ltd.—Capital, £2,000 in £1 shares. Return dated January 11th, 1929. All shares taken up. £2,000 paid. Mortgages and charges, £500.

Flather & Co., Ltd.—Capital, £20,000 in £1 shares. Return dated November 20th, 1928 (filed February 22nd, 1929). 11,044 shares taken up. £9,544 paid. £1,500 considered as paid. Mortgages and charges, nil.

Melbourne Electric Supply Co., Ltd.—Capital, £1,750,000 in 150,000 8 per cent. first preference shares of £5 each and £1,000,000 consolidated ordinary stock. Return dated December 26th, 1928. 100,000 preference shares and £800,600 ordinary stock taken up. £1,286,445 paid on 100,000 preference shares and £786,445 ordinary stock. £14,155 considered as paid on £14,155 ordinary stock. Mortgages and charges, £1,864,056.

George Moritz, Ltd.—Capital, £10,000 in £1 shares. Return dated December 20th, 1928. 9,081 shares taken up. £9 paid. £9,072 considered as paid. Mortgages and charges, nil.

Vulco Dry Battery Co., Ltd.—Capital, £8,000 in 1,500 preference and 6,500 ordinary shares of £1 each. Return dated December 7th, 1928. 1,500 preference and 6,333 ordinary shares taken up. £3,500 paid. £4,333 considered as paid. Mortgages and charges, nil.

V. Badman, Ltd.—Issue on April 30th, 1929, of £25 debentures, part of a series already registered.

City Notes.

Associated Electrical Industries, Ltd.

The annual general meeting was held on May 7th, Mr. Howard C. Levis presiding. In presenting the report (*vide* Elec. Rev., May 3rd, p. 798), the chairman referred to the steps which had led to the formation of the company and to the merging of the interests of the Metropolitan-Vickers Electrical Co., Ltd., the British Thomson-Houston Co., Ltd., the Edison Swan Electric Co., Ltd., and Ferguson, Pailin, Ltd. He said that, while it would of necessity take time to fully realise the expected economies, the important fundamental steps had been taken. Several plans were considered, and that which was finally adopted involved the use of the company as a holding company. The ordinary shares of the British Thomson-Houston Co. were purchased by exchanging for them ordinary shares of the Metropolitan-Vickers Co., and shares of the other two companies were acquired for cash. To provide the cash necessary to complete this purchase, to pay the expenses incurred in connection therewith, and to provide additional working capital, each existing ordinary shareholder of the Met.-Vick. Company was given the right to subscribe for one new ordinary share for each ordinary share held, at 25s. per share. All of the new ordinary shares and those issued to pay for the B.T.H. shares ranked for dividend from January 1st, 1929. The Met.-Vick Company's name was changed to Associated Electrical Industries, Ltd., and to preserve the goodwill connected with the old name it was intended to change the name of an existing subsidiary company to Metro-Vick Electrical Products, Ltd.; later, however, it was decided to change the name of the subsidiary to the old name, Metropolitan-Vickers Electrical Co., Ltd., and that was its name at present. The owners of the 500,000 deferred shares of 1s. each—each share having a vote—consented to their holdings being converted into 25,000 new ordinary shares of £1 each—the holders sacrificing 475,000 votes. Only the deferred shares and the preference shares enjoyed voting rights, and as it was desirable, the right to vote was extended to ordinary shareholders, both old and new. The number of directors was increased from 11 to 15, and certain of the then existing directors resigned from the board and became members of the board of the Metropolitan-Vickers Electrical Co.; and Sir William Guy Granet, Gen. the Hon. Sir Herbert Lawrence, Messrs. W. C. Lusk, O. H. Smith, V. H. Smith, C. F. Spencer, the Earl of Verulam and himself (the chairman) joined the Associated Electrical Industries board. Sir Philip Nash became the managing director of the company, and chairman of the Metropolitan-Vickers Electrical Co., Ltd., as reconstituted, and he had joined the board of the British Thomson-Houston Co., Ltd. Together the companies employed nearly 30,000 people in England, and also possessed manufacturing facilities in Australia. With the exception of the output of the Australian shops, and of an insignificant number of specialised articles for which the demand in this country had not as yet justified manufacturing here, all the products sold by the group were at present, and would continue to be, entirely manufactured in Great Britain. Having dealt at length with the balance sheet, the chairman said that the situation as regarded competition, both at home and abroad, had become more severe even than a year ago. The large orders placed by the Central Electricity Board had undoubtedly increased the volume of business offering, and the group had had a fair share of these, but that work had had the effect of attracting the efforts of such a large number of competitors that price levels had fallen as a result. It was a matter for regret that the facilities available for the manufacture of electrical apparatus in this country continued to extend at a greater rate than the increasing demand, with the inevitable result of fiercer competition and a lower level of price. These enlarged facilities also resulted in increased competition in the foreign markets, with resulting lower levels of prices there, created in many cases by competition between English firms. This all pointed to the advisability of every effort being made by those in control of the industry in England to secure co-operative arrangements which would tend to produce an adequate return for the investment of money and brains in the industry. The results of the year under review were satisfactory, considering the circumstances, but the profits were not adequate, having in mind the efforts put forth, the quality of the products sold, and the service rendered to their customers. It was essential for the maximum possible turnover to be obtained in order to get any adequate return on the capital invested, and with that end in view the company had established and had continued to extend its activities in every market in the world where conditions gave any promise of obtaining work. It was satisfactory to note that in spite of competition, not only from British firms, but from all the well-known concerns in Europe and America, they had been able in recent years to obtain about half their business from export markets. He had laid stress on existing conditions with a view to emphasising the need for better organisation of the industry as a whole, and the steps already

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taken to merge the interests of the companies now within their group could be regarded only as the beginning of what should be done if the electrical industry in England was to develop successfully and be in a position to render adequate service in this country, and, in addition, bring to Great Britain its proper share of world business in competition with other countries. The report covered the work of the Metropolitan-Vickers Electrical Co., Ltd., as it stood before the fusion, and it was satisfactory to note that during the year the intake of business increased approximately 16 per cent. in money value, representing in actual volume of material a still greater increase, while the output constituted a record in the history of the company. As regarded the group as a whole, during the first four months of the current year the volume of business had increased relative to the corresponding period of 1928, and there was indication, from the business offering, that the volume should be well maintained during the year; prices, however, still tended to be on a lower basis. An examination of the increased business this year showed that there had been a substantial increase in the number and volume of orders for the smaller class of apparatus rather than an increase in contracts of considerable magnitude. This increase in the number of smaller orders indicated not only an improvement in the day-to-day demands for electrical apparatus arising from industry generally in this country, but also denoted the growth of the goodwill of the companies forming the group. Sir Philip A. M. Nash seconded the motion, and the report was adopted without discussion.

British Thomson-Houston Co., Ltd.

This company's report was reviewed in our issue of May 3rd (p. 797). Mr. H. C. Levis (chairman) presided at the annual meeting on May 8th, and in the course of his address mentioned the resignation from the board of Mr. O. H. Smith, who had joined the board of Associated Electrical Industries, Ltd., and the appointment of Sir Philip Nash as a director. He repeated the statements regarding the acquisition of the B.T.H., Edison Swan and Ferguson, Pailin shares by Associated Electrical Industries which he had made at the meeting of the last company on the previous day. Mr. Levis then reviewed the accounts in some detail, and proceeded to say that the company now employed nearly 12,500 people. Their policy had always been to manufacture in this country everything which they sold, with the exception of a very small number of items where the volume of sales was too small to warrant production. It was their intention, and that of the associated companies, to continue that policy. He had referred at last year's meeting to the holding of the company's ordinary shares by the International General Electric Co. Those and the other ordinary shares of the company had been acquired by Associated Electrical Industries, Ltd. They could never speak too highly of the assistance—technical and financial—which had been rendered to the company in the past, and had been so instrumental in helping to build up the great business.

Mr. W. C. Lusk seconded the motion, and the report and accounts were adopted.

Johnson & Phillips, Ltd.

The annual meeting was held on May 9th, Mr. J. Macgregor (chairman and managing director) presiding. In moving the adoption of the report (*vide* our last issue, p. 842), the chairman referred to the paying-off in full of the Burndept debenture. He said that a great deal of criticism had been levelled against them when they made that loan, but the policy of the board in supporting the Burndept Co. was sound finance. The Burndept Co. had been a good customer in the past, and they hoped that it would continue to be so for many years to come. He was pleased to be able to report that the temporary falling-off in business had passed, and there were now more orders going through than at this time last year. The business done during the first four months of this year exceeded the business done during the corresponding period of 1928 by 20 per cent. The directors considered the results of the year's working disappointing; the scarcity of work and the keen competition for orders was responsible for this. The demand for electrical plant had not yet caught up with the productive capacity of the industry. The low price of copper ruling during 1928 affected the value of the turnover and the ratio of profit. The coal, iron and steel and shipbuilding industries, all large customers for electrical plant, had only of recent months begun to turn the corner, and though large contracts were placed by the Central Electricity Board during 1928, these had not by any means made up to the electrical manufacturing industry as a whole for the falling off in business due to the waiting attitude of its customers which the new developments in the industry had entailed. Their goodwill in 1928 had been fully maintained, as was proved by statistics compiled by their Sales Department from carefully collected data, which demonstrated that their share of the total general business placed had actually grown. The exceptionally large contracts now being placed by the Central Electricity Board were bound to have a beneficial effect on their business in the future, both directly and indirectly, so that the directors looked forward to a substantial expansion of business from now onwards. It was a tribute to the service rendered by their sales and distribution organisation, and to the quality and reputation of their manufactures, that they had held their own in a period of restricted expansion, and consequently aggravated competition. There were many signs that the lull in electrical development which had characterised the last two or three years would shortly be followed by a period of great activity, apart from the effect of the great national supply scheme. The electrification of the rest of our railways in heavy traffic areas was a certainty of the near future. The operating results shown by those already electrified had put that beyond doubt. The extension of the telephone system was a programme to which all political parties were committed; so was the development of our Crown Colonies, in connection with which the company had already secured much valuable business. In the great overseas Dominions and in the Indian Empire they had also been successful in maintaining their share of the available business, although in certain directions not so much electrical material was imported into those countries as in previous years owing to local considerations and difficulties. Their service and distribution organisation in those great countries was extensive and highly efficient, their reputation in all of them stood high, and they felt confident of being able to share in their future prosperity. In particular, he would mention the expansion of their business in South Africa, which had resulted in their forming a subsidiary company there known as Johnson and Phillips (Pty.), Ltd., the whole of the share capital of which belonged to the company. Towards the end of the year they entered into possession of new London offices at Columbia House, Aldwych, more in keeping with the present status of the company and in closer touch with the centre of electrical and engineering affairs. In addition to the improved office accommodation, these premises contained what were probably the finest cable stores in Central London. Their business had already perceptibly felt the benefit of the change, and the directors were confident that it would have the effect of considerably improving their trade. The report and accounts were adopted.

British Power and Light Corporation (1929), Ltd.

On Monday last this company offered for public subscription 1,600,000 shares of £1 each at par. Its total authorised capital is £2,000,000, and it was registered on May 7th to operate directly, or through subsidiaries, electrical generating and distributing undertakings. Arrangements have been made to acquire a controlling interest in the North Wales Power Co., Ltd., the Electricity Distribution of North Wales and District, Ltd., the East Suffolk Electricity Distribution Co., Ltd., the South Somerset and District Electricity Co., Ltd., the Trent Valley and High Peak Electricity Co., Ltd., the West Hampshire Electricity Co., Ltd., and the Ringwood Electric Supply Co., Ltd. With regard to the North Wales Power Co., Ltd., the Corporation is acquiring at par 1,806,652 of the 2,000,000 issued 10s. shares, and will advance £300,000 to the company for immediate and future capital requirements. The Corporation is purchasing 88,000 ordinary shares (fully paid) and 50,000 preference shares (5s. paid) of the Electricity Distribution of North Wales and District, Ltd., and is to pay up the balance of the preference capital to provide the company with funds for extensions and working capital. With the exception of the Ringwood concern the other companies involved in the matter are distributing undertakings only. The Corporation is acquiring 119,356 £1 shares in the five companies for £144,674, and will advance to them £100,000 for the purpose of extensions and working capital. The net revenue attributable to the Corporation is estimated at £54,704 for 1929, rising to £160,375 by 1932. It is anticipated that dividend payments will be commenced in the early part of 1930. The directors of the Corporation are Messrs. H. A. Vernet (deputy-chairman, Underground Electric Railways Co. of London, Ltd.); chairman; E. de Stein; C. E. Benson, D.S.O. (Robert Benson & Co., Ltd.); G. W. Partridge (managing director, London Electric Supply Corporation, Ltd.); and G. V. Twiss, managing director. The registered office is at 27, Old Broad Street, E.C.2.

Reuter (New York) reported on May 9th that, in co-operation with a London syndicate, Clark, Dodge & Co. were to offer for public subscription on Monday last a new issue of shares in sterling of the British Power and Light Corporation, Ltd. The American portion of the issue was to consist of 1,600,000 shares at £1 par value.

Brush Electrical Engineering Co., Ltd.

The annual meeting was held on May 13th, Mr. E. Garcke (chairman) presiding. In presenting the report and accounts (ELEC. REV., May 10th, p. 840), the chairman said that the electrical industry as a whole had never been on a higher level of activity, or possessed a more favourable outlook or capacity to render service to the community than at present. This activity was not shared by other important and kindred industries, and these general clouds were now threatening to overshadow the electrical industry. The serious problem was the existence of excessive competition out of all proportion to the merits of emulation and efforts to improve the results of enterprise. Having regard to the difficult nature of the general electrical industry, the profits were not adequate in comparison with the large provision which should be made for cost of research, risk of obsolescence of plant, and for fair remuneration of the highly specialised technical services. Where the bad general situation hit the company in particular was that during the past year it had had to sell 25 per cent. more output in order to obtain the same profit. The company had specialised in the relatively small sizes of Ljungström turbines, but latterly the Electricity Commissioners had decided

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to discourage the extension of plant at many of the smaller power stations in order to concentrate the generation of electricity at relatively few selected super-stations. Regarding the suitability of the Brush-Ljungström turbine for sizes about 15,000 kW, and even for super-power station use, the company's technical experts considered that it was adaptable to the highest capacity of unit that might be called for. Referring to transformers, the chairman said they were one of the few firms engaged in their manufacture, but now a number of other manufacturers had entered the field, and they were all exposed to cut-throat competition, with the result that this department of manufacture, which was remunerative to a few, had become ruinous to the many. The co-partnership scheme which had now been in operation for about three years, had proved successful. The report and accounts were adopted, and resolutions were passed converting the share capital of the company into stock, and making certain alterations in the articles of association.

Urban Electric Supply Co., Ltd.

Mr. P. D. Tuckett (chairman) presided at the annual meeting on May 9th, and in presenting the report and accounts (ELEC. REV., May 10th, p. 841) said that they had been able to maintain the dividend on the larger capital caused by the addition last year of 160,000 ordinary shares. The decrease of £4,431 in revenue was more than accounted for by the compulsory purchase of the Walton undertaking. Reductions in charges had been made in practically all their undertakings within a period which affected the results for 1928, but, on the whole, the reductions had not adversely affected the profits. The approval of the local authority to the sale of the Godalming undertaking to the Aldershot, Gas, Water and District Lighting Co. had been withheld, but as the time limit for the sale had not yet expired, some further development in the situation was still possible. The company had issued 44,975 shares in exchange for a like number of shares of the Newquay Company. This company was in the area of the Cornwall Power Co., and the bulk supply to Newquay would be a valuable addition to the business of the Power Co. During the past year the output was materially affected by the closing down of the Tolgus and Tresaran tin mines supplied by the Cornwall Co., the sale of the Walton undertaking, and the abandonment of the tramways at Glossop and Redruth, but there was an increased consumption of 4,282,000 kWh by other consumers. All their undertakings would seriously suffer from the increase in their payment of local rates, due to the heavy increase in their assessments under the recent valuation, and these additional payments, which would exceed £13,000, were likely to seriously curtail their ability to further reduce charges in the near future. Notice had been received of the compulsory purchase of their Stamford undertaking and part of the undertaking of the Twickenham Company. The report and accounts were adopted.

Marconi's Wireless Telegraph Co., Ltd.

The directors in their report for the year ended December 31st, 1927, state that the profit, after meeting debenture interest, was £412,971, to which was added £25,197 brought forward, making £438,168. Two interim dividends of 10 per cent. were paid, leaving a balance of £23,777 to be carried forward. The 1928 figures are not yet complete, but the directors anticipate that the available profit, after meeting debenture interest and preference dividend, will be about £408,500 plus the amount brought forward. They are paying an interim ordinary dividend of 20 per cent. and an additional 10 per cent. on the 7 per cent. cumulative participating preference shares. Although the distribution will be greater than the profit for the year the directors consider that they are justified in maintaining the dividend, in view of the merger. The report reviews the steps which led up to the merger and re-states the proposed arrangements. After recommending the shareholders to agree to the exchange of their shares for shares in Cables and Wireless, Ltd., the directors state that, in their view, the holders of the £1 shares would be acting in a manner contrary to their own interests by remaining shareholders of the Marconi Company instead of shareholders of Cables and Wireless, Ltd. It is shown that by exchanging their holdings both ordinary and preference shareholders stand to receive a larger return. At the general meeting on May 29th resolutions are to be submitted providing for alterations in the company's articles of association rendered necessary or desirable by the merger scheme. After mentioning the retirement from the board of Sir Frederick Sykes and Mr. P. Ashley Cooper, and the death of Sir John Denison Pender, the directors show how the profits of the company have risen since the reorganisation of the company. The figures, after the deduction of debenture interest, are as follows: 1925, £177,938; 1926, £198,947; 1927, £430,471; and 1928, £426,000.

Calcutta Electric Supply Corporation, Ltd.

The annual meeting was held on May 8th, Lord Meston (chairman) presiding. In presenting the report and accounts (*vide* ELEC. REV., May 10th, p. 841), the chairman said that the fourth 6,000-kW set in the southern station was put into commission in July last, and one of the old Oerlikon sets at Cossipore was replaced by a 10,000-kW set. The sales of electricity amounted to 148,000,000 kWh, as compared with 129,000,000 kWh in 1927, and as a result of reductions in charges the average price per kWh obtained fell from 1.51 to 1.36 annas. The Calcutta Municipality had accepted a seven-years' contract for the supply of electricity to municipal buildings at 2 annas per kWh, and for street lighting at 1½ annas per kWh. The "standard rate A" to large power consumers was being reduced by 10 per cent. as from July 1st next. During 1928 the Government of Bengal had granted the company a licence for the supply of electrical energy to Serampore. To serve this new area, as well as the Bully-Utterpara municipalities, for which, also, a licence had been obtained, a ring main had been constructed, and this had commenced to carry electricity on April 20th last. Sir James Donald and Mr. G. C. Gooding had joined the board to fill the vacancies caused by the death of General Mahon and Mr. P. V. Luke. The report and accounts were adopted, and a proposal to increase the share capital from 3,000,000 to 4,000,000 in £1 shares was passed.

Ever-Ready Co. (Great Britain), Ltd.

The report for the year ended March 31st last records a profit of £210,167, as compared with £187,964 in 1927-28. The addition of £30,022 brought forward makes available £240,189. Of this, £41,130 is placed to reserve, and "donations" absorb £363, leaving £198,696. As we have already reported, the final dividend on the old ordinary shares is 25 per cent., making 35 per cent. for the year as for 1927-28. The new ordinary shares, issued as a bonus, receive 25 per cent. During the year £39,675 was spent on extensions of plant and equipment, while £340,059 was expended on the acquisition of an interest in Lissen, Ltd., and deferred shares in the Ever-Ready Trust and Finance Co., Ltd., and the provision of further capital for the Continental businesses. Reference is made to the issue of bonus shares made in January last, and an issue of 395,200 ordinary shares in February at 20s. 6d. per share. The report also records the death of the chairman, Mr. C. H. C. Moller, and the appointment of Mr. F. S. Johnson to the board. Meeting: May 31st.

International Telephone and Telegraph Corporation.

At a special meeting on May 8th, it was decided to change the stock of the Corporation from shares each of a par value of $100 to shares without par value and to increase the authorised capital stock of the Corporation from 2,500,000 shares of a par value of $100 to 15,000,000 shares without par value and to change the number of issued shares of capital stock of the Corporation to three times that number. The directors later announced that they had authorised the issue of common stock of the Corporation without par value at an issue price of $50 per share and the offer of that stock to the stockholders in the ratio of one share for each 10 shares of no par value stock, or the equivalent thereof, standing in their respective names on the transfer books of the Corporation on May 24th.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

Last week an offer to purchase the whole of the company's "A" and "B" ordinary shares at 50s. per share was made by the Greater London and Counties Trust, Ltd., of which Lord Birkenhead is chairman. The balance sheet of the company as at December 31st, 1928, showed that there were in issue 300,000 "A" shares and 755,000 "B" shares of £1 each, a total of £1,055,000. The dividend on the "A" shares was 8 per cent., and that on the "B" shares 7½ per cent.

Greater London and Counties Trust, Ltd.

Following the announcement of the offer by the Trust to purchase the "A" and "B" shares of the Shropshire, &c., Power Co., reported above, a statement of the Trust's policy was made last week by Lord Birkenhead, the chairman. He said that the directorate of the trust was, and would remain, British. The same was true of the directors of all its subsidiary companies, of its engineers, and its entire personnel. Moreover, the labour and material employed would continue to be British. "It is my purpose, with the concurrence of all concerned, at a suitable moment, to recommend a public issue in which the British investor will be able to subscribe for as many shares as he wishes, with the result that if such subscription as is anticipated is made upon the scale required for that purpose, the full control will in the ordinary course become British."

Bogota Telephone Co., Ltd.

The directors have informed the shareholders of an offer made by the Cable, Telephone & General Trust, Ltd., to purchase the whole of the issued ordinary capital of the company at 35s. per share. The offer is conditional upon acceptance by the holders of 75 per cent. of the shares on or before May 21st. The directors have accepted the offer so far as their own holdings are concerned, and advise the shareholders to do the same. Under the terms of the offer the directors and certain officials of the company will retire, receiving £12,000 between them as compensation for loss of office. The purchasers are to undertake that all equipment required for use in Bogota, which is not manufactured in Colombia, shall be purchased in England for the next ten years, so far as is practicable, or that an equivalent amount of other business shall be placed in England.

It is reported that a sufficiently large percentage of shareholders have accepted the offer and the purchase is to be proceeded with.

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Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted :—

Associated Electrical Industries.—1,225,000 ordinary shares of £1 each, fully-paid, Nos. 2,185,001 to 3,385,000 and 4,521,951 to 4,546,950.

Brompton and Kensington Electric Supply.—210 ordinary shares of £1 each, fully-paid, Nos. 350,797 to 351,006.

Newcastle-upon-Tyne Electric Supply.—925,000 ordinary shares of £1 each, fully-paid, Nos. 3,082,682 to 4,007,681; and 1,400 5 per cent. preference (non-cumulative and participating) shares of £1 each, fully paid, Nos. 1,537,553 to 1,538,952.

Underground Electric Railways of London.—4,662 ordinary shares of £1 each, fully-paid, Nos. 7,116,651 to 7,121,312.

Application has been made to the Committee to allow the following to be officially quoted :—

Adelaide Electric Supply Co.—£250,000 5½ per cent. redeemable consolidated debenture stock.

Associated Electrical Industries.—1,136,950 ordinary shares of £1 each, fully-paid, Nos. 3,385,001 to 4,521,950.

British Electric Transformer Co., Ltd.

The profit for the past year was £14,740, as compared with £53,703 for 1927. The addition of £10,855 brought forward makes available £25,595. From this, £4,000 (against £5,000) is transferred to depreciation reserve, and six months' dividend is paid on the 7 per cent. preference shares, leaving £11,905 to be carried forward. Last year £10,000 was put to reserve, and a dividend of 5 per cent. was paid on the ordinary shares. The directors state that conditions during the year were very difficult, and there was a great deal of price cutting. The current year has opened with unprecedented activity, for in addition to the ordinary business large orders for transformers have been received from the Central Electricity Board. These orders will provide work for the next two or three years. There were indications of a large electrical development in this country which should react favourably on the company's future. The company has established a lamp factory in extension of its "Sunray" radiator business. To provide working capital negotiations for the sale of some of the properties are in hand. Pending the realisation of this, the directors have decided to defer the payment of the last half-year's preference dividend; this will be considered at a later date during this year. Meeting: May 21st.

Birmingham District Power and Traction Co., Ltd.

The revenue for the past year amounted to £120,626, and after deducting payments to local authorities and income tax there remains £99,729, to which is added £44,995 brought forward, making £144,724. Interest on debenture stock (£10,817) and renewals (£6,971) are deducted, leaving £126,882. A dividend of 7 per cent. for the year on the ordinary shares is recommended, and the balance carried forward is £45,855. Meeting: May 29th.

Aeonic Radio, Ltd.

A meeting was held on Tuesday last for the purpose of raising the authorised capital from £225,000 to £450,000 by the creation of 2,250,000 new shares of 2s. each. Of these 1,250,000 will be offered to existing shareholders at par. The proceeds are required to finance the purchase of the Kramolin concern, Berlin, which owns a large number of radio patents, including a "push-button" receiver by means of which any one of 20 stations can be picked up automatically.

Lewes and District Electric Supply Co., Ltd.

The net receipts for the past year were £11,218, as compared with £11,598 in 1927, and after meeting expenses, interest, and £3,500 for renewals, there is a surplus of £3,658 (against £4,522), to which is added £3,403 brought forward, making £7,062. A dividend on the ordinary shares of 10 per cent., and the placing of £2,000 to reserve are proposed, leaving £2,735 carried forward.

Swansea Improvements and Tramways Co.

The total revenue for 1928 was £136,546, and after deducting expenses, debenture interest, &c., £9,009 payable to Swansea Corporation, and setting aside £20,000 for renewals, there is a surplus of £11,102, which, with the addition of £6,481 brought forward, makes £17,583. It is proposed to place £2,000 to reserve, and pay a dividend of 6 per cent. for the year, leaving £5,183 to be carried forward.

British Electric Traction Co., Ltd.

The directors recommend a cash dividend of 5 per cent. on the deferred ordinary stock, together with a bonus of 10 per cent. in fully-paid £1 ordinary shares, in respect of the year ended March 31st last, as for 1927-28. The 6 per cent. cumulative participating preference stock thus becomes entitled to an extra dividend of 1.67 per cent.

Siemens Bros. & Co., Ltd.

A final dividend of 5 per cent. is recommended, making 7½ per cent. for the year as for the preceding year.

Stocks and Shares.

MONDAY EVENING.

STOCK EXCHANGE markets present various features of interest, in spite of the circumstances that fight in their courses against the likelihood of activity prevailing on the eve of the General Election, and the Whitsuntide holidays, and on account of the monetary outlook. One of the principal features is the marked attention that is being paid to electric lighting shares. In the cable group, activity has subsided in consequence of the fact that the transfer-books of the companies concerned in the merger are closed. Amongst manufacturing issues, United States operators display decided interest in two or three of the companies whose control it is reported that American interests are desirous of acquiring. On the whole, however, Stock Exchange markets are quiet, and are expected to remain so until the end of the present month. There is, nevertheless, an obvious tendency to assume that the shrinkage in the prices of a good many stocks and shares, due to the uncertainties attaching to the General Election, has been carried far enough, and that, whatever happens, the probabilities point more in favour of improvement than of further declines.

American Influences.

Shropshire, Worcestershire and Staffordshire shares have come into the limelight in consequence of an offer which is being made of 50s. per share for "A" and "B" alike. Evidently there must have been people with knowledge of the likelihood of such an offer maturing, who had been endeavouring to purchase the shares in advance, for the rise in price during the past month has been considerable. Rumours as to what might happen in connection with the company have been in circulation for some time past. It is expected that the majority of shareholders will accept the offer, and the prices of both shares—"A" and "B"—have moved up to 48s. 9d. Midland Counties, which are supposed to be affected in a similar way by the influences which have been at work in connection with Shropshires, have risen 4s. to 34s. Strong inquiry arose for Metropolitan Electric ordinary; the price is 6s. 3d. up, at 47s. 6d. The market is on the *qui vive* for further developments in connection with the industry, and any rumour which links a company with the possibility of being bought out by, or amalgamated with, some other undertaking receives eager attention. North Metropolitan Electric ordinary rose to 32s. 6d. County of London are 1s. 6d. up, at 35s. 6d. The 7 per cent. debenture is better at 106. Isle of Thanet—said to be an object of desire to one of the London undertakings—have advanced to 40s.

Provincial and New Issues.

Bournemouth and Poole ordinary at 65s. 9d. are ex dividend, and have regained the 1s. 9 3/5d., less tax, taken off the price last week. Scottish Power hardened to 32s. Egham and Staines has been a feature of strength with a jump to 35s., after the lists had closed for subscription to the new shares at 30s. Underwriters received 1s. 6d. per share commission; "money for jam," one of them called it. The new Lancashire Electric ordinary are better at 9d. premium bid, and Clyde Valley new firmed up to 12s. premium. An issue was made at the week-end of £1,600,000 British Power and Light Corporation. The shares, of £1 each, were offered at par. The company is obtaining a controlling interest in the North Wales Power Company, the Electricity Distribution of North Wales and District, and five other electricity supply companies. The company is expected to be in a position to begin payment of dividends early next year. The issue of Young Accumulator shares was left largely in the hands of the underwriters, and the price started at 1s. discount. Northampton Electrics jumped from 38s. to 47s. before easing off to 46s. Midland Electric Power Distributions hardened to 35s. 9d. bid, and Newcastle-on-Tyne ordinary to 26s. 3d.

Central Electricity Board.

The Central Electricity Board, in publishing its first report, hints at the possibility of a loan in the fairly near future. The Board has arranged temporary advances with the Bank of England; the sum borrowed up to the end of last year amounted to £339,000. This was to provide for expenses during the initial period before the disbursements of the Board should become sufficient to justify raising a loan. Doubtless the stock, when it appears, will be gilt-edged in character.

Marconis.

Announcement was made on page 842 of last week's ELECTRICAL REVIEW that Marconi's Wireless Telegraph Company would pay a dividend of 20 per cent. on its ordinary shares, and an additional 10 per cent. on the 7 per cent. participating preference shares (making 17 per cent. on the latter) out of profits made in respect of 1928. This means 2s. on the ordinary Marconi shares of 10s., and 4s. on the company's £1 shares. The directors state in the report that "to have allotted twice as many shares to holders of £1 shares, arising out of conversion of the Marconi debenture, as to the original shareholders, is a proposition that could not in fairness be entertained." The prices of the Marconi shares will be quoted ex dividend on the Tuesday following Whitsun.

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Merger Meetings.

The meetings of shareholders in the Marconi and cable companies will be held on May 29th, for consideration and approval of the necessary changes in the Articles of Association. Proprietors in all the companies will receive, nine days earlier, the documents relating to the offer of exchange of shares. Stock Exchange prices are quiet in the meantime. Marconis remain close to 85s. The £1 shares are 5, and the preference 4⅞, all virtually unchanged on the week. Canadian Marconis have dropped 6s. 3d. to 33s. 9d. In the cable group, Western Telegraphs put on 10s. at 28. there being no valid reason why their price should not rank on the same level as Eastern ordinary and Eastern Extensions. The company's 4 per cent. debenture stock dropped 1, to 79½. Globe Telegraph and Trust ordinary have risen to 28½, and the 6 per cent. preference shares, a remarkably well-covered investment, advanced 2s. 6d. to 11⅜. Indo-Europeans at 52½, ex dividend of 37s. 6d., are all but unchanged, allowing for that marking. Oriental Telephones are 1/16 up, at 58s. 9d. American Telephone and Telegraph at 230 are ex rights valued at about 6 points This means a slight fall on the week. International Telephone and Telegraph gained 20 points, at 280, on the announcement that shareholders will receive early in June the rights to subscribe to a new issue of shares.

Rises in Undergrounds.

Political parties are profuse with promises relating to panaceas for unemployment, and some of these are to be fulfilled, we are told, through the medium of the railways. Hence a firmer disposition amongst Home Railway stocks. The Undergrounds shared in an improvement which lifted Districts to 76½, "Mets." to 60, and Underground Electrics to 24s. and 114 for shares and income bonds respectively. There has been no particular accession of fresh business. Prices were marked up on a moderate demand for stock coming into a market where sellers had been, for some time past, decreasing in numbers.

Stock at 1,000.

British Electric Traction deferred ordinary stock has risen 100 points, and now stands at 1,000. Business is so recorded in the Stock Exchange Official List. The company has declared a dividend, on the stock, of 5 per cent., and a bonus of 10 per cent. in fully-paid deferred ordinary shares of £1 each. The participating preferred stock thereby becomes entitled to an extra 1.67 per cent. dividend over and above its 6 per cent. The B.E.T. controls the Birmingham District Power and Traction Company, which holds the controlling interest in the Shropshire, Worcestershire and Staffordshire Company. The Birmingham District Power and Traction has declared a dividend on its own ordinary shares of 7 per cent., which is the same rate as for the previous year.

Tramways and Traction.

London United Tramways 4 per cent. debenture stock is changing hands with rather unusual frequency, and the price has been put up a couple of points to 64. At the same time, London and Suburban Traction preference were advanced to 13s., although this appears to be complimentary, in view of a marking at 12s. 1½d. In the foreign group, Brazilian Tractions came back to 55½. The Mexican division remains dullish, with no outstanding feature. Lisbon Electric Tramways attracted business at a guinea. La Plata 6 per cent. preference, just ex their dividend of 1s. 6d., are quoted nominally at 22s. 6d. Para Electric Railway ordinary has been done within the past few days at 4s., and Cape Electric Trams at 9s. 9d.

Manufacturing Companies' Shares.

Associated Electrical Industries have moved back sharply to 45s. ex dividend. The fall is ascribed to a willingness to take profits on the part of people on both sides of the Atlantic. The preference, on the other hand, rose to 55s. Atlas advanced 2s. 6d. to 28s. General Electrics shed ⅛, going back to 2⅞. This compares with 4¼, touched earlier this year, during the time when the Americans were buying so fervently. Philips Glow Lamps have had another substantial rise, the Amsterdam Bourse becoming greatly excited over a report that the company's German competitors need no longer be feared. Henley's are a good market, at 6 1/16. British Insulated, with a 3s. rise in one day, are up to 3⅝. Enfields drooped to 4¼. Siemens hold their price at 27s. 6d.; the 10 per cent. preference at 32s. have shed a few pence. No change occurred in Telephone Manufacturing at 5s. 9d. A fall of 1/16 reduced Electric Constructions to 18s. 9d.

Miscellaneous.

Power Corporation of Canada reacted 2½ to 107½. Pennsylvania Water and Power shares drooped to 86½. Hydro-Electrics at 34½ and International Holdings at 8⅝ are a dull market. General Electrics (America) reached a record price of $268 on rumours of the shares being split. Babcock & Wilcox are a few pence lower on the week, at 64s. 6d.; Vickers remain firm at 10s. 10½d. Rubber shares are better, thanks to a trifling recovery in the price of the produce.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Approx. Dividend. 1927.	1928.	Price May 13 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	65/9xd	+1/16	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/-	—	5 7 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1		8	32/6	—	... ...
County of London	1	7½	10	55/6	+1/6	3 12 0
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	57/3	+1/-	3 17 0
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	27/6	+6d.	5 1 10
Metropolitan	1	9	9	28⅜	+5/16	3 15 9
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	34/-	+4/-	3 16 8
Mid. Elec. Power	1	15	8	35/9	—	4 9 6
Newcastle on-Tyne Ordinary ...	1	6	6	26/3	+1/16	4 11 5
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	+¼	5 9 1
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	+1/6	5 0 0
South London	1	8½	8½	26/6xd	—	5 5 8
Urban Ordinary	1	7	—	43/8	—	... ...
Westminster Ordinary	1	8⅝	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,,	8	8½	60	+½	5 16 8
do. District	,,	4	5	76½	+1	6 10 9
Underground Electric	£1	5	7	24/-	+6d.	5 13 10
do. do. Income ...	Bonds	6	6	114	+1	5 5 2

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	1½	24½	—	6 2 6
Automatic Telephone	1	10	12½	2⅞	—	5 13 0
Eastern Extension	10	10	10	28	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	280	—	*3 11 6
Globe Tel. and T. Ord.	10	10	10	28½	+¼	*3 10 2
do. do. Pref.	10	6	6	11⅜	+⅛	5 5 8
Great Northern Tel.	10	20	—	33	—	... ...
Indo-European	25	10	10	52½xd	—	*4 11 9
Marconi	10/-	10	—	4¼	—	... ...
Marconi-Marine	1	12½	15	3¼	—	4 13 4
Oriental Telephone Ord.	1	12	12	2 15/16	+1/16	... ...
Western Telegraph	10	10	10	28	+½	3 11 5

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	38⅝	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	31½	—	7 13 0
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	,,	5	5	1000	+100	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	55½	—3	3 13 0
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	18/-	+6d.	... ...
London United Tram Deb. ...	Stock	4	4	64	+2	6 9 1
Mexico Trams. 5% Bonds	—	5	5	71½	—	6 19 10
Mexican Light Common	100	Nil	Nil	77½	—	... ...
do. 7% Pref.	100	7	7	74½	—1	9 9 0
do. 1st Bonds	—	5	5	76½	—	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	45/-xd	—6/-	2 13 4
Babcock & Wilcox	1	13	15	64/6	—6d.	*4 13 0
British Aluminium Ord.	1	10	10	50/9	—6d.	*3 13 9
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	38⅝	+½	4 2 5
Brush Ord.	1	10	10	28/9	+1/16	6 14 3
Callenders	1	15	15	4⅝	—	8 9 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 9
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	18/9	—1/16	8 0 0
Enfield Cable Ord.	1	20	20	4¼	—1/16	4 14 1
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	8	Nil	8/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 6
do. Ord.	1	7½	10	2⅜	—⅛	3 9 8
Henley...	1	25	25	6 1/16	+1/16	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 1
Siemens Ord.	1	7½	7½	1⅝	—	5 9 1
Telegraph Construction	12	10	10	24¼	—	*4 19 5

* Dividends paid free of Income Tax.

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Conditions in Poland.

A Review of Trade and Industry.

A REPORT upon economic conditions in Poland by Mr. R. E. Kimens, C.M.G., Commercial Secretary at Warsaw, has been published for the Department of Overseas Trade by the Stationery Office (1s. 6d. net). The preface to this report contains some general information regarding Poland, stating, *inter alia*, that the area of the country is 386,273 sq. km. and the population over 30,000,000. The languages used are numerous, but Polish, French and German are usually employed in commerce; English is not used a great deal. The United Kingdom provides over 9 per cent. of the imports which in 1928 totalled £77,830,000.

Mr. Kimens says that during the last six years or so Poland has improved and developed in all branches. In 1928, further progress was shown by industry, mining, agriculture, traffic and trade. The exchange remained stable and the country's finances were satisfactory. Against these favourable factors there has to be placed the large adverse foreign trade balance. It is explained that this was due to the expansion of imports of machinery, plant and raw materials, not to increased imports of articles of direct consumption; and to the failure to increase exports to any large extent. Conditions for doing business were not less favourable than in 1927. Although in some branches United Kingdom exporters experienced greater difficulty in obtaining payment, the losses sustained did not exceed the average business risk, in spite of a larger volume of trade and keener competition with other countries. There are no indications that a deterioration of the situation is likely to take place this year. There has been a tightness of money due to increased industrial activity and expansion of trade incommensurate with the financial resources of the country and this has led to too-extended credit.

The Electrical Trade.

It is shown that the imports of apparatus, conductors and other electro-technical materials in 1928 were valued at 93,136,000 zloty (about £2,150,000), while exports of the same class had a value of 937,000 zloty (about £22,000). Imports of machines and apparatus (which apparently include electrical machinery) reached a value of 320,040,000 zloty (£7,390,000). The report says that in the general and electrical machinery trade the British share is small owing to higher prices and to the reluctance to grant credits which, in this trade, range between two and five years and are readily accorded by other countries. It is said that the Polish mechanical and electrical engineering and machine building industries developed further during 1928. The demand for radio apparatus is growing but competition with foreign and local manufactures is difficult.

Advice to Exporters.

It is considered that United Kingdom firms are not obtaining as much of the increased import trade as they should, the main reasons being strong foreign competition, high prices and reluctance to grant credit, under-estimation of the potentialities of the market and inadequate adaptability to local business methods. Mr. Kimens recommends a careful study of the market in general; the quotation of competitive prices; the selling of goods on a credit basis provided that the security is sufficient; the adaptation of goods to local requirements; the use of Polish in correspondence, or, failing that, French or German; the submission of full details, photographs and drawings with tenders, and the employment of the metric system; the appointment of reliable agents whose activities should be controlled by periodical visits of representatives; the establishment of consignment stocks; full inquiry into the standing of firms with which it is proposed to do business, with the assistance of the commercial diplomatic or consular services; and a careful study of the customs tariff, import regulations and transport conditions.

French Foreign Electrical Trade.

A Large Increase in Imports.

THE French imports and exports of electrical machinery, apparatus, and goods during the past two years are shown in the appended tables; the values have been converted at an exchange rate of 124 francs to the £.

	1927. £	1928. £	Inc. or dec. £
Imports—			
Dynamo-electric machines and transformers	426,185	532,878	+106,693
Wireless sets and apparatus ...	48,298	169,515	+121,217
Wireless valves	26,532	191,782	+165,250
Other telegraph and telephone apparatus	606,938	1,220,669	+613,731
Frames of dynamos and motors	871	347	− 524
Incandescent lamps	208,064	483,072	+275,008
Arc lamps and parts	1,330	1,435	+ 105
Carbons for industrial purposes	50,532	100,589	+ 50,057
Electric wire and cable	181,911	433,000	+251,089
Armatures and electrical machinery parts	166,185	181,443	+ 15,258
Magnets other than electro-magnets	7,451	9,387	+ 1,936
Accumulators and parts	18,855	36,363	+ 17,508
Dry batteries and condensers ...	3,161	17,443	+ 14,282
Porcelain and other insulators ...	12,677	26,919	+ 14,242
Totals	£1,758,990	£3,404,842	+1,645,852
Exports—			
Dynamo-electric machines and transformers	700,790	872,790	+172,000
Wireless sets and apparatus ...	266,516	257,234	− 9,282
Wireless valves	36,130	34,443	− 1,687
Other telegraph and telephone apparatus	869,137	847,274	− 21,863
Frames of dynamos and motors	1,460	4,661	+ 3,201
Incandescent lamps	164,840	169,290	+ 4,450
Arc lamps and parts	2,137	5,315	+ 3,178
Carbons for industrial purposes	224,300	245,742	+ 21,442
Electric wire and cable	253,340	376,871	+123,531
Armatures and electrical machinery parts	187,887	254,185	+ 66,298
Magnets other than electro-magnets	3,371	790	− 2,581
Accumulators and parts	168,700	149,717	− 18,983
Dry batteries and condensers ...	36,484	55,096	+ 18,612
Porcelain and other insulators	117,153	115,250	− 1,903
Totals	£3,032,245	£3,388,658	+356,413

It will be seen that, whereas the imports have increased to the extent of £1,645,852, or over 90 per cent., the advance in the case of the exports amounts to only £356,413, or under 12 per cent.

Electrical Imports of British Malaya.

A Comparison of Two Years' Figures.

BELOW are given the values during 1927 and 1928 of the imports of electrical and allied material into British Malaya, together with notes of increases or decreases in the trade:—

	1927. $	1928. $	Inc. or dec. $
Wire and cable, insulated—			
Total	1,605,000	2,187,000	+582,000
From United Kingdom ...	1,549,000	2,124,000	+575,000
,, Japan	17,100	12,800	− 4,300
,, United States ...	13,600	1,800	− 11,800
Telegraph and telephone instruments and apparatus—			
Total	658,000	686,000	+ 28,000
From United Kingdom ...	642,000	656,000	+ 14,000
,, United States ...	1,500	5,900	+ 4,400
,, Continent of Europe	7,700	6,700	− 1,000
Electric lamps and parts—			
Total	50,600	106,000	+ 55,400
From United Kingdom ...	18,200	42,000	+ 23,800
,, Continent of Europe	29,000	57,000	+ 28,000
Electric lamp bulbs—			
Total	458,000	348,000	−110,000
From United Kingdom ...	225,000	152,000	− 73,000
,, Continent of Europe	125,000	123,000	− 2,000
,, United States ...	43,600	36,600	− 7,000
,, Japan	58,000	31,600	− 26,400
Batteries and accumulators—			
Total	556,000	744,000	+188,000
From United Kingdom ...	94,000	84,000	− 10,000
,, Japan	11,500	3,900	− 7,600
,, United States ...	388,000	495,000	+107,000
Electric lighting accessories and fittings—			
Total	240,000	292,000	+ 52,000
From United Kingdom ...	165,000	212,000	+ 47,000
,, Continent of Europe	21,000	42,000	+ 21,000
,, Japan	47,500	34,000	− 13,500
,, United States ...	3,000	1,000	− 2,000

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	1927. $	1928. $	Inc. or dec. $
Electrical goods and apparatus (not machinery) not elsewhere mentioned—			
Total	1,876,000	2,146,000	+270,000
From United Kingdom ...	1,147,000	1,879,000	+732,000
,, Continent of Europe	158,500	92,700	− 65,800
,, United States ...	538,000	160,000	−378,000
Electric generators—			
Total	128,000	130,000	+ 2,000
From United Kingdom ...	117,000	119,000	+ 2,000
,, Continent of Europe	8,100	3,700	− 4,400
,, United States ...	—	300	+ 300
Motors—			
Total	367,000	538,000	+171,000
From United Kingdom ...	260,000	420,000	+160,000
,, Continent of Europe	53,200	90,000	+ 36,800
,, United States ...	40,000	11,000	− 29,000
Ignition magnetos—			
Total	41,000	32,000	− 9,000
From United Kingdom ...	5,000	3,500	− 1,500
,, Continent of Europe	31,500	24,000	− 7,500
,, United States ...	4,000	3,500	− 500
Other electrical machinery—			
Total	1,419,000	2,403,000	+984,000
From United Kingdom ...	974,000	2,184,000	+1,210,000
,, Continent of Europe	406,000	166,000	−240,000
,, United States ...	27,000	41,000	+ 14,000

Electrical Communication.

Some Aspects of Modern Telephony and Telegraphy.

(*Extracts from a lecture before the* ROYAL SOCIETY OF ARTS.)

THE object of this recent lecture by Mr. G. H. Nash, C.B.E., M.I.E.E., European chief engineer of the International Standard Electric Corporation, was to make known to those who were not yet conversant with modern developments, some of the problems that arise on very long telephone connections, the means adopted for reducing or for overcoming difficulties, and to explain how, by modern methods of telephony and telegraphy, a number of communications can be made simultaneously over a single pair of wires without mutual interference.

The lecture was illustrated with a large diagram that indicated the main links in a long telephone connection between two subscribers over two continents, with an intermediate transoceanic link. An improved form of subscribers' set was shown, which was claimed to be more convenient and more comfortable to use than the familiar pedestal type. A difficulty said to be surmounted, said the lecturer, was the variable distance between mouth and mouthpiece, owing to diversity of size of human heads. Entire freedom of movement of a speaker, or listener, during a conversation by telephone was also a point to be gained by correct design of the set.

Mr. Nash then proceeded to describe and to demonstrate a modern automatic system of telephony, and to distinguish it from a trunk exchange, *i.e.*, from an exchange designed for operating long-distance traffic. The arrangements of the Rugby radio station were briefly explained, the lecturer referring to the fact that, as a supplement to the long-wave transatlantic link, a short-wave circuit was now in operation, *i.e.*, two circuits were available during most hours.

Atttention was directed to certain effects that manifested themselves on long-distance telephone connections, namely:—(*a*) *Attenuation distortion*, sometimes called "frequency distortion," being the variation of the attenuation, or the change of power efficiency, with frequency. (*b*) *Phase distortion*, introduced by the difference in time of travel at different frequencies, the time of travel depending upon the way in which the phase shift of the complete system varied with frequency. (*c*) *Echoes*, caused either by the return of part of the speech energy to the talker after an odd number of reflections, or by subsequent repetitions of the speech arriving at the receiving end after an even number of reflections. A typical arrangement for echo suppression used by the International Standard Electric Corporation on four-wire systems was exhibited. In connection with the transatlantic circuit, a special type of voice-operated switching device was employed which differed from a normal echo suppressor in that it was capable of suppressing an echo having zero delay. It was necessary because of the desirability of operating transmitting and receiving stations on the same wave-lengths, so that the receiving system was capable of amplifying the relatively weak signals received from the distant station and yet rejecting the much stronger signals received from the local transmitting station. For that purpose, to avoid clipping the speech, it was necessary to introduce relay networks to retard the speech while switching operations were in progress. The receiving circuit was normally through, and the transmitting circuit normally blocked. Outgoing speech from the toll board arrived first at the amplifier detector bridged across the upper circuit; it operated one relay which blocked the incoming circuit, and another relay which removed the short circuit from the outgoing path. In that condition incoming speech or noise had no effect on the circuit. With the cessation of outgoing speech, the circuit returned to normal. Incoming speech blocked the outgoing circuit and thus prevented any unbalance currents that passed the terminating set from operating the amplifier detector associated with the outgoing circuit. In every case the delay network was of such a length that the switching processes were complete before the speech arrived at the output of the delay network. (*d*) *Interference*, which might be inductive or introduced by the charging and floating machines associated with the power plant of the amplifier stations. Atmospheric interference was a very special problem in itself.

From a technical aspect, no two points on the earth were so remote from one another that it was impossible to connect them by long-distance telephone. Economic limitations of supply and demand had so far prevented the installation of many very long circuits. That which was recently set up between Stockholm and New York was an example of the possibilities of long-distance communication: It was 22,400 km. long and was made up as follows:—10,400 km. of extra-light-loaded cable, 4,700 km. radio link, 6,850 km. of open-wire line, and 314 km. of submarine cable. It was equipped with 138 four-wire repeaters, 24 carrier repeaters, six cord-circuit repeaters, and eight echo suppressors, including the special voice-operated switching device at London and New York.

Various systems had been designed to enable the maximum use to be made of the zero 30,000-cycle frequency range; they comprised: (1) the composite telegraph system, which was superimposed on the telephone system and occupied the frequency range from 0-80 cycles; (2) the carrier telegraph system, which occupied the frequency range from 3,000 to 10,000 cycles; and (3) the carrier telephone system, which occupied the frequency range from 5,000 to 30,000 cycles.

(1) *The composite system*, on an open-wire telephone circuit, provided two independent earth-return telegraph channels. The speed of transmission over each channel might be up to 25 cycles per second, or approximately 60 words per minute, Morse, and by the use of the ordinary telegraph duplex balance the transmission might be in two directions simultaneously. As the use of telephone ringing current fell within the range of 0 to 80 cycles, it was not permissible over a composited circuit, since it would interfere with the telegraph; therefore it was necessary to insert special composite ringer apparatus on the exchange side of the line repeating coils to translate the outgoing 16-cycle ringing current from the exchange to a higher frequency, frequently 135 or 500 cycles, and transmit it over the line. Similarly, it translated incoming calling signals from the line and transmitted 16-cycle current to the exchange.

(2) *The carrier telegraph system* provided 10 independent telegraph channels in both directions, each channel being capable of transmission at a telegraph speed of 40 cycles per second; the currents were more severely attenuated than in the case of direct-current telegraphy, and carrier repeaters must be provided to compensate for the increased attenuation. They were designed so that their spacing would correspond with the telephone repeater spacing on the line, and it was thus possible to accommodate the telegraph repeaters in buildings already housing telephone repeaters.

(3) *Carrier telephone systems* provided one, three, or more channels over an open-wire line, or short underground, or submarine, cable which might be already in use for the usual purposes, *e.g.*, voice-frequency telephony and composite

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telegraphy. From a trunk exchange operator's point of view, there was no difference between carrier and any ordinary trunk circuits, and the subscriber would notice only that the carrier circuit was free from the noise usually heard on open-wire trunk lines. At carrier terminals the speech frequencies received from a subscriber's set were used to modulate the carrier frequency; modulation had the effect of converting the speech frequencies to higher frequencies, which were transmitted along the line, and at the receiving terminal the latter were "demodulated," or detected, back to their true place in the frequency scale. By moving the frequencies resulting from several subscribers' lines to different parts of the frequency scale it was possible to provide several conversation channels on the same pair of wires. Separation between the frequencies resulting from the different conversations was effected by means of electric wave filters, each designed to pass a band of frequencies and to eliminate all others. Although it might be thought that carrier apparatus must be comparatively expensive, in practice it was otherwise. In many cases, particularly for distances greater than 200 miles, it was cheaper to install and maintain carrier systems than to provide and maintain additional pairs of wires to give the same facilities. Indeed, a single-channel system had proved to be the more economical for distances as short as 40 or 50 miles.

The North-East Coast Exhibition.

Electrical Features of the General Lay-out and Exhibits.

AT an exhibition in an area such as that on the North-East Coast, where the great shipbuilding and allied industries "swamp" the others, one would not expect to find electrical manufacturing represented to a very great extent. With that in mind, the electrical exhibits at the North-East Coast Exhibition, which was opened at Newcastle-on-Tyne by H.R.H. the Prince of Wales on Tuesday last, may be described as a good show. Some three dozen or so purely electrical manufacturing companies are displaying their goods at the exhibition, while very many firms are using electricity extensively for driving their exhibits, lighting their stands, and so on. The electrical exhibits are to be found in the Palaces of Engineering and Industries, two large pavilions covering a total floor space of 260,000 sq. ft.

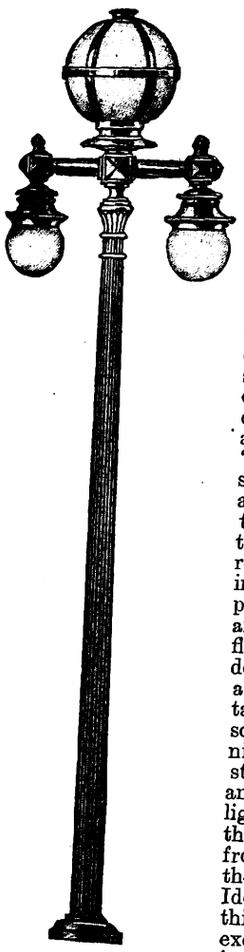

Fig. 1.—Exhibition Grounds Lighting Standard; B.T.H.

A general feature of the Exhibition is the remarkable scheme of illumination, which reveals, among other things, some of the immense possibilities of coloured lighting. Visitors on passing through the huge entrance pylons find a row of attractive fluted standards along each side of the central roadway. These standards, nearly 100 of which are installed throughout the grounds, are of novel design, each consisting of a decorative steel pillar with a cross-arm from which are suspended two "Alabas" lanterns, while a special spherical ornamental globe, housing a floodlight projector, is mounted at the top, fig. 1. The "Alabas" lanterns provide illumination for the roadway, and the floodlight projector in the spherical globe serves the dual purpose of illuminating the grounds and of providing supplementary floodlighting of the buildings. The double line of standards is broken by a large "Mazdalux" electric fountain, which provides a spectacle somewhat resembling a pyrotechnic display, produced in this instance by means of the vivid and rapidly-changing coloured floodlighting of jets of water thrown into the air to heights continually varying from 15 to 40 feet. This fountain is the one which was displayed at the Ideal Home Exhibition at Olympia this year. The operation is the same except that this time remote control is provided.

Approaching the exhibition pavilions, one of the most ambitious applications of spectacular coloured floodlighting ever achieved in this country immediately becomes the centre of attraction. Remarkable esults are obtained by means of floodlight projectors concealed t ground level in the foliage around the buildings. These rojectors, 50 of which are employed, are of special design. nabling the entire length of the main buildings, including he massive towers of the Grand Court, to be panelled in right coloured light. The windows of the towers release eams of ultra-violet light from banks of special mercury-apour lamps suspended in the centre of each tower. Above hese, in the lantern tower, 60-cm. searchlights throw moving eams of light into the clouds. The searchlights were supplied y the London Electric Firm, in conjunction with Messrs. A. Parsons & Co., Ltd.

The lighting scheme is the result of close co-operation between the lighting engineers of the British Thomson-Houston Co., Ltd., the consulting engineers, and the architects to the Exhibition authorities. The lighting of the Palaces of Engineering and Industry was carried out by Falconar, Cross and Co., Ltd., to the specification of Messrs. Mountain, Wood and MacLean, consulting engineers. The former installation has 112 300-W "Holophane" reflector fittings and additional lights at the entrances and outbuildings. "Hewittic" tubes are employed in the tower, the face of which is floodlighted. The wiring is carried out with v.i.r. "Nonazo" cable on porcelain insulators, iron-cased distribution boards being used throughout.

Advantage has been taken of the opportunity to display the switchgear and transformer equipment in connection with the electricity supply to the Exhibition. At the main Exhibition sub-station in the Palace of Engineering standard C-type Reyrolle switchgear receives the incoming supply at 6,600 V and controls a Ferranti voltage regulator and a Parsons step-down transformer, in addition to a feeder to another "sub" in the grounds. Standard D-type switchgear of the same make is employed for the 440-V distribution. Arrangements are made for floodlighting the equipment; the h.p. portion is screened by expanded metal.

A feature of the general layout of the Exhibition is a figure of "Industry" in the grounds holding a model of a Parsons turbine in one hand and a model of a ship in the other.

The scheme of the stand of the British Electrical Development Association includes one main doorway at the end nearest the entrance to the Hall of Industries in which the exhibit is situated. The side jambs and head of this doorway are glazed with frosted glass, illuminated from behind. The main part of the interior is used as a lounge, in which kinema films are displayed from time to time. On either side of the room two reproductions of the Association's poster boards are erected, on which posters are exhibited and will be changed as the Exhibition proceeds. Below the poster board is a shelf on which are fixed at intervals boxes bearing illuminated transparencies showing various applications of electricity; when possible these will link up with the visit of any particular Convention to the Exhibition. Provision has been made on each side of the stand for seven panels to display paintings of electrical interest. On one side of the main entrance is a painting of a female figure turning a switch, and from the switch coloured streamers are carried to appropriate panels representing domestic applications of electricity. On the other front panel is a painting of a male figure representing power. From this coloured ribbons also stream from the switch which he holds to corresponding panels, showing the many industrial uses of electrical energy. For the interior lighting of this stand there are four ceiling boxes, each 8 ft. by 3 ft. by 1 ft. deep. On one side of each box are three reflectors, facing and illuminating the poster boards. In the centre of each box is a glass panel, 2 ft. by 8 ft., glazed with opal glass, behind which lamps are fixed. Eight wall brackets are also provided. Colour lighting is used, and the wall brackets and centre glazed ceiling panel are of amber. The floodlights, centre panel lighting and wall brackets are on separate circuits, so that they can be individually controlled.

In view of the fact that the first satisfactory electric lamp was developed by Sir Joseph Swan in the vicinity of Newcastle, it is appropriate that the Electric Lamp Manufacturers' Association should be responsible for the display of a veritable "Hall of Light" at the Exhibition. This stand has been designed to indicate how the lamp of the present day, which has been evolved so rapidly from Swan's first lamp, may be employed to the greatest advantage in every field of lighting service. The building itself presents a distinctly modern elevation and is constructed on the latest architectural lines with a lavish use of built-in lighting features. The stand is divided into three interiors, consisting of two outer rooms and a central entrance "Hall of Light." The hall lighting of the ceiling and upper walls is of particular interest as indicating the decorative possibilities of architectural lighting. This form of lighting is not obtained by any system of pendant units installed after the building is erected.

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but takes the form of lighting fittings actually designed with and built into, the structure. The second interior is devoted to the use of electric lamps in the various fields of service. The room is divided into sections, each of which is equipped or furnished in such a manner that realistic settings are provided for the electric lighting. The very latest designs in industrial lighting and office lighting are shown in two of the sections, while almost every application of the electric lamp as a beautifier of the home is indicated in the other two interiors, which are domestic in character. All the displays are carefully indicated by tasteful luminous signs, and the visitor experiences no difficulty in being guided round the stand by these silent demonstrators, while Lighting Service Bureau specialists are in attendance to give advice on all illumination problems.

Passing into the interior devoted to the lighting service work of the Association, the visitor finds particular interest in the model all-electric house, and also the model factory and shop. These models demonstrate in miniature both correct and incorrect uses of electric lamps. Another display which is particularly interesting is the portable demonstration equipment used by the Lighting Service Bureau in connection with lecture demonstrations on various lighting subjects. Four illuminated display panels recessed into the walls indicate the work of the Lighting Service Bureau and are deserving of special attention, since they indicate the widespread nature of this service work and the high ideals upon which it is organised, the aim of the Association being not only to produce electric lamps of the best quality, but to ensure that the lamps are used in the most effective manner.

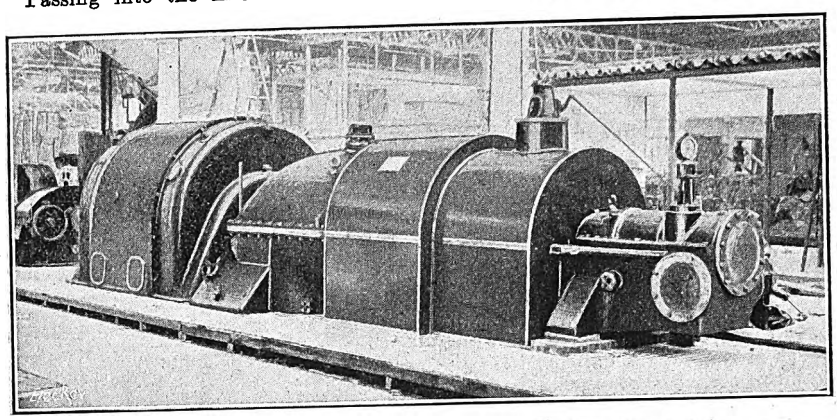

Fig. 2.—6,250-kW "Parsons" Turbo-alternator.

Among the exhibitors of heavy-type machinery are Messrs. C. A. PARSONS & Co., LTD., whose main exhibit is a 3,000-r.p.m. reaction turbine, supplied with steam at 165 lb. per sq. in., abs., and coupled to a 6,250-kW alternator, 3 phase, 11,000 V, 50 cycles, and exciter, fig. 2. The closed-circuit system of ventilation is employed for the alternator, a surface air cooler being incorporated in the alternator foundation block. The growth in turbine manufacture and design is shown by a comparison with a small set, 4 kW, 18,000 r.p.m., built 44 years ago and used for lighting the Newcastle Exhibition in 1887.

Another item of interest on the Parsons stand is an outward radial flow turbine which was made in 1891, 100 kW, 4,800 r.p.m., 140 lb. per sq. in. It ran as a condensing turbine and, when officially tested, the consumption per kW-hour was 27 lb., demonstrating the superiority of the steam turbine over the best reciprocating condensing engine at that period. Another feature of this exhibit is a gear case with a wheel and pinion, an example of the Parsons "creep-cut" gearing, which is designed to transmit 670 b.h.p. at 5,000/600 r.p.m. A transformer built in 1890, and in service until a few years ago, is also shown on this stand, and also a section of h.p. and l.p. windings of a present-day 11,000/400-volt transformer. A tapping switch for a 20,000-V, 200-A transformer is another item. Two searchlight reflectors are also shown, one of 90 cm. diameter and the other of 220 cm. diameter. The large reflector is mounted in an angle ring ready for attachment to the back of a projector, and is claimed to be the largest yet made. The weight independent of the mounting is 420 lb.

Messrs. BABCOCK & WILCOX, LTD., have arranged a display of their principal manufactures. The Babcock boiler is represented by two scale models, one representing a cross-type marine boiler, and the other a marine boiler as installed in the mercantile service; the latter is fitted for burning oil fuel. The company is also showing a complete model of the equipment for the Babcock process of low-temperature coal distillation, providing for the recovery of tar oils. Low-temperature retorts supply pulverised semi-coke to the furnace of a pulverised-fuel boiler or, alternatively, supply semi-coke in lump form to the chain grate of a stoker-fired boiler. Another exhibit is the firm's patent balanced-lever luffing crane as used for coal unloading.

Messrs. CLARKE, CHAPMAN & Co., LTD., have an interesting display of pulverising equipment. The No. 5 "Resolutor" pulveriser is capable of dealing with 10 tons of coal per hour at a shaft speed of 960 r.p.m. It is driven by a 180-h.p. motor. The No. 0 "Resolutor" pulveriser is capable of dealing with 30-160 lb. of coal per hour, and is driven by a 3-h.p. motor at 2,800 r.p.m. Another item of interest on this stand is an electrically-driven ship's windlass. The 47-h.p., 900-r.p.m., 220-V, d.c. motor is carried on the windlass bedplate and is controlled by the Clarke, Chapman patent booster system. There is also an electrically-driven ship's cargo winch controlled by the same system. Another Clarke, Chapman exhibit is a motor-generator set, consisting of a 70-h.p., 440-V, 3-phase, 40-cycle, squirrel-cage motor driving a standard marine-type 45-kW, 220-V d.c. compound-wound generator. This set is used to supply the necessary direct current for the winch and windlass.

Messrs. J. H. HOLMES & Co., LTD., are showing an electro-plating motor generator, fig. 3, consisting of an a.c. squirrel-cage motor coupled mechanically to a d.c. electro-plating generator with a separate exciter. The whole set is mounted on a combination bedplate, and the output of the dynamo is 550 A at any pressure between 2 V and 10 V. Another Holmes exhibit is a demonstration welding set, consisting of an a.c. squirrel-cage motor coupled mechanically to a d.c. welding dynamo with a separate exciter, the whole equipment being mounted on channel-irons. The output of the dynamo is 25/200 amperes at 18/30 volts. On this stand is also an a.c. totally-enclosed, external-fan-ventilated motor (ELECTRICAL REVIEW, April 19th, 1928, p. 694) belted to the first dynamo made by the company in 1885. This dynamo was running in actual service until quite recently, and it was only at the special request of Messrs. Holmes that it was returned to them for retention on account of its historical interest. Other exhibits by this firm include a d.c. motor of the ventilated-enclosed type, with an output of 10-h.p. at 900 r.p.m., a bank of unbreakable grid resistances, and some domestic appliances. Electric traffic signalling is also featured by Messrs. Holmes by means of a working exhibit in conjunction with a representation of a typical suburban road junction.

INTERNAL COMBUSTION, LTD., are showing a model of the high-pressure boiler plant of Messrs. Synthetic Ammonia and Nitrates, Ltd. of Imperial Chemical Industries, Ltd. This consists of eight "Lopulco" boilers, each of 269,000 lb. evaporation at 800 lb. pressure, fired by the Lopulco pulverised-fuel system. The installation is claimed to be the largest high-pressure industrial boiler plant in the world.

A model of the Barking power station of the County of London Electric Supply Co. is another feature of this stand, and a model of the new "R" type burner for the "Lopulco" pulverised-fuel system is also to be seen. This display also includes exhibits of MESSRS. COAL OIL EXTRACTION, LTD., a subsidiary company of International Combustion, Ltd., which designs and constructs low-temperature carbonisation plant.

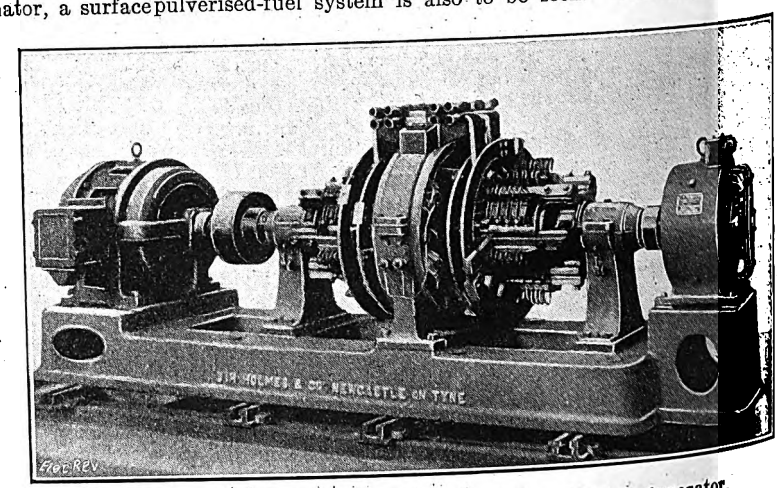

Fig. 3.—"Holmes" Electro-plating Motor-generator.

The exhibits of the UNDERFEED STOKER CO., LTD., are a typical model of the company's coal-handling plant, a model of its "L" stoker, and also one of its air heaters.

The central feature of the stand of the YORKSHIRE COPPER WORKS, LTD., consists of a structure built up of "Yorkshire" aluminium, bronze and cupro-nickel condenser tubes. Interested persons are invited to inspect the internal surface of the various qualities of tubes exhibited by means of the apparatus provided. The company makes a special feature of the investigation and control of corrosion problems. There is also a show case display of tubes illustrating the various types of corrosion attack.

(To be continued.)

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Electricity Supply in Tientsin.

Notes from the Chief Engineer's Report on the Working of the Undertaking in 1928.

WE have received from Mr. A. M. Sillar, M.Inst.C.E., consulting engineer to the British Municipal Council of Tientsin, China, a copy of the report of the chief engineer of the electricity undertaking, Mr. R. A. Williams, O.B.E., on the working of the concern for its sixth year of its operation, 1928.

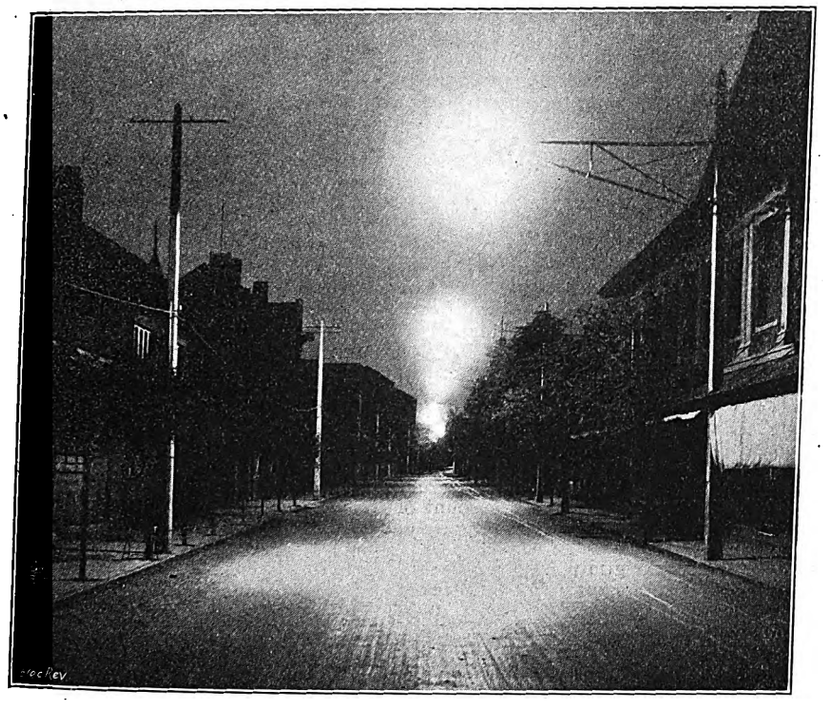

Fig. 1.—Electric Lighting in a Tientsin Street.

The gross and net profits on the year's working were, respectively, £34,717 and £27,927. The net surplus for 1927 was £19,626. The total sale of electricity during the year amounted to 8,023,485 units, as compared with 6,167,312 units in 1927—an increase of 30 per cent., which can be regarded as very satisfactory, especially when the retarding influences of the civil war are considered. The amount of electricity generated during the year was 9,825,314 units, as compared with 7,860,100 units in 1927—an increase of 25 per cent. The capital of the department increased during the year by the amount of £7,688, which was spent on the construction of new transmission lines, &c., and on improvements in the power station. The total capital outlay of £134,136 for 7,500 kW in the power station and the whole of the transmission lines, house services, &c., is £17 17s. 8d. per kW; the cost of the power station alone was £95,769, which is equivalent to £12 15s. 2d. per kW. Both of these figures are considerably lower than those recorded for the average municipal system in Great Britain, and compare favourably with those of any electricity undertaking in the world. Practically the whole of the output of the station was supplied during the past year from the two 2,500-kW Metropolitan-Vickers machines, which have given excellent service in every way. The two original 1,250-kW sets are now only seldom used, as they are small for even light loads. The operation of the larger machines has been very good. The only serious troubles that were experienced during the year were due to the silting up of the Wei Tze Creek, and it is hoped that the dredging that is to be carried out during this year will improve the results of the operation of the station.

The total amount of coal consumed in 1928 was 14,218 tons, or 3.24 lb. per unit. This figure is not as good as that for the previous year, 3.13 lb., which is accounted for by the fact that during the railway troubles in the summer, the undertaking was obliged to use old stocks of coal, and also that, during the winter, the load had risen to such an extent that use was made of the older and less efficient machines and boilers. The total capacity of the boiler house is 86,000 lb. of steam per hour, made up of three boilers each of 12,000 lb., one of 20,000 lb., and one of 30,000 lb. A new boiler of 50,000 lb. capacity has been ordered, and will be erected in time for load in the coming winter.

The whole of the system outside the power station was maintained in excellent condition throughout the year. A considerable amount of work has been carried out to strengthen the mains where required by the increasing load, and at the same time to improve the voltage and lighting in private residences and offices. A number of the terminal overhead high-pressure lines have been taken down and replaced by underground cables, particularly in the neighbourhood of the power station. Nearly the whole of the transmission and distribution is operated on the overhead system by wires carried on substantial concrete poles, the only underground parts being the terminal portions entering into the power or sub-stations. It is noteworthy

Fig. 2.—General View in Electricity Showroom.

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that there was not a single accidental interruption during the year that could be attributed to the overhead system. The sub-stations and transforming plant are built as simply as possible, so as to require the minimum of attention and losses in transmission; that this has been attained is shown by the fact that the total losses in transmission for the year were 9.4 per cent., a considerable reduction on previous years' figures. The total capacity of the transformers in service on the system was 4,400 kW, serving a connected load of 7,410 kW. The maximum demand of the year on the power station was 3,100 kW, an increase of 8.5 per cent. on the figure for the previous year.

The load factor of the distribution system, based on the actual load supplied outside the station and the electricity sold, was 32.5 per cent. This is a considerable improvement on any previous figure, and is accounted for by the very large increase in the use of electric power during the first half of the year. The corresponding factor for the generating plant was 36 per cent., which again is better than for any previous year.

The total amount of electricity sold in the British municipal area alone during the year was 6,311,108 units, which corresponds to 163 units per head of population. The total number of consumers on the mains at the end of the year was 3,170, the total number of meters installed being 4,202. The total load connected was 7,410 kW, of which 3,215 kW was for private lighting. The average number of units sold per consumer in the British area during the year was 2,010, or 12 per cent. higher than the figure for 1927, indicating the increasing use of electricity for all purposes. The amount of lighting connected to the mains at the end of the year was 3,215 kW. The amount of electricity used for power purposes showed a considerable increase—from 1,612,424 units in 1927 to 2,564,558 in 1928—a gain of 59 per cent.—and there is no doubt that this would have been still higher but for the railway troubles that took place during the second half of the year.

The amount of electricity used for cooking and heating purposes during the year was 548,401 units, which is an increase of 8 per cent. over the preceding year. This increase is comparatively small, and is due to a shortage in the supply of cookers, which has since been remedied.

The street lighting system has been maintained in good condition throughout the year. Fig. 1 gives an idea of the lighting in one of the main streets.

The showroom, fig. 2, has continued to be one of the most useful branches of the Department. No fewer than 1,422 appliances were sold from the showroom during the year, and 464 articles were repaired.

The Institution of Electrical Engineers.

The Annual General Meeting and Report of the Council for 1928-9.

THE annual general meeting of corporate members took place on May 9th, the attendance being considerably larger than of late years. After announcing some of the premiums awarded by the Council for papers read during the session, the president, Lt.-Col. K. Edgcumbe, moved the adoption of the Council's report for the year 1928-29, extracts from which follow.

Annual Report.

During the year the net growth in membership was 518, raising the total to 13,561. During the year 84 members died. The associate membership examination was held in 11 home towns and in 6 countries abroad; a number of candidates submitted written papers or theses in lieu of the examination.

Honours and distinctions were conferred upon 10 members. Action was taken last November in the Court of Chancery against a former student who was describing himself as "A.M.I.E.E." The defendant consented to the granting of a perpetual injunction restraining him from using any designation implying that he is connected with the Institution; he also agreed to pay the costs of the action.

The collection of oil paintings in the lecture theatre has been augmented by gifts by Mr. R. W. Paul and Sir George Sutton, Bt., of paintings of Alessandro Volta and of Sir Charles Wheatstone, respectively.

The Council also accepted offers of further oil portraits from Mr. Ll. B. Atkinson (portrait of Clerk Maxwell), Sir T. Callender (Hopkinson), Mr. E. Garcke (Ampère), Sir Hugo Hirst (Graham Bell), and Sir Charles Parsons, F.R.S. (Swan).

During the past twelve months, 388 meetings were held in London and at the Local Centres by the members, the Council, and the various committees. The attendance and proceedings at the local centres and sub-centres maintained the high standard of the past. As a result of the scheme approved by the Council in 1922 for the formation of local technical libraries in the provinces, there are now such libraries in existence at Dublin, Glasgow, Leeds, Manchester and Newcastle. Sets of technical books to the value of £50 are supplied by the Council to any centre which may wish to have them for lending, or reference, purposes and has proper facilities for accommodating them, and also on condition that each collection is maintained and added to out of the funds of the Local Centre.

The activities of the Wireless Section continued to be satisfactory. Seven meetings, at which six papers were read, and one informal discussion, took place; the average attendance was 118.

The past year marked a further increase in the activities of the Institution in the formation of a Meter and Instrument Section which will be conducted generally on the lines of the Wireless Section, after negotiations with the Meter Engineers' Technical Association, as a result of which the Association was wound up and the bulk of its members joined the Institution.

Eleven informal meetings were held during the session, the average attendance being 69, as against 75 last year.

The large number of lapsed memberships in the class of students was carefully investigated by the Council. There were 3,313 students on the register of the Institution, and the eight Students' Sections carried out a full programme of meetings, visits to works, and social functions. A new feature was introduced in the programmes this session by the delivery of a lecture by Prof. S. Parker Smith, D.Sc., on "Ignition Systems in Automobiles." The lecture, which was given at each of the Sections, was much appreciated, although the attendance at some of the meetings was disappointing. The aggregate attendance amounted to some 400. In response to requests from the Students' Committees, the Council approved of arrangements being made for similar lectures to be delivered annually, to be known as "The Students' Lecture."

The eight Faraday lectures delivered by Mr. Ll. B. Atkinson, his subject being "How Electricity Does Things," were attended by a total audience of approximately 4,800, and the presence of over 4,000 non-members indicated that the lecture achieved the object in view, *viz.*, the bringing of electricity to the attention of the public.

Continuing the series of reviews of progress in electrical engineering which were published in the *Journal* in 1926, 1927 and 1928, reviews on the following subjects have been, or will be, published during 1929:—

"Electrical Standardisation."
"Power Stations and their Equipment."
"Radio-Telegraphy and Radio-Telephony."
"Research."
"Telegraphy and Telephony."
"Transmission and Distribution."

The reviews to be published in 1930 will be on the following subjects:—

"Domestic Applications of Electricity."
"Electrical Equipment of Automobiles."
"Electrical Plant and Machinery."
"Electro-Physics."
"Electric Traction."

The Council awarded three scholarships of £50 and made three grants of £65 each from the War Thanksgiving Education and Research Fund, besides awarding the Coopers Hill War Memorial Prize; the age limit for the I.E.E. award of the latter has been raised to 35 years.

The Jubilee of the first public exhibition of the incandescent lamp (December 18th, 1878) was commemorated by a lecture on the work of the late Sir Joseph Swan, which was given by Mr. James Swinburne, F.R.S., on December 20th, 1928, and by a comprehensive exhibit of early models of lamps.

The Council set up a Committee, consisting largely of members who have had considerable overseas experience, to examine the question of increasing the activities of members in India and the Dominions, and establishing closer links between them and members of the Institution at home.

The Council has drawn up a set of conditions with which, in general, an international technical organisation desiring the official support of the Institution should conform. The status and scope of the various existing international organisations are receiving consideration.

At the annual conversazione the attendance was very large, over 1,700 members and guests being present. At the annual dinner over 600 members and guests were present.

The Gas and Electricity Joint Committee, set up by the National Gas Council and the Council of the Institution in 1926, has drawn up a first report on a section of its terms of reference; publication will be considered later when a more complete report is available.

The number of applicants on the register of the Electrical Appointments Board in March, 1929, was 36, against a total

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of 65 last year. The Council earnestly hopes that members who are in a position to assist will not fail to make use of the register.

During the year 270 books and pamphlets were presented to the reference library by members and others, and 103 volumes have been purchased. The total number of readers for the year was 5,985, of whom 285 were non-members, as against 5,400 and 176, respectively, in 1927-1928. Some 86 new volumes were purchased. The total number of readers were issued to 1,006 borrowers, the corresponding numbers for the previous year being 2,287 and 982, respectively.

The physics volume of *Science Abstracts* for 1928 contained 3,355 abstracts, as compared with 3,238 in 1927. The electrical engineering volume contained 2,110 abstracts, as compared with 1,985. The very slight interest taken in *Science Abstracts* by the general body of members is of considerable disappointment to the Council. Out of a membership of over 13,000, less than 900 subscribe to *Science Abstracts*, some 460 members subscribing to both sections and 410 to section "B" only.

Awards of National Certificates and Diplomas in Electrical Engineering in England and Wales were as follows: 361 ordinary certificates; 155 higher certificates (including 6 post-higher certificates); 8 ordinary diplomas; and 6 higher diplomas. The Institution, in conjunction with the Scottish Education Department, has drawn up a scheme for the award of the above certificates and diplomas in Scotland.

Regarding Model General Conditions for Contract, the Council authorised the preparation of a new set of model conditions "E" for the supply and laying of cables at home, and approved of the issue of revised editions of the following sets of conditions:—

A (home—with erection) (April, 1929).
B1 (export—delivery f.o.b.) (December, 1928).
B2 (export, including complete erection or supervision of erection) (December, 1928).

Some modifications to the second edition of the Regulations for the Electrical Equipment of Ships are under consideration. The Regulations for the Electrical Equipment of Buildings continue to be in steady demand, which is an indication that they are being more and more widely adopted; the drafting of a tenth edition is in progress. A pamphlet containing a number of regulations dealing with radio apparatus connected to public or private supply mains was issued in June, 1928, as a supplement to the ninth edition.

In connection with the meeting between the I.E.E. Low-Tension Overhead Lines Conference and representatives of the Post Office, and as the result of representations made by the Electricity Commissioners, the Postmaster-General has intimated that he is prepared, as a final settlement of the question of protection as between electric lines and works of authorised undertakers and those belonging to the Postmaster-General, to bear the whole cost of providing guarding, or alternative protection, when the Post Office is second-comer, provided the following conditions are satisfied:—(1) That the undertakers' legal obligations remain as at present. (2) That the Post Office will only bear the cost of guarding, (*a*) if satisfied that protection is necessary, and (*b*) on condition that where alteration to the power lines is desired, the undertakers will, before carrying out such alteration, meet the Post Office in adopting the most appropriate methods of dealing with the particular circumstances of each case, and will furnish such estimates as will enable the Post Office to determine the course to adopt. (3) That the maintenance of any protective fixtures forming part of their systems remains the responsibility of the undertakers.

The Committee of Management of the Benevolent Fund of the Institution reports that on December 31st, 1928, the total assets of the fund amounted to £15,045, of which £12,068 was on capital account, and £2,977 in respect of unexpended income. The figures include a legacy of £50 from the late Mr. A. R. Bennett. The donations and subscriptions to the fund in 1928 amounted to £1,998, in which amount are included the proceeds of golf competitions organised by the Mersey and North Wales (Liverpool) and Scottish Centres. In 1928, 99 grants were made to 32 persons, amounting to a total of £1,409. Two bequests were made to the fund by will: one of £50 in 1928 from the late Mr. A. R. Bennett (member), and one of £100 in 1929 from the late Dr. C. S. Du Riche Preller (member).

The Institution's annual accounts show that after making provision for contingencies there is a balance to the good on the revenue account for 1928 of £6,040. This amount, which has been carried to the credit of the general fund, compares with £3,675 in 1927. During the year the property in Tothill Street was disposed of on favourable terms, and of the money received (after paying expenses) £9,559 was utilised to pay off the remainder of the mortgage on the Institution building, the balance being invested. The Institution is now clear of any mortgage.

The assets amount to £177,437, which, in comparison with those of the year 1927, show an improvement of £14,675. The investments (including re-investments and conversions) made during the year were £30,058.

Premium Awards.

The Council made the following awards of premiums for papers read during the 1928-29 session, or accepted for publication:—

The Institution Premium to Messrs. Johnstone Wright and C. W. Marshall, B.Sc.

Ayrton Premium to Mr. L. G. H. Sarsfield, M.Sc.

Fahie Premium to Messrs. A. E. Foster, P. G. Ledger, and A. Rosen, Ph.D.

John Hopkinson Premium to the Hon. Sir C. A. Parsons, O.M., K.C.B., F.R.S., and Mr. J. Rosen.

Kelvin Premium to Messrs. E. B. Wedmore, W. B. Whitney, B.Sc., and C. E. R. Bruce, M.A., B.Sc.

Paris Premium to Mr. J. L. Carr.

Extra Premiums to Capt. J. G. Hines, Mr. B. L. Goodlet, Mr. L. H. L. Badham, Mr. W. Phœnix.

Wireless Premiums to Mr. T. L. Eckersley, B.A., B.Sc., Capt. P. P. Eckersley, and Messrs. A. B. Howe, R. M. Wilmotte, B.A., and J. S. McPetrie, B.Sc.

The awards for papers read before Students' Sections will be announced later.

The adoption of the report was seconded by Mr. P. Rosling.

Mr. L. W. PHILLIPS congratulated the Council upon furnishing technical libraries for the local Centres and the appointment of a lecturer to give special students' lectures; he suggested that a feature of such lectures should be the lives of pioneers of the electrical industry. He also suggested that the summer meeting might be held at some other period of the year than June, as that was not always a convenient time for many members to attend. Insufficient publicity had been given to the jubilee of the incandescent lamp by the Council. The Electrical Appointments Board had only 36 names on the list of applicants on March 29th, against 65 last year; was that due to the better state of the industry, or to the fact that the Appointments Board was not very productive in finding jobs for people? Members of other societies were supplied with *Science Abstracts* at lower rates than those charged to members of the Institution, which might be the reason for the small number of copies purchased.

The PRESIDENT said that more appointments had been found last year than in previous years and that accounted for the smaller number of names on the books. The other points mentioned would be considered by the Council. The Institution was not an organisation for publicity and left that matter to the E.D.A. and similar bodies.

Major THEODORE RICH, with regard to the jubilee of the incandescent lamp, said that in a few months' time in America there would be a big "flare up" and he suggested that the Institution should hint that probably Swan had something to do with the invention, because it was evident that the celebration in America would give all the credit to Edison.

The PRESIDENT replied that the Council had been considering that point only that afternoon, and was proposing to take some action in America. In any case, however, he doubted whether the publicity of the Institution would reach the level of the American publicity.

The annual report was then adopted.

Lieut.-Col. CORTEZ LEIGH, in presenting the accounts, which showed a credit balance of £6,040, mentioned that that would be his last year as hon. treasurer and that during his three years of office the assets of the Institution had increased by £22,431. The Council, he added, was considering a proposal to establish a scholarship available at Universities, and also other means of making satisfactory use of the funds available.

Mr. W. C. P. TAPPER congratulated the Council on having at last got rid of the Tothill Street property. A profit of £5,000 had been made, but it would be interesting to know the percentage return on the investment since the property was first acquired. Instead of accumulating assets, it would be wise to spend the money in some useful manner.

The Hon. TREASURER stated that during the first few years of the investment on the Tothill Street property the return was 3 per cent., but in more recent years it had been 4¼ per cent.

Mr. LL. B. ATKINSON reminded the meeting that those figures did not include the £5,000 profit.

The PRESIDENT said the difficulty in recent years had been to make both ends meet and therefore perhaps the Council had been a little ultra conservative. Now, however, that the position had improved steps were being taken to make the best use of the money available.

The accounts were then adopted and votes of thanks were accorded to the hon. local secretaries at home and abroad and to the retiring hon. treasurer. The auditors, Messrs. Allen, Attfield & Co., were re-elected.

Revision of By-laws.

After lengthy consideration by the Council and the Membership, Examinations, and General Purposes Committees, as well as by the Committees of the Local Centres, the Council sent a circular to members briefly outlining various alterations to the by-laws, the most important of which relate to the qualifications for membership. The alterations were considered at a special general meeting of corporate members held immediately after the conclusion of the annual general meeting.

The PRESIDENT, in explaining the scheme, drew attention to the formation of a new class, known as "Companions," and outlined other alterations to be made as regarded graduates and students. There had been more discussion over the word "Companions" than over any other matter, but even those who objected to it had eventually to acknowledge that they could not provide a better one. There was a precedent for it because the Institution of Mechanical Engineers had a Companion class, and the intention was that in that class should be men who were not necessarily electrical engineers, but

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who were eminent in their particular spheres. Under the by-laws, as proposed to be modified, ex-enemy members would no longer be under the disability that they could not join the Institution until a special meeting had been called by the Council; the matter could be dealt with by the Council.

Mr. PHILLIPS expressed dissatisfaction at the manner in which the Council had dealt with this matter. Faraday was an Englishman, Volta was an Italian, Ampere was a Frenchman, and Ohm was a German, all of which indicated our international indebtedness. He moved the deletion of the final words in the proposed bye-law, namely, "and for such further period thereafter as the Council may determine." In other words, he wished that ex-enemy members should automatically become members again at the close of hostilities.

Sir THOMAS PURVES, chairman of the Committee which has dealt with this matter, whilst expressing sympathy with Mr. Phillips' views, did not think the amendment would be of any value, because a member who had ceased to be a member would have to apply for readmission in any case. He could not automatically go back on to the membership roll.

Mr. PHILLIPS said he desired that such ex-members should be able to apply for membership immediately on cessation of hostilities, and that the Council should not have the power to prevent them doing so, as would be the case under the proposed new bye-law.

Mr. F. GILL suggested that such members would be in a better position under the proposed new bye-law, because if they were to apply for membership immediately after the cessation of hostilities such feeling might still exist that he would be rejected, whereas if it were left to the discretion of the Council to feel the pulse of the Institution it would be able to judge the best time for inviting ex-enemy members to rejoin.

Mr. PHILLIPS' amendment was then put to the meeting and lost by a large majority, only three voting for it.

Mr. A. C. SPARKS referred to the difficulty of engineer officers in the Army, Navy, and Air Force obtaining admission to the Institution through not being able to obtain the necessary support from people who must, under the bye-laws, personally know their qualifications. The difficulty arose through so many officers being stationed abroad, who were therefore unable to obtain the necessary signatures. Mr. Sparks also referred to the period of office of members of Council, and suggested that it should not be possible for a member to serve for as long as eight years out of 10; it would be more to the advantage of the Institution to reduce the period in order to spread service on the Council over a wider field. A maximum of five years, he suggested, was ample.

Sir THOMAS PURVES said the difficulty of Service members getting the necessary signatures had been modified and he hoped publicity would be given to the fact that qualified people placed in such a difficulty could obtain membership on the recommendation of persons who had interviewed them and formed a judgment.

The PRESIDENT, referring to membership of Council, suggested that there were difficulties in the way of making an alteration which would reduce the period to five years. On the advice of the solicitor, it was not a matter which could be gone into in detail at that meeting, but he promised that the Council would carefully consider what Mr. Sparks had said. Incidentally, the Institution of Electrical Engineers was the most democratic of all engineering institutions in that respect.

Mr. E. H. O'SHAUGHNESSY suggested that the point mentioned by Mr. Sparks could be handled quite well by the members themselves, because when they learned that a man had been nominated for a second term of office on the Council they could make other nominations themselves.

The resolutions regarding the alterations in the by-laws were unanimously adopted.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Portable Electric Blower.

A recent useful introduction by Metro-Vick Supplies, Ltd., Trafford Park, Manchester, is the "Cadillac" blower, fig. 1, an electrically-operated device which can be used for such varied requirements as cleaning printer's type and type-cases, and for spraying disinfectants or insecticides; indeed, for both these purposes there are special attachments, in addition to brushes and nozzles of various shapes and sizes for detail and showcase work. Its applications are innumerable, and it can be instantly converted to a suction cleaner, if required. It is made in three types: model F will give a suction of 22 in. of water with a flow of 65 cu. ft. per min.; model G is a 50 per cent. more powerful edition of model F; and model L will blow cold or hot air as required. All models are arranged with ball bearings, are very strongly made, and weigh only 7 to 9 lb. each. The blowers are fitted with specially constructed universal motors for voltages up to 250 V, with loadings of 205 W in the case of models F and L, and 300 W in the case of model G.

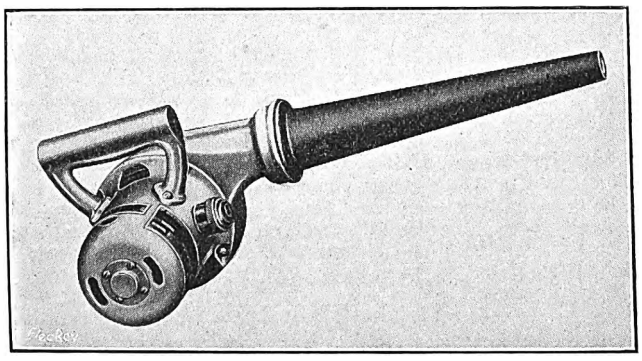

Fig. 1.—The Cadillac Blower.

New Gate-End Circuit Breaker.

The accompanying illustration, fig. 2, shows an a.c. automatic gate-end circuit breaker, recently introduced by Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow, which is claimed to be of novel construction to meet special conditions. The breaker has a capacity of 100 A and is suitable for medium-pressure systems. It is of the automatic oil-immersed type and flameproof in construction, having wide machined joints to the oil chamber. The breaker unit is arranged to be lifted out of the tank, so that the working height is much less than would be the case if space had to be allowed for tank lowering. Accessibility is, however, it is claimed, not sacrificed, as by the provision of suitable disconnectors, the breaker unit can be lifted out of and supported on the tank for inspection and adjustment in a most convenient position and without the collection of dirt. Moreover, the provision of disconnectors avoids the disturbance in any way of the permanent armoured cable or plug connections. Fig. 2 shows the apparatus with the breaker unit withdrawn and supported on the tank for inspection. The breaker units are interchangeable, so that spares of these can be stocked, instead of complete equipments. Further, a breaker unit of lower rating can be substituted for a larger one if required. The gate end circuit breaker can be supplied with two or three overload trips, and a no-volt trip can also be fitted if required. Leakage protection can be provided by the incorporation of a core-balance transformer with a suitable trip.

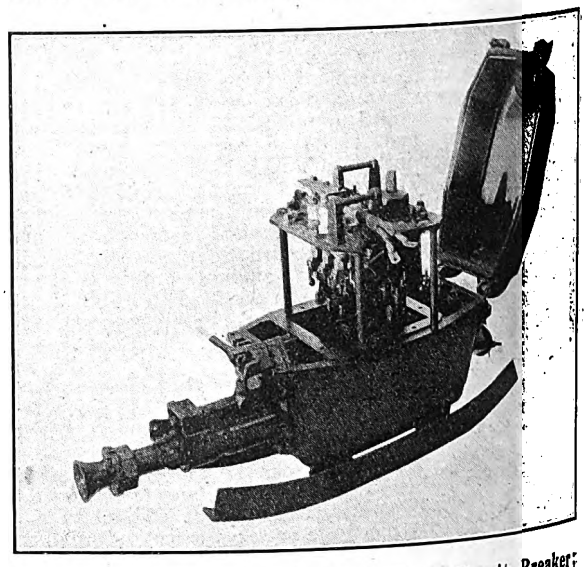

Fig. 2.—A.C. Automatic Gate-End Circuit Breaker, Breaker Unit Withdrawn.

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Commutator Slotting Files.

The MARTINDALE ELECTRIC CO., LTD., The Hyde, Hendon, N.W.9, has recently introduced to the home market special commutator slotting files, fig. 3, which are made in two sizes. The standard size has an angle of 60 deg. between the cutting edges, and the other 40 deg. for thin mica. The files are

Fig. 3.—Commutator File.

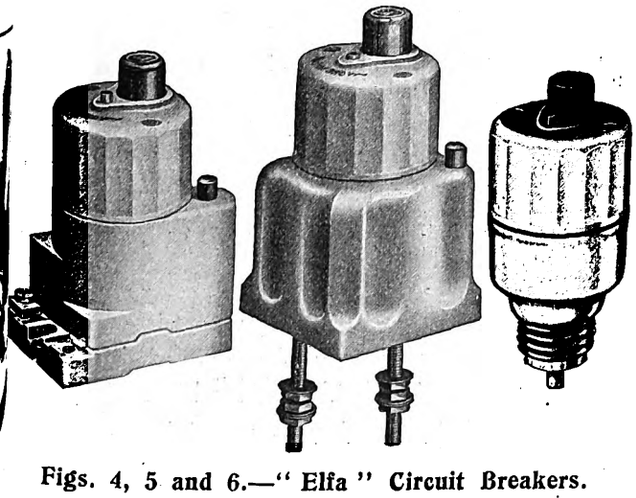
claimed to do their work rapidly, to be easy to operate, to leave a "V"-shaped slot, and to be in every way a great improvement on the old method of using broken hack-saw blades. They are fitted with wooden handles.

An Adjustable Adaptor Plug.

We have received from Messrs. H. E. ASHDOWN (BIRMINGHAM), LTD., Aldridge Road, Birmingham, a sample of their recent development, a bakelite adjustable adaptor plug. The pins (two) are adjustable by revolving a knurled ring and cap over the body of the plug, through slots in which the pins project, thus preventing any risk of touch contact, such as sometimes occurs when the pins themselves have to be held by the fingers for adjusting to position with the socket holes. Spare pins can be provided for 5-, 10- and 15-A loadings.

A Novel Automatic Cut-out.

The "Elfa" automatic circuit breaker, which is marketed in this country by the A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1, offers, it is claimed, great advantages over cartridge and wire fuses, being constructed to withstand momentary peak loads, while at the same time giving full protection against sustained overloads or short-circuits. When the circuit is opened it is only necessary to press the push button which, on being released, closes the circuit. It is impossible to "play" on the contacts once the push button is released, on account of a locking pawl which, on lowering the contacts into position, prevents the push button being pressed in. There are two independently-acting devices for effecting the release, namely, a magnetic release and a thermal release. The current flowing in the magnetic coil develops a magnetic flux which flows through the divided iron core. The lower part of the core is movable and is attracted by the upper fixed part, towards which it is drawn if the magnetic pulling force exerted by the current flowing in the coils is greater than the pull of the adjustable spring which keeps the lower movable magnet in position. The thermal release consists of two bow-shaped bi-metal strips (a nickel-steel alloy) hot-rolled together. The consequential change of shape of the bow which arises on sufficient current flowing trips the switch. The cut-outs are made in three types, namely, screw, switchboard, and built-in types. The screw pattern can be used in Zed fuse bases, in place of the cartridges. The other two types are each fitted with an extra push-button release, enabling the circuit to be opened without trouble when necessary. Where a number of "Elfa's" are mounted to-



Figs. 4, 5 and 6.—"Elfa" Circuit Breakers.

gether the coloured button fitted below the push button indicates which circuit has blown, *i.e.*, when protruding above the surface the cutout is off, when flush the circuit is closed. The circuit breakers can be used for circuits up to a maximum of 415 V, a.c., and in the case of the screw pattern also on d.c. circuits up to 250 V. In all models there are 15 sizes, with capacities ranging up to 15 A. On 50 per cent. overload the circuit breaker will open within 15 min.; on higher loads the time is considerably shortened; and on five times the normal load the time taken is approximately four seconds. Figs. 4, 5 and 6 show, respectively, the built-in, switchboard and screw patterns of the "Elfa" cutout.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Dissolution.

Parliament was dissolved on Friday, May 10th. The general election takes place on May 30th, and the new Parliament will assemble on June 25th.

Special Orders.

Special Orders have been approved relating to Dulverton, Somerset; parts of the rural districts of Crediton, St. Thomas, and Tiverton, Devon; the urban district of Wiveliscombe, and the rural district of Wellington, Somerset; the urban district of Withernsea and part of the rural district of Patrington, East Riding, Yorks.; the acquisition and use by the Mayor, Aldermen, and Councillors of the Metropolitan Borough of Stepney of lands for the extension of the generating station at Limehouse; the urban district of Rainford, Lancaster; the urban district of Bollington and part of the rural district of Macclesfield, Chester; parts of the rural districts of Chapel-en-le-Frith and Bakewell, Derby; and the parishes of Gretna and Dornock, Dumfries-shire.

A Trade Facilities Loan.

On May 9th, Mr. T. KENNEDY asked the Financial Secretary to the Treasury whether the Shropshire, Worcestershire and Staffordshire Electric Power Company had been guaranteed a loan under the Trade Facilities Acts; if so, would he state the amount guaranteed; whether he was aware of the proposed sale of this undertaking to an American syndicate; and whether, in guaranteeing the loan any condition was laid down for the maintenance of British control over this company.

Mr. A. M. SAMUEL said that guarantees under the Trade Facilities Acts amounting to £770,000 had been given in respect of loans raised by the Power Company. He had seen references in the Press to the effect that an offer had been made, apparently by foreign interests, to purchase the ordinary share capital of the company. The answer to the last part of the question was in the negative.

Mr. KENNEDY asked if the Government would make representations to this company, in order to find out what had happened.

Mr. SAMUEL said that was not necessary. The control of a company or the nationality of its shareholders was not within the purpose of the Trade Facilities Acts. The object of those Acts was to facilitate the raising of capital to be used for purchasing plant and machinery in Great Britain, with a view to employment being given in the production of such plant and machinery. Guarantees could be given, and were given, under those Acts, to foreign Governments and foreign companies, provided that they spent the guaranteed loans on British goods.

Electricity in Rural Areas.

On May 10th, Sir D. NEWTON asked the Minister of Transport if he was aware that difficulties had arisen in obtaining suitable sites for sub-stations required for the distribution of electricity in rural areas.

Col. ASHLEY said he was not aware that such difficulties had arisen, but if Sir D. Newton would give him particulars, he would ask the Electricity Commissioners to consider them. Special Orders could be made, if necessary, to authorise the compulsory acquisition of land for stations for generating, transforming, converting or distributing electricity.

Royal Assent.

The Royal Assent has been given, by Commission, to the following Acts: Yorktown (Camberley) District Gas and Electricity, Pacific Cable Board, Leamington and Warwick Traction, Jarrow and South Shields Traction, Chatham and District Traction, Cheltenham and District Traction, Mexborough and Swinton Traction, Mansfield District Traction, Derbyshire and Nottinghamshire Electric Power, and London County Council (General Powers), &c.

Coal Mines Regulations.

The Secretary for Mines announces that the 1928 edition of the annual volume of "Regulations and Orders relating to Mines under the Coal Mines Act, 1911," has been published by H.M. Stationery Office (price 1s. net, by post 1s. 4d.). The book contains all the Orders (including Regulations) of a general nature relating to mines under the Coal Mines Acts, which were in force on January 1st, 1929, including the general regulations as to the organisation and training of rescue workers made by the Board of Trade on December 10th, 1928. The book also contains lists of permitted explosives and approved types of safety lamps, safety-lamp glasses and breathing apparatus; and memoranda on the official tests for safety lamps, explosives and rescue apparatus. A list of recent Parliamentary and other official publications relating to the coal mining industry is printed in an appendix.

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Legal.

The Gasfilled Lamp Patent.

The hearing of the application of the British Thomson-Houston Co., Ltd., for a five-year extension of its gasfilled lamp patent was resumed in the Chancery Division by Mr. Justice Luxmoore on May 8th.

Sir Duncan Kerly, K.C., referred to the position of the Nox Electric Co., which he represented. He said that his clients had a definite agreement with the B.T.H. Co. for a licence. The suggested terms of the licence now put forward entitling the Nox Co. to manufacture 100,000 gasfilled lamps annually was ridiculous. The number of these lamps manufactured last year was 17 millions, and it was doubling every five years. If an extension of five years was granted it would mean that 40 millions of the lamps would be manufactured. What was the good of offering the Nox Co. the opportunity of manufacturing 100,000 lamps? It would probably not pay to manufacture on that scale. The Nox Co. understood that it was to have a real commercial licence, and refused to accept the proffered terms.

Sir A. Colefax, K.C. (for the B.T.H. Co.) said that the total output of the Nox factory, according to the evidence, was 750,000 lamps a year. The offer of a licence to manufacture 100,000 gasfilled lamps, plus a 10 per cent. increase annually, was, in the circumstances, perfectly proper.

The Judge said that if the Nox Co. had a concluded agreement the question of specific performance would be a matter that would arise after the applicants got their extension, if it were granted.

Mr. John Gray, of the B.T.H. Co., stated, in reply to questions by counsel representing the opposition, that at an interview which he had with a representative of the Nox Co., it was fair to infer that the B.T.H. Co. would grant the Nox Co. a licence to manufacture, but he assumed that there would be negotiations as to the terms of the licence. He agreed that licences were only granted on condition that prices would be maintained. It was true that there was an increase in the output of gasfilled lamps during the war. The demand for high-power gasfilled lamps was partly increased by the shortage of carbons for arc lamps. There was an obvious advantage in the bigger gasfilled lamps, which were easy to manufacture and market. With regard to the smaller lamps he could not say that small gasfilled lamps gave more light than vacuum lamps of equal wattage, but the gas enabled the filament to be heated 300 or 400 degrees more than it was possible to heat the vacuum lamp filaments, and the result was a better and brighter light.

Mr. Corsellis, for the Kye Electric Co. and Tungstalite, Ltd., two of the objectors, suggested to witness that in 1914 the production of gasfilled lamps was 28,000, and of drawn wire lamps 9½ millions, and in 1918 the figures had gone up to 1¾ million gasfilled lamps and 18½ million drawn-wire lamps.

Mr. Gray replied that he did not think so. The B.T.H., the G.E.C., and Siemens accounted between them for 80 per cent. of the total sales of gasfilled lamps. They did not pay royalties to each other. He did not think that the amount received in royalties by the B.T.H. Co. totalled more than £150,000. Asked to explain the statement that if the patent was not prolonged the country would be flooded with foreign-made lamps, Mr. Gray said that if the foreigner found that he could get a higher price here than he got at home he would sell here to get that profit. The quality of his product did not matter because he was not concerned with establishing an industry here, but merely with getting a profit. It was not generally true that the prices of foreign lamps were lower than in this country. He did not agree that if the patent was not extended the prices of British lamps would come down. There had already been a reduction, and he did not believe that prices would get any lower.

In further cross examination on May 9th, Mr. Gray said that it was the policy of the sales department of his company to advocate the use of internally-frosted lamps, but he did not know that a preferential discount was being allowed on those lamps. He could not say whether it had been the company's policy to emphasise the gasfilled lamp during the past six years rather than the vacuum lamp, but he thought it quite natural that it should be so. He agreed that the sale of gasfilled lamps had greatly increased compared with vacuum lamps in recent years. Their improvements were now being directed to the gasfilled lamps, but they might make improvements in vacuum lamps.

Replying to Sir Arthur Colefax, Mr. Gray said that at his interview with the representative of the Nox Co. the question of the terms of the licence was not discussed at all. The Nox Co. was a new firm, and he considered the offer to it of a licence to manufacture 100,000 lamps a year with a 10 per cent. annual increase was fair. A 10 per cent. annual increase was usual in their licences.

Mr. Wilson, of the General Electric Co., Ltd., said that his company made a substantial proportion of the English lamp output. They paid as manufacturers no royalties to the B.T.H. Co. He had not the slightest doubt that the war was an impediment to the commercial manufacture of the gasfilled lamp.

This concluded the evidence for the applicants, and evidence of opposition witnesses was called.

Dr. Elkan Wechsler, representing Tungstalite, Ltd., said that that company was incorporated in 1923 with a nominal capital of £2,000, subsequently increased to £3,000. He and another gentleman of the same name owned more than half the shares. The company was formed to manufacture and deal in all kinds of electric lamps. They had a factory at Stoke Newington where they manufactured lamps, employing about 25 hands. Their output of incandescent electric lamps was about 1,000 a day, or a quarter of a million per annum. During the war he was employed at Pope's Electric Lamp Works.

Sir A. Colefax suggested to witness that Pope's did not manufacture gasfilled lamps during the war. Witness said his recollection was that they did. He was chemist there and made experimentally the first gasfilled lamp, he thought, about the end of 1918, Pope's having become licensees of the B.T.H. Co. in April, 1918. Pope's manufactured tungsten during the war and produced, he believed, drawn-wire tungsten filaments in 1916. Early in the war there was difficulty in getting tungsten wire, but it was available, from people at Hanwell, who supplied it in defiance of a patent.

Mr. B. Wechsler, also associated with Tungstalite, Ltd., said his experience was that 40-W and 60-W gasfilled lamps were not superior in lighting qualities to vacuum lamps, but were often inferior.

Mr. B. R. Agazar, representing the Kye Electric Co., Ltd., said he had been associated with a number of companies which dealt in imported lamps. Two of these companies had been proceeded against by the applicants for infringement of patent, and the relief sought was granted, and one of them, Kye, Ltd., was compulsorily wound up in 1928. The Kye Electric Co. was a fresh registration. It dealt entirely in lamps of its own manufacture. It had a factory in London and its output was now 30,000 lamps a week. Witness maintained that the demand for gasfilled lamps had been checked by the high prices. The cost price of gasfilled lamps was not more than that of vacuum lamps, yet during the war the average price of gasfilled lamps was 12s. 6d. against 4s. 3d., afterwards increased to 5s. for equivalent vacuum lamps. Abroad the cost of gasfilled lamps was less than that of vacuum lamps. He did not agree that gasfilled lamps were more durable than vacuum lamps. The cost of manufacture of a 200-V 60-W drawn-wire lamp to-day was about 5d.; it was sold at 1s. 11d. or 2s. Lamps could be imported from abroad at 4s. 8d. or 4s. 9d. a dozen.

Mr. Horace Woolridge, of the Nox Co., said that his company was incorporated in 1923 with a capital of £2,000, increased in 1927 to £15,000, all issued. Debentures for £12,000 or £13,000 were outstanding. The company had a factory in Leeds, where it manufactured not only lamps, but glass for the lamps. Their output was 750,000 lamps a year, which they expected to increase to a million next year. They employed over 200 persons. While the company considered that the terms of the licence offered them were generally fair and reasonable, they objected to the restriction of output to 100,000 per annum.

Sir A. Colefax said he should not contend that the Nox Co. was not a proper company to receive a licence.

Mr. Norman E. Paine, works manager of the Nelson Co., said that they had a factory in Merton Park, and their output of lamps varied from 3,000 to 11,000 a week. The company was incorporated in 1925, the authorised capital being £50,000.

This concluded the evidence.

Sir Duncan Kerly, for the Nox Co., said they were content to leave the matter of the limitation in the licence offered to them to further discussion, and he did not further oppose the extension of the patent.

The hearing was continued on May 13th, when Mr. Corsellis, on behalf of Tungstalite, Ltd., and the Kye Electric Co., Ltd., contended that the patentees had not suffered loss owing to the war. That was proved by the figures which had been put forward. Mere figures of number of sales of lamps were of little value compared with the figures showing the actual receipts as indications of what profit or loss had come to the patentees owing to the war. During the war vacuum lamps increased from 10 millions in 1914 to 18 millions in 1918, and the gasfilled lamps from 28,000 to 1¾ millions.

The Judge said he did not think 1914 was a fair year for comparison. The patent was not in full working then. He had to consider whether the life of the patent had been interrupted by the war, and the evidence was that it was.

Counsel argued that the interruption by the war could only have been in the direction of the small lamps. The war increased the sales of large-sized gasfilled lamps. The question was, could the small lamps have been made if there had been no war?

The Judge pointed out that in 1919 the sales of gasfilled lamps were two millions, in 1920 four millions, and the sales had risen since to 17 millions.

Counsel said that every one of these patents took three or four years to get going. The evidence was that most of the sales since the war had been by the G.E.C. and Siemens, who did not pay royalties, and the figures which had been put forward of the sales of lamps were no criterion of what profits the patentees would have made. The only figures which mattered were those of the patentees' own sales and those in which they were interested from a royalty point of view. Those figures were not before the Court, but it was admittedly a small proportion of the whole. The B.T.H.

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Co., by means of its gasfilled lamp patent, had been in effect prolonging its monopoly with regard to vacuum lamps, because those who wanted to sell any kind of vacuum lamp could not do so by reason of the conditions inserted in their contracts with the B.T.H. Further, the B.T.H., or the Association of which they were members, in contracts with municipal users had inserted in the printed contract conditions directly contrary to the penal section of the Patents Act, the conditions being that the user only got the advantage of certain discounts if he bought all his lamps from a particular company. Before any extension of the patent was granted that ought to be considered.

Mr. SHELLEY, for the Nelson Electric Co., said the evidence showed that there had been a considerable diminution in the price of gasfilled lamps in the period since the war, and that during the war the price was high and maintained at more or less the same level. Thus the increase in demand was materially improved by the decrease in price. Further, all the improvements relating to lamps had been in the gasfilled lamps, and that had also had an effect in stimulating demand. The patentees' experience during the war years was just the same as that of other patentees during the first few years of the working of a patent.

Mr. STAFFORD CROSSMAN, for the Comptroller-General of Patents, said that the view of the Comptroller was that, if his Lordship thought there ought to be an extension of the patent, in all the circumstances, having regard to some extent to the sale by the applicants of imported lamps, any extension that his Lordship granted should not exceed two years. Further, any extension granted should be subject to an undertaking by the applicants that they would use their best endeavours to register all the licences mentioned in their affidavits. The greater number of the licences were not on the register.

Sir ARTHUR COLEFAX, K.C., in replying on behalf of the B.T.H., contended that, so far as the municipal contracts were concerned, those contracts were not with the applicants, but with the Electric Lamp Manufacturers' Association. There was no restriction on the user of lamps, and the conditions of the contracts merely were to give special conditions as to discount if the municipality undertook to purchase lamps only from members of the Association. He submitted that the contracts did not come within the scope of the section of the Act at all.

The hearing was concluded on May 14th. Sir Arthur Colefax continued his statement, and Mr. Justice Luxmoore gave his decision immediately afterwards. He said that he had come to the conclusion that two years was a proper period for extension. The patent would therefore be extended for that time and the applicants must endeavour to obtain the registration of licences forthwith. There was no order as to costs. A report of the judgment will appear in our next issue.

Marconi Company's Royalties Appeal.

THE hearing was resumed on May 8th of the appeal by Marconi's Wireless Telegraph Co., Ltd., from an order of the Comptroller-General of Patents in favour of the Brownie Wireless Co., Ltd., granting the latter a compulsory licence on special terms.

The Attorney-General (Sir T. Inskip, K.C.), on behalf of the Crown, said he did not desire to express an opinion on controversial matters; his duty was to help the Court in the interpretation of a difficult section of the Act of Parliament. The view he took was that it was quite clear that Parliament intended that a patentee should himself or indirectly put on the market the article in respect of which he had secured monopoly rights, and that he should work the patent not for his own selfish purposes only, but so as to secure to the public an advantage by reason of the discovery which he had made. The Act intended to prevent an abuse of patent rights. It would be clearly an abuse if there was a failure to work the patent on a commercial scale without good reason, or if foreigners were preferred by the patentee, or if there was an insufficiency of supply on reasonable terms. The Comptroller-General had suggested that there were a large number of people in the country who were unable to satisfy their desire to possess valve receiving sets because they could not afford to pay existing prices, that it was desirable that they should have sets, and that sets could be produced more cheaply if a wider licence was granted by the Marconi Co. on terms which would be to the advantage of the Marconi Co. and reasonable to the licencee. It was easy to come to the conclusion in all the circumstances that public interest required a compulsory licence to be granted. Then the applicant had to show that by reason of the refusal to grant a licence on reasonable terms his trade had been prejudiced. If his Lordship was satisfied that it was in the public interest that a licence should be granted, counsel suggested that his Lordship should attach great importance and respect to the views which the Comptroller-General had expressed on the matter. He (the Attorney-General) had no wish to express any opinion on the subject of the amount of the royalty. He merely suggested that if 12s. 6d. per valve holder was interfering with the widest possible use of the invention in this country, and with a lower royalty there could be a wider use of the invention consistently with a maximum advantage to the patentee and reasonable profit to the licencee, then the figure of 12s. 6d. was unreasonable. Public interest seemed to be the over-riding matter, it being clearly laid down by Parliament that the intention of the grant of the monopoly was not to enable ingenious manufacturers to make enormous profits at the expense of the public, but that in return for the monopoly rights they were to give the public the advantage of their discovery upon reasonable terms which would enable as many people as possible to enjoy it. The Attorney-General added that he did not say that wireless had yet become a necessity in our everyday life, but it might. With regard to the prohibition of exports clause in the licence, he thought it not unreasonable. If his Lordship came to the conclusion that for other reasons a licence should be granted, it would be, he considered, unreasonable for the patentee to insist on royalty being paid on unpatented articles.

Mr. Justice Luxmoore reserved judgment.

Marconi's Wireless Telegraph Co., Ltd., v. Langham Radio.

IN the Official Referee's Court on May 6th Sir Francis Newbolt, K.C., had before him an action brought by Marconi's Wireless Telegraph Co., Ltd., against Langham Radio, Regent Street, W., in which plaintiffs claimed a declaration that they were entitled to inspect the defendants' books and accounts relative to certain licences granted by the plaintiffs to defendants to ascertain the amounts due. The matter came before Mr. Justice McCardie in January, who sent it to the Referee as the defendants submitted to judgment.

Mr. SAMUELS, for the plaintiffs, said that the auditors found that there was due to the plaintiffs £11,066.

Mr. GARDINER, for the defendants, did not contest this, and the Official Referee entered judgment for plaintiffs for the amount stated with costs.

An Overhead-lines Book Dispute.

A MOTION for an injunction to restrain the alleged infringement of the copyright in a book dealing with the design of overhead electrical transmission lines, published by Chapman and Hall, Ltd., came before Mr. Justice Romer in the Chancery Division last week, the defendants being Sir Isaac Pitman and Sons, Ltd.

Mr. MCGILLIVRAY, for the latter, said he desired substantial time to answer the plaintiffs' evidence. It was a case that concerned a technical text-book, the material for which must be derived largely from common knowledge and common sources. He asked for the motion to be adjourned until next sittings.

Mr. GRAY, for the plaintiffs, said that part publication of the book had taken place, and he wanted an injunction to restrain further publication. On February 19th complaints were made to the defendants that certain passages and illustrations in their book were similar to those in the plaintiffs' book, but their author denied that there had been any copying. His instructions were that the book was one volume of a work that was coming out in parts.

Mr. GILLIVRAY said he would give an undertaking in the terms of the notice of motion if the motion was adjourned.

His Lordship thereupon said that the motion would be adjourned until the second motion day of next sittings.

Sequel to a Fatal Shock.

In the Cardiff County Court on May 7th, Judge Thomas awarded £100 damages to Elizabeth Bale against Alice A. Jesseman. It was stated for the plaintiff that the defendant ran an electric wire from her house to a garage at the bottom of her garden. A child playing near the wire came into contact with it and called for assistance. The plaintiff's son, aged 16, went to the child's rescue and as a result received a shock which killed him. The Judge found that the insulation of the wire was perished and there had been negligence upon the part of the defendant. The latter's solicitor announced his intention of appealing against the decision.

Another B.T.H. Patent Application.

THE British Thomson-Houston Co., Ltd., announces that on June 11th an originating summons will come before Mr. Justice Luxmoore in the Chancery Division for directions as to hearing. The summons relates to an application for a five years' extension of Patent No. 14,892, dated June 27th, 1913, granted to the company for the invention of "Improvements in and relating to vacuum tubes." Particulars regarding opposition procedure appear in our advertisement pages.

British Thomson-Houston Co., Ltd., Litigation.

THE Zenith Electric Co., Ltd., Willesden Green, N.W.2, asks us to state that it has no connection whatever with the defendants in the case reported in our last issue under the above heading.

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Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Behaviour of Lead Cable Sheaths.

It is interesting to note that Mr. C. J. Beaver proposes a method to obviate the permanent distension of the lead, which was the very thing he set out to prove did not take place. The particulars of the cable under test in the notes published in the ELECTRICAL REVIEW of March 1st last, page 370, are almost identical with those in Mr. Beaver's fig. 5, the mean diameter under the lead being 2.674 in., and mean thickness of the lead 0.154 in. May I explain that the permanent expansion of the samples under test was ascertained, not by measuring the diameter, as Mr. Beaver kindly suggests, but by the method of accurately weighing them when immersed in water at a known temperature, and the increase in diameter in mils was calculated in order that readers might the more readily compare the results obtained.

That Mr. Beaver does not find his deductions from the curve in fig. 3 agree with the expansion of fluid oils rather goes to show that some important factors were omitted from his calculations, possibly the "air content." The tests shown in figs. 4 and 5 were both taken on the same armoured cable. The armouring consisted of 69 galvanised soft-steel wires, each No. 9 s.w.g. As most super-voltage cables are wire armoured, the tests are the more practical for this reason, and it is surprising to find, with the large number of variables involved, that there was such close agreement between the results of the different tests we conducted. Mr. Beaver's cable sample was first put through a series of heat cycles, which must have generated internal pressure, and the sample, therefore, was not representative of a normally unloaded cable. His calculation of space content is then based on a normal pressure of 12 lb. (*i.e.*, already, say, 6 in. of vacuum). Surely as the first observed run after long preliminary treatment started at 15 lb., the air content should be calculated with that figure as a basis, and not the vacuum figure. Here I owe Mr. Beaver an apology, as the result will then be an air content of 0.056 cubic inch (the previous figure of 0.064 was incorrect) in place of his figure of 0.042 cubic inch. After all, it is quite evident that cables with small air content will be subjected to higher internal pressure than those with a greater air content.

H. Gurney Wood.

Woolwich, S.E.18, *May 6th*, 1929.

In his original article on page 142, Mr. C. J. Beaver makes the following statement: "A certain amount of the cable impregnating medium is of necessity lost in making the end connections to the cable, and in order to make this good *with absolute certainty*, the pipe and its contents are put through a few daily cycles of heating and cooling. . . . This is repeated until *there is no doubt as to the cable being completely filled*."

On page 735 in his second article he says: "In a degree, therefore, their conclusion" (that there was occluded air in the dielectric of his cable sample) "was a substantial part of my premises."

We find some difficulty in reconciling these two statements. If the precautions Mr. Beaver took to fill the cable sample completely were inadequate, and they apparently were, if he admits that there is still air there, then his test is not one of lead-sheath distension, but of residual air content. Under these circumstances we agree that it is possible to have an appreciable rise of temperature of the cable without permanent expansion of the sheath. That this is the real cause of the absence of permanent expansion in his experiment is shown, not only by his admission on page 735 quoted above, but also by his reference to dielectric compressibility. Since the cubic compressibility of either oils or cellulose is negligible, dielectric compressibility can only be due to its compressible gas content. His reference to absorption effects also supports the same view. "Absorption effects" is a vague term. There are no volume changes in such a mixture as that of cellulose and oil, and what the term really means is a movement of compound into a previously unoccupied space, or, rather, gas-occupied space.

How far it is possible to exclude all traces of air by any process of impregnation during manufacture, and how much harm they do if they remain are other and much larger questions which cannot be settled by discussion in the columns of your journal. It is sufficient to state here that the air can be reduced well below the 0.5 to 1.5 per cent. which Emanueli infers, by extrapolation of results of tests on impregnation after lead covering, must occur in usual cables.

There still remains the question whether sheath-distension effects occur in service. However uniform a cable is when it leaves the factory, and cable manufacturers do their utmost to make it so, there are always inevitable inequalities of treatment in service. There may be special local strains during installation, there are widely different ground conditions as regards heat dissipation, and there are differences of level. One example will suffice to illustrate our point. During the publication of the first of Mr. Beaver's articles, one of the writers received a letter from Mr. Roper, the well-known superintendent of the Street Department of the Commonwealth Edison Company, of Chicago, from which we are sure he will not mind our quoting. We trust Mr. Beaver will regard the evidence as impeccable.

"We are interested in the subject of the expansion of lead sheaths of cables which have oil-filled joints, as we have several thousands of such joints in service. Our records indicate in some cases that the voids within the cable are gradually being filled with oil, or that the entrained air is being displaced by the oil from the oil-filled joints; but we have been unable to discover by measurements of cables in service that there has been any increase in the diameter in sections of cable that were fairly level. As you know, hills in Chicago are pretty scarce, but we do have some tunnels under the river, and we have noted a gradual expansion of the lead sheath of a cable in a tunnel when the water in the tunnel was removed for work on other lines. This expansion finally developed a defect in the lead, and the cable was removed without any failure having occurred. When we tested the piece of cable to see how much damage had been done to it by the slight expansion of the sheath which we found, to our surprise we discovered it was the best piece of cable that we had ever tested. . . ."

What probably happened in the case Mr. Roper quotes is that there was a movement of compound during heating and cooling cycles towards the lowest part of the cable run. This section would tend to become fuller of compound than the remainder of the cable, and on heating, local pressures, sufficient to stretch the lead, would be developed before pressure equalisation could occur; the extra volume so created would be filled in again by settlement of the compound, leaving voids elsewhere, and further stretching would again occur. On removal, however, since this section was particularly full of compound, it would give an excellent power factor-voltage characteristic with no ionisation, and would therefore appear to be in excellent condition.

Whether this is the true explanation, or not, the fact still remains that here is a definite case of lead-sheath expansion occurring in service due to causes which could not be reproduced on a 6-foot experimental length.

We have in our possession reports of tests by another operating company which definitely prove that intermittent stretching of the lead sheaths of ordinary type cables fed from joint reservoirs takes place. These will no doubt be published in due course, but for the present the case quoted must suffice.

T. N. Riley.
T. R. Scott.

London, N.W.9, *May 6th*, 1929.

The Compulsory Earthing of Prepayment Meters.

How it must horrify some of these earthing cranks to enter a house and see all the 3-ampere tumbler switches with metal covers unearthed. Lead-covered wire, &c., should be earthed in case of fire, but, except in bathrooms, where the greatest care should be taken, why all this fuss about apparatus which *may* go wrong?

Why deliberately try to break down the insulation of kettles, irons, radiators, &c., by earthing them? It does not matter very much if somebody does get a slight tingle of 200 or 230 volts to earth once in 50 years. If such things are really dangerous owing to a large proportion of the population having heart, or some other serious complaint, then manufacturers should get rid of metal casing altogether from everything electrical.

The most dangerous thing in an all-electric, gas, or any other house is a kettle of boiling water, to say nothing of the usual tub of boiling water carefully left for the baby to fall into. The next is the usual gas geyser in the bathroom.

In nine cases out of ten a pre-payment meter may become "alive" and not even be discovered. In the tenth case, the lady of the house might receive a little shock, when she would probably give 1s. to "hubby" to put in the meter so that he could get one too. Soon somebody will discover that the lamp-holders on the ends of flexible wires and the iron bedsteads are not earthed.

A. J. Abraham.

Bexleyheath, *May 7th*, 1929.

Three-phase or Single-phase Lighting?

It would be interesting to have your readers' views on the proposed installation of a 3-phase to single-phase transformer for dealing with a large lighting installation.

It is claimed that, after including the transformer, a considerable saving would be shown on switchgear and sub-mains, on the conversion from 3-phase to single-phase. Faults occurring on the single-phase, four-wire system would automatically be distributed over the three phases on the two-wire system, and also one-third, or even two-thirds, of the load could be out of action without upsetting the supply company's balance.

It is proposed to install a static transformer, which will load each of the three incoming phases in the approximate

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ratio of 1 : 1 : 2. Surely the supply companies concerned should not object, as the best they can hope for, especially on theatre installations, is a paper balance.

London, *May 6th*, 1929. **H. J. Holmes.**

Correspondence Schools.

"Ric" is unfair to the correspondence school in his article "An Old Problem—from a New Point of View." One or two of these schools guarantee to successfully coach students for the different institution examinations (such as A.M.I.E.E.), and to continue such coaching until the student passes. As these examinations are actually carried out under the eye of the particular institution concerned, surely it is something more than an "attempt to carry out the promise in their advertisements."

Northampton, *May 11th*, 1929. **W. H. Hunt.**

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

26,853. "Ignition systems, with coil, for internal-combustion motors." A. Petrella. October 8th, 1926. (278,759.)
27,790. "Television apparatus." J. L. Baird and Television, Ltd. October 19th, 1927. (309,965.)
29,138. "Luminous electrical discharge tube." R. W. James (Manhattan Electrical Supply Co., Inc.). October 22nd, 1927. (310,066.)
30,709. "Signalling installations." Siemens and Halske Akt. Ges. November 16th, 1926. (280,919.)
34,088. "Method and means for recording or reproducing sound." J. Neale. December 16th, 1927. (309,930.)
34,302. "Methods of guarding for overhead electric lines." W. Fennell. December 19th, 1927. (310,070.)

1928.

639. "Means for distributing electric current." Sykes & Dyson, Ltd., P. Sykes, and W. Cooper. August 11th, 1928. (310,096.)
1,316. "Synchronous motors." Electrical Research Products, Inc. April 6th, 1927. (288,236.)
1,405. "Thermionic valve circuits." A. F. Pollock and D. A. Pollock. January 16th, 1928. (309,846.)
1,427. "Multi-contact switches for telegraph or like systems." Automatic Telephone Manufacturing Co., Ltd., and W. J. Brown. January 16th, 1928. (309,847.)
1,430. "Lead-through insulators." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 16th, 1928 (309,884.)
1,481. "Systems for converting light energy into electrical energy, and *vice versa*." Electrical Research Products, Inc. April 6th, 1927. (288,237.)
1,553. "Electrical connectors or adaptors." F. D. Berners and L. Burns. January 17th, 1928. (309,890.)
1,570. "Arrangements for exciting commutator machines cascaded with asynchronous machines." Siemens-Schuckertwerke Akt. Ges. January 22nd, 1927. (283,957.)
1,620/1. "Electrical synchronising apparatus." T. W. Ross, C. Ryder, and Associated Electrical Industries, Ltd. January 17th, 1928. (309,897/8.)
1,636. "Electric lampholders." R. Nettle. January 18th, 1928. (310,078.)
1,693. "Lead-through insulators." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 18th, 1928. (309,936.)
1,711. "Sound recording and reproducing means." R. L. Aspden. January 18th, 1928. (310,079.)
1,712. "Controlling or preventing electrical interference with wireless installations due to the operation of electric motors." A. J. Haswell and Waygood-Otis, Ltd. January 18th, 1928. (309,939.)
1,717. "Means for generating alternating electric current with reciprocating engines as the driving power." Siemens-Schuckertwerke Akt. Ges. January 22nd, 1927. (283,961.)
1,745. "Television systems." Electrical Research Products, Inc. April 6th, 1927. (288,238.)
1,812. "Switching arrangement for zone time-metering in inter-urban telephonic connections chargeable at different rates." Soc. Anon. Hasler *ci-devant* l'Atelier des Télégraphes de G. Hasler and M. Neu. January 19th, 1928. (310,081.)
1,820. "Indicating means for electric remote-control installations." Siemens and Halske Akt. Ges. January 20th, 1927. (Patent of addition not granted.) (283,935.)
1,847. "Television and like systems." Electrical Research Products, Inc. April 6th, 1927. (288,239.)
1,931. "Electric selective distant-control systems." G. Maurer. January 21st, 1927. (283,966.)
1,932. "Magneto-electric machines." R. B. North and A. Massey-Allen. January 20th, 1928. (310,083.)
1,934. "Thermionic valves and their method of application." Radio-technique. January 21st, 1927. (283,967.)
1,961. "Electric insulators." J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). January 20th, 1928. (310,087.)
2,001. "Rotary stepping switches." Associated Telephone & Telegraph Co. March 7th, 1927. (286,638.)
2,017. "Television and like systems." Electrical Research Products, Inc. March 2nd, 1927. (286,262.)
2,901. "Electric heating resistance elements." General Electric Co., Ltd., A. Kinnes, and J. L. Rycroft January 30th, 1928. (310,102.)
3,002. "Protective covers for underground electric cables." G. Barnard and E. L. Cotterell. January 31st, 1928. (310,107.)
3,035. "Galvanic cell." G. Gaiser. January 31st, 1928. (Convention date not granted.) (284,626.)
3,126. "Electrotherapeutic appliances." N. Coe and A. Lithman. February 1st, 1928. (310,111.)
3,127. "Railway signalling devices." W. Gabbitas. February 1st, 1928. (310,112.)
3,648. "Headlights of automobiles." J. Bayley. September 3rd, 1928. (310,114.)
4,159. "Electronic discharge bulbs." Etablissements Gaiffe-Gallot et Pilon. December 7th, 1927. (301,855.)
4,645. "Systems for metering telephone calls." Telefonaktiebolaget L. M. Ericsson and E. A. Ericsson. February 14th, 1928. (301,120.)
5,340. "Sound reproducers for use in wireless telephony." R. O. Bridger. February 20th, 1928. (310,127.)
5,898. "Manufacture of electron-emitting bodies." Westinghouse Lamp Co. February 24th, 1927. (285,884.)
6,263. "High-voltage insulators." Associated Electrical Industries, Ltd. May 19th, 1927. (290,651.)
7,106. "Electric control apparatus." British Thomson-Houston Co., Ltd. March 16th, 1927. (287,136.)
7,758. "Electric protective devices." British Thomson-Houston Co., Ltd. March 19th, 1927. (287,454.)
8,335. "Lighting installations, comprising one or more discharge tubes having a high starting voltage." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 19th, 1928. (310,154.)
8,898. "Ionisation chambers." Siemens-Reiniger-Viefa Ges für Medizinische Technik. September 8th, 1927. (296,769.)
10,720. "Arrangement for the automatic regulation of the degree of transmission of transmission systems, particularly of high-frequency transmission systems." Siemens & Halske Akt. Ges. May 28th, 1927. (Patent of addition not granted.) (291,083.)
11,320. "Sound-reproducing apparatus." C. Menkens. April 17th, 1928. (310,180.)
11,581. "Electrically-operated steel roller shutters and the like." S. Haskins & Bros., Ltd., and E. R. Watts. April 19th, 1928. (310,183.)
12,692. "Galvanic batteries." E. Wolff. January 28th, 1928. (305,009.)
12,964. "Portable electric power unit for use in dental surgery." J. M. Roig. May 19th, 1927. (290,974.)
13,135. "Indirectly-heated incandescent cathode for a vacuum tube." Dr. S. Loewe. May 4th, 1927. (289,860.)
13,281. "Electrical transformers and the like." M-L. Magneto Syndicate. Ltd., and R. H. Woodall. May 5th, 1928. (310,198.)
13,503. "Manufacture of electrical porcelain insulators." C. H. Thompson. May 8th, 1928. (310,201.)
14,489. "Direction indicator for motor vehicles." J. J. V. Armstrong (Spezial-Werk-zeng-Fabrik Feuerbach Ges). May 17th, 1928. (310,208.)
15,549. "Ignition apparatus for internal-combustion engines." M-L. Magneto Syndicate, Ltd., and E. A. Watson. May 26th, 1928. (Cognate application, 26,414/28.) (310,216.)
16,312. "Electric insulators." P. Porzellanfabrik Rosenthal & Co. Akt. Ges. and W. Schmidt. June 5th, 1928. (310,222.)
17,284. "Electric heaters." E. N. Lightfoot. July 15th, 1927. (293,853.)
17,731. "Voltage-regulating systems." C. Coppock. June 19th, 1928. (310,229.)
18,658. "Non-metallic sheathed multiple-conductor cables." British Thomson-Houston Co., Ltd. Jun 28th, 1927. (292,983.)
21,181. "Induction measuring instruments." Landis & Gyr Soc. Anon. August 30th, 1927. (296,368.)
22,373. "Electrical switches." Rainsford & Lynes, Ltd., and R. K. Lynes. August 2nd 1928. (310,250.)
22,392. "Thermo-magnetic relays." International General Electric Co., Inc. August 5th, 1927. (295,039.)
23,532. "Electrically-driven household machines." Siemens-Schuckertwerke Akt. Ges. August 25th, 1927. (296,067.)
23,755. "Electric discharge devices." Westinghouse Lamp Co. September 8th, 1927. (296,778.)
26,885. "Electric remote-control systems." Associated Telephone and Telegraph Co. October 8th, 1927. (298,470.)
31,664. "Electrical teaching device." A. Huber. November 7th, 1927. (300,175.)
31,677. "Magneto-electric machines." E. Morel. November 9th, 1927. (300,240.)
31,889. "Railway signalling devices." W. Gabbitas. February 1st, 1928. (Divided application on 310,112.) (310,277.)
33,473. "Electric discharge devices." British Thomson-Houston Co., Ltd. November 16th, 1927. (300,614.)
34,212. "Sparking plugs." Siemens & Halske Akt. Ges. March 27th, 1928. (Addition to 302,893.) (308,708.)
35,337. "Television and like electro-optical transmission systems." Electrical Research Products, Inc. April 6th, 1927. (Divided application on (288,239.) (301,474.)

1929.

5,646. "Insulating materials." W. E. Beatty (Bell Telephone Laboratories, Inc.). December 15th, 1927. (Divided application on 307,966.) (309,851.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 8th :—

Eloden. No. 499,542. Class 8. Fitted electric switchboards, wireless telephonic and telegraphic apparatus and parts thereof, etc.—Eloden Muller and Co., Berlin. (British representatives: W. H. Beck & Co., 26-28, Holborn Viaduct, E.C.1.)

Symphonista, No. 499,635, Symphonion, No. 499,636, and Symphonetta, No. 499,831. Class 8. Radio-telephonic apparatus and parts thereof.—Dulcetto-Polyphon, Ltd., 2 and 3, Newman Street, W.1.

Bulldog's Head (design only). No. 499,962. Class 8. Primary and secondary electric batteries.—A.F.A. Accumulators, Ltd., 9a, Diana Place, Euston Road, N.W.1.

Procell. No. 500,896. Class 8. Electric cables.—Mersey Cable Works, Ltd., Linacre Lane, Bootle, Liverpool.

Tunganite. Nos. 501,329 and 501,330. Classes 8 and 11. Electric accumulators (not for medical purposes). No. 501,331. Class 13. Accumulator boxes of lead.—Walter Haddon, 132, Salisbury Square, E.C.4.

An Irish Allegory.

The 1929 summer exhibition of pictures at the Royal Academy contains some splendid examples of British art. The nearest approach to a problem picture is Mr. John Keating's "Night's Candles Are Burnt Out," which is of the nature of an allegory, apparently concerned with the past, present, and future of the Irish Free State. A skeleton hanging on the left, workmen resting or putting up lamps to light the dusk, a gunman humbly saluting a proud and obese engineer, a mother showing her child vast building operations across a valley, and a priest in the corner reading his breviary by the light of a candle: what does it all mean? According to J. M. N. J., presumably it means in the new Ireland disorder crumbling, the gunman yielding to the arts of peace, the Shannon electricity scene in the background, and the priest, contented at last, able to read his private prayers.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALDERSHOT.—Cinema, High Street, for the Empire (Aldershot), Ltd. secretary.

ANNAN.—School, for Dumfries-shire E.C.; J. R. Hill, architect, Education Offices, Dumfries.

ASHTON-UNDER-LYNE.—Housing scheme (92), for the T.C. J. Rowbottom, borough surveyor (returnable deposit of £2 2s.).

AYLESFORD (MAIDSTONE).—Central school, for Kent E.C.; director of education, Sessions House, Maidstone.

AYR.—County buildings (£100,000); county clerk.

BEESTON.—Two schools, Lenton Abbey site (£45,650): Notts. Education Committee.

BIRMINGHAM.—Extensions, salvage depôt, Rotten Park Street (£125,000); city engineer. Two schools, Court Farm estate and Allen's estate; Education Committee.

BLACKPOOL.—Additions to Winter Gardens buildings; general manager. Municipal aerodrome; borough surveyor.

BOLTON.—Housing scheme (58), off Hulton Lane, for T.C. (deposit £2 2s.); Housing Department, 51, Victoria Square.

BOOTLE.—Housing scheme (122), Northfield Road (deposit £2 2s.); borough engineer, Town Hall.

BURNLEY.—Housing scheme, Barden Lane; borough surveyor.

BURTON-ON-TRENT.—Housing scheme, Clarence Road brewery site; borough engineer.

BURY (LANCS.).—Re-erection of portion of Gigg Mills, for the Bury Papermaking Co., Ltd. (£70,000).

BUTE.—Infectious diseases hospital at Lamlash, Arran (£9,000); medical officer, Arran.

CAMBUSLANG.—School, Dalton, for Lanarkshire E.C. (£20,000); director of education, Glasgow.

CARLTON.—Central school (400 places); Notts. Education Committee.

CHERTSEY.—50 houses at Victory Park, for U.D.C. (£18,636); contractor: A. E. Jones, Chertsey Road, Woking.

CHESHIRE.—Mental Institution, Grange Hall estate; Cheshire Joint Board for Mental Defectives.

COLCHESTER.—Additional 133 houses, for the T.C.; borough surveyor.

COULSDON AND PURLEY.—Public offices (£24,000), for the U.D.C.; surveyor. Secondary school, Coulsdon Court estate; Surrey county architect.

COVENTRY.—Factory, Canley, for the Coventry Plating and Presswork Co., Ltd.

CRICKLADE AND WOOTTON BASSETT.—Housing scheme (46), for the R.D.C.; R. C. Hawkes, clerk, High Street, Wootton Bassett (returnable deposit of £2 2s.).

DAGENHAM.—Secondary school, for Essex E.C.; director of education, Chelmsford.

DARLINGTON.—New St. Matthew's Church (£8,000); R. N. Stoddart, vicar.

DARTFORD.—Laboratories, Temple Hill; Burroughs, Wellcome & Co.

DATCHET.—Power station, for the Southern Railway Co., Ltd.; engineer.

DUDLEY.—564 houses, Priory estate (£229,542); Suburban Homes, Birmingham. 73 houses, Bowling Green estate; Messrs. Griffiths.

DUMFRIES.—Town hall buildings, for the T.C.; Mr. Barker, burgh surveyor.

DUNDEE.—Girls' school; clerk, Education Authority.

EASTLEIGH AND BISHOPSTOKE.—Additional housing scheme (260), for the U.D.C.; surveyor.

EDINBURGH.—Reconstruction scheme at University (£60,000); the Chancellor.

GALASHIELS.—Re-erection of Whitelee House, residence of Mr. Alexander Wyllie (£8,000).

GLASGOW.—Municipal maternity hospital; city architect. School, Springfield Road; W. J. B. Wright, architect, 1, Blythswood Square. Housing scheme, Quarrybrae Street; city engineer.

HALESOWEN.—Additional 200 houses, for the U.D.C.; surveyor.

HITCHIN.—Extensions, boys' grammar school (£34,000); governors.

ILKESTON.—Alterations, factory, Primrose Hill; W. Beardesley & Sons, Ltd.

LARGS.—Concert hall, for Town Council (£7,000); town clerk.

LEAMINGTON.—57 houses, Rushmore Farm estate; A. Ward, Coventry.

LEOMINSTER.—Extensions, cottage hospital; J. Budd and Sons, architects.

LIVERPOOL.—Cinema in Scotland Road, for W. L. Hampson.

LONDON (EAST HAM, E.).—Municipal offices, Barking Road site; borough engineer. Additions, East Ham Hospital, Shrewsbury Road; Clemens Bros., Ltd.

(WHITECHAPEL, E.).—Bank, Commercial Street and Brushfield Street (£15,000); Barclay's Bank, Ltd.

(BERMONDSEY, S.E.).—Warehouse, 55-7, Tanner Street; H. W. Wagstaff.

(LAMBETH, S.E.).—Extensions, School of Printing (£33,000); L.C.C. architect.

(SYDENHAM, S.E.)—Shops and flats, West Hill; North, Robin & Wilsdon, architects.

(WANDSWORTH, S.W.).—Warehouse premises, for Lighting Trades, Ltd.; J. Oran & Son.

(WEST KENSINGTON, W.).—Four-storey premises, West Kensington Gardens, for Olympia, Ltd.; James Carmichael (Contractors), Ltd., builders.

LUTON.—Extensions, Borough Engineering Works, Ltd. School, Denbigh Road (600 places), for the borough E.C.; W. Smith, clerk.

MACCLESFIELD.—Works, Lower Heyes Mill, for the Viscose Paper Co.; City and Continental Trust, Ltd.

NORTHAMPTON.—Factory, Abbey Street; E. W. Hasdell. 11 shops and 27 houses, Wellingborough Road; Manfield and Sons, Ltd. Housing scheme (49), for the T.C.; A. Fidler, borough engineer (returnable deposit of £5).

NORTHERN IRELAND (BELFAST).—Flour mill, for J. Rank, Ltd., millers. Elementary school in Blythe Street, for E.C. (£31,000).

OLDHAM.—Housing scheme (300), Limeside (deposit £2 2s.); borough engineer.

OLLERTON.—Further housing scheme; Butterley Colliery Co.

RICKMANSWORTH.—Housing scheme (58), for the U.D.C.; surveyor (returnable deposit of £2).

ST. ALBANS.—Mental hospital; J. M. Sheppard, architect for Herts. C.C.

ST. AUSTELL.—Girls' secondary school (£15,000), for Cornwall E.C.; F. R. Pascoe, secretary, Truro.

SEDGEFIELD.—Housing scheme (56), for the R.D.C.; surveyor.

SOUTHPORT.—Extensions, Southport Convalescent Hospital; secretary.

SOUTH SHIELDS.—158 houses, Marsdon Lane, Harton, for H. Brown & Sons; T. A. Page & Son, architects. School (800 places) housing estate; R. H. Morton, architect.

SOUTHWELL.—School (300 places); Notts. Education Committee.

STOCKPORT.—Cinema, Mersey Square, for S. G. Owens. The Willows, Hibbert Lane, Marple; W. Thornley, architect. Senior school, Great Moor, for the borough E.C.; director of education. Houses (90), for the T.C.; T. Davies & Son, builders.

STRETFORD.—118 houses, Barton estate; Grinshaw and Thomas. 146 houses, Barton estate; C. R. Bradley, Stacksteads.

SUNNINGHILL.—Central post office, for H.M. Office of Works, King Charles Street, London, S.W.

TROWBRIDGE.—Shops and offices, for the West Wilts. Electric Light and Power Co., Ltd.; W. W. Snailum, architect, Church Street.

WALSALL.—School, Ida Road (£28,500), for the borough E.C.; borough surveyor.

WATFORD.—Extensions, nursing home (£10,000); Herts. C.C.

WEST BRIDGFORD.—Secondary school; Notts. Education Committee.

WINCHCOMBE.—Electric lighting installation, Parish Church; vicar.

WINDSOR.—Hall, girls' county school, for Berks. E.C.; director of Education, Reading.

YORK.—Extensions, fever hospital (deposit £2); F. W. Spurr, city engineer.

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The

Electrical Review

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London's Electricity Supply.

IN this issue we review the report of the London and Home Counties Joint Electricity Authority for 1927-1928, which relates to an important area of Great Britain, containing nearly 20 per cent. of the population and accounting for about 22 per cent. of the country's total sales of electricity. We are, of course, able only to deal with the report as a whole, but its main interest lies in the very complete details which are given for each individual undertaking. The figures reflect very clearly the effect of local conditions upon load factor, sales, revenue, costs and charges. With regard to capital expenditure, for instance, it is seen that while the local authorities with their compact areas have only expended 2.6 per cent. of the total upon main transmission lines, the companies show a proportion of 12.5 per cent. On the other hand, the local authorities have spent a larger proportion than the companies on generation and distribution.

The importance of the lighting and domestic load is apparent when it is reported that two-thirds of the revenue comes from this source although it accounts for only two-fifths of the sales of energy. Most of the undertakings have realised the remunerative nature of the load and are encouraging it by means of two-part tariffs, often in conjunction with schemes for the hire of apparatus. There are still several, however, which adhere to high flat rates, judging by the schedule of charges appended to the report, but they are a rapidly diminishing number. The poor load factors recorded by so many of the authorities (76 were under 30 per cent.) points to the need for intensive development rather than further extensions of supply. It will often be found far more profitable to encourage the existing consumers to make a better use of the electrical service than to connect up new customers.

The increase in the sales of energy during the period covered by the report was 21.0 per cent.; this compares favourably with the increase of 19.6 per cent. reported for the whole country. In some individual cases the advance was remarkable. The County of London Co., which of course is a special instance, showed an increase of 70.4 per cent. in sales. The Ascot and Brentford Companies recorded increases of 80.6 and 73.8 per cent., respectively. Among the municipalities the outstanding

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advances were 53.7 per cent. in the case of Epsom and 33.6 per cent. in that of Woolwich. The extra-London companies as a whole showed the remarkable advance of 43.5 per cent., but this was mainly due to a 220 per cent. increase in the sales of the Kent Power Co. whose supply was nearly all purchased and re-sold for power purposes.

As regards charges, it will be observed that the municipalities were more favourable to the lighting and domestic consumer, the difference in the average prices charged by the two classes of undertaker being considerable. For other classes of supply the differences were not so great; the extra-London companies showed the lowest charge per kWh for power purposes. None of the municipal undertakings had to draw upon the rates; conversely, 21 of them contributed a total of £92,081 in relief of rates. Three of these—St. Pancras, West Ham and Woolwich—provided over £10,000 each. This fact, coupled with the satisfactory dividends recorded for the great majority of the company undertakings, shows that the London electricity supply industry is in a flourishing condition.

The Gasfilled Lamp Patent.

MUCH interest was taken, both in this country and abroad, in the application of the British Thomson-Houston Co., Ltd., for an extension of its patent for the gasfilled lamp. In granting the company a two years' extension a very fair review of the circumstances was made by Mr. Justice Luxmoore, who kept closely to the law and found that the company had undoubtedly suffered loss on account of the war.

As the company and its associates have been largely instrumental in making two lamps shine where one shone before (as Swift might have said) they have performed a public service and are entitled to the full reward which the war prevented them from receiving.

The I.E.E. Membership.

WITH respect to the complaint that the notice convening the special general meeting of corporate members of the Institution of Electrical Engineers (which was held immediately following the annual general meeting) for the purpose of sanctioning changes in the by-laws, was too short to allow the Council's proposals to be thoroughly examined, the fact must not be overlooked that a communication was issued to all members in November, 1928, outlining the proposed modifications. During two sessions the Council, with the assistance of the Membership, Examinations, and General Purposes Committees, and that of the Committees of the Local Centres as well, had devoted much consideration to the manner in which reclassification could best be carried out, and the sanctioning, almost unanimously, of the necessary amendments to the by-laws by the special meeting as reported last week, shows that a considerable measure of agreement had been reached.

Briefly, the major changes are as follows:—Normal admission to the class of Member will, in future, be *via* that of Associate Member. Chiefly, however, the regrouping has been deemed necessary because experience proved the Graduate class, which was formed in 1912, to be very unpopular, owing to its consisting of two very different types of men; that is to say, first, young engineers who have satisfied the Institution's educational requirements, but have not the requisite responsible practical experience for Associate Membership; and, secondly, engineers (not necessarily young) who although possessed of practical responsible experience in the profession, are never likely to pass the A.M.I.E.E. examination, which, incidentally, is to be known in future as the "Graduateship Examination." Hence the Council felt that the time had arrived when those two types should be separated, and accordingly the latter now become a non-corporate body of Associates.

A new class has been created. The old class of Associates contained a number of persons of distinction who were interested in, or connected with, the electrical profession and industry, but were not electrical engineers. They are now to be transferred to the new class designated Companions, and will be represented on the Council by one of their class, who will take the place of one of the two Associates who formerly served on that body. The chairman of the Wireless Section also becomes an *ex-officio* member of Council during his term of office. It is worthy of note that the honorary treasurership, vacated by resignation under the length of service rule, was not filled at the annual meeting, and it may be surmised that the new treasurer will probably be chosen from the new class of Companions, who must be eminent in their respective spheres and have "rendered important services to electrical engineering in the fields of commerce, finance, law, or science, or is so connected . . . . that his admission . . . . will conduce to the interests of the Institution."

The remainder of the by-law amendments relate to the re-admission of ex-enemy members, re-adjustment of age limits and subscriptions, and such other minor modifications as have been rendered necessary by the re-classification.

The North-East Coast Exhibition.

DURING a visit to the North-East Coast Exhibition, a review of the electrical exhibits of which we are concluding in this issue, we were impressed by the enthusiasm with which the N.E. Coast people have entered into the enterprise. The district has been particularly hard hit by the depression in the shipping industry, more so, probably, than is generally realised. The show is a bold effort to effect a trade recovery, and one of its principal objects is to entice new industries into the area. From this point of view it is perhaps a pity that more "outside" electrical manufacturers are not displaying their goods, although it must be said that the N.E. Coast firms have made a particularly good show.

One very encouraging fact is that the highly-developed electricity supply industry in the area is ready to supply the fundamental need of cheap power for any industrial enterprise that opens out in the area, and manufacturers should be close at hand to meet the demands for British plant.

The excellent general lighting arrangements throughout the Exhibition, which will, no doubt, play such an important part in making the venture a success, call for congratulation to all those who have put their energies into the enterprise, including Mr. H. W. Clothier, M.I.E.E., chairman, and his colleagues on the Electrical Committee, and the manufacturers and contractors.

High-voltage Underground Cables.

AN announcement of unusual interest is made elsewhere in this issue. We refer to the statement in the timely and informative article signed by Mr. G. Martinez that two 132-kV lines, totalling 52 miles of single-core underground oil-filled cable, are shortly to be laid in London. Remembering the expressions of opinion relative to voltage limits made soon after the adoption of 33,000-volt cables in this country, one realises the truly compelling character of Hobson's choice. When anything really becomes an urgent necessity how soon the exceptional becomes acceptable!

Oil-filled 132-kV underground cables have been in operation in Italy and America for some time now, and although caution, within reason, is never unwise, whatever the future may be productive of in this direction it is probably hopeful. We are told that the London cables are to be installed as an experiment, but their manufacturers seem to have passed that stage, for they have accepted the contract at their own financial risk entirely and subject to stringent guarantees of replacement by cables designed to operate at lower voltages in the event of mishaps. It is to be hoped that their confidence has not been misplaced, and that they will reap the reward of their enterprise.

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Underground Super-voltage Cables.

This article, dealing with the total cost per mile of completely installed underground cables, is of timely interest and assistance, especially in view of the fact that the six graphs represent in a clear and concise manner comparisons of practical importance.

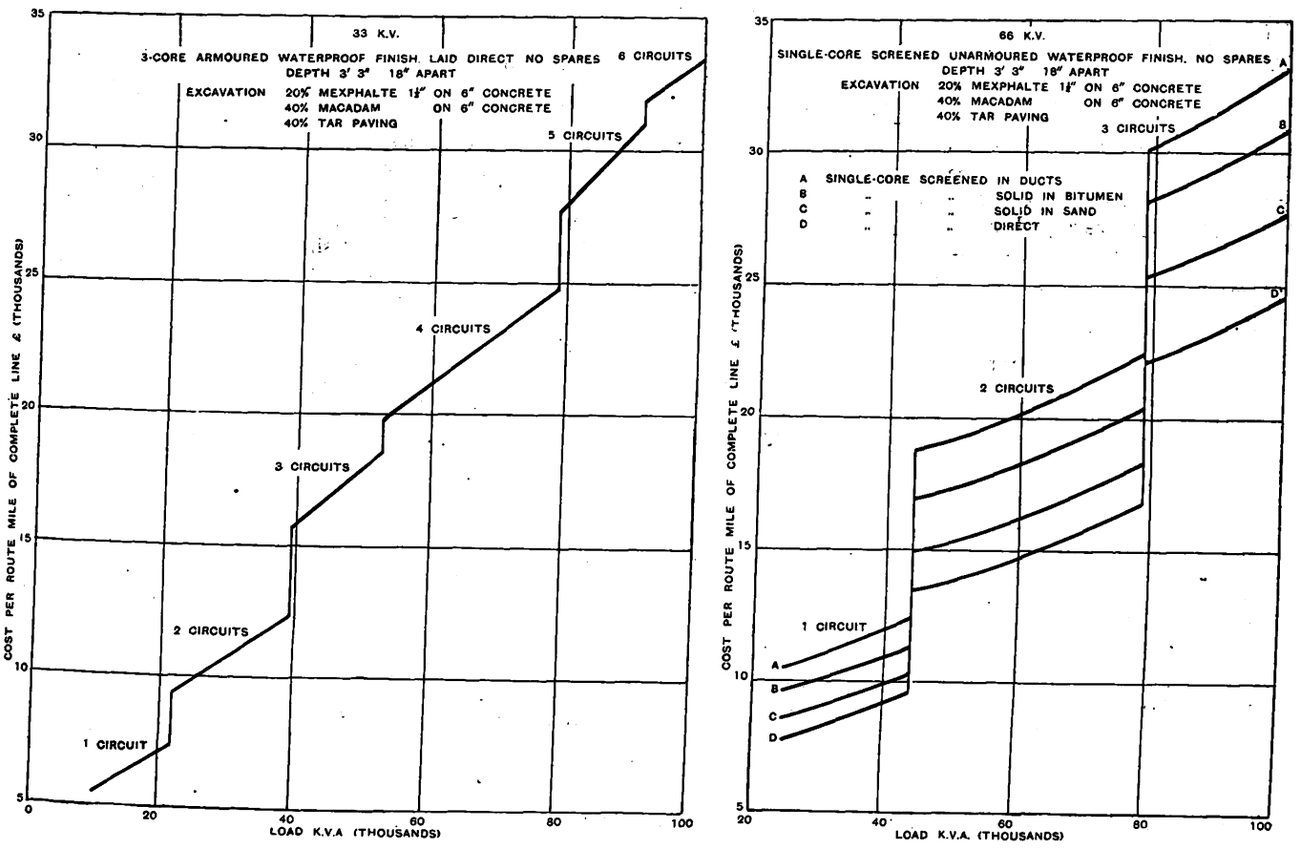
By G. MARTINEZ, A.M.I.E.E.

FOR underground transmission lines up to and including 33 kV working pressure, the usual procedure is to lay one or more three-core armoured cables direct. The curves in fig. 1 show the total cost per mile of completely installed lines for 33 kV working pressure and of various carrying capacities; also the cross section of the trench required.

For working pressures higher than 33 kV, various systems of laying are commonly used, *i.e.*, (*a*) pulled into ducts; (*b*) laid in troughs, solid; (*c*) laid in troughs, with sand; and (*d*) laid direct with sand and protection slabs. The set of curves in fig. 2 shows the total cost per mile of completely installed lines of various carrying capacities at a pressure of 66 kV, laid on the four different systems mentioned above, and, further, the cross section of the trench to be excavated to accommodate the line, if the latter be laid direct.

It is obvious that the direct-laying system is the cheapest. As regards mechanical protection of the cable, there is little to differentiate between the different systems of laying because none are proof against an iron stake or fencing pin being driven directly against the line; if however, the cable be laid at a sufficient depth to make the chance of this happening remote, the system of laying direct should be satisfactory if protection by means of suitable slabs be provided. Slabs used as top covers, however, will not, of course, protect the cable from a pick used below it from one side, as, for example, might happen when excavation work is being carried out along the cable route; the lower the cable can be laid, therefore, the safer it will be. The danger of flint working its way up to the cable can be to a great extent minimised by taking the necessary care in the filling of the trench.

With regard to the risk of attack by electrolysis, the duct system is certainly the worst. The laid-solid system is better, if the filling compound can be guaranteed to be non-brittle at the lowest temperature found in the soil. Practical experiment seems to indicate that direct laying in the ground with compounded-tape insulation over the lead is at least as good, if not better, than any other system, and provided reasonable bonding precautions are taken, no trouble from electrolytic phenomena should be experienced.



Figs. 1 and 2.—Total Cost per Mile of 33-kV and 66-kV Cable Lines.

It is obvious that whatever the conditions the provision of a second lead sheath makes the cable much safer, as it is then possible to break up the return path of stray currents by arranging for the outer sheath of each length to be disconnected from those adjacent.

It seems right to conclude that the direct-laying system is the most practical, as it is cheaper and no more dangerous than the others. Why, then, should not a

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33-kV cable be laid unarmoured direct in the ground? Fig. 3 shows a comparison of costs between a 33-kV three-core armoured cable (of the screened or triple-lead-

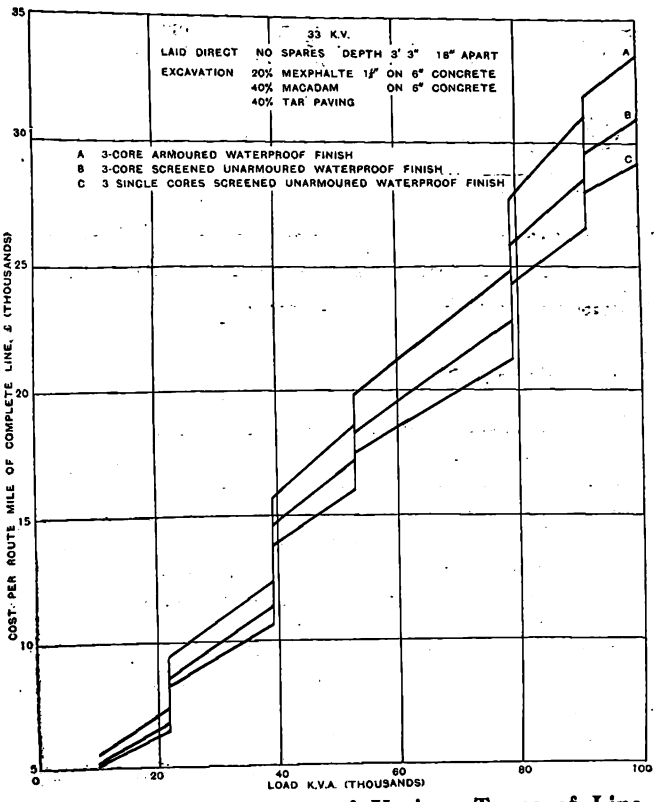


Fig. 3.—Cost Comparison of Various Types of Line.

sheathed type); a 33-kV three-core screened-type cable, unarmoured; and a 33-kV line composed of three separate single-cores, unarmoured, all laid direct; from which it appears that the last mentioned is the cheapest method, the three single-core 33-kV cables being exactly in the same condition as any 66-kV single-core cables laid direct.

It may now be of some interest to consider how the new type of oil-filled cable lines compare with the lines which have been installed previous to its appearance. The oil-filled cable (fig. 4) has inside the conductor a longitudinal duct which is connected to special reservoirs, the capacity of which, owing to the design, can vary. The duct in the conductor and the reservoir are full of thin oil. The reservoirs receive the oil forced out during thermic expansion, due to load or temperature of the surroundings, and give it back to the cable during contraction. The conductor is insulated in the usual

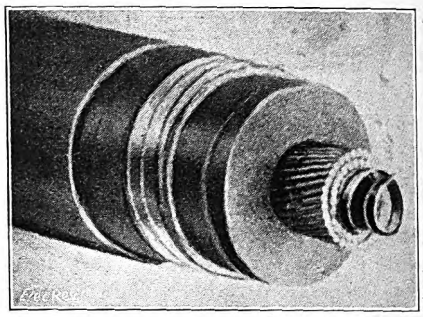
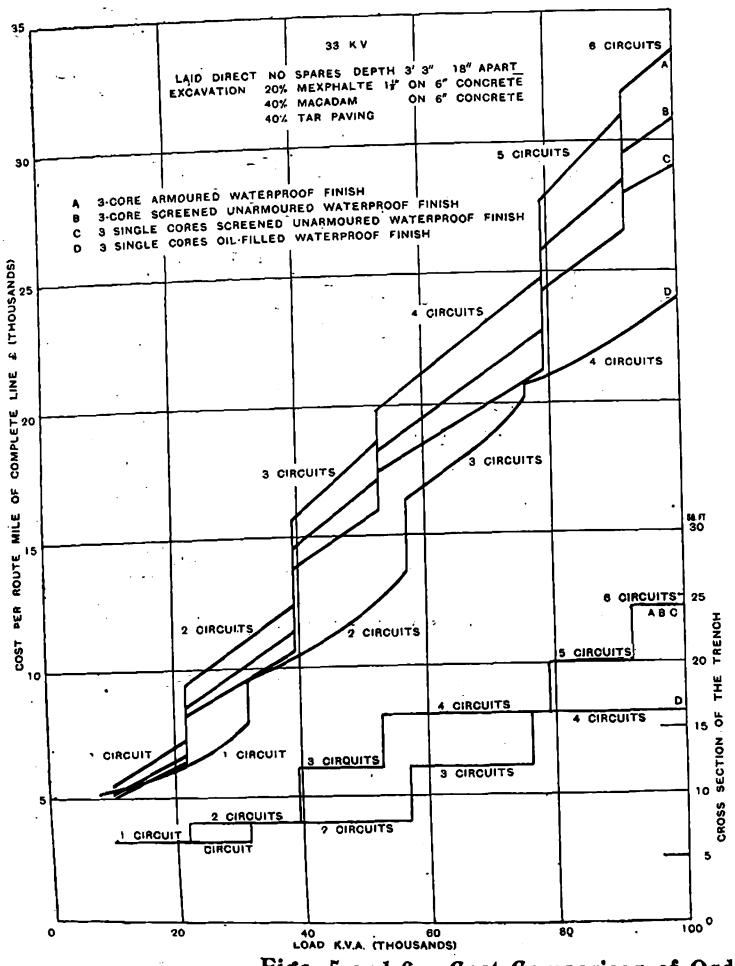
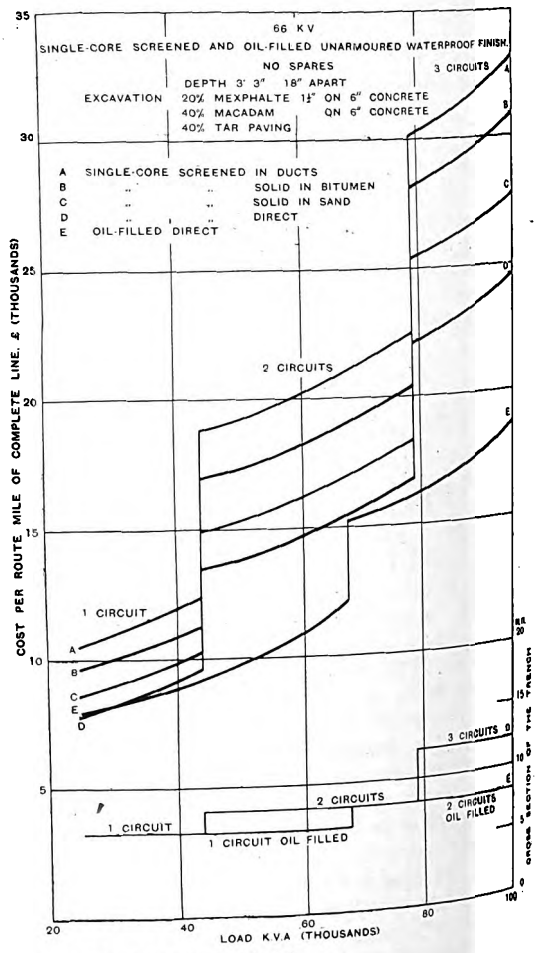


Fig. 4.—Oil-filled Cable.

way, the only difference being that the thickness of insulation required for a certain working pressure can be considerably reduced. The ordinary lead sheath is applied over the insulated core, and is protected with impregnated cloth tape. The cable is then armoured with hard brass strip, which compensates for the lack of strength and elasticity of the lead. The brass armouring is protected and insulated by impregnated cloth tape and then a second lead sheath of ternary alloy is applied. As an overall finish, waterproof serving is used.

Owing to the provisions made for the lack of elasticity and strength of lead, and to give the compound suitable room for expansion, the working temperature of the oil-filled cable can be much higher than that of the ordinary cable, and as a consequence its load-carrying capacity is much greater. Thus, if oil-filled cable is used in place





Figs. 5 and 6.—Cost Comparison of Ordinary and Oil-filled Cables.

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of ordinary cable, the cost per mile and per kVA transmitted will be reduced; the cost of laying may also be reduced, owing to the smaller total copper section required and consequent reduction of the number of cables necessary. The oil-filled cable is actually an armoured cable, and is double lead-sheathed; it can therefore be laid direct in the ground and yet have a much larger coefficient of safety than the ordinary type of cable.

In special cases when it is essential that the cable be armoured with steel tape, or wire, a three-core oil-filled cable can be used for 33 kV or 66 kV working pressure. Three-core oil-filled lines have already been installed and are working satisfactorily at 33 kV and 66 kV in Italy and in the United States. Figs. 5 and 6 show a comparison between costs of complete lines of ordinary and oil-filled cables for 33 kV and 66 kV working pressures, and also the ground room required in each case.

The oil-filled type of cable, besides the economical consideration, has some advantages also over the ordinary type from the technical point of view. Defects in the lead sheath cannot cause trouble, because pinholes, porosity in the press mark, or similar defects, are detected during manufacture, owing to the high vacuum obtained in the cable at a high temperature (100 deg. C.). The cable is, in fact, given a preliminary drying operation in the usual manner; the first lead sheath is applied and the complete drying of the insulation then carried out. A very high vacuum can be built up and maintained in the cable itself, because of the small volume concerned and the high-grade laboratory vacuum pump used. As soon as electrical tests of insulation resistance, capacity, and power factor indicate that the cable is well dried, it is impregnated at 100 deg. C. with dried degasified oil, and left connected to a feeding tank while it is cooled to the ambient temperature with cold water. In this way it is possible to make practically perfect impregnation.

Faults in the lead which might occur after despatch, and damage during or after laying may result in leakage of oil, but this can be detected by inspection of the reservoirs, and by replacing the necessary amount of oil the cable can be kept in service until a convenient time is found for repair. Thus, continuity of service can be maintained.

There are no voids, or regions of low pressure, in an oil-filled cable. When there is a void in an ordinary cable, due either to faulty impregnation, or to expansion of the lead caused by variation of temperature, not only do electrical discharges take place across the void, but owing to the low pressure the dielectric strength of the insulation at that point is also considerably reduced. Oil-filled cable is completely free from these troubles because the impregnation is practically perfect and the minimum pressure of the oil is atmospheric.

There is a very high coefficient of safety in an oil-filled cable joint, as this does not undergo changes from high pressure to partial vacuum due to uncontrolled movements of the impregnating medium, but remains perfectly impregnated at all times.

Researches concerning the life-curves of both the ordinary type and the oil-filled type have clearly shown that such curves for the latter type are much flatter.

In vertical installations of normal-type cable, or where it is laid on a slope, it is difficult to avoid migration of the compound to lower points, thus creating dry areas at the high points and high hydraulic pressures at the low points; both conditions are likely to cause considerable trouble. The special devices which are sometimes installed at the joints to replace compound can only magnify the trouble eventually, although they may show some temporary improvement. Oil-filled cables are designed to work in the position in which they are installed, whether it be on a slope or level, and all the effects due to their position can be foreseen and provided for.

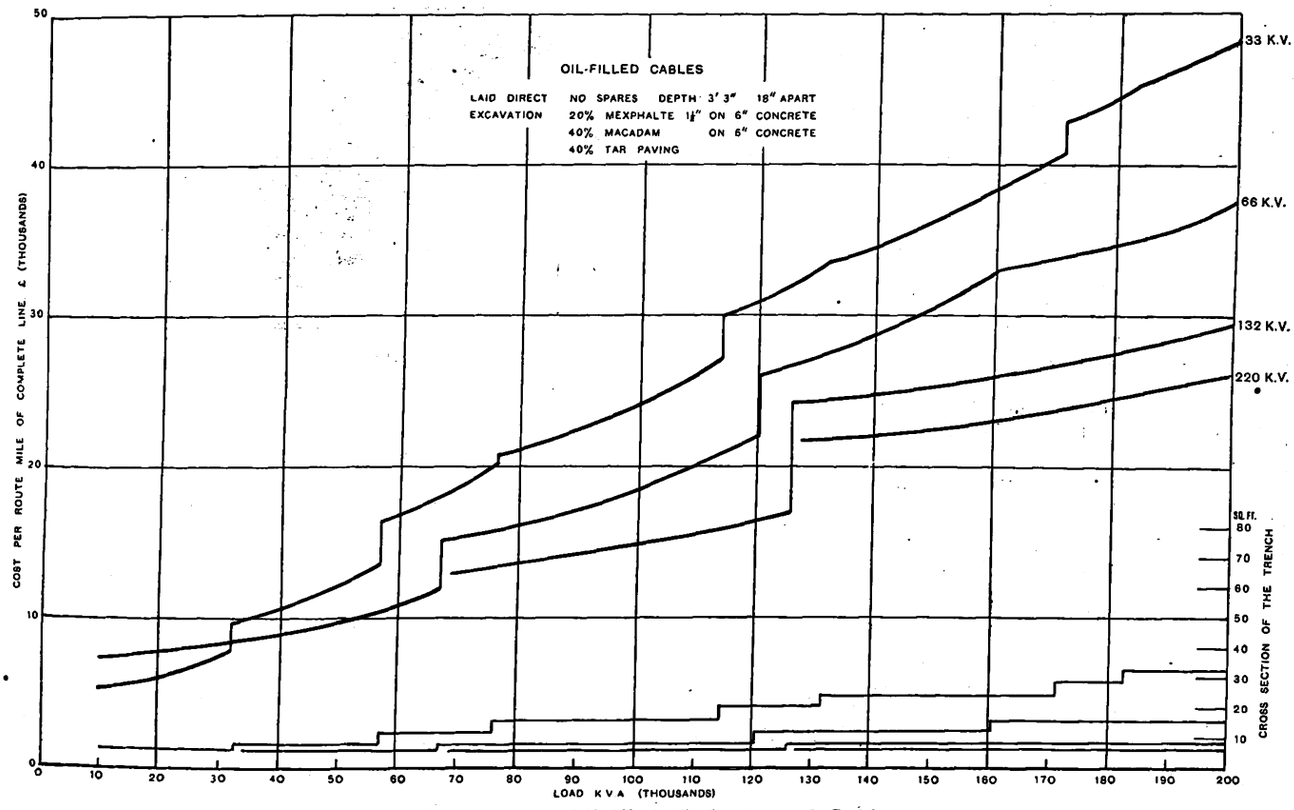

Fig. 7.—Cost of Oil-filled Underground Cables.

Furthermore, the principle and the construction of the oil-filled type of cable makes it possible to install underground lines for working pressures up to 220 kV. Two important lines carrying 100 kVA each at 132 kV working pressure were installed two years ago, one in New York and one in Chicago, totalling approximately 50 miles of single-core cable, and have since been working without a single breakdown of any kind; also several shorter 132-kV lines have been working for years in Italy. Two 132-kV lines, totalling 52 miles of single-core cable, will be installed in London in the very near future and, although they are being treated as experimental, the makers have so much faith in their performance that they are taking the greater part of any risk which may exist. It is interesting to note that 220-kV lines are under consideration on the Continent.

Fig. 7 shows the cost of oil-filled underground transmission lines, laid, to carry up to 200,000 kVA at various working pressures from 33 kV up to 220 kV, and also the space required to accommodate the cables.

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parts of the country. In interesting contrast to this modern plant, which is illustrated in fig. 2 on the previous page, are the two 1,500-kW reaction-type steam turbo-sets which were installed by the same Company in 1906 (fig. 1). After generating nearly 50 million kWh in the first six years these machines were still giving valuable service during peak loads last winter, 22 years after their installation.

The illustrations which we are able to reproduce of the sets referred to above provide a useful indication of the progress that has been made in the last 23 years in power-station practice.

A Large Transporter Crane.

Brief Details of an Electrically-driven Installation Recently Completed on the Continent.

At the celluloid factory at Attisholz, Switzerland, there has just been completed a fine piece of engineering that was carried out by the Ateliers de Constructions Mécaniques, of Vevey, and by the courtesy of Mr. A. Dommer, of those works, and Mr. H. Demierre* we are able to reproduce photographs and give details of the installation.

The construction and erection of the transporter illustrated herewith gave rise to one or two difficulties which have been very neatly overcome. One of the problems had to do with the fact that, in order to avoid scaffolding and the raising to somewhere about 21 metres of a total weight of about 370 tons, the entire fabric was raised at one and the same time by means of two all-metal towers. A second difficulty which made the task rather tricky was that it had to be carried out in the open, and that resistance to wind pressure had to be calculated, not only for the vertical loads, but also for the oblique. The towers were placed by means of four hydraulic screw-jacks, worked by two electric pumps; and though the screw-jacks could move up to 22 cm., for prudence sake the lifting was carried out at the rate of only 18 cm. The stability of the towers, which were separated by a distance of 81.60 m., was guaranteed by shuttering lengthways and across, the latter bars being placed in position as the tower was raised. The cabin containing the machinery for the moving of the truck, weighing twenty-two tons and a half, was raised at the same time as the framework of the transporter.

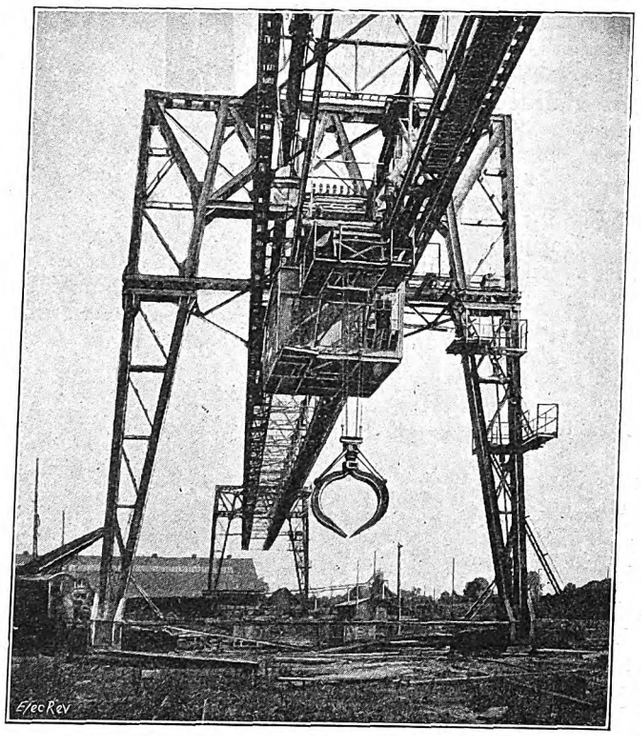

Fig. 1.—Transporter Crane.

Special precautions had to be taken with respect to the weight to be carried, which was calculated to be 45 tons per girder, allowing for a wind-pressure of 150 km. per square metre. Rails of a weight of 57 kg. to the metre, duly riveted, are arranged along the whole length of 366 metres, with reinforced-concrete sealing, so as to reduce ground-pressure to 2 kg. per cm.^{2}, with expansion joints every twelve metres. The transporter, having to work over an area of 5½ acres and heap up wood to a height of five metres, runs at a speed

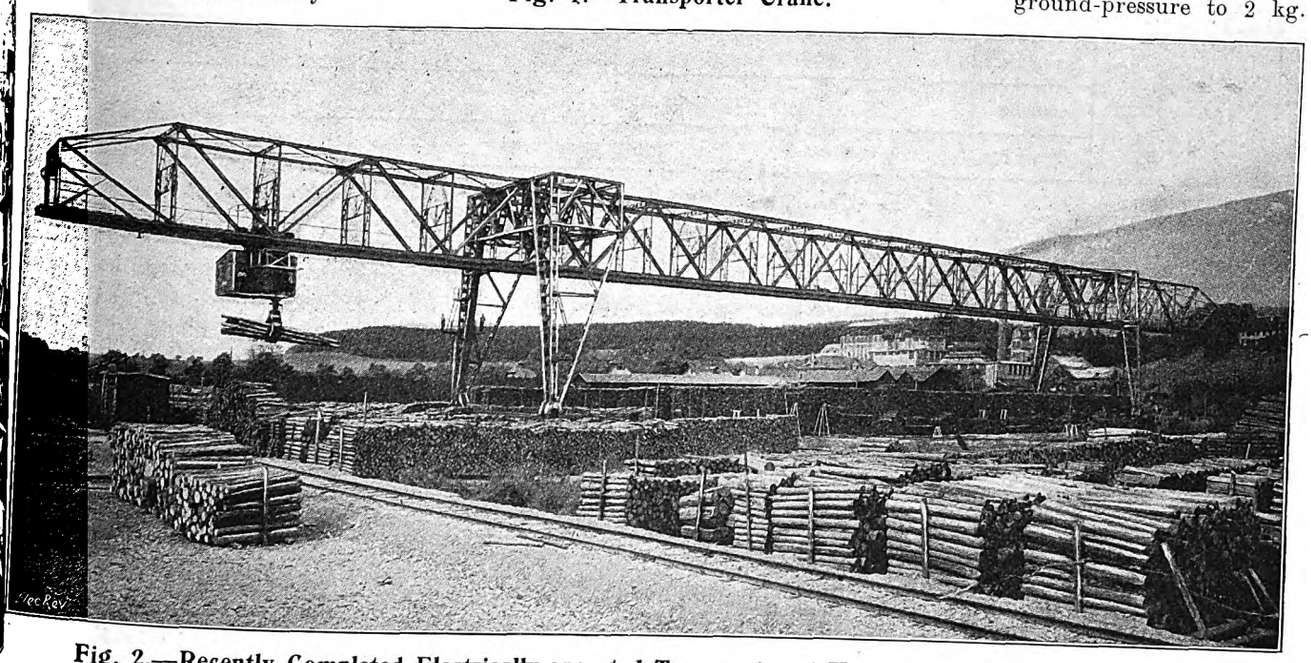

Fig. 2.—Recently Completed Electrically-operated Transporter at Vevey, Switzerland.

* Editor of the *Bulletin Technique de la Suisse Romande.*

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of 20 metres a minute, being driven by an electric motor of 70 h.p.

The truck wheels and axle, a combination of a four-wheeled truck and a pivoting crane, slides on the transporter at a speed of 240 metres a minute, driven by means of a motor of 60 h.p., and the grab tackle, which is pincer-shaped, is operated by a motor of 34 h.p. This grab is moved vertically by means of a 50-h.p. motor at a speed of 58 metres per min., and the rotation motor of the crane is a 5-h.p. one.

The electricity used is three-phase, 500 volts, 50 periods, and is collected from a wire some 347 metres long that is supported on metal towers 6.56 metres above the level of the rails of the transporter. A vertical arm placed at the end carries the three trolley wires.

The permanent weight per metre is an average of 1,600 kg.

The weight of the moving crane is 25.5 tons.

The load of a crane is 5.5 tons.

The horizontal maximum effort in braking per beam is 5.20 tons per truck.

The shock is 26 tons per buffer.

The wind-force is 100 kg. per sq. metre for the crane when working, and 150 kg. per sq. metre when at rest.

The transporter, having been duly tested and approved, is now working at Attisholz.

Electrically-heated Hotbeds.

The electrical heating of hotbeds, which was brought about in Sweden by the shortage of stable manure, is claimed to have advantages over the older method.

By DR. ALFRED EKSTRÖM, M.I.E.E.

THE use of electricity for heating hot-beds has raised much interest in Sweden during the last two years. Its initiation can be traced to Norway, where it was noticed that in parts of a field where underground cables transmitting electricity were laid in springtime the snow melted sooner and vegetation began earlier than in other parts, due to the soil absorbing warmth from the cables transmitting the electric power.

A Norwegian engineer, Georg Jacobsen, took advantage of this fact and constructed hot-beds of which the soil was heated by means of resistance wires laid in the beds, the wires being heated by very low-voltage electric power.

In Sweden the idea was developed by a merchant-gardener in the neighbourhood of Stockholm, Mr. Edgar Eriksson, in co-operation with Mr. Harald Edholm, engineer of the Royal Water Power Board. For this purpose special cables were constructed, consisting of a resistance wire insulated with asbestos and paper-impregnated cotton ribbons, surrounded by an airtight lead covering. The cable is then covered with a composition to prevent damage from acid in the soil and stray direct currents. The latter are very disastrous for the lead cover, if it is not very carefully protected.

Lately a construction without a lead cover has proved to have certain advantages, being at the same time considerably cheaper.

The electric power used for this purpose is at a pressure of 127 or 220 volts. The resistance wire of the cable is connected to the phase-wire, while the lead cover is connected to the grounded wire, the resistance-wire and lead covering being in this case soldered together at the far end of the cable.

The result of the experiments is that at present several hundred gardeners are using electric hot-beds with a total area of about 25,000 sq. yards and a total load of about 3,000 kilowatts all over Sweden.

Economic Considerations.

The real reason for the application of electricity for heating hot-beds was the lack of stable manure, on account of the greatly increasing use of the motor-car, as well as the withdrawal of the cavalry regiments, which has brought about a great difficulty for the gardeners in the neighbourhood of the larger towns. Electrically-heated hot-beds have, however, proved to offer new advantages for the industry.

The method of manuring hot-beds, as is well known, is to heat the soil in the springtime, and this is effected by the process of fermentation in stable manure; the manure burns, so to speak, and after four to six weeks is burnt out. During this time the temperature of the surrounding atmosphere is supposed gradually to increase and to take over the transmission of the necessary warmth to the hot-beds. In the case of bad weather conditions it may happen that if the stable manure is burnt out before the necessary increase in the atmospheric temperature has come about, the growing vegetation in the hot-beds will be damaged.

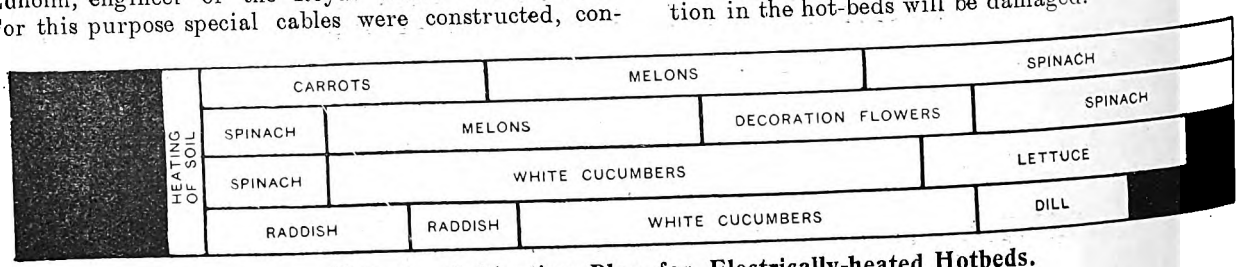

Fig. 1.—Cultivation Plan for Electrically-heated Hotbeds.

In the autumn, when the atmospheric temperature is gradually decreasing, artificial heating by the use of stable manure is generally not possible.

The electrically-heated hot-bed is in all cases independent of the season of the year, and of the more or less uncertain weather conditions. The transmission of the necessary heat can always be controlled exactly—"a tropical heat" of the soil and its vegetation can readily be attained, thus affording gardeners new possibilities for the development of their cultivation. Moreover, the time of vegetation can be correspondingly increased.

The electrically-heated hot-bed has also other advantages. The stable manure hot-bed must, as soon as the manure is burnt out and the vegetation is ready for use, be renewed completely, and can thus be used for only one occasion. An electrically-heated hot-bed, on the other hand, can be used without renewal for continuous lots of cultivations—one after the other—not only during one season, but so long as the necessary store of nourishment in the soil is available, which will

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generally continue for two or three years. This fact can be utilised during one season of vegetation in the following ways :—

1. Early cultivation can be undertaken, such as the very early table vegetables, spinach, lettuce, radishes, carrots, &c.
2. Cucumbers and melons.
3. Lastly, during the late summer, again table vegetables.

The cultivation of table vegetables during the last period of summer is arranged in such a way that they are ready for use just at the end of the

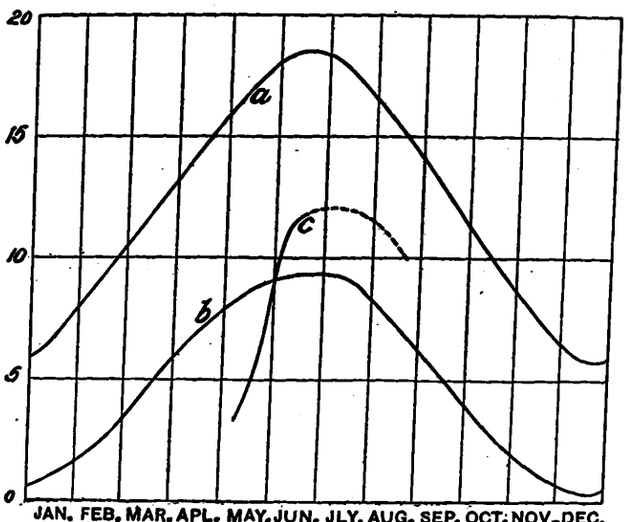

Fig. 2.—Vegetation Data for Stockholm Area.

vegetation period and kept in that state by a supply of only so much heat as will prevent the hot-beds from being frozen up to the first month of the winter, when they are taken out and sold.

Fig. 1 shows such a plan of cultivation for a large set of hot-beds which is in continuous use from February to the end of the year. The plan consists of three parts—early table vegetables are cultivated; then cucumbers and melons, partly also flowers for decoration; lastly, table vegetables for keeping and selling in the winter months.

Experience has shown that in the middle of Sweden the vegetation period for horticulture, on an average, will hold not more than about eight months—from the end of February to the end of October. No doubt this is a result of the length of the day, the hours of daily sunshine, as well as of the temperature of the soil. Fig. 2 shows the average figures for the surroundings of Stockholm.

From this figure it can be seen that in that climate vegetation necessitates a minimum sunshine of four hours per day and daylight for about ten hours per day. From the figure, however, it will be observed that in the months of April and May sunshine and daylight increase so much that vegetation is mainly kept down by the low temperature of the soil. By the utilisation of artificial heating of the soil there might thus be obtained a vegetation of similar efficiency during a certain period before June 21st as is now obtained during a similar period after that date. Many series of experiments by the Royal Acadamy of Agriculture is Sweden have confirmed this supposition.

During the period from end of October until the end of February it will not be possible to cultivate vegetables that require light. Several experiments have been made to substitute artificial electric light for sunlight, but no real economic results have until now been attained in that respect.

Fears have been expressed that the electrically-heated hot-beds would not give as good results as the stable-manure hot-beds, owing to the lack of carbonic acid gas (CO); this has, however, been proved not to be the case.

How to Lay Down an Electrically-heated Hot-bed.

The soil to be used for an electrically-heated hot-bed must be well drained and the hot-bed built up on a foundation of slag. It is necessary that this foundation should consist of a good insulating material, so as to prevent the heat being transmitted down into the earth. If possible, it is advisable to use above the slag a layer of charcoal residue, which is a good insulator of heat, and will in the end also give off carbonic acid gas.

On this foundation the hot-bed is then arranged. The electric-resistance cables are placed at distances from each other of about 7 in. in tubes of brick, fig. 5; above these a thin layer of sand is put down, the sand being a good conductor of heat. Then the garden soil is put down to form a layer of 5 to 10 inches. For ventilating the soil it will be suitable to arrange vertical tubes of brick above each row of the horizontally-laid tubes protecting the cable. One vertical tube is then arranged every tenth yard between two adjoining horizontal tubes. Inside the walls of the hot-beds above the soil there is also placed a resistance cable for heating the air in the hot-bed (fig. 3). (A standard frame was illustrated in ELEC. REV. of August 10th, 1928, p. 230.)

The glass frames covering the hot-beds must be made to fit tightly, and the soil round the beds should also be heat-insulated. At night the windows of the hot-beds should be covered, as usual, with mats of weeds or a similar material.

The Consumption of Electrical Energy.

In order to obtain an increase of temperature in the soil of about 75 deg. F., it is necessary to use in the middle of Sweden in the spring about 1.1 kWh per sq. yard during 24 hours. It might, however, be suitable to calculate with 1.4 to 1.5 kWh. This energy being generally utilised only during the 12 hours of the night, the result is a maximum demand of about 120 W per sq. yard. The supply of night energy is naturally of great advantage to the electricity works. It has, however, been proved that it is also advantageous to the hot-beds. By supplying heat to the hot-beds during the night, they will be warm early in the morning when the daylight is most efficient. During the day the sunshine will take over the necessary transmission of warmth. The light rays of warmth pass, as is well known, quite easily through the glass windows, which is not the case with the dark rays of warmth. Thus, the bed will keep its need of warmth provided for during the day.

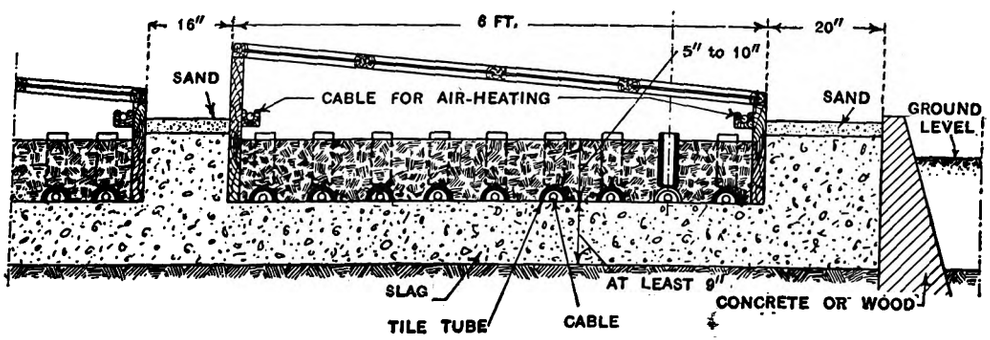

Fig. 3.—Construction of Electrically-heated Hotbed, showing Disposition of Cables.

A special heating and switching arrangement for the supply and regulation of the necessaryy electrical energy is constructed by the Sieverts Cable Works, of Stockholm. Fig. 4—given by Engineer Edholm—shows the need of energy during one period of vegetation for

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a large set of hot-beds for cultivation according to fig. 1. In this case a small amount of energy is used day and night, the peak (from February until July) only being reached at night.

Economy of the Electric Hot-bed.

The price of the necessary electrical energy is obviously of great importance for the economic use of electrically-heated hot-beds. In the neighbourhood of Stockholm, where the price of stable manure, when available, is about 5s. to 7s. per cu. yard, it has proved economical to pay a price of about 1d. per kWh for effectively managed hot-beds.

The same results have also been obtained in the north of Germany; in the publication of the Association of the German Electricity Works ("Elektrizitätswirtschaft"), Director Petri, at the Central Overland. Pommern, has recently stated the maximum price to be from 8 to 10 pfennigs per kWh for the application of electricity for this purpose.

It is, as yet, too early to prophecy about the importance of this application of electricity to the electricity works. In a country with a climate like Sweden and England this question is undoubtedly of interest, especially to the gardeners in the neighbourhood of larger towns. But even by private people living in the suburbs in houses with a little land attached—used for horticulture on a small scale—electrically-heated hot-beds are beginning to be used. At all events this is a question the development of which the electricity works ought to follow up with attention.

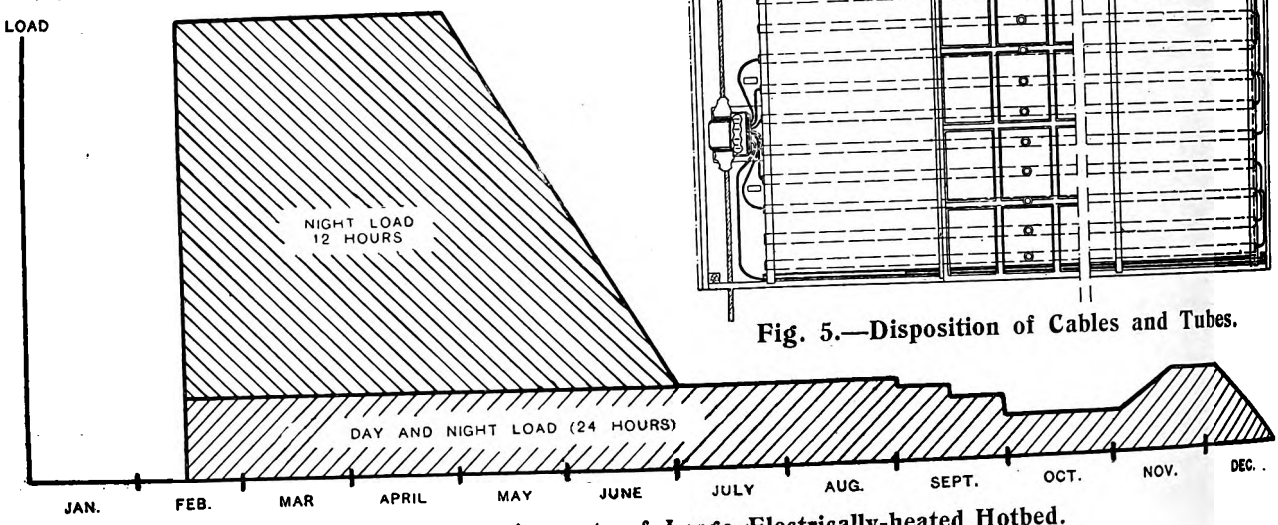

Fig. 4.—Energy Requirements of Large Electrically-heated Hotbed.

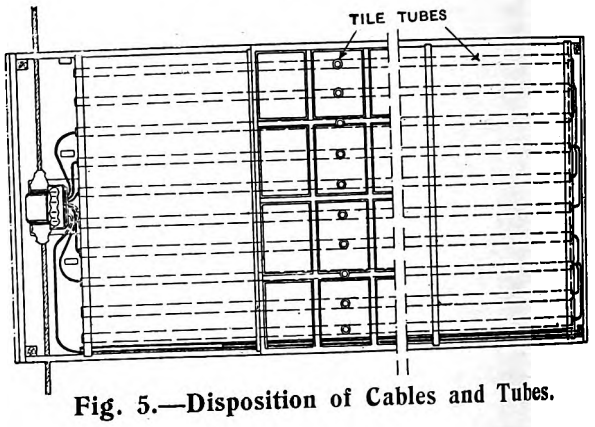

Fig. 5.—Disposition of Cables and Tubes.

The Royal Society's Soirée.

Annual Exhibition and Demonstrations.

THE annual conversazione arranged by the president, Sir Ernest Rutherford, O.M., and Council of the Royal Society took place on May 15th at Burlington House, Piccadilly.

Some 38 exhibitors, 12 more than last year, provided the customary display of specimens and apparatus for the inspection of Fellows and guests.

Though not of an electrical nature, Dr. R. G. Canti's kinematograph demonstration of the movements and growth of living tissue cultivated *in vitro* was a striking illustration of the value of kinematography to the scientist.

Extremely interesting also was the exhibit of Mr. Bryan Matthews, which indicated the use of a moving-iron oscillograph for recording sensory nerve action currents. The instrument has been developed to record the transient change of potential which occurs at the surface of a nerve trunk when a nervous message passes in it. A trunk may contain 10,000 individual fibres; when any one of them transmits an impulse a potential change of some 20 microvolts occurs and lasts about 2/1,000 second. In order to record the electrical changes accurately a very rapid and sensitive recording system is necessary. The potentials are led off from the nerve with non-polarisable electrodes, and are applied to the grid of a valve amplifier and amplified by four resistance-capacity coupled valves. The amplified potentials are applied to the grids of four five-electrode valves which drive the oscillograph. The moving system has a natural frequency of vibration of 6,000 per second, and in this way accurate records are obtained of potentials of a few microvolts of one or two milliseconds duration, and an exact physical record can be made of the impulses which constitute a sensation on their way to the brain.

The Research Department, Woolwich, loaned pictures of progressively rolled "Armco" an annealed iron obtained in three directions, normal, parallel and transverse; they show that orientation appears much sooner in the transverse direction than in the others, and persists in the same direction after annealing.

Amongst other items, Messrs. Adam Hilger, Ltd., showed Dr. Jean Thibaud's X-ray grating spectrograph which is intended for the study of the soft X-rays and of the extreme ultra-violet. Its principal feature is the use of a ruled grating at very nearly grazing incidence, in which position the effective spacing of the grating is sufficiently small to disperse a beam of soft X-rays and at the same time, owing to the refractive index for such radiations being less than unity, total reflection takes place at the grating surface. To avoid absorption of the radiations the entire spectrograph is exhausted by a Holweck, or other suitable high-vacuum pump. The discharge tube, or X-ray tube, can be mounted alternatively on the spectrograph; the latter is of a specially designed hot-cathode type.

The Department of Scientific and Industrial Research, radio research station, Slough, had an instantaneous visual direct-reading radiogoniometer on view. This cathode-ray direction-finder gives a direct visible read-

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ing of the azimuth of a wireless transmitter relative to the receiving station. The direction of arrival of the wave-train is read on a compass dial drawn on the screen of a low-voltage cathode-ray oscillograph, the indication being a line of fluorescence on the screen. The indication is instantaneous; thus, for example, the direction of arrival of a single atmospheric lasting for a thousandth of a second, or less, can be read with an accuracy within one degree. The directions of two, or more, transmitting stations working simultaneously on the same wave-length can be determined. Charts showing the distribution of sources of individual atmospherics, located by two such instruments at the ends of a base 500 km. long, were exhibited.

The Cavendish Laboratory, Cambridge, showed a cæsium tube (Mr. N. A. de Bruyne) which contained a tungsten filament and a collecting plate in cæsium vapour at a pressure of 10^{-6} mm. It can be used to demonstrate the existence of Knudsen's "critical temperature" above which condensation of atoms on a surface cannot take place. By applying a positive voltage to the plate the enormous effect of a monatomic layer on the thermionic emission can also be shown; when the filament current is switched off the emission actually rises, due to the deposition of cæsium.

The National Physical Laboratory indicated methods of measuring the thickness of films between surfaces in close (wringing) contact (Mr. F. H. Rolt and Mr. H. Barrell). The apparatus exhibited was that used by Rolt and Barrell in the experiments on wringing films described in the Royal Society's *Proceedings*, A, Vol. 116, p. 401, 1927.

The Cambridge Instrument Company's portable electrocardiograph makes use of a galvanometer of the Einthoven type, but which is more compact and lighter than the standard instrument, and as it is ironclad throughout there is little external magnetic leakage (see ELEC. REV., January 18th, 1929, p. 122).

Professor G. P. Thomson's diffraction of electron waves photographs are the result of a beam of cathode rays (electrons) passing through a very thin film of metal. Rings are caused by the regularities of the metallic crystals acting like a diffraction grating on the waves which guide, and perhaps partly compose, the electrons. The metal films used are of the order of one-millionth of a cm. thick; they are transparent to ordinary light.

The Anglo-Persian Oil Co. exhibited apparatus for the visual examination of oils while being "cracked" under pressure. The oil is contained in a transparent silica tube which is in communication with a steel cylinder containing mercury, so that any pressure up to 1,000 lb. per sq. in. can be maintained on the oil. The silica tube is inserted into an electrically-heated air oven fitted with glass windows and working at temperatures up to 500 deg. C. The oil can be "cracked" to any desired extent by introducing the silica tube into the oven for a limited time during which the phase relations can be observed. The oil can be agitated during the experiment by means of a magnetic stirrer.

Sir Robert Hadfield, Bt., F.R.S., exhibited specimens illustrating the properties of ferrous alloys and also special metallurgical and other processes. For example, "Era" heat-resisting steel and its application to the Berthelot calorimeter bomb. Specimens of steam-turbine blading prepared from forged and rolled sections of "Hecla/A.T.V." non-corrodible steel; there are now in use turbines aggregating over one million horse power equipped with this material. A new and improved tool steel, possessing extraordinarily high cutting qualities, which is a combination of iron with no less than eight other elements, and is even capable of machining the hard material known as manganese steel. Photomicrographs of very high magnification, up to 8,000 diameters, of various types of steel. Photograph of the new type of high-frequency furnace working at 500 cycles, now in regular use at the East Hecla Works, Sheffield, with specimens of the steel castings produced therefrom. Photographs of a new large capacity British-made crusher, which has an output of over 200 tons of crushed material per hour, and also of a block of hard North Wales granite weighing 2¼ tons, and the large number of fragments into which it was crushed in the short space of 55 seconds, with an exerted energy of 175 h.p.

An interesting collection of photographs of eminent scientific men taken by Mr. A. A. Campbell Swinton between the years 1877 (wet-plate process) and 1912 was on view.

The Davy Centenary.

The Peerless Scientist's Contributions to Electro-chemistry.

By T. B. F.

WHEN Sir Humphry Davy, the inventor of the safety lamp, was at the height of his fame, Cuvier, the anatomist, declared that he "occupied in the opinion of all that could judge of such labours the first rank among the chemists of this, or of any other, age."

There have been few, if any, parallels to the brilliant achievements of the narrow-chested and undergrown Cornish boy who, in the brief space of thirty years or so, raised himself from obscurity to a position of acknowledged supremacy in the scientific world, and his centenary on May 29th claims the special attention of electrical scientists by virtue of the part which Voltaic electricity played in his researches.

Davy, the son of a wood carver, born at Penzance on December 17th, 1778, up to his nineteenth year had never seen a chemical operation performed, but with an unconquerable thirst for fame; Lavoisier's *Elements* as a text book; phials, wine glasses, tea-cups, tobacco pipes and an odd earthen crucible as his paraphernalia; and the common mineral acids, the alkalis, and a few drugs from the surgery as his stock of chemicals, he set out to conquer.

Three years later he was well on the high road to success, being appointed lecturer to the Royal Institution of London. Before leaving Bristol, where he had discovered "laughing gas," he contributed a number of short papers on what was then termed "Galvanic Electricity" to *Nicholson's Journal*. He succeeded in establishing the intimate connection between the electrical effects and the chemical changes going on in the pile, and drawing definite conclusions concerning their mutual dependence. But the distractions of his duties at the Royal Institution, which made large demands upon his time, temporarily prevented him from pursuing his researches in this direction, and it was not until Volta's capital discovery of the Voltaic Pile had imparted a new impulse to the

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study of Voltaic electricity, its effect and applications, on the part of English men of science, that he found the opportunity to turn again to the subject.

As he himself said, "the Voltaic battery was an alarm bell to experimenters in every part of Europe; and it served no less for demonstrating new properties in electricity, and for establishing the laws of this science, than as an instrument of discovery in other branches of knowledge; exhibiting relations between subjects before apparently without connection, and serving as a bond of unity between chemical and physical philosophy." Davy seems to have been particularly impressed by the power of the Voltaic Pile as an analytic agent; and the Laboratory journals preserved at the Royal Institution contain numerous references to his trials of the behaviour of compound substances under its influence. Dr. Thorpe points out very truly that it was actually in this intermittent way, by the utilisation of odd chances now and then, that "Davy gradually succeeded in unravelling the fundamental laws of electro-chmeistry, and in thus importing a new order of conceptions, altogether unlooked for and undreamt of, into science."

A Memorable Paper.

The conclusions arrived at by Davy were embodied in a paper "On Some Chemical Agencies of Electricity" submitted to the Royal Society and made the Bakerian lecture of the year. There was no scientist of the day at all comparable with Davy for his natural eloquence, his chemical knowledge, his happy illustrations, his well conducted experiments and his clearness and lucidity of style, and we are told that the publication of that paper, which reflected all his distinctive qualities, created a profound sensation, both at home and abroad. Long afterwards Berzelius characterised it as one of the most remarkable memoirs that had ever enriched the theory of chemistry. What was more important at the time, however, was the action of the French Institute.

Bonaparte, with a view of stimulating investigation, had instituted a medal "for the best experiment which should be made in the course of each year on the galvanic fluid," and had further intimated his desire to give the sum of sixty thousand francs "à celui qui, par ses expériences et ses découveries fera à faire a l'electricité et au galvanisme un pas comparable à celui qu'ont fait faire à ces sciences Franklin et Volta." A committee of the Institute, consisting of Laplace, Halle, Coulomb, Hauy and Biot, awarded the medal to Davy, a tribute which was rendered all the more noteworthy by the fact that at the time France and England were at war, and intense and bitter feelings prevailed on both sides of the Channel.

In the experiments which led him to the discovery of the new metals, potassium, sodium, barium, strontium, calcium, and magnesium, Davy made constant use of the Voltaic battery.

"A Troublesome Person in Chemistry."

In November, 1807, in another Bakerian lecture which carried him to the pinnacle of his fame, he dealt specifically with "some new phenomena of chemical changes produced by electricity, particularly the decomposition of the fixed alkalies; and the exhibition of the new substances which constitute their bases; and on the general nature of alkaline bodies."

His discoveries were all made and perfected with marvellous speed, and at times he worked under the stress of great mental excitement. His cousin, Edmund Davy, who acted as his assistant during the period in which he was engaged in decomposing and recomposing the fixed alkalies, used to say that when he saw the minute globules of the quicksilver-like metal burst through the crust of potash and take fire his delight knew no bounds; he danced about the room in ecstasy, and it was some time before he was sufficiently composed to continue his experiments.

No one had imagined that potash and soda contained metals, and the sentiments of the Aberdonian professor who is said to have irritably remarked that this "ane Davy was a vera troublesome person in chemistry" only mildly reflected the astonishment of the whole body of scientists whose convictions had been so rudely disturbed by the young and self-taught scientist.

In a lecture at the Royal Institution, delivered at the request of the managers, while Davy was prostrated by illness, Dr. Dibdin pronounced the verdict that Davy's investigations:—"May justly be placed amongst the most brilliant and valuable discoveries which have ever been made in chemistry, for a great chasm in the chemical system has been filled up; a blaze of light has been diffused over that part which before was utterly dark; and new views have been opened so numerous and interesting that the more any man who is versed in chemistry reflects on them, the more he finds to admire and to heighten his expectations of future important results. Mr. Davy's name, in consequence of these discoveries, will be always recorded in the annals of science amongst those of the most illustrous philosophers of his time. His country with reason will be proud of him."

Meeting with Volta.

Hungry as he was for scientific fame, with a hunger that was unappeasable, Davy on his recovery lost no time in returning to his laboratory. The results of his renewed activities were embodied in his fourth Bakerian lecture "On some new electro-chemical researches on various objects, particularly the metallic bodies, from the alkalies and earths and on some combinations of hydrogene." It was through his inquiries in this particular domain that Davy was led to the discovery of telluretted hydrogen. Impulsive in his methods, his phenomenally active mind was not content with ordered ideas of approach to any subject. Often he had half a dozen experiments proceeding simultaneously on disconnected parts of the same inquiry.

After discovering the two chlorides of phosphorus, Davy experimented in the electrisation of pure liquid fluoric acid, as well as conducting inconclusive investigations with nitrogen chloride, one of the most powerful explosives known to chemists. Whatever subject he touched he invested with something new which passed immediately into the currency of accepted scientific doctrine.

In 1814 he saw Volta at Milan, but confessed himself disappointed by his conversation, which was not brilliant; but the disappointment seems to have been mutual. Davy, it is related, had written to announce his intended visit, and on the appointed day and hour Volta, in full dress, awaited his arrival. "On the entrance of the great English philosopher into the apartment, not only in *déshabille*, but in a dress of which an English artisan would have been ashamed, Volta started back in astonishment, and such was the effect of his surprise that he was for some time unable to address him."

Honours were showered upon Davy. He was first knighted and then created a baronet, elected president of the Royal Society, and for his invention of the safety lamp was presented with a public testimonial. He died at Geneva on May 29th, 1929, at the early age of 52. A statue in his native town of Penzance, and a tablet in Westminster Abbey bear tribute to his genius, but as a writer in "Silliman's American Journal of Science and Arts" happily expressed it "his reputation is too intimately associated with the eternal laws of nature to suffer decay; and the name of Davy, like those of Archimedes, Galileo, and Newton, which grow greener by time, will descend to the latest posterity."

Electricity and the Tides.

Notification has been received by Mr. E. L. Fleming, secretary of the Exe Power Experiment Association, that the Board of Trade will grant the Association permission to moor two pontoons in the Exe estuary for the purpose of ascertaining what power can be obtained from the tidal waters in connection with the scheme for harnessing the Exe for electrical purposes.

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Possibilities in Palestine.

The author shows that many kinds of activity are being stimulated by the spread of electricity supply in the Holy Land, and urges British manufacturers to take advantage of the opportunities which offer.

By C. H. DOBELL, A.M.I.Mech.E.

AN article on the development of Palestine can be very conveniently divided into three parts, the electrical development, the advancement of other trades, and the benefits to be derived by the home manufacturers, and since it is evident that the last two are dependent upon and will progress in proportion to the first we will deal with them in that order.

In 1921, two Concessions were granted to Mr. Pinhas Rutenberg for the supply of electricity to the whole country (excluding Jerusalem and district within a radius of 20 km. from the Church of the Holy Sepulchre, in the centre of the old city), one to utilise the waters of the river Auja, which runs into the Mediterranean Sea near Jaffa, and the second to utilise the waters of the rivers Jordan and Yarmak, which, combined, run into the Dead Sea.

The first is operated by the Jaffa Electric Co., which has abandoned the idea of using the fall in the Auja, since the power to be obtained there was only 500 h.p. and quite inadequate to meet the demands of Jaffa and district, and has erected a fuel station at Tel Aviv, consisting of two 500-h.p. Deutz engines driving 6,600-V A.E.G. alternators, distributing by underground cables to transformer stations and supplying the l.p. networks at 380/220 V 3-phase. The supply was brought into service in 1923; the demand rose very rapidly and with the construction of the first overhead transmission line, 14 km. in length, to Sarafand to supply light and power to the Air Ministry's cantonments and workshops, which was brought into service in November, 1924, it was necessary to increase the capacity of the station and to that end an additional unit of 250 h.p. by Mirrlees, Bickerton & Day was installed. Following further extensions of the service in Jaffa to residential quarters and the conversion of factory drives to electricity, plus the springing up of new industries, a second set of the same power by the same makers was laid down. Overhead extensions followed to Rishon Le Zion, Petach Tikvah, and Nes Ziona, all flourishing colonies, mostly interested in the cultivation of vines and oranges and the vintage of wines. Pole transformers were installed where necessary to supply electricity for pumping and lighting to the groves and vineyards *en route*.

In the meantime, activities were commenced by the Palestine Electric Corporation, which had taken over the second or Jordan concession, in Haifa, where a fuel station was erected, comprising in the first place, three 250-h.p. sets of Metropolitan-Vickers alternators and Mirrlees, Bickerton & Day engines (since increased to four). This station was opened in June, 1925, some six or eight months after the commencement of the work. In Tiberias the Corporation put up a 150-h.p. station, primarily for the supply of electricity to the new pumping station on Lake Tiberias for the town's water supply. On completion of the Jordan works (which were described in our issue of May 3rd, p. 773) all these fuel stations will act purely as reserve stations, and the whole normal supply will be taken from the hydro-electric works. The present supply in Haifa is on the same system as in Jaffa, but the station at Tiberias produces at low pressure and supplies the network direct.

A third concession, for Jerusalem and district, which was granted to M. Mavromatis, has been recently taken over by Messrs. Balfour, Beatty & Co., who are now constructing a power station at Jerusalem.

The Jaffa Electric Co. experienced such a demand, that in 1926, three years only after its inauguration, further extensions had to be put in hand and the addition of a 1,125-h.p. Fraser & Chalmers set driving a G.E.C. alternator was made, while the power house was enlarged sufficiently to accommodate two more such sets if the necessity arose.

Thus has the seed been sown towards the growth of an all-electric country and great credit is due to Mr. Rutenberg and all those working with and under him for the speed with which the advance has been made. Side by side with this advance, other trades and commercial concerns have grown up, attempting to obtain by gradual development every ounce of wealth which the country will yield.

The hope of the country is in its agriculture, and as electricity has been brought within reach of the countryside, new orange groves have been planted, more land brought under cultivation, water supply made easier and the colonists' homes made cleaner and more comfortable. Thus we may safely expect that all agricultural machinery will one day be entirely electrically driven. The needs of the country have been enumerated in a previous article, and in looking back over experiences there, one realises the amount of work to be done and the enormous possibilities dependent upon and arising from a cheap and efficient electricity supply.

The electrification of the Government-owned Palestine Railways from Haifa to Kantara on the Suez Canal, with branch lines to Jaffa, Jerusalem and towards Damascus (the last named passing the Jordan works), and the construction and electrification of a railway from Bagdad to Palestine are possibilities of the future.

The enormous benefit to the Port of Jaffa in the handling of goods by electric lifts and cranes, and the replacing of the present petrol locomotives on the decauville railway from the Custom House to the railway station by electric trucks will be apparent to all. The use of electricity, in the construction of Haifa Harbour, in the transport of the mineral wealth of the Dead Sea to the coast, and in pumping stations for the supply of water to the towns, will render the works easier and more rapid in each case.

In both Haifa and Jaffa the growth of factories has been encouraged by the installation of electricity, and among present and future loads will be found the pumping of water for irrigation on agricultural and fruit-farming lands, the motive power for agricultural machinery, rock drilling and pneumatic machinery, stone crushers, small and large engineering and carpenter's shops, the lighting of places of worship and of entertainment, and of otherwise badly lit streets, the handling of goods, heating and, after a time, cooking in the better class houses and hotels. The possibility of exporting electricity must not be overlooked since it is almost certain that there will be an ever increasing demand in the countries bordering on Palestine.

It is to be hoped that the regulations governing the supply of electricity will not be too strict, since it is impossible to open up a country if there are too many hampering rules and regulations. It is better by far to let them evolve themselves; for example, the difficulties of running overhead lines in any Eastern bazaar under rules that apply to highly-civilised provincial towns will be appreciated by all, yet the electrical companies have

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had to overcome such difficulties and are prepared to supply the humblest dwelling in the meanest *souk*.

Having reviewed the possibilities, let us now inquire to what extent the manufacturer at home is going to benefit. It is a matter entirely in his hands whether he will be wise and go out himself or send a representative of authority to study the situation on the spot, or leave it alone. If he decides on the first, he will find the business to be obtained worthy of a very determined effort, he will find men on the spot well able and willing to represent him, and if he makes up his mind to make a great display of his goods, to assist in the education of the people in the use of his products and to give generous terms to those who are willing to trade with him, the great bulk of the trade will drift into his hands, for commerce in Palestine will grow in proportion to the extension of supplies of electricity. Electricity will be brought into the service of the farmer and the manufacturer, it will be brought into the service of the transporter and the carrier and will finally load the produce of the country on board ships, speeding up the work of each and enabling this prospective all-electric country to take pride of place among the countries administered by us. Are we at home going to allow this future market to fall into the hands of foreign competitors when our position there was gained at the expense of British lives and money, or are we going to take the necessary steps to seize the prize before the foreigner does so?

Electricity in Schools.

Report of a Conference convened by the Electrical Association for Women.

AN informal conference on "Electricity in the Schools," convened by the Electrical Association for Women, was held on May 8th. Mrs. S. E. Hammer (chairman, E.A.W. Council) took the chair, and welcomed the representatives of the various organisations present. The idea of calling the Conference, she said, was to have a frank discussion between representatives of the electrical industry and educational organisations with regard to the desirability of introducing some teaching on matters electrical into girls' schools, and also to discuss the question of suitable training for girls who wish to enter the electrical industry.

Miss C. HASLETT, director, E.A.W., stated that the Association was constantly receiving requests from headmistresses for a syllabus of simple instruction on matters electrical suitable for girls' schools; also considerable interest had been shown in the subject by domestic science teachers and other representative educational folk. As a result of these various negotiations the E.A.W. felt that the time had arrived when some co-ordinated effort should be made in connection with that important matter. The Association was making a survey of the kind of domestic electrical apparatus which existed in girls' schools and domestic science centres; with the exception of a few progressive centres the equipment, if it existed at all, was often out of date. There was an increasing demand for women to act as demonstrators and saleswomen in the electrical industry, and an indication that other posts would become available in time.

Miss H. SHAW, B.Sc. (member, E.A.W. Council) said that most of the domestic science training colleges were trying to work somewhere in their syllabuses a certain amount of training in electrical work. Those who needed help were those already out in secondary and elementary schools; the teachers were only too anxious to use electricity. The objection raised by the teachers in the elementary schools was that the children were not using electricity in their own homes and, therefore, did not need electrical knowledge; it was better to teach them about the apparatus they had already got, *i.e.*, coal ranges, gas stoves, &c. The following points must be realised: (1) the children would not always be using the same apparatus, as they were the mothers of the future and ought to have some kind of training in using electrical apparatus; (2) some of the children would be going out into domestic service where they would be working in homes which were electrically equipped.

Lt.-Col. W. A. VIGNOLES, D.S.O., M.I.E.E., director, British Electrical Development Association, stated that at the present time the electrical industry was suffering from a want of knowledge on the part of the consumers. He referred to the excellent scheme at Barnsley, and also to the fact that Grimsby had installed electric cookers in all the domestic science centres and girls' schools. The E.D.A. would be very pleased to do what it could to provide any instruction which was required, and to collaborate with the E.A.W. in the matter.

Mrs. B. M. WILSON (honorary secretary, E.A.W., Ashford District Branch) gave a report of a student class which had been commenced some two or three months ago, which had been attended by 20 or 30 senior girls, whose average age was 15, and mistresses from the two principal secondary schools in the town. The lectures were given by the local electrical engineer, and had the support of the Electrical Contractors' Association.

Mr. L. L. ROBINSON, M.I.E.E., borough electrical engineer, Hackney, referred to the fact that the teaching on electrical apparatus was not always given in a practical way in the schools, and read a report from a local school where an electrical installation had been put in. There had been no meter on the electric cooker, and no records had been kept of comparative costs with other methods. He referred to the apathy of the electrical industry in not providing more lecture services for the public and the schools.

Mr. A. C. CRAMB, M.I.E.E., honorary secretary, Incorporated Municipal Electrical Association, stated that they had put in an electrical installation in the High School at Croydon some time ago, and electricity had been paid for at the lowest possible price. The teachers had visited the local showrooms. Close co-operation between teaching staffs and the supply undertakings would do a great deal to help along the uses of electricity, provided electricity was supplied at a reasonable price in the district.

Miss DAWSON CAVES, M.I.H., A.R.San.I. (organiser of Domestic Subjects and Needlework, Cheltenham Education Committee) stated that in the domestic science centres at Cheltenham gas cookers had been installed free of charge, and that electric cookers had been hired at the rate of 5s. per quarter. There was first-class equipment at all centres, for which thanks were due to the Education Committee and also the borough electrical engineer, Mr. Bache. They hoped to have the age raised for girls attending the classes to 15 within a very short time. The Hadow Scheme had been started. All the domestic science teachers were members of the E.A.W., and keenly interested in the lectures given under the auspices of the Association.

Mr. H. E. HUGHES, of the E.L.M.A. Lighting Service Bureau, referred to the importance of the correct use of electric light as a subject to be taught in the schools. E.L.M.A. had already done a good deal of work for the domestic science teachers in connection with the giving of lectures, and was always ready to help.

Mr. W. G. PHILLIPS, Association of Teachers in Technical Institutions, stated that he felt that every assistance would be given by the technical colleges in connection with any instruction which might be given relating to domestic electrical appliances. He felt very strongly that lectures should be given on simple household repairs, and said that he would be pleased to give assistance in the matter, outlining a possible course.

The Motor Ship "Highland Brigade."

The new motor ship *Highland Brigade*, one of the five ships of the kind built, or being built, at the Belfast yard of Messrs. Harland & Wolff, Ltd., left Belfast Lough on April 27th for her trial trips, which have been of a successful nature, to London. The vessel is of 14,350 tons, and is propelled by twin-screw Harland and B.W. double-acting 4-cycle engines. She is well equipped with up-to-date electric lighting, and power. The installation consists of four Diesel-driven generators, each having an output of 200 kW at 220 volts. Electric motors are installed to drive all ventilating fans, and all the engine-room and deck machinery, including steering gear, capstans, windlass and winches. The ship is electrically heated throughout and, in addition to electric radiators, each state room is provided with its own ceiling fan and berth light, all being under the control of the passenger. The water-tight doors are electrically controlled and operated from the captain's bridge, where indicators show whether they are opened or closed. The installation on the boat deck, which, while normally lighting for dances, can be swung outboard and give the necessary light for operating the boats. The ship is equipped with a very complete telephone and bell installation, and wireless of the latest type.

The four generators are driven by 6-cylinder trunk motors of the Harland and B.W. type, fitted with specially large compressors which supply the manœuvring air. Two emergency sets are provided in a separate room on the boat deck and connected up with the refrigerating plant so that should the main motors go out of action the refrigerating plant can be kept going.

The *Highland Brigade* will be employed on the Brazil and Argentine route, *via* Spain and Portugal, and carry passengers, 135 first-class, and 66 intermediate, and many emigrants, and cargoes of refrigerated stuffs. She is the third of five sister ships.

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British Switchgear for Shanghai.

An order that was secured against international competition was recently shipped to a municipal electricity undertaking in China.

A LARGE metal-clad switchboard for the Shanghai (China) Municipal Electricity Department that was despatched recently from the works of Messrs. A. Reyrolle & Co., Ltd., weighed 125 tons, and was conveyed to Birkenhead in a special train of 25 trucks. The order was secured against international competition, and forms part of a scheme whereby the Shanghai undertaking is extending and strengthening its switchgear installation. The Brennan Road sub-station constitutes an important link of the system, and with a total plant capacity of 161,000 kW at the Riverside station, the switchboard will have a very important duty to perform.

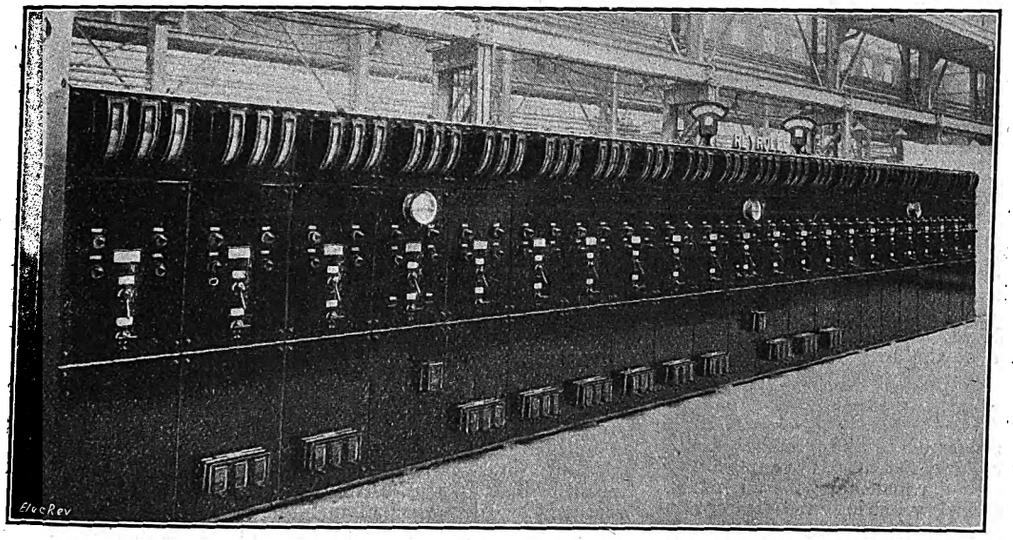

Fig. 1.—Control Board for Switches shown in Fig. 2.

This product of Tyneside is built up of units of the company's duplicate-bus-bar "A2" type, furnished with certain special features to comply with the operating conditions: for example, oil-immersed bus-bar change-over selector switches mounted over the circuit-breakers proper. These enable the load of any circuit to be transferred from one bus-bar to the other without interrupting the supply, and in order to ensure that the bus-bars are in step prior to the change-over, the bus-bar coupler switch is interlocked with the circuit controlling the motors provided for operating the bus-bar selector switches in such a way that unless the bus-bar coupler is closed electrical operation of the selector switches cannot take place.

As is usual in this switchgear, the interlocks protect against inadvertent operation, and they include one that makes it impossible to move the circuit-breaker portion when the selector switch is in an intermediate position, notwithstanding that this condition could only arise if the switches had been operated by hand after withdrawal.

One feeder is of the split-conductor type, and the others have Merz-Price pilot-wire protection. Two have been fitted with the Reyrolle split-pilot system.

Fig. 2 shows the metal-clad switchboard itself, and fig. 1 shows the control board for operating the former; both photographs were taken at the company's Hebburn works before the boards were dispatched.

22,000-V main switchgear has also been supplied by Messrs. Ferguson, Pailin, Ltd., and step-up transformers have been supplied for the station by the International General Electric Co.

In line with the increased capacity of the generating plant, the distribution system is also being increased. New h.p. cables connecting the power station and the various sub-stations have been laid, banks of transformers with units of 4,200 kVA capacity are installed, and new sub-stations distributing at 6,300 V have been built and equipped. The total sale of electricity by the undertaking in 1927 was 400,343,385 kWh. The highest maximum peak load recorded during the year was 90,000 kW.

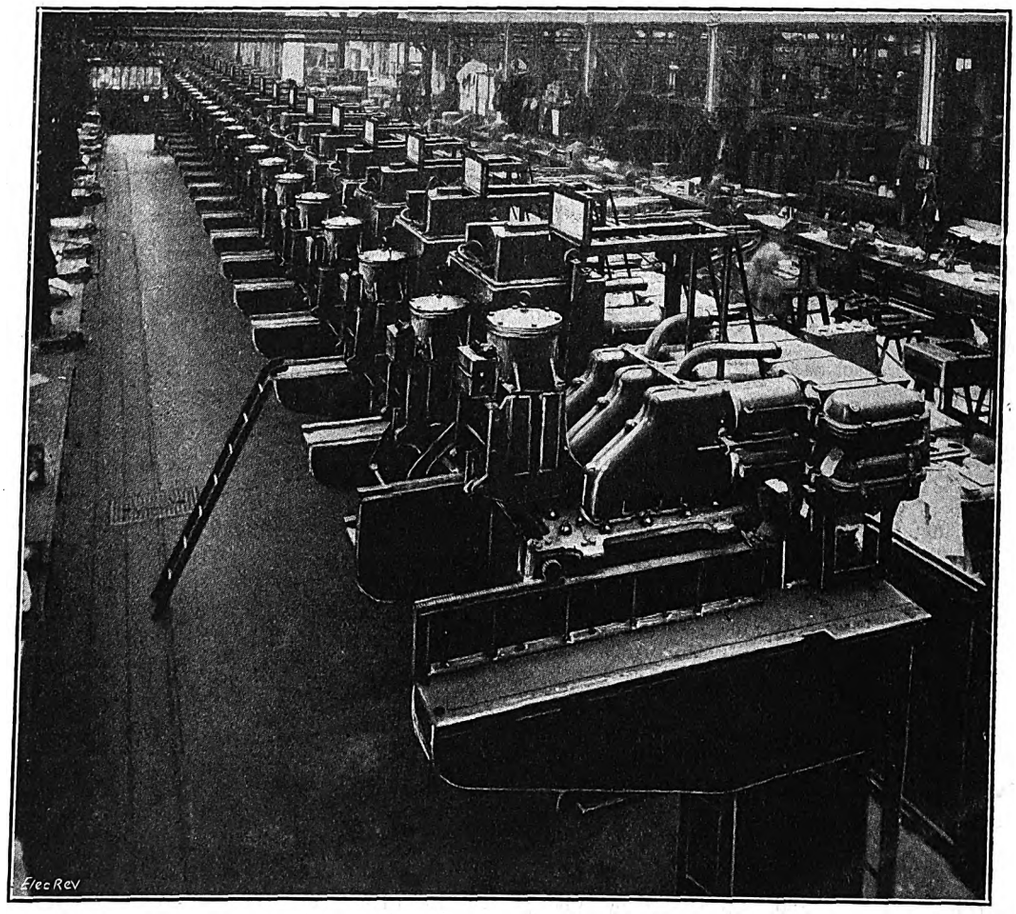

Fig. 2.—Switchboard of Reyrolle "A.2" Duplicate Bus-bar Units.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

District Joint Industrial Council Meetings.

The annual meeting of the District Joint Industrial Council and the District Joint Board, Electricity Supply Industry (No. 11, South Coast Area) were held at Brighton on May 14th. At a luncheon at the Royal Pavilion, the Mayor of Brighton, in proposing the toast of "The District Council," said that it was essential that collective bargaining should take place between employers and employed. That masters and men were able to refer to an independent authority on which there was equal representation made for the harmonious running of an undertaking. Alderman Ainger, in reply, said that there were far too many men to-day who were busy trying to cause mischief between employer and employed, and it was their duty to put themselves in the place of the men and try to solve the difficulties that arose.

The Marking of Imported Belting.

The Board of Trade has referred to the Standing Committee under the Merchandise Marks Act, 1926, the applications for Orders-in-Council to require the marking with an indication of origin of imported machinery belting, and strap butts of leather. The dates of the Committee's public inquiries will be announced later, and communications regarding them should be addressed to the Secretary, Mr. E. W. Reardon, Board of Trade, Great George Street, S.W.1, not later than June 14th.

The Dublin Electricity Department.

We have received from Dublin an interesting little brochure describing many phases of the activities of the City Electricity Department (engineer: Mr. Laurence J. Kettle). The first part is historical, and traces the growth of the undertaking since its inauguration in 1892. Many photographs of the old and present works are reproduced. The distribution system is then described, and a review of the development and finance of the Department follows. A large section is devoted to domestic electrification, and this is illustrated with views of the fine showrooms, which are situated in Grafton Street, one of the city's most popular thoroughfares. The reasons for the difference in lighting and other rates are briefly stated, and the booklet concludes with a number of illustrations of the principal buildings and undertakings upon the system

Another publication received from Mr. Kettle is entitled "How Electricity Made Dreams Come True." It tells in a series of advertisements how the troubles of a newly-wedded couple were solved electrically, and includes a number of consumers' testimonials.

Conditions in Finland.

The Stationery Office has published (at 1s. net) for the Department of Overseas Trade a report on economic conditions in Finland by Mr. C. H. Mackie, British Consul at Helsingfors. In this it is stated that after an almost unbroken period of progress Finland suffered a setback in several directions during 1928. It is hoped, however, that this was merely a passing phase. An Economic Council was appointed towards the end of the year to recommend measures for improving the situation, particularly with regard to foreign trade. The immediate outlook appears to be more hopeful. The United Kingdom provided 12.3 per cent. of the total Finnish imports during 1928 (against 14.4 per cent. in 1927), and took 35 per cent (against 40 per cent.) of Finland's exports. In 1928 Finland imported 2,421 metric tons of electrical machinery valued at 69,300,000 Finnish marks (about £350,000); 3,644 tons of insulated wires and cables valued at 35,500,000 marks (about £180,000); and 142 tons of electric lamps valued at 20,000,000 marks (about £104,000). The share of the United Kingdom in this trade is not stated.

Mr. Mackie recommends the appointment of agents within the country selected only after a personal interview. He points out that the distance to Finland is not great and can be accomplished by the shortest route in three days. It is stated that great progress was made in the Finnish telephone service during 1928, and further extensions are in hand both in the country itself and in the connections with neighbouring states. In an appendix to the review it is reported that, after several years of work, the rapids at Imatra are about to be utilised for the production of electrical energy. All the machinery has been installed, the transmission lines are ready, and trials have taken place. It was anticipated that the supply would be commenced early this year.

International Telephone Corporation in Germany.

The International Telephone and Telegraph Corporation through its subsidiary, the International Standard Electric Corporation, is entering into the field of the manufacturing of electrical communication apparatus in Germany by the purchase of a substantial interest in the Ferdinand Schuchhardt Berlin telephone and telegraph works. It is planned to expand this German factory in order to increase its distribution of telephone, telegraph and radio apparatus. In taking this step the International is extending to Germany the benefit of the inventions and technical experience resulting from the world-wide system of the International Standard Electric Corporation and its associated companies. The Ferdinand Schuchhardt factory is one of the oldest of the communication apparatus factories in Europe, and occupies a prominent position in the field. The International Standard Electric Corporation, the principal manufacturing organisation of the International system, has factories in England, France, Belgium, Spain, Italy, Austria, Hungary, Czecho-Slovakia, Australia, China and Japan, with a sales organisation extending throughout the world.

The Shanghai Electricity Department.

In a recent issue we stated that Messrs. Preece, Cardew and Rider were consulting engineers to the Shanghai Municipal Electricity Department. This was incorrect: Messrs. Preece, Cardew & Rider act in the capacity of inspecting engineers and have watched the Department's interests in this country so far as the progress of manufacture of plant and like details are concerned.

New French Companies.

Among the companies recently formed in France are the Société Hydro-Electrique du Drac Inférieur, Grenoble (27, Rue de Turenne), capital 15 million francs, to acquire an interest in a number of hydro-electric power undertakings; La Société Hydroélectrique des Cevennes, Ales (Gard), capital three million fr.; and the Société de l'Union Electrique des Pyrenées Occidentales, Paris (156, Rue de l'Université), capital 12 million fr., to acquire an interest in a number of electricity undertakings in the Western Pyrenees.

Our French contemporary *L'Electricien* reports that a company has been formed in Paris (42, Rue Pasquier), with a capital of one million fr., and the title La Société Stone, to acquire rights for the manufacture of electric lighting equipment for railway trains in France from Lege Reet & Co., Ltd., London. Among the directors of the new concern are Sir John Prestige, Mr. B. W. Preston, and Mr. H. Bissell, all of London.

The New Canadian Customs Regulations.

The Ottawa correspondent of *The Times* reports that the Dominion Government was criticised in the House of Commons on May 14th in connection with its new regulations requiring goods entering Canada to be 50 per cent. British as to labour and material to qualify for preferential treatment. It was declared that the regulations would prove an impediment to British trade and would probably react on Canadian trade with the United Kingdom. The Minister of National Revenue said that the Government's intention was to help Empire trade, and quoted examples of goods which were practically all of Continental manufacture being re-exported to Canada after finishing processes in the United Kingdom. It was complained that copper was one of the materials which British manufacturers could not obtain from Empire sources, but Canada could supply it. The Minister of Finance said that Great Britain, Australia and New Zealand had introduced similar regulations to those in question. However, if it could be shown in any case that British industry could not qualify properly in respect of raw materials obtainable within the British Empire, Canada was prepared to consider modifications of the list of exemptions from the new regulation.

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Unemployment in Germany.

The Berlin correspondent of *The Times* says that the German unemployment insurance returns for the first fortnight of April show a marked decline. Between April 1st and 15th the number of persons in receipt of relief decreased by 420,000 or 22 per cent., from 1,900,000 to 1,480,000. The number receiving extended benefit increased from 192,000 to 198,000, so that the total number of registered unemployed on April 15th was 1,678,000.

E.D.A. Activities.

The British Electrical Development Association has planned the June portion of its campaign with a hope that there will be a continuance of warm weather. That is, the subjects are cooling and refrigeration. This, together with the fact that there are three or four electrical conventions during the month, has shown great confidence in June, which we hope will prove not to have been misplaced.

All the usual features of the monthly E.D.A. programmes are retained, *mutatis mutandis*, for June—the national and local Press advertising, posters, publications, lectures and lantern slides, &c. As usual, members are offered a choice between two window displays, both of which are illustrated herewith. They are both planned on simple lines. The one demonstrating electric cooling (fig. 1) consists merely of a few fans mounted at various heights to make an effective show, one of them being in motion and blowing out streamers. In the background there appear the large switch and the campaign slogans which are a feature of all the displays. The cardboard lady who appeared in one of the May window arrangements is given a new lease of life in the second of the June displays (fig. 2). She stands before a well-stocked refrigerator, which demonstrates the variety of food which can be kept in condition by electrical means.

Fig. 1.—An E.D.A. Fan Display.

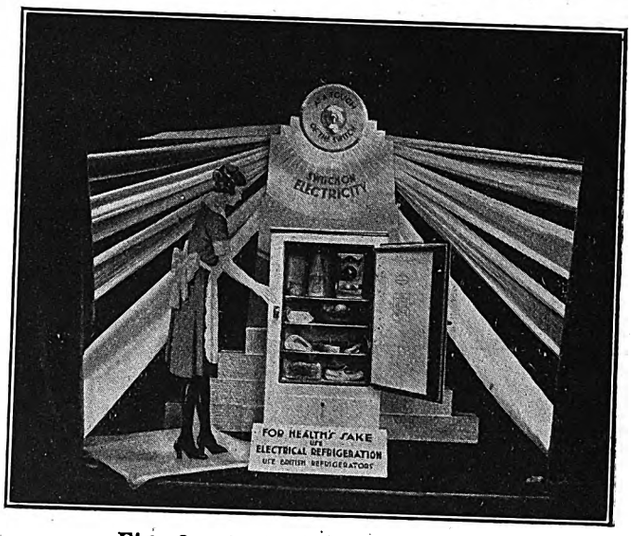

Fig. 2.—A Refrigerator Window.

In our last issue, when dealing with the North-East Coast Exhibition, we made reference to the display which has been arranged by the British Electrical Development Association. We are now able to reproduce an illustration of the stand (fig. 3). This shows the information bureau and one of the sides, which is divided into seven panels each of which illustrates an application of electricity for lighting, heating, cooking and labour saving.

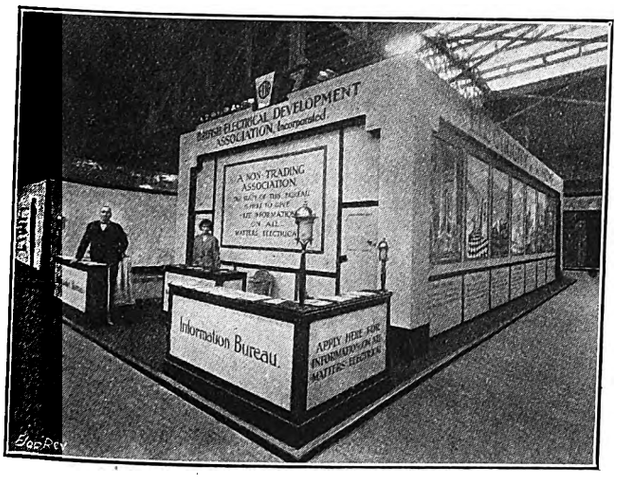

Fig. 3.—The E.D.A. Stand at Newcastle.

A British Trade Fair in Argentina.

In a recent issue we reported that the British Chamber of Commerce in the Argentine Republic had planned a British Empire Trade Fair, to be held in Buenos Aires from November, 1930, to February, 1931 (the Argentine summer season). We have now received from the Chamber a preliminary prospectus which "sets forth the scope, policy and organisation suggested for carrying the undertaking to a successful issue." Appeals for their assistance and encouragement are addressed to the British Ambassador in Argentina and to the Parliamentary Secretary to the Department of Overseas Trade. The prospectus emphasises the great opportunities which exist in the Republic for British trade, and gives particulars of the sections into which it is proposed to divide the exhibition. These include the heavy and light metal trades, the electrical trades, transport, radio, and many other classes of industry. Two striking aerial views are included; one shows Buenos Aires from the water-front, while the other depicts the beautiful grounds of the Argentine Rural Society which are being lent for the purposes of the Fair.

Book Notices.

"Estimating," by T. H. Hargrave. Pp. viii+120; figs. 40. London: Sir Isaac Pitman & Sons. Price 7s. 6d. net.

"Radio Receiving Tubes," by J. A. Moyer and J. F. Wostrel. Pp. vii+297; figs. 180. Price 12s. 6d. net; "Electrical Engineering Problems," Part II, "Alternating-current Circuits and Apparatus," by J. G. Pertsch, Junr., and E. M. Strong. Pp. vii+105; figs. 48. Price 7s. net. London: McGraw-Hill Publishing Co., Ltd.

Art and humour are again skilfully combined in the 1929 Summer Number of *Punch* (1s. net). A number of our contemporary's regular contributors have co-operated in the production of an annual which is always anticipated with pleasure.

"*Journal* of the Institution of Electrical Engineers," Vol. LXVII, No. 389. May, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

Canadian Copper Production.

The *Board of Trade Journal* states that, according to statistics published in the Preliminary Report on the Mineral Production of Canada during 1928, the Dominion is the world's fourth most important producer of copper, with every prospect of becoming the third greatest source of the red metal within the next eight or ten years, being then surpassed only by the United States and Chile. At present, Africa also produces more copper than Canada. Producing 201,940,172 lb., or 100,970 tons, in 1928, Canada showed an advance of more than one-third over 1927. British Columbia was responsible for more than half of the copper produced.

Wages in the Cable-making Industry.

The Joint Industrial Council for the Electrical Cable Making Industry informs us that as the B.O.T. cost-of-living index figure on May 1st was 61 per cent. above the 1914 level, there will be no change in wages on the third pay day in June, 1929, in the industry.

British Industries Fair Catalogues.

As in previous years, the Department of Overseas Trade is drawing attention to the fact that the catalogues of exhibits at this year's British Industries Fair at London and Birmingham form a very useful buyers' guide to British goods. A limited number of the catalogues is still available, and can be obtained at the price of 1s. each, post free, from the Department, 35, Old Queen Street, S.W.1.

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The Swedish Industries Fair.

The Swedish Industries Fair will be held at Gothenburg from May 25th to June 2nd in the magnificent exhibition building of 30,000 sq. metres floor area, which was originally erected for the engineering section of the Gothenburg Exhibition a few years ago. It is said to be the largest timber structure of its kind in the world. The Fair this year will be particularly comprehensive, and certain sections, such as electrical apparatus, paper, wireless, and a separate department of inventions should be especially attractive and interesting. Last year the number of exhibitors was 700, representing about 1,400 Swedish manufacturers. The visitors numbered 106,000 from 22 countries.

For Sale.

Messrs. Fuller, Horsey, Sons & Cassell will sell by auction, at the depôt adjoining the main entrance of the Wembley Exhibition Grounds, on June 19th, electrical plant and stores removed from the Wembley Exhibition. (See our advertisement pages to-day.)

Topical Showcards.

Many advertisers have seized the opportunity provided by the General Election for effective publicity. The GENERAL ELECTRIC Co., LTD., for instance, has produced two showcards in colours bearing on the political situation. One of these bears portraits of the leaders of the three parties and asserts that all parties agree that "Osram" valves are best. The other counsels the reception of election results by means of "Gecophone" radio receivers and loud speakers.

Bankruptcy Proceedings.

G. RANGER, motor and wireless dealer, 1889, Pershore Road, King's Norton, Birmingham.—Receiving order made May 9th on a creditor's petition.

C. B. MARSDEN, electrical engineer, rear of 60, Pisgah Street, Kenfig Hill, Glamorgan.—Receiving order made May 11th on debtor's own petition. First meeting May 30th, at 34, Park Place, Cardiff; public examination June 20th, at the County Court, Bridgend.

J. STIRZAKER, electrical engineer, late of Wen Roe, Llanfairfechan.—First meeting held May 23rd at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester. Public examination May 31st at the Court House, Bangor.

J. H. MCBEAN (H. W. D. Battery Co.), electrical engineer, 29, Bradford Road, Batley Carr.—First meeting held May 23rd at the Official Receiver's office, 12, Duke Street, Bradford. Public examination June 6th at the County Court House, Dewsbury.

H. PEOVER, electrical apparatus and tool merchant, Market Lane, Newcastle-upon-Tyne.—First meeting held May 22nd, at the Official Receiver's office, 81, St. Mary's Place, Newcastle-upon-Tyne. Public examination June 6th, at the Court House, 56, Westgate Road, Newcastle-upon-Tyne.

E. E. HARRISON, electrician, 27, School Lane, Heaton Chapel, Lancaster.—First meeting May 24th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, June 28th, at the Court House, Stockport.

G. M. WILSHAW & G. SHARPE (Wilshaw & Sharpe), electrical dealers, 320, Padiham Road, Burnley.—First and final dividend of 2s. 6½d. in the £ payable at the Official Receiver's office, District Bank Chambers, Blackburn.

S. PERKINS, wireless dealer, 1, Lodge Lane, Beeston, Leeds.—First and final dividend of 1s. 9d. in the £ payable May 24th, at the Official Receiver's office, 24, Lower Bond Street, Leeds.

D. B. JOHN (D. B. John & Bros.), electrical engineer, &c., 8, Commercial Place, Pontycymmer, and Nanthir Stores, Nanthir Road, Blaengarw, Glam.—Receiving order made May 13th, on debtor's own petition. First meeting May 30th, at 34, Park Place, Cardiff; public examination June 20th, at the County Court, Bridgend.

E. R. D. LINDSAY, wireless and cycle agent, 96 & 98, Victoria Road, Aldershot.—Application for discharge to be heard June 6th, at the Guildhall, Guildford.

G. S. DOUTHWAITE (G. S. Douthwaite & Co.), electrical engineer, 25, Dean Street, Newcastle-upon-Tyne.—Trustee, Mr. A. J. Gray, 48, Pilgrim Street, Newcastle-upon-Tyne, released March 15th, 1929.

W. H. EDWARDS, electrical engineer, The Docks, Milford Haven.—Last day for proofs for dividend May 31st. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen.

Company Liquidations.

TELEPHONES & ACCESSORIES, LTD.—A petition for the winding up of this company has been presented to the High Court by the Erewash Electric Wire Co., Ltd., of Bennett Street, Long Eaton, Derby. Creditors, &c., will be heard in London on June 4th.

ELECTRIC FACTORS (BLACKPOOL), LTD.—A meeting of creditors is called for May 30th at the Arcade Café, Feldman's Arcade, Central Beach, Promenade, Blackpool.

CHURCH STRETTON ELECTRIC SUPPLY CO., LTD.—A meeting of members is called for June 12th, at 1c, King Street, St. James's, S.W., to hear an account of the winding up from the liquidator, Mr. A. E. Dalton.

WHITFIELD ELECTRICAL CO., LTD.—First meeting of creditors and contributories, May 27th, at 29, Russell Square, W.C.

Deeds of Assignment.

MRS. NINA RAYNER, trading as D. D. Rayner & Co., electrical engineers, Derby.—The trustee in this matter, Mr. J. M. Sibbald, 41, St. Mary's Gate, Derby, reports that judgment against the surety remains unsatisfied and he is assured that there is no prospect of recovering any payment. He therefore proposes to distribute the balance in his hands in accordance with the deed of assignment.

S. C. SMITH, wireless and electrical engineer, 10, The Facade, Devonshire Road, Forest Hill.—Particulars of claims by May 31st, to the trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C.2.

A. RUTHERFORD, electrical engineer and contractor, Plowman's Yard, Church End, Finchley, N.3.—Particulars of claims to the trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C.2, by May 31st.

New Catalogues and Lists.

DRAKE & GORHAM WHOLESALE, LTD., 67, Long Acre, W.C.—Pamphlet No. 465, illustrating, with prices, various designs of fans.

H. J. GALLIERS, The Electric Shop, 167, North Street, Brighton.—The 3rd monthly issue of "Galliers' Electrical Bulletin," including notes on lighting ideas, country house electrical installations, &c.

VERITYS, LTD., Aston, Birmingham.—Publication 1070, showing "Orbit" oscillating fans. Priced. Publication 1069 dealing with "Verity-Heemaf" high-torque motors, with stock list; also a new price list of "Aston" switchgear.

ARTHUR PREEN & CO., LTD., Crown Works, Cricklewood Lane, N.W.2.—Illustrated folders giving instructions for the construction and operation of the "Screen Grid Three" wireless set, and describing with prices "Formo" radio components.

The POWER CENTRE CO., LTD., 15, Park Lane, Liverpool.—An illustrated leaflet describing the "Turret" patent trunk cable conduit system.

METRO-VICK SUPPLIES, Trafford Park, Manchester.—An illustrated folder drawing attention to the company's electric fans.

DAVID BROWN & SONS (HUDDERSFIELD), LTD., Park Works, Lockwood, Huddersfield.—A well-produced booklet entitled "Worm Gear Transmission," being a general review of the development and possibilities of the worm drive.

ELLIOTT BROTHERS (LONDON), LTD., Century Works, Connington Road, Lewisham, S.E.—A folder dealing with the firm's portable testing instruments.

MICA MANUFACTURING CO., LTD., Volta Works, Bromley, Kent.—Price list of electrical spotted mica.

CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—A pamphlet giving historical details of Jervaulx Abbey and the electrical installation there, including a Chloride battery of 54 cells.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Two leaflets, priced and illustrated, describing the Philips aerial discharger, and 2- and 3-valve "all-electric" receivers.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38 & 39, Upper Thames Street, E.C.4.—May price list of lighting fittings, "Xcel" domestic appliances, &c.

Recent Contracts.

Contracts for electric lighting installations in the following buildings have recently been placed with Messrs. G. E. WALLIS AND SONS, LTD., Ashford, Kent:—Raglan Road Council School, Bromley; new telephone exchange, Farnborough, Kent; Gordon School, Gravesend; new telephone exchange, Herne Bay; new telephone exchange, Pembury, Kent; and new telephone exchange, Southborough, Kent.

Messrs. JOSEPH KAYE & SONS, LTD., Leeds, have recently secured an order for their patent mortice door locks to master key for the extensions at Barking power station.

Unemployment.

The number of persons on the registers of the Employment Exchanges for the week ended May 6th, showed a decrease of 31,108. At that date the total was 1,132,700, as compared with 1,163,808 on April 29th, and 1,103,822 on May 7th, 1928.

Prices of Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, May 22nd: No change in copper and lead prices.

Messrs. Edward Till & Co. report, May 22nd: India-rubber. Para fine, 11¾d., ½d. inc.

Messrs. James Forster & Co., reporting on May 18th, stated that a little better demand for lead was experienced last week from home consumers, but, with freer arrivals, this had little effect on prices. Continental demand is still very quiet and is being easily met by sales of American and Mexican lead. It is reasonable to expect, with the General Election out of the way and the reparations questions settled, an improved demand from consumers both here and on the Continent. On the other hand, with the position in Mexico back to normal, more lead from that quarter is to be expected, while shipments from Australia should be plentiful. The Board of Trade Returns for April, 1929, show:—Imports, 25,415 tons; exports, 2,009 tons; leaving for home consumption, 23,406 tons.

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Lighting and Power Notes.

Argentina.—BUENOS AIRES.—The report of the Compania Italo-Argentina de Electricidad for the year ended December 31st last states that work on the construction of Section VI of the new port, where the large new power station is to be erected, was completed, and the construction of the first section of the station, which will have a capacity of 100,000 kW, was commenced. The ultimate capacity of the station will be from 300,000 to 350,000 kW. At the Pedro Mendoza power station the last four boilers were installed. The length of cables laid increased by 534 km. to 2,732 km., and fifty new sub-stations were put into service, bringing the total up to 190, with an installed capacity of 42,865 kVA. The total connected load was 142,350 kW, an increase of 23,107 kW, and the sales of electrical energy amounted to 109,333,915 kWh.

Blairgowrie (Perthshire).—ELECTRICITY SUPPLY.—The convener of the Electricity Committe has reported to the Town Council that the general manager of the Grampian Electricity Company has assured him that Blairgowrie will be supplied with electricity in time for next lighting season. Work has been delayed owing to the winter but is now well in hand. The maximum price is to be 8d. per kWh for lighting, and 3d. for power.

Brackley.—STREET LIGHTING.—The Town Council has decided to accept the tender of the Northampton Electric Light Co. to light the streets of the town for the next ten years. This tender includes the fixing, lighting, and maintenance of 52 lamps for ten years at a net cost of £186 per annum.

Bradford.—MAINS EXTENSIONS.—The Corporation Electricity Committee has sanctioned further expenditure on extensions of mains, &c., up to a total of £20,000.

LOAN.—The Committee is seeking sanction to a loan of £20,000 for estimated expenditure on transformers and sub-station switchgear during the next three years.

Canada.—ELECTRICAL DEVELOPMENT.—The preliminary report of the Dominion Bureau of Statistics on the central electric station industry in Canada for 1927, shows that the total overhead line mileage increased by 3,878, or 13 per cent.; and the output was greater by 2,455,654,000 kWh, or 20 per cent., for an increase in total primary power of 404,026 h.p., or 11 per cent. Commercial stations produced 2,149,193,000 kWh, or 27.6 per cent. more than in 1926, and municipal stations showed an increase of 7.4 per cent. The principal increase was in Quebec, where privately-owned plants increased their output by 1,594,879,000 kWh, or 32.6 per cent. Hydro-electric stations in Canada in 1927 generated 98.6 per cent. of the total amount of electrical energy produced. The number of power plants increased during the year by 34, of which hydro-electric plants numbered 8 and fuel plants 26, most of the latter being in Saskatchewan. The population served by central electricity stations was approximately 5,830,000, or 61 per cent. of the total estimated population of the Dominion.

Carlisle.—LOANS.—The Corporation Electricity Committee is to lay an additional feeder between Willow Holme and Holme Head works, and has instructed the town clerk to obtain sanction to borrow £3,500 to cover the cost. The Committee is also to seek sanction to loans of £15,000 for mains and services, and £5,000 for the purchase of meters.

Continental.—BELGIUM.—The Société d'Electricité Interbrabant which last year acquired the power station at Droogenbosch belonging to the Imperial Continental Gas Association and the station at Schaerbeek, Brussels, of the Société Bruxelloise d'Electricité has decided to proceed immediately with the extension of the Schaerbeek plant from 80,000 to 160,000 kW by the addition of four 20,000-kW turbo-generators. The new building will be constructed so as to provide for the addition of two further sets of similar capacity at a later date. The company is also proceeding with a big power station interconnection scheme so that in the event of any breakdowns the load may be taken over by other plants and the two stations at Droogenbosch and Schaerbeek have already been linked up. A similar linking operation is about to be effected between the stations of the Interbrabant Co. and those of the Brussels municipality and of the Brussels Tramway Co., and that at Oisquercq of the Société des Centrales Electrique des Flandres et du Brabant.

ITALY.—The Società Elettrica dell' Adamello has recently completed a new hydro-electric power station at Sonico in the Alte Valle Camonica. The plant, which works under a head of about 1,426 ft., comprises five Pelton-type turbines direct coupled to 16,000-kVA alternators generating at 42 and 52 cycles 7,000 V and from 420 to 500 r.p.m. The installation also includes an outdoor 7/130-kV transformer plant.

BULGARIA.—A report recently issued by the Bulgarian State Water Department shows that the number of hydro-electric power stations in Bulgaria increased from about 20 in 1918 to 139 at the end of 1927. The output in the last mentioned year amounted to 25,635,000 kWh, of which 15,192,000 kWh were produced by one station. At the end of 1927 there were also 109 steam-operated electric power plants in the country, of which, however, 69 had a capacity not exceeding 100 h.p., only two being of more than 2,000 h.p. The total output of the steam stations in 1927 is given as 11,097,000 kWh.

HUNGARY.—Considerable improvements have been made during the past year in the equipment of the electric power plant of the Hungarian coal mines. The Government has approved the so-called "Talbot" concession authorising the construction of a large electric power station at Banhida, in the heart of the Tata coal-field district. It will utilise annually about 300,000 tons of the peat of the district, and will produce electrical energy for Budapest and other cities as well as works, factories, and mines within a projected radius of about 100 miles. The plant is to be completed by the end of the present year.

Federated Malay States.—PENANG.—According to *Eastern Engineering*, rapid progress has been made by the municipal electricity supply undertaking serving Georgetown and the Province of Wellesley, and 8,000 consumers have now been connected. Capital expenditure amounting to £100,000 has been authorised to cover extensions from 1930 to 1932. This includes £35,000 for a submarine cable from Prai to Presgrave, and £23,000 for a new 5,000-kW turbo-generator. It is reported that consideration is being given to the advisability of installing a 10,000-kW set instead of the 5,000-kW set at present proposed.

Hastings.—STREET LAMPS.—The Corporation is to extend mains and provide street lamps at a cost of £1,500.

ELECTRICITY SUPPLY.—The Corporation Electricity Committee is to provide a supply of electricity to Crowhurst at a cost of £7,500.

Irish Free State.—WATERFORD.—The Mayor recently performed the ceremony of switching on the new electricity supply. Waterford is the first provincial city in Ireland to receive electricity *via* Dublin under the Free State Government national electrification scheme.

London.—HAMMERSMITH.—In connection with the extension of Olympia, the Electricity Committee has recommended the provision of two 6,600-V, three-phase mains with transformers and switchgear, at a cost of £13,087.

SHOREDITCH.—The Lighting Committee has recommended the expenditure of £13,183 for mains extensions, and also £10,000 for the provision of prepayment and other meters.

Lothians.—MAIN TRANSMISSION LINES.—By the closing of an 11,000-V switch on May 11th, Mr. W. B. Cownie, the managing director of the Lothians Electric Power Co., completed the last section of the main transmission lines in East Lothian; this took place at the company's Belhaven sub-station. He subsequently welcomed Baillie McLaren of Dunbar, and invited him to close the 3,000-V switch which gave a supply of electricity to Dunbar, Belhaven and West Barns.

Lowestoft.—YEAR'S WORKING.—The report of the Mayor on last year's working of the Electricity Department shows that, in spite of the present uneconomical double system of supply resulting from the purchase of a partial bulk supply from Yarmouth and of a reduction in price of electricity for lighting and heating purposes, the total income was £48,732, an increase of £512 on that of the preceding year. Working expenses, sinking fund and interest absorbed £46,417, of which £10,918 was paid in sinking fund charges. Generation and bulk supply costs showed an increase of £4,023, while the interest and sinking fund charges were increased by £512. There was, however, a balance of income over expenditure of £2,315. In the reserve and renewal fund there was a credit balance of £9,136. The assisted wiring scheme and hiring-out of cookers has been very successful. In four months 175 new consumers have been connected and over 100 cookers hired out.

Manchester.—PROGRESS DURING MARCH.—During the month of March the Corporation electricity undertaking showed an increase in connections of 8,292 kW, bringing the total up to 382,140 kW; and the number of applications received for supply, including those for additional supplies, was 1,271, representing a total of 2,124 kW. The number of hired cookers connected increased by 70, bringing the total of hired cookers actually connected to 5,182. Applications for the hire of cookers totalled 98. Two new sub-stations were put into commission, and additional plant was installed at three existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 5,061 consumers up to April 13th last and sanction had been given and work was in progress involving 1,045 consumers.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

ALDERLEY EDGE AND WILMSLOW.—Lighting: To 8d. per kWh. Power and heating: To 3d. per kWh.

STOCKTON-ON-TEES.—Lighting: From 4d. to 3¾d. per kWh, and 3½d. above 1,500 kWh. Heating: From 1½d. to 1¼d. per kWh. Power: From 2d. to 1¾d. per kWh, and 1½d. above 5,000 kWh. Alternative rate for private houses: 1s. 9d. per quarter per 100 sq. ft. of floor area, plus 1d. per kWh for the first 240 kWh per quarter for any purpose, and ½d. per kWh beyond. Tramway supply: From 1¼d. to 1d. per kWh. In the parishes of Preston and Eaglescliffe.—Lighting,: From 5½d. to 4½d. per kWh. Heating: From 2d. to 1½d. per kWh. Power: From 3d. to 2d. per kWh. Domestic rate: From

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2s. 9d. per quarter per 100 sq. ft. of floor space to 2s.; plus 1d. per kWh for any purpose.

WALLINGFORD.—*Wallingford & District Electric Supply Co., Ltd.*—Lighting: From 1s. to 10d. per kWh.

Scarborough.—LOAN.—The Town Council is to apply for sanction to a loan of £17,000 for further plant, including a turbo-alternator, in connection with the scheme of bulk supply to Bridlington and the parishes in the Filey district, required in 1930-31, by which time the Bridlington station is expected to have reached its total possible output. The scheme has been the subject of consultations with the Electricity Commissioners and the Central Electricity Board.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Dorking Electricity Supply Co., Ltd., to supply electricity in the urban district of Dorking and parts of the rural districts of Reigate and Dorking.

The Minister of Transport has confirmed the Special Order made by the Commissioners authorising Hull Corporation to supply electricity in the boroughs of Beverley and Hedon, the urban district of Cottingham and parts of the rural districts of Beverley, Skirlaugh, Sculcoates and Patrington.

Stirlingshire.—STREET LIGHTING.—Arrangements for the public lighting of the villages of Cowie, Plean, and Fallin have been completed by the County Council. Electricity is to be supplied by the Scottish Midlands Electricity Supply Co. and carried by l.p. overhead distributors for street lighting. It is expected that the scheme will be in operation by the beginning of the next lighting season.

Swansea.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains to Ynystawe at a cost of £2,000.

POWER STATION PLANT.—The Finance Committee has approved the purchase of the proposed 10,000/12,500-kW turbo-generator for the Strand power station at a cost of £34,476.

United States.—ELECTRICAL DEVELOPMENT.—A £6,000,000 project to harness the Osage River in the State of Missouri is announced by the president of the North American Company. The new plant will form part of a system supplying a population of 1,300,000, scattered over an area of 2,700 sq. miles. Steel tower transmission lines will carry the power to Crystal City, where one firm has entered upon a long-term contract calling initially for 150,000,000 kWh per annum. A concrete dam over 100 ft. in height is in the course of construction. The plant is to have an initial capacity of 120,000 kW, with provision for additional units up to 160,000 kW capacity.

According to *Power*, ground has been broken at Sayreville, N.J., for the erection of a new power plant to be operated by the New Jersey Power Company, a subsidiary of the Utility Power and Light Corporation. The initial installation will be 60,000 kW in two 30,000-kW units, and this capacity will be increased to 180,000 kW as the demand for power in eastern and central New Jersey justifies the expansion. Steam at 400 lb. pressure and a total temperature of 700 deg. F. will be generated by four 12,000 sq. ft. boilers, stoker fired and equipped with air preheaters, &c. It is anticipated that the plant will be ready for operation by April 1st, 1930.

Warrington.—ELECTRICITY SUPPLY.—Mr. F. V. L. Mathias, borough electrical and tramways engineer, has submitted to the Electricity and Tramways Committee a report dealing with the supply of electricity to High Legh, Warburton, and Agden. These districts, which immediately abut the eastern boundaries of the Lymm area of the Corporation supply, are chiefly residential and agricultural in character, and the demand would, therefore, be mainly for lighting, cooking and heating, with a certain proportion of power load. There is no gas supply in these districts and it is probable that the requirements in three years will amount to 161,000 kWh, with a demand of 98 kW.

Tramway and Railway Notes.

Bradford.—LIGHT RAILWAY ABANDONMENT.—In connection with the water department, the Corporation a few years ago constructed a railway to Nidd Valley. The Water Committee of the Corporation now reports that, in view of particulars submitted showing progressive diminution of passenger traffic on the Nidd Valley Light Railway, the committee authorised the engineer to take preliminary steps with a view to closing the railway for public passenger transport. Meanwhile it is recommended that reduced fares should be introduced with a view to meeting the omnibus competition which has arisen between Pateley Bridge and Lofthouse.

Continental.—SPAIN.—According to the *Révue Générale des Chemins de Fer*, a considerable amount of activity is projected in connection with the electrification of railways in Spain, following the presentation of a report by a technical commission appointed by the Ministry of Public Works to investigate the question. This commission recommends the electrification of the lines: (*a*) Madrid-Avila and Villalba-Medina des Campo via Ségovie, northern section; (*b*) Encina-Valence and Cuenca-Valence; (*c*) Madrid-Villanuera de la Reina; (*d*) Catalan section; (*e*) Miranda-Bilbao and Cordillère Cantabrique. The reinforcement of bridges will be put in hand in order to permit heavy trains to pass from Zuera to Turinana. These plans involve 2,200 km. of line and the provision of from 150,000 to 200,000 h.p. It is estimated that present installations will be sufficient to provide this energy, and it is understood that the Ministry of Public Works will invite tenders for the rolling stock and various other requirements.

SWITZERLAND.—The St. Gall-Gais-Appenzell tramway is to be electrified.

AUSTRIA.—Electric trains are now running over the section of the Austrian State railways between Innsbruck and Lake Brenner. The power is being drawn from the power stations at Ruetz and Achensee by means of two 55 kV transmission lines. For express passenger trains 2,760-h.p. electric locomotives, capable of a speed of 62½ m.p.h. are being used and for freight trains 1,800-h.p. engines with a speed of 31¼ m.p.h. As compared with the old steam trains a saving of time of respectively 28 per cent. and 42 per cent. is being effected by passenger and freight trains between the two terminals of the section.

Japan.—TRAMWAY DEVELOPMENTS.—According to the recently-issued report of the Japanese Government Department of Railways for the year ended March, 1927, there were at that date 156 tramway undertakings with a total mileage of 1,668 in operation in Japan. Of the total 88 with a mileage of 1,142 were electrically operated. At the end of the year 106 new tramway routes with a total of 663 miles were under construction, 68 of them being electric.

NEW ELECTRIC RAILWAYS.—A new high-speed electric railway is being planned between Kyoto and Kobe, *via* Osaka. The Tsukuba High-speed Electric Railway Co., Ltd., also proposes to build a short underground electric railway from Nippori to Ueno.

Lowestoft.—YEAR'S WORKING.—The report of the Mayor on the year's working of the tramway undertaking shows a total income from trams and 'buses of £22,484, an increase of £471 on the previous year's receipts. Working expenses, interest and sinking fund absorbed £20,371, leaving a balance of £2,113, as against £1,935 in the preceding year. On the loan account the total amount paid off is £51,276, leaving £39,901 outstanding. The total number of passengers carried was 3,471,632, an increase of 107,436 on the preceding year.

Manchester.—TRAMWAY ABANDONMENT.—Details are being prepared for the Tramways Committee with regard to the proposal to substitute about 70 'buses on the circular route from Cheetham Hill Road to Stretford Road. The 'buses, which will be of a special type, will cost about £100,000, and the road alterations will amount to about £33,000.

Nottingham.—RAILLESS CARS.—The Corporation Tramways Committee has decided to extend its railless car system and to discontinue tramway services in the two areas of the city traversed by St. Ann's Well Road and Wilford Road. The system is also to be employed on the new arterial thoroughfare which has been constructed communicating with London Road.

United States.—RAILWAY ELECTRIFICATION.—One of the greatest engineering feats in American railway history has been brought to a successful conclusion with the recent completion of a tunnel 7¾ miles in length through the Cascade Mountains by the Great Northern Railway Co. at an expenditure of about $14,000,000. Coincident with the opening of this tunnel has been the electrification of 75 miles of main-line track through the Cascades between Wenatchee and Skykomish, Wash., bringing the total expenditure for the improvement to approximately $25,000,000.

Telegraph and Telephone Notes.

Fernando Po.—SHORT-WAVE WIRELESS.—Some time ago the Spanish Government decided to establish a direct wireless service between Madrid and the Spanish Colony, Fernando Po, in Equatorial Africa. The principal Spanish and foreign wireless companies competed for the supply of the apparatus and the specification of Marconi's Wireless Telegraph Co., Ltd., for a short-wave transmitting and receiving station was approved and its tender accepted. In addition, an order was given to Marconi Co. for a medium-wave valve transmitter and receiver to replace the existing medium-wave spark station in the Colony, which is used for working to ships and neighbouring colonies and can no longer be regarded as sufficiently up-to-date. The geographical position is not an ideal one for the reception of long-wave signals from Europe, owing to the Colony's close proximity to the equator, but short-wave signals from Europe are received with regularity and accuracy. The transmitter which is required to work with ships and

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neighbouring countries uses medium-waves, because the new International Washington Regulations provide that ships shall work on wavelengths between 600 and 800 metres, or between 2,000 and 2,400 metres. The short-wave transmitting and receiving gear has been installed at Fernando Po, and tests with Madrid have given excellent results. It is of the type used for British Imperial beam stations, but of smaller power and simpler design, owing to the fact that it is required to work on one wavelength only. The short-wave receiver is the Marconi-Mathieu standard.

The medium-wave apparatus consists of a Marconi 1½-kW Type "U" valve transmitter suitable for telegraphy on continuous-waves and interrupted-continuous-waves on wavelengths between 600 and 1,200 metres, which range can be extended by the provision of extra tuning coils to 3,000 metres. The medium-wave receiver is a Marconi type RG.6a, for wavelengths between 300 and 3,000 metres. The existing spark station at Fernando Po will be transferred to Bata in the Spanish Colony Rio Muni, on the African Mainland, and will be used for communication with Fernando Po when the new medium-wave valve gear has been installed.

Germany.—RADIO-TELEPHONY.—Conversation by telephone between Berlin and Sydney was recently carried out experimentally by the Trans-Radio Co. The experiment was a great success, the voices at both ends being perfectly audible.—*Reuter's* (Berlin).

Irish Free State.—TELEPHONY AND TELEGRAPHY.—In Dail Eireann on May 15th the Parliamentary Secretary to the Ministry for Posts and Telegraphs made a detailed statement on the finances of the Department, which he said was not altogether self-supporting, but was as near to it as possible, taking into account the circumstances controlling it. The estimated revenue for the year was £1,771,000, and the estimated deficit was £502,435, as compared with £669,995 last year. The estimated revenue of the telephone service during 1928-29 was £343,000. The telephone service definitely took second place amongst the activities of the Postal Department; it took precedence of the telegraph service, and was gradually expanding and increasing, while the telegraph service was expanding also. Revenue from telephony had increased by £29,000, and with regard to increased charges for telegrams, they anticipated a revenue of £66,000. The employment of the Department totalled 12,532 persons.

Spain.—NEW WIRELESS STATIONS.—With a view to establishing direct telegraph communication with America and eliminating dependence upon London and Paris as is the case at present, the National Trans-Radio Co. is erecting a short-wave wireless station at Aranjuez, a country town some thirty miles from Madrid. Work is being pushed forward as much as possible in order that the station may be completed before the meeting of the Council of the League of Nations, which is to be held in Madrid at the beginning of June, as the Arenjuez station will be the means of communicating with all other countries. The company also intends to erect transmitting stations in the more important commercial centres, such as Bilbao, Barcelona and Seville. In view of the need for completing the Aranjuez station as soon as possible, the materials used in its construction have been imported, but in the case of the other stations to be erected as much of the material as possible will be Spanish.—*Reuter's* (Madrid).

The Telephone Service.—NEW EXCHANGES.—An automatic telephone exchange was recently inaugurated at Churchstoke. It is the second of its type to be installed in the Chester district.

The change over to the new automatic system at Walsall took place recently also. The plant deals with 2,460 subscribers, and is capable of extension to 5,000 lines.

Radio Notes.

Czecho-Slovakia.—NEW STATION.—Test transmissions of the new broadcasting station at Bratislava have been heard in all parts of the British Isles. Out of 479 reports from Great Britain that were specially analysed only 20 indicate the use of more than four valves, the most popular receiver appearing to be the three-valve type, says *The Times*. A number of listeners claim that it is well up to the standard of the principal European high-power stations. The station comprises a Marconi 12 kilowatt transmitter, type PA.5, employing low-power modulation, and among its features is the half-wave-length aerial, the first of its kind to be used in the broadcast band to give the maximum local service area and to minimise fading at greater distances.

Common Wavelength.—PLYMOUTH.—On May 17th the Plymouth station was added to the list of B.B.C. relay stations operating on the national common frequency of 288.5 metres.

Poland.—LICENCES.—The total number of licensed listeners increased during the first three months of this year from 189,481 to 202,561. The number of "pirates" is supposed to be very substantial. Most of the listeners are in the urban districts, a comparatively insignificant number of sets being registered in the rural regions. The largest number is in West, South-West and Central Poland.

Holland.—TRAMWAY DISTURBANCE.—The Commission appointed by the Burgomaster and Council of The Hague to inquire into the disturbances of radio reception by tramways has asked for, and been granted, its discharge on the grounds that any further inquiries can only be profitable if made by an engineer familiar with the various factors of such disturbances and that the matter is one which concerns not only The Hague, but all large cities. One of the tasks of the Commission, says *World-Radio*, has been to induce leading authorities to agree to act whenever occasion arises, which has been done.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ayr.—District Committee. Installation of electric wiring in the District Fever Hospital, Old Cumnock. Specifications from Mr. J. MacEwan, consulting engineer, 62, Robertson Street, Glasgow.

Town Council. Electrical work at 36 houses. Plans at office of Mr. W. Cowie, architect, 5, Wellington Square, Ayr; schedules (£1 deposit) from Town Clerk.

Belgium.—ANTWERP.—June 17th. Municipal Council. 32 electric travelling cranes for the new dock. (Cahier des charges No. 755.) (A.X. 7924.)*

Chile.—VALPARAISO.—June 1st. Port Administration. Four three-metric-ton electric travelling cranes.

Croydon.—June 3rd. Electricity Department. Supply, delivery, and erection of one 20/25,000-kW turbo-alternator, with auxiliaries, boiler-house extensions with two 100,000-lb. boilers, coal handling plant, &c., engine room extension, switchhouse, bridges, and pump house, and 6,600-V switchgear, transformers, &c. (May 10th.)

Dundee.—June 5th. Town Council. Electrical installation at housing scheme. Particulars from Mr. G. Baxter, director of housing.

East Ham.—June 12th. Education Committee. Installation of electric lighting at Salisbury School. Specification 10s., from F. H. Thompson, secretary, Town Hall, East Ham.

Eccles.—May 29th. Health Committee. Installation of electric light wiring and fittings in 68 houses, Westwood Park, Morton. Specification and form of tender from borough electrical engineer, Electricity Works, Cawdor Street, Patricroft. (Deposit £1 1s.)

Edinburgh.—May 30th. Electrical installation at George Heriot's School, Edinburgh. Specifications from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

Epsom.—May 25th. Electricity Department. Supply, delivery and erection of a l.p. d.c. switchboard. (May 10th.)

Grimsby.—May 31st. Electricity Department. Electrically-driven boiler feed pump. (May 17th.)

Hastings.—June 3rd. Boiler fuel for period commencing July 1st, 1929. (May 10th.)

India.—May 27th. India Stores Department. 500-kW, 6-phase, rotary convertor, starting panel, &c. (B.X. 5279.)*

May 31st. South Indian Railway Co., Ltd. Supply of spare parts for train lighting cells and v.i.r. cotton and silk covered copper and galvanised iron wire. (May 17th.)

London.—CENTRAL ELECTRICITY BOARD.—June 17th. Supply, delivery and erection of 33-kV and lower voltage switchgear for the North-West England and North Wales Electricity Scheme, 1928. (May 17th.)

ST. PANCRAS.—June 6th. Electricity Department. Supply of one 1,000-kW motor convertor. (May 17th.)

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COMMISSIONERS OF H.M. WORKS.—June 3rd. Supply of fuse boards and switches. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—June 12th. Installation of two electric passenger lifts at Colindale Hospital, fire-alarm system at High Wood Hospital, and electric bell system at Wandsworth casual ward. (See this issue.)

Central London School District. June 8th. Four motors, switchgear equipment, steel shafting, leather belting, &c. (See this issue.)

Manchester.—May 28th. Tramways Committee. Electrical equipments, trucks, and air brakes, for tramcars. Specifications and forms of tender from general manager, Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—June 16th. Posts and Telegraph Department. Telephone bells. (B.X. 5272.)*

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

Ogmore and Garw.—May 31st. Electricity Department. A short length of 11-kV transmission line, and l.p. overhead and underground mains. (May 10th.)

South Africa.—JOHANNESBURG.—June 1st. Town Council. Truck type cubicles. (B.X. 5285.)* Oil switches. (B.X. 5283.)*

PRETORIA.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. (B.X. 5273.)*

Stockton-on-Tees.—June 11th. Electricity Department. Supply and delivery of two 1,250-kVA 3-phase transformers and l.p. 3-phase switchgear. (See this issue.)

Uruguay.—PORT AUTHORITIES.—July 22nd. 300-kilo electro-pneumatic drop-hammer. (A.X. 7974.)*

Walthamstow.—June 12th. Electricity Department. Supply, delivery and erection of two cooling towers and one ferro-concrete tank. (See this issue.)

West Ham.—June 17th. Education Committee. Installation of electric lighting at Fyfield open-air school extension, and installation of water-heating apparatus at Balaam Street School, Plaistow. (See this issue.)

Yorks.—May 31st. West Riding Education Committee. Electric light installation for the Malty Craggs and Aston Schools. Mr. A. Adcock, divisional clerk, "Craigmoor," Godstone Road, Rotherham.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bradford.—Tramways Committee. Accepted:—
60 tons hand brake shoes (8s. 6d. per cwt.), and 60 tons track brake blocks (8s. 9d. per cwt.).—Yorkshire Repetition Castings Co., Ltd.
Electric tire heater (£174).—Equipment & Engineering Co., Ltd.

Electricity Committee. Accepted:—
Six 400-kVA indoor type and six 600-kVA outdoor type transformers.—Hackbridge Electric Construction Co., Ltd.
Six 400-kVA outdoor type transformers.—Bruce, Peebles and Co., Ltd.
Fourteen 600-kVA indoor type transformers.—English Electric Co., Ltd.

Recommended:—
Two 300-kVA indoor type rotary convertor transformers for Odsal sub-station.—Metropolitan-Vickers Electrical Co., Ltd.
6,600-volt metal-clad switchgear for Valley Road power station.—A. Reyrolle & Co., Ltd.

Carlisle.—Electricity Committee. Accepted:—
Cables.—Metropolitan Electric Cable & Construction Co.; British Insulated Cables, Ltd.; Macintosh Cable Co., Ltd.

Plant for new power station and James Street sub-station. Accepted:—
Circulating water screens (£2,893).—Blakeborough and Sons, Ltd.
Two 8,000-kVA transformers, voltage ratio 11,500/3,300 (£5,370).—English Electric Co., Ltd.
One turbo feed pump (£575).—G. & J. Weir, Ltd.
3,300-volt switchgear equipment: Feeder equipment (£2,092); transformer equipment (£1,359).—British Thomson-Houston Co., Ltd.
Switchgear for auxiliary turbine (£810).—British Thomson-Houston Co., Ltd.
Switchgear for rotary convertor (£312).—Bertram Thomas, Ltd.
One 22-in. V.S. circulating pump equipment: Pump and equipment (£915); oil catchers (£18).—Worthington-Simpson, Ltd.
One 1,000-kW rotary convertor (£1,877).—Harland Engineering Co., Ltd.

Bedford.—Electricity Committee. Recommended:—
Overhead cable (£2,404).—R. M. Russell.
Main line to Wootton Pillinge (£1,329).—Pirelli-General Cable Works, Ltd.

Dumfries.—Town Council. Accepted:—
Turbo-alternator plant (£7,913).—Brush Electrical Engineering Co., Ltd.

Glasgow.—Tramways Committee. Accepted:—
Motors for saw mill machinery.—Electric Construction Co., Ltd.
Renewal of battery at Pinkston.—Tudor Accumulator Co., Ltd.

Recommended:—
Copper trolley wire (£1,260).—Felten & Guilleaume, Germany, per W. F. Dennis & Co. (Lowest British tender was £1,372).

London. — ISLINGTON. — Cleansing Committee. Recommended:—
Replacement of batteries in two electric vehicles (£409).—Chloride Electrical Storage Co., Ltd.

ST. MARYLEBONE.—Electricity Supply Committee. Recommended:—
Supply of cables for 12 months.—British Insulated Cables, Ltd.; Enfield Cable Works, Ltd.; Callender's Cable and Construction Co., Ltd.; Pirelli-General Cable Works, Ltd.
Renewal of battery at Blandford Street sub-station (approx. £2,000).—Tudor Accumulator Co., Ltd.
Enclosing the 3,000-kW convertor set (£585).—General Electric Co., Ltd.

Spalding.—Urban Council. Accepted:—
500-kVA step-up transformer (£279), and kiosks (£827).—Crompton Parkinson, Ltd.
Cable (£479).—Pirelli-General Cable Works, Ltd.

Forthcoming Events.

Physical Society.—Friday, May 24th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Institution of Electrical Engineers (Western Centre).—Cheltenham. May 24th to May 27th. Summer meeting. June 11th-22nd. Summer meeting in France.

Association of Ex-Siemens' Men.—Wednesday, May 29th. Hotel Cecil. Dinner.

Incorporated Municipal Electrical Association.—June 3rd-8th. Torquay. Annual convention.

E.H.P. Conference.—Paris, June 6th to 15th.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

AUTEX-REEL cord absorber (American; name of British agent wanted).

PHŒNIX washer.

Notes.

Electricity Output in the U.S.A. in 1927.

The total output of electricity reported by electric light and power plants in the United States for 1927 has recently been given by the Bureau of the Census as 74,654,531,374 kWh, an increase of 85.3 per cent. over the electricity generated in 1922, as determined in the preceding quinquennial census of electrical industries. The generator capacity is reported to have increased during the same period by 80.3 per cent., being 25,802,530 kW in 1927. Marked increases were shown also for the h.p. of steam turbines, internal-combustion engines, and hydro-electric turbines in use as prime movers. Municipal establishments decreased in the 5-year period from 2,581 to 2,192, or by 15.1 per cent., owing, it is explained, to the abandonment of municipal generating systems and the acquisition of distributing lines by commercial systems. Centralisation of ownership or control and the absorption of independent generating stations accompanying the extension of transmission lines explain the decrease of 43.4 per cent. in the number of commercial establishments, which were 2,135 in 1927, as compared with 3,774 in 1922.

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Industrial Electric Heating.

Mr. R. Alan S. Thwaites, when recently addressing the North Midland Section of the British Electrical Development Association, said that it was often assumed, because even the most efficient existing electricity generating station utilising steam only converted about 25 per cent. of the heat in the fuel into electrical energy, that therefore the use of electricity for industrial heating purposes could have only a limited field of application. Such an assumption had no regard to various factors which were definitely to the advantage of electricity, the efficiency of utilisation of which was far higher than with any other form of heating, reaching in many cases well over 90 per cent. In the case of an electric furnace it paid to spend money on extra brickwork and heat-insulating material to keep down the losses to a minimum, and that was one reason why electric furnaces were comparatively expensive. A glass-annealing lehr consisted of a chamber 50 ft. or more in length, in one end of which hot glass articles were inserted, and they travelled slowly through the furnace during the period of a few hours, leaving the other end in a cold condition. Such a lehr was usually heated by gas, but recently an experimental electrically-heated lehr was constructed. Considerable attention had been given to heat insulation, and when put into use it was found that no electric current was required, as the heat put into the furnace in the glass articles was quite sufficient to balance the radiation losses. That might be regarded as a limiting case. There were thus a series of applications, starting with the exceptional case in which (given sufficient heat insulation) the process might be carried out without heat being artificially provided, and working progressively through stages in which the aspect of heat retention became less and less important, to the other extreme in which the main object was to get the heat into a metal reasonably quickly without any necessity for retaining the temperature reached for any appreciable length of time. Regarded purely from a thermal point of view, the commercial possibilities of electric heating were a maximum for the classes of process first referred to, and became progressively less favourable down the list. While practically all heating processes could be done electrically, there were many for which it would at the present time be unsound to advocate electric heating. Experience, both in this country and America, made it clear that there was no necessity for cutting the price to ribbons in order to satisfy consumers, so long as attempts were not made to cope with impossible conditions. In districts where tariffs for power load were reasonably low similar tariffs were usually satisfactory for heating purposes. As an example, the usual price of electricity for brass melting appeared to be between 0.5d. and 0.6d. per kWh. The potential load to be obtained by the application of electricity to industrial heating purposes was enormous.

The Swiss Rupperswil Sub-station.

Owing to the good results obtained with outdoor sub-stations, the Swiss Federal Railways now build practically all their sub-stations of the outdoor type. A typical installation of this description is at Rupperswil, which is the centre of distribution of power for the railway system in Northern Switzerland; it serves to step-down the pressure of the incoming single-phase supply at 16⅔ cycles from 132,000 to 66,000 volts. The equipment comprises at present three 9,000-kVA transformers, but provision has been made for three further sets, bringing up the capacity to 54,000 kVA. The sub-station is provided with two busbar systems on the 132,000-volt and on the 66,000-volt sides, corresponding to the two incoming 132,000-volt lines. Both busbar systems are subdivided by means of isolating switches into three sections, each intended for two transformers. The circuit breakers for 132,000 volts, as well as for 66,000 volts, are made up of single-pole units coupled together, and arranged for remote control from the service building. The isolating switches are provided with horn-type arcing contacts and are so designed as to permit of the disconnection of transformers and lines on light load. The neutral point of transformers is connected direct to earth without the insertion of resistance on the 132,000-volt side, while on the 66,000-volt side the transformers are earthed through a resistance of 6,600 ohms. The installation has been entirely equipped by the Oerlikon Company and is fully described in Bulletin No. 92.

A Panhard-Oerlikon 2-ton Electric Lorry.

The Panhard-Levassor Co., of Ivry, Paris, France, has lately added to its range of productions a 2-ton electric lorry, the details of which have been worked out in conjunction with the Swiss electrical Société Oerlikon. The motor is of the series, tetrapolar type, spring-mounted at the rear of the chassis, a pinion on its shaft engaging with a crown wheel surrounding the differential on the rear axle. The power is supplied by a battery of 40 Dinin accumulators of a capacity of about 400 amp.-hours. The cells are divided into two groups and carried in two trays below the centre of the chassis, each tray being provided with four small wheels and so hung that it can readily be lowered to the ground and wheeled out of position when it is necessary to remove the battery for charging or other purposes. The controller is located under a small bonnet at the front of the vehicle; the various speeds are obtained by means of a pedal which is so arranged that when foot pressure is released the controller is automatically brought into the neutral position. The driver has also at his command a pedal and a hand lever actuating brakes on all four road wheels, and another hand lever controlling the reverse motion. The vehicle has a track of 5 ft. 2½ in., a wheel base of 9 ft. 9 in., and an overall length of 14 ft. 9 in., the body space behind the driver's seat being 13 ft. 1 in. in length. The detachable steel disk wheels are shod with 895 by 135 mm. tires. In running order the vehicle weighs 5 tons, of which 24 cwt. is the weight of the batteries. The Panhard Co. states that the electric lorry can cover distances of over 50 miles on one charge at speeds equal to those attained by petrol vehicles of similar capacity.

Chemical Works Rules.

A new and important activity of the Association of British Chemical Manufacturers is the issue of Model Safety Rules for use in chemical works. There will ultimately be two parts: *Part* 1—Model Rules in concise form, and *Part* 2—an explanation of the rules, fortified with examples of safety measures gathered from the accumulated experience of the industry and the Factory Branch of the Home Office. The safety matter is intended to supplement that contained in the Chemical Works Regulations, 1922, and to cover all chemical manufacture except authorised explosives, which are subject to special statutory rules. Compilation is being undertaken by the Works Technical Committee of the Association, under the chairmanship of Dr. E. F. Armstrong, on which are represented some of the largest manufacturing interests in the industry. At present the rules are only in provisional form, and are being circulated to members of the Association for inspection and criticism.

Electric Lamp Invention.

Referring to the paragraph under the above heading on page 795 of our issue of May 3rd, we are informed by Mr. A. A. Campbell Swinton that since he made the suggestions, he has found, through the courtesy of Mr. Lane Fox Pitt himself, who lent him a copy of his patent No. 3,988 of October 9th, 1878, that he was not only the first patentee of electricity distribution at constant potential, with everything in parallel, but that he was also, in the same specification, the first to patent what is now known as the gasfilled metal-filament lamp, his patent being prior to any lamp patent of Swan, and before even Edison's British patent for a platinum-wire lamp, which is dated the 23rd of the same month and year. No doubt modern lamps of this character use filaments of tungsten, and are filled with argon gas, while Mr. Lane Fox Pitt used a platinum-iridium alloy for his filament and nitrogen for his gas. In his time, however, neither tungsten in the form of wire, nor argon in any form, was known, and in his patent specification Mr. Lane Fox Pitt was careful to say specifically: "In order to prevent the deterioration of the material when incandescent, I sometimes surround it with an atmosphere of nitrogen gas," just as in modern lamps argon is introduced to prevent the deterioration (probably evaporation) of the tungsten. No doubt tungsten is a better substance than platinum-iridium to use as a filament, as being able to stand higher temperatures, while no doubt argon, as a more suitable gas, is better than nitrogen; but in both cases the principle involved is exactly the same, namely, the use of a filament with the highest possible melting point, and the prevention of the evaporation of the hot filament by counter bombardment by a neutral gas.

International Dam Construction Commission.

As a result of a movement started at the World Power Conference in Basle, Switzerland, in 1926, an International Dam Construction Committee has recently been organised, the object of which is the study of all technical questions in connection with the construction of large dams. The headquarters of the new Commission, on which twenty countries are so far represented, are in Paris. Signor Ponti, president of the Union of Italian Electricity Producers, has been elected the first president of the Executive Committee of the new body.

Electricity in Rice Cultivation.

Experiments have been going on in China for some little time now in connection with the application of electric power to rice growing, and so much success has already been achieved that projects are being mooted for its intensive exploitation. One of the essentials in rice growing is water, and in many places irrigation by natural means is difficult and even impossible. On several farms pumping by electricity is now being carried on, motor-operated pumps of up to 20 h.p. capacity having been installed for this purpose. The Foochow Electric Co. is not only supplying the electricity in the neighbourhood of that city, but also wiring the farms and installing the pumps. The charge for energy is comparatively small and the water can be well controlled, promoting the growth of the plant and bringing it to maturity without risk of reverse from the moisture standpoint. It ensures a second crop within the year in places where only one crop can be grown under natural, or manual, conditions. Proposals are now being made to run an overhead network of conductors over the rice swamps, to see whether the increased yield secured in experimental work by this course can also be secured on a commercial scale.

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Street Escalators in France.

Escalators are now very generally used in connection with the tube railways in London, and are steadily replacing the lifts hitherto employed. It has, however, remained for France to install the first escalator in a public street, one having recently been completed in Havre to connect the low and high parts of the port. The escalator has a horizontal length of about 164 yards and an incline of approximately 14 in. per yard. It is operated by three synchronous electric motors of 10, 45, and 140 h.p.; the first is used to move the escalators slowly when repairs are necessary, the others are brought into use at different periods of the day, according to the traffic. The necessary power is supplied at 5,000 V, and is stepped down to 200 V by means of two 80-kW transformers.

Large D.C. Generators.

The Swiss Oerlikon Co. is making eight direct-current generators of 6,000 kW, which are designed to furnish 12,000 amperes at from 470 to 520 volts and a speed of 250 r.p.m. They will be driven by water turbines and must withstand an overspeed of 480 r.p.m. The direct current generated by them will be used by the Norsk Hydro-ammonia Works in Norway for the production of hydrogen by the electrolysis of water.

Local Society.

The Salford Technical and Engineering Association visited the Henry Simon (Engineering Works), Ltd., at Cheadle Heath on May 11th. The annual picnic tea will be held on June 15th at Alton Towers.

An Italian Science Exhibition.

The Historical Exhibition of Italian Science recently opened by King Victor Emmanuel covers a wide range, and has taken five years to prepare. Its object is to illustrate the wealth of scientific material existing all over Italy and to prove that many of the wonders of applied science owe their origin to Italian genius. In the Florence section are the thermometer invented by Galileo in 1602; his pendulum and the famous little telescope which he invented at Venice in 1609 and with which he discovered Jupiter's moons. The Bologna section contains records of Galvani's experiments in animal magnetism. The Ministry of Communications exhibit starts with the germ of modern electricity, Volta's "pile," and follows with all the developments of telegraphy and telephony that have since taken place, including the pantograph for the telegraphic transmission of pictures invented in 1856 by Giovanni Caselli.

A New Direction-finder.

Mr. William Dubilier, well-known in the American wireless industry, arrived in London on May 17th from New York, bringing with him a new type of direction-finder for aeroplanes. It was invented by Mr. Warren S. Eaton, an aviator, for whom the Dubilier Condenser Corporation is building 30 instruments, for prolonged tests by the United States Government. Mr. Dubilier has brought the original instrument with him, and is to show it to the Air Ministry, says the *Evening News*. It works like a compass, except that instead of pointing north, it points to whatever place one may set it. In another form it can be used for piloting ships along tortuous channels, in dense fog, at speed. The instrument is quite light; it weighs about 7 lb.

Appointments Vacant.

Principal engineering inspector for the Electricity Commission. Distribution engineer for the Burma Electric Supply Co., Ltd. Lady demonstrator for Scarborough Corporation Electricity Department. (See our advertisement pages to-day.)

Domestic Electric Water Heating.

In a paper under the above heading recently delivered by Mr. A. H. Langley, B.Eng., at the Liverpool University, are some interesting points of design in relation to the lagging of storage tanks and the placing of the heating elements. The most important feature in the design of the storage tank is the heat insulation, and the greatest care must be taken in the design of this part to ensure efficient working. The heat carried away through insulation depends not only on the conductivity of the solid material, but also on the way in which it is massed together. The rate of heat transmission is greatly reduced by the inclusion of air within the substance, as air is a very poor conductor and the surface of separation between the air and the solid substance offers considerable resistance to heat flow. It has been found by experiment that cotton wool or brown felt are the best insulators, with cork very nearly as good. The former harbour vermin, so that cork in the form or cork sheets, loose or cemented ground cork is generally preferred for insulation. The thickness of heat insulation depends on the air temperature in which the tank is placed, and also the temperature of the water. For tanks above 20 gallons capacity, a thickness of from 2 to 5 inches is usual for a water temperature of 190 deg. F., the larger figure referring to the smaller sizes, this being due to the higher inherent efficiency of the larger sizes. The top and bottom should have somewhat heavier insulation—particularly the top—where there is a continuous demand.

The heating element should be placed inside the tank and not in a separate circulator, and should be placed so that it does not impede the heated water in rising, *i.e.*, if of the flat double-bladed type, the flat face should be vertical. It should be as near the base of the tank as is practicable and should be removable without draining off the water. An auxiliary emergency heater may be placed at the top of the tank, so that a small quantity of hot water may be obtained immediately after the full contents of the tank have been drawn off. The inlet should be in the base of the tank and covered with a dome-shaped baffle to prevent the incoming cold water mixing with the hot water. By experiment it is found that in addition to efficient baffling the height of the tank should be at least twice the diameter. A thermometer is a very useful addition and it is advisable to place this about the middle of the tank.

A New Electric Brazing Furnace.

A new electric brazing furnace, which has been placed on the market by the General Electric Co. of America, utilises a gaseous atmosphere and is automatic in operation. The only labour involved in its operation is that necessary to keep the furnace supplied with work. The furnace is of the tunnel type, the furnace proper resting on supports above a roller conveyor. On this conveyor rests a row of trays on which the work is loaded. The furnace itself has openings at either end, in the bottom. It is heated at the entrance end and cooled at the other. Motor-operated elevators located beneath the furnace openings raise the trays of work into, and lower them from, the furnace. In operation, the trays are loaded on the roller conveyor which is completely covered with trays from end to end. The elevators at the beginning of the cycle are in the lower position. The heating units located at the entrance end of the furnace are arranged in several zones, the temperature of which is automatically controlled. There is a short neck just beyond the heating zone where some cooling takes place, while the remainder of the furnace is water jacketed for final cooling. This is so effective that the work, when it leaves, has a temperature below that at which oxidation will take place. The time for a complete cycle of operation is adjustable between certain limits. There is also a time interval between the completion of one motion and the beginning of a succeeding motion, and this is adjustable from ½ to 1½ seconds. The time between cycles is adjustable by means of a master timing relay which has a time setting adjustable between 5 seconds and 33 minutes. This range of time adjustment allows a wide range of variation in the product which is to be brazed.

A 200-mile Welded Pipe Line.

A pipe line 205 miles long, running from Jal, New Mexico, to El Paso, Texas, U.S.A., is now being electrically welded. This pipe line, 16 in. in diameter, will carry gas for the El Paso Utilities Co. The electric arc welding of the entire pipe line is being done under the direction of Messrs. Fred. Clark and F. G. Hoffman, and a total of 27 G.E.C. (America) welding equipments are in use, some mounted on Fordson tractors and driven by the tractor engine, and others mounted on trucks and trailers. The pipe, in 30-foot sections, is strung along the cleared right-of-way. Seven of the 30-foot lengths are then lined up, making a section approximately 200 feet long. One welding crew fixes the sections temporarily in position by tack welding and another completes the welds.

An Automatic School-lighting Switch.

A small automatic electrical device has been developed by the research engineers of the General Electric Co. of America for automatically switching on and off electric light in schools when necessary. The device consists of a small box, about the size of an ordinary radio receiving set. On one end is a lens, which allows light from the outside to fall upon a photo-electric tube, which is set for a certain degree of daylight intensity, and whenever the light from outside falls below that mark the "electric eye" causes a small relay to switch on the electric lamps in the school room. This instrument, placed near an outside window of the school room, can be adjusted easily to any degree of light intensity desired. An automatic time clock disconnects the apparatus during the hours when school is not in session, thus preventing the light being switched on automatically at night.

Institution Notes.

Institution of Electrical Engineers.

WESTERN CENTRE.—The summer meeting is being held at Cheltenham from May 24th to 27th. This evening the annual general meeting and declaration of ballot for the 1929-30 Committee vacancies was to take place at the Queen's Hotel, and was to be followed by dinner and a concert, by invitation of the Mayor, Ald. C. H. Margrett, O.B.E., J.P., and Coun. James Moore, chairman of the Electricity Committee. To-morrow, Saturday, the party will drive by motor coach to Cirencester, Bibury (where a trout farm will be inspected) and Chedworth (where a fine example of Roman villa will be seen); thence to the old town of Burford, where luncheon will be served at the "Cotswold Gateway" Hotel. The party will then proceed *via* Bourton-on-the-Water, Lower Slaughter and Moreton-in-Marsh to Broadway, where tea will be provided by the Shropshire, Worcestershire and Staffordshire Power Co. The return to Cheltenham will be *via* Stanway,

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and *en route* the company's sub-station at Hester's Way, which transforms Cheltenham's bulk supply from 66,000 to 11,000 V, will be inspected. The total distance of the tour is about 94 miles. On Saturday evening the Western Centre dinner will be held at Cheltenham. On Sunday afternoon the past-chairmen's golf cup will be competed for on the Lilleybrook course, and tea will be provided by the courtesy of Mr. J. Marshall. On Monday the Gloucester Wagon Works will be inspected.

SCOTTISH CENTRE.—Members paid their annual visit to Dundee on April 26th, 1929, and had luncheon in the Queen's Hotel. In the evening the seventh ordinary meeting of the session was held; Mr. D. S. Munro, chairman of the Scottish Centre, presided, and there was a good attendance. Two papers were read and discussed. On April 27th there was an excursion by road from Dundee to Elie, *via* St. Andrew's and the Fifeshire coast. Luncheon and tea were served in the Marine Hotel, Elie, and time was allowed for a round at golf. The return journey was made *via* Cupar.

SOUTH MIDLAND CENTRE.—A summer meeting has been arranged to take place at the Avonmouth docks of the Port of Bristol on July 2nd. Charabancs will meet the Birmingham train at Bristol and convey the party to Avonmouth along the bank of the River Avon, and the undermentioned equipment will be inspected at the docks: e.h.p. and l.p. electrical gear at the Royal Edward Dock, motor-driven grain machinery, cold-storage equipment, new intake machinery, and large squirrel-cage motors (direct switching). Tea will be provided by the Port of Bristol Authority, and will be followed by a drive to the Somerset seaside resort of Clevedon.

Institute of Metals.

A large attendance is promised at the forthcoming German meeting of the Institute of Metals, to be held in Düsseldorf from September 9th to 12th. It will be not only the first meeting of the Institute to take place in Germany, but will also constitute the first gathering of metallurgists and engineers to take place in Germany since 1914. The Conference is to be held by invitation of the Verein Deutscher Ingenieure and of the Deutsche Gesellschaft für Metallkunde. In addition to papers by members of many nationalities, there will take place visits to works as well as gatherings of a social character.

Institutions of Engineers and Shipbuilders.

At the joint summer meeting that the North-East Coast Institution of Engineers and Shipbuilders is holding with the Institution of Engineers and Shipbuilders in Scotland from July 2nd to 4th at Newcastle-upon-Tyne, the papers to be read will include one on "Developments in the Uses of Electricity" by Mr. R. P. Sloan, C.B.E. The Duke of Northumberland has placed the Guest Hall at Alnwick Castle at the disposal of the Institutions for luncheon, which will be taken there during a visit to places of interest in Northumberland, and Lord and Lady Armstrong have invited the members attending the meeting to take tea at Cragside, Rothbury, during the course of the tour.

Faraday Society.

The annual report of the Council for 1928 shows that during the year 44 new members were elected. There were 19 resignations and three deaths; the roll at the end of 1928 was 466 members and three students.

On November 9th the Society celebrated the 25th anniversary of its formation, which took place on June 30th, 1903.

Its financial position continued to improve during the past year. The income and expenditure account showed a balance of £541. Only as recently as 1926 was the Society first able to show a credit balance after the war; although on January 1st, 1928, there was an overdraft at the bank amounting to £188, it was cleared off, and a cash balance of £129 was carried forward to 1929.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. E. W. HILL, M.I.E.E., chief engineer of Aron Electricity Meter, Ltd., has been elected to fill the chairmanship of the Meter and Instrument Section of the Institution of Electrical Engineers, rendered vacant by the recent sudden death of Mr. G. D. Malcolm. The appointment runs until the end of the current session (September 30th next).

It is reported that Mr. W. A. VALENTINE, C.B.E., Controller of the London Telephone Service, is retiring at the end of this month after more than 40 years' connection with the National Telephone Co. and the General Post Office.

At a meeting last week of the Sheffield Special Sub-Committee which is dealing with the appointment of a successor to Mr. S. E. FEDDEN in the post of city electrical engineer it was decided to interview eight applicants.

Hammersmith Borough Council Establishment Committee recommends that, subject to the approval of the Minister of Health, a gratuity of £600 be made to the widow of the late Mr. FRANK HILL, in recognition of his services as borough electrical engineer.

Mr. C. B. FISHER, C.B.E., is to represent the Surveyors' Institution (of which he is president) at the conference called by the Electricity Commissioners to consider matters connected with the supply of electricity in rural areas.

The Board of Trade has appointed Mr. ANDREW AGNEW, C.B.E., of the Shell Transport and Trading Company, to be a member of the National Fuel and Power Committee, in the place of Sir John Cadman, K.C.M.G., who has resigned owing to pressure of other work.

Mr. W. JACKSON, M.Sc., lecturer in electrical engineering at the Bradford Municipal Technical College, has resigned, to take effect from August 5th.

Mr. A. HUGH SEABROOK, M.I.Mech.E., M.I.E.E., has resigned his directorship of, and severed his connection with, Overhead, Limited.

The Sutton Coldfield Town Council has increased the salary of Mr. T. BLOORE, electrical engineer, from £850 to £1,000 per annum.

The Bedford Corporation Electricity Committee has appointed Mr. J. R. BLAIKIE as constructional engineer in connection with the preparation of plans, specification, &c., for the erection of the proposed switch house, at a salary of £32 per month.

Mr. F. G. TICEHURST, A.M.I.E.E., of the Lancashire Dynamo and Motor Co., Ltd., will shortly take up an appointment on the staff of the British Electric Transformer Co., Ltd.

Mr. ARTHUR C. WATTS, of the Premier Electrical Co., Tunbridge Wells, has been elected chairman of the Sussex branch of the Electrical Contractors' Association.

The marriage of Mr. FRED E. HOOPER, electrical engineer, Bradford, and Miss Irene Harrison, West Melton, took place at West Melton on May 20th.

Mr. MAURICE SIMPSON, of Shildon (Co. Durham) has been appointed assistant mains engineer to the Luton Corporation Electricity Department.

Obituary.—MR. W. R. ROGERS.—The death has occurred of Mr. William R. Rogers, district engineer in Gateshead for the Newcastle-upon-Tyne Electric Supply Co., Ltd., by whom he had been employed for 23 years.

DR. L. LUCAS.—The death recently occurred in Berlin, at the age of 65 years, of Dr. Lorenz Lucas, the chief engineer of the Accumulatoren Fabrik Gesellschaft of that city and a leading German authority on secondary batteries.

MR. G. H. WRIGHT.—We learn with regret of the death, on May 15th, of Mr. George Henry Wright, secretary of the Birmingham Chamber of Commerce and of the Birmingham Section of the British Industries Fair. Mr. Wright, who was in his 56th year, had been seriously ill for some time.

MR. J. W. BARRASS.—The funeral of the late Mr. Joseph William Barrass, of Morecambe, took place at Torrisholme last week. Mr. Barrass had been manager of the Morecambe electricity sub-station for a considerable period, but was compelled to relinquish his position owing to poor health.

MR. C. R. C. HART.—Mr. C. R. C. Hart, chairman and managing director of the Dermatine Co., Ltd., passed away on May 7th. He had been associated with the company for over 36 years, being managing director from 1911 and chairman and managing director from 1926.

MR. J. A. H. HUNT.—We regret to learn of the death of Mr. J. A. Harry Hunt at Llandudno on May 7th. Mr. Hunt had been connected with the fittings firms bearing his name for the whole of his lifetime, although he had not been actively engaged in business for a number of years. The family has been continuously engaged in the fittings business for at least four generations, and a point of interest in this connection is that the six bearers at the funeral, drawn from the present employés of his firm, had served a total of 278 years. The business is being continued under the direction of Mr. J. C. B. Hunt, the deceased's only son.

Mr. A. GRAHAM.—The death took place on May 8th at Forest Hill, of Mr. Alfred Graham. He was 72 years of age.

MR. E. J. REID.—We regret to learn of the death, on the 17th inst., of Mr. E. J. Reid, late of Reid Brothers, Engineers, Ltd. The cremation was to have taken place at Golders Green on Wednesday last.

MR. M. J. DOWNING.—We learn with regret of the death of Mr. Michael Joseph Downing, mains superintendent of the Guildford Corporation Electricity Department. Mr. Downing was involved in a motor-cycle accident on May 16th while on duty. He was 40 years of age.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

R. S. Mackereth, Ltd.—Private company. Registered May 15th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, mechanical engineers and contractors, manufacturers of and dealers in wireless apparatus, &c. The directors are:—Alice Broadbent, "Briar Cliff," 77, Claremont Road, Wallasey, Ches. (permanent); R. S. Mackereth, 56, Rock Lane West, Rock Ferry, Ches., merchant (managing director). Registered office: 11, Lord Street, Liverpool.

Marco Refrigerators (1929), Ltd.—Registered as a public company May 14th. Capital, £200,000 in 1s. shares. Objects:—To acquire the business carried on by Marco Refrigerators, Ltd., and all or any of the assets, together with the trade mark "Marco," to adopt an agreement with the said company, R. A. Fulford and A. E. Leach, and to carry on the business of manufacturers of and dealers in refrigerators, ice cream freezers and coolers, cold storage and general warehousemen, mechanical, electrical, and general engineers, &c. The first directors are:—Sir Sven W. Hansen, Bt., M.B.E., "Belwethers," Cranleigh, Surrey; R. A. Fulford, Kenley House, Kenley, Surrey; A. E. Leach, "Camber," Norbury Hill, S.W.16. The last two are directors of the vendor company. Registered office: Manor Works, Streatham Vale, S.W.16.

British Power and Light Corporation (1929), Ltd.—Registered as a public company May 7th. Capital, £2,000,000 in £1 shares. Objects:—To acquire (1) not less than 90 per cent. of the issued share capital of the North Wales Power Co., Ltd., with a view thereto to enter into an agreement with Robert Benson & Co., Ltd.; and (2) not less than 90 per cent. of the respective share capitals of the East Suffolk Electricity Distribution Co., Ltd., the Trent Valley and High Peak Electricity Co., Ltd., the South Somerset and District Electricity Co., Ltd., the West Hampshire Electricity Co., Ltd., and the Ringwood Electric Supply Co., Ltd., with a view thereto to enter into an agreement with the Power Development Co., Ltd., to carry on the business of an electric light and power company in all its branches and that of electrical engineers and manufacturers and maintainers of plant for the generation, accumulation, transmission and supply of electrical energy for light, heat and power or otherwise, manufacturers of and dealers in plant and machinery, &c. Purchase consideration: £1,050,280, £2,280 in cash and £1,048,000 in shares. The vendors of property purchased or acquired, or proposed to be acquired are: Aluminium Corporation, Ltd., Buckingham Gate, S.W.1; K. M. Clark, Wellington House, Buckingham Gate, S.W.1; W. H. McAlpine, R. McAlpine (the younger), Sir Thomas M. McAlpine, and A. D. McAlpine, 50, Pall Mall, S.W.1; Robert Benson & Co., Ltd.; and the Power Development Co., Ltd. The first directors are:—H. A. Vernet, 24, Old Broad Street, E.C.2, merchant; E. de Stein, Pinners' Hall, Austin Friars, E.C.2; C. E. Benson, 24, Old Broad Street, E.C.2; G. W. Partridge, 25a, Cockspur Street, S.W.1, engineer; G. V. Twiss, 25, Victoria Street, S.W.1. Secretary: J. Rankin. Registered office: 27, Old Broad Street, E.C.2.

H. J. Poole, Ltd.—Private company. Registered May 13th. Capital, £500 in £1 shares. Objects:—to adopt an agreement with H. J. Poole, to carry on, develop and turn to account the agencies and invention referred to therein, to carry on all kinds of agency business and that of electrical and mechanical engineers, &c. The directors are:—H. J. Poole (chairman), 1, Warwick Dene, Ealing, W.5, engineer; G. J. Poole, 7, Western Gardens, Ealing, W.5, engineer. Registered office:—Aldwych House, Aldwych, W.C.2.

Alfred H. Hughes & Co., Ltd.—Private company. Registered May 13th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of importers, exporters and manufacturers of, agents for and dealers in apparatus and accessories for wireless telegraphy, telephony or television, or in connection with the generation, accumulation, supply, distribution and employment of electricity for all purposes, &c. The subscribers (each with one share) are:—A. H. Hughes, Mansion House, Old Whittington, near Chesterfield, importer; A. H. Spalton, 25, Wellington Street, Sheffield, electrical factor. The first directors are to be appointed by the subscribers. Solicitor: M. J. Whitehead, 131, Norfolk Street, Sheffield.

Official Returns of Electrical Companies.

Hendon Electric Lamp Co., Ltd.—H. Bell, 27, Pont Street, S.W.1, and 22, Bedford Row, W.C.1, was appointed receiver and manager on May 2nd, 1929, under powers contained in debenture dated December 21st, 1928.

Liskeard Gas and Electricity Co., Ltd.—Particulars filed of £6,000 debentures authorised March 28th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital (subject to £8,000 first debentures dated 1925), the amount of the present issue being £300.

Electro-Mechanical Brake Co., Ltd.—Mortgage on freehold premises known as Eagle Works, Moor Street, West Bromwich, with machinery, &c., dated April 29th, 1929, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Tyche, Ltd.—Satisfaction in full on May 1st, 1929, of debenture dated August 29th, 1927, securing £200.

Johnson Billington Electricity Meters, Ltd.—J. J. Ure, 11a, Hart Street, W.C., ceased to act as receiver or manager on May 7th, 1929.

Lewis Thomas & Sons, Ltd.—Capital, £2,000 in £1 shares. Return dated September 5th, 1928 (filed February 21st, 1929). 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges, £2,500.

Wrexham Motor and Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1928. 1,428 shares taken up. £1,428 paid. Mortgages and charges, nil.

Nordisk Electrical Power Co., Ltd.—Capital, £10,000 in £10 shares. Return dated December 31st, 1928 (filed March 11th, 1929). All shares taken up. £20 paid. £9,980 considered as paid. Mortgages and charges, nil.

C. B. King (Magnetos), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1928 (filed February 19th, 1929). All shares taken up. £1,000 paid. Mortgages and charges, nil.

Willett & Robinson, Ltd.—Capital, £7,000 in 3,000 "A" cumulative preference, 1,000 "B" cumulative preference, and 3,000 ordinary shares of £1 each. Return dated August 14th, 1928 (filed February 9th, 1929). 2,000 "A" preference and 2,000 ordinary shares taken up. £4,000 paid. Mortgages and charges. £390. Return of allotments, made up to February 8th, 1929, shows a further 150 preference and 150 ordinary shares allotted, payable in cash and fully called up.

Galliers (Wholesale), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1928 (filed March 25th, 1929). 100 shares taken up. £50 paid, £50 calls unpaid. Mortgages and charges, nil.

Albany Accumulators, Ltd.—Capital, £1,000 in £1 shares. Return dated September 21st, 1928 (filed April 8th, 1929). 206 shares taken up. £202 paid. £4 considered as paid. Mortgages and charges, nil.

Burgoyne Manufacturing Co., Ltd. (old company).—E. D. Hine, Abbey House, Victoria Street, Westminster, ceased to act as receiver or manager on March 31st, 1929.

Nuneaton Engineering Co., Ltd.—E. J. Patterson, Throgmorton House, 15, Copthall Avenue, E.C., was appointed receiver and manager by Order of Court, dated March 23rd, 1929.

Johnson & Tanner, Ltd.—Charge on premises at Worcester Park, Surrey, dated May 3rd, 1929, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £250.

Cleethorpes Radio Supply, Ltd.—Issue on May 1st, 1929, of £200 debentures, part of a series already registered.

Bower Electric (1926), Ltd.—Particulars filed on May 2nd by permission of the Court of £19,992 debentures authorised February 23rd, 1929, and covered by trust deed of same date, charged on certain neon electric tube signs comprised in hire agreements and the company's other assets, present and future, including uncalled capital, the amount of the present issue being £294. Trustees: J. de la Valette and H. G. Foice, 6, Austin Friars.

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Forum & Co., Ltd.—Satisfaction in full on April 2nd, 1928, of debenture dated January 9th, 1926, securing £10,000 and premium of 6 per cent. (Notice filed May 7th, 1929).

Barrett & Morris, Ltd.—Capital, £100 in £1 shares. Return dated July 26th, 1928 (filed April 20th, 1929). All shares taken up. £2 paid. £98 considered as paid. Mortgages and charges, nil.

William Johnson & Co. (Sheffield), Ltd.—Capital, £2,500 in £1 shares. Return dated December, 31st, 1928 (filed April 20th, 1929). 2,025 shares taken up. £1,025 paid. £1,000 considered as paid. Mortgages and charges, nil.

Melville Production Co., Ltd.—Capital, £300 in £1 shares. Return dated December 28th, 1928 (filed April 12th, 1929). All shares taken up. £300 paid. Mortgages and charges, nil.

E. Goldston, Ltd.—Capital, £2,500 in 2,250 preferred ordinary shares of £1 each, and 5,000 founders' shares of 1s. each. Return dated July 11th, 1928 (filed March 23rd, 1929). 1,282 preferred ordinary and 5,000 founders' shares taken up. £200 paid on 200 preferred ordinary shares. £1,332 considered as paid on 1,082 preferred ordinary and 5,000 founders' shares. Mortgages and charges, nil.

Marshall Electrical Co., Ltd.—Capital, £3,000 in 2,300 preference and 700 ordinary shares of £1 each. Return dated March 30th, 1928 (filed April 2nd, 1929). 2,300 preference and 682 ordinary shares taken up. £2,302 paid. £680 considered as paid. Mortgages and charges, nil.

City Notes.

Oriental Telephone and Electric Co., Ltd.

The annual meeting was held on May 14th, Sir A. Henry McMahon (chairman) presiding. In presenting the report and accounts (*vide* ELEC. REV., May 10th, p. 842), the chairman said that the work of installing the new automatic exchange equipment at Singapore was well in hand, and the new exchange should be in full working order shortly after the close of this year. The increase in the number of new exchange lines had not been quite so marked this year as it was last, due mainly to adverse trade conditions. These, however, were passing, and the company could look forward to the renewed expansion of the Singapore branch. The Mauritius branch was the one weak spot in their field of operations. The new scale of charges fixed by the Government of Mauritius came into force last May, but met with a certain amount of hostility, and there was something in the nature of a boycott at the outset. As, however, people gradually realised that the new rate was both fair and equitable, a return to a more reasonable frame of mind by telephone users might be anticipated. After referring to the operations of the associated companies in Bombay, Bengal, Madras, Rangoon and Hong Kong, the chairman moved the adoption of the report, and the motion was carried.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

Alphian Wireless, Ltd.
Auto-Electrics, Ltd.
British Glowlamp & Valve Co., Ltd.
Cambrian Electricity Supply Corporation, Ltd.
Diesel Erection and Repairs Co., Ltd.
Elco Electric Mfg. Co., Ltd.
Electric Coils, Ltd.
Electrical Insulating Composition Co., Ltd.
Electricity, Gas, Share, Debenture, Investment and Guarantee Trust, Ltd.
Essex Radio (Ilford), Ltd.
Headphones (Manchester), Ltd.
Lighting and Power Finance Corporation, Ltd.
London and South Wales Electrical Engineers, Ltd.
Luen Electrical Supplies, Ltd.
Magneto, Accumulator and Generator Services, Ltd.
Radio and Electrical Supplies (Bolton), Ltd.
Radio Appliances, Ltd.
Radio Engineering Co., Ltd.
Radio Experimental Co., Ltd.
Roddis Electric, Ltd.
Rubber Cables, Ltd.
Shaftesbury Wireless and Engineering Co., Ltd.
Spa Radio Co., Ltd.
Universal Moulded Insulators, Ltd.
Victor Radio, Ltd.
Vinco Wireless Co., Ltd.
Willesden Electric, Ltd.

Official Notice re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Cogent Electrical Co., Ltd.
Sun Power Co. (Eastern Hemisphere), Ltd.

Nigerian Electricity Supply Corporation, Ltd.

Presiding at the recent statutory meeting, the chairman (the Hon. Lionel Holland) reviewed the results of the capital issue made last month and spoke of the present position and future prospects of the company. He said that the cost of fuel in Northern Nigeria increased working costs considerably and the tin-mining companies would be eager to take a supply of electricity from the company; there was no question of a demand existing for the power which the company would generate. They had entered into 15-year contracts with several of the leading mines to take the whole of the power generated up to 6,000 h.p. on mutually advantageous terms. It was anticipated that the financial results when the installation was in operation would make the participating rights of the preferred shares of substantial value. The plant was on order and constructional work was well advanced. The storage reservoir was expected to be completed by the end of March, 1931, but generation would commence before that. It was expected that next year's revenue would be sufficient to pay the fixed dividend on the preferred ordinary shares.

Lancashire Electric Light and Power Co., Ltd.

The report for the year ended March 31st last shows that the trading profit of the Parliamentary Company (the Lancashire Electric Power Co.) plus interest receivable, amounted to £238,512, to which is added £3,000 brought forward, making £241,515. Of this £13,927 has been appropriated towards income tax, £50,000 for depreciation, &c., and £3,186 carried forward, leaving a balance of £174,401, which has been paid to the Limited Company with other amounts, making a total of £187,063. The balance at credit of profit and loss account of the Limited Company is £150,885, and to this is added £3,110 brought forward, making £153,995. After meeting preference dividends, a dividend of 7½ per cent. is paid on the ordinary shares and £3,308 is carried forward. Good progress has been made with the erection of the Kearsley generating station and the first section will be brought into commission in the autumn of this year. The electrical energy generated or purchased increased from 202,668,129 to 237,279,437 kWh, and the maximum load rose from 92,700 to 104,400 h.p.

Anglo-American Telegraph Co., Ltd.

Presiding at the annual meeting on May 14th, Lord Cochrane (chairman) referred with regret to the death of Mr. R. H. Benson, a director, and said that his son, Major R. Benson, had been elected to fill the vacancy. The relationship of the company with the Western Union Co. continued to be harmonious, and that company had kept the cables in excellent condition. The past year had been one of great activity in the cable world, notably the great merger of wireless and cables. Wireless telegraphy would never entirely supersede cable telegraphy, and in support of that statement he pointed out that the cable receipts of the Western Union had increased during the past year, while the volume of traffic handled was greater than that of any other year. The report and accounts were adopted.

Cawnpore Electric Supply Corporation, Ltd.

The accounts of this company were reviewed in our issue of May 10th (p. 842). The annual meeting was held on May 14th, when Mr. J. G. B. Stone, the chairman, said that the electrical energy sold for lighting and fans increased by about 11 per cent., for power by 4 per cent., and public lighting and special contract supplies each showed an increase of 8 per cent. The maximum supply demanded rose by 12 per cent. The year under review had been one of great depression in the cotton trade, but they were nevertheless steadily increasing their connection among the various industries in Cawnpore, and as a result of last year's experience, they had been able to make reductions in the charges for power purposes. The demand upon their generating plant was approaching the limit, and they had now under consideration the extension of plant to provide for the anticipated increase in demand. The report and accounts were adopted.

Prospectus.

Marco Refrigerators (1929), *Ltd.*—Last week this company offered for public subscription 2,420,000 shares of 1s. each at par (£141,000) out of a total authorised capital of £200,000. The prospectus stated that applications for over 2,000,000 of these shares had already been received. The company has acquired the business of the manufacturers of "Marco" refrigerators, including an automatic electric model. The purchase consideration is the allotment of 1,080,000 shares as fully paid, and £6,000 in cash. It is estimated that the working capital available from the issue will be about £94,000. Further details of the concern appear in our "New Companies" section to-day.

Anglo-Portuguese Telephone Co., Ltd.

The directors have sent a circular to the holders of the ordinary and "A" ordinary shares offering them 113,012 new ordinary shares of £1 each at par. These will be allotted in the proportion of one new share for each five shares already held. The circular states that the issue is to provide for the

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expansion of the company's business and that the present market price of the existing ordinary shares is about 25s. per share. The new shares will rank *pari passu* with the existing ordinary shares as from January 1st, 1929. The offer remains open until June 4th and holders of bearer shares are required to deposit their warrants with the company on or before May 27th in order to qualify for the offer. The Portuguese public are being offered 5,000 new shares; these will be offered in the first place to the company's subscribers.

Cable, Telephone and General Trust, Ltd.

Presiding at the annual meeting on May 10th, Sir Alexander Roger (chairman), in presenting the report and accounts, said that increased business had been transacted by means of short-term borrowing, and while it was not proposed at the present time to create any additional share capital, it was probable that further capital would be issued in the not far distant future. The company had sought to maintain a distribution of its interests over different kinds of securities in the various countries throughout the world. A firm foundation had been laid on which it could build, and it looked forward to the future with considerable confidence. He referred with regret to the death of Mr. J. Lee, a director. The report and accounts were adopted.

Simms Motor Units, Ltd.

Speaking at the recent annual meeting of the company, the chairman (Mr. F. R. Simms) said that their electrical service at home and overseas was efficient and highly appreciated. The Standard Insulator Co., Ltd., whose entire capital was held by the company, had proved an excellent investment. The increased demand was necessitating the extension of the works. The company's own new works, extending over 6½ acres, at East Finchley, had just been completed. Partly to finance this, 100,000 £1 6 per cent. preference shares were issued in February. They had formed a South African company, and intended to extend their successful branch policy over the entire British Empire, and possibly other overseas countries.

Siemens Bros. & Co., Ltd.

The directors' report for the past year shows that the profit again declined slightly—from £356,735 to £335,758. The ordinary dividend is, however, maintained at 7½ per cent. The amount carried forward is increased from £250,041 to £313,360. This is accounted for by the fact that for 1927 £7,560 was reserved for taxation and £93,200 was written off debenture discount. The report states that the company's turnover was well maintained during the year, and the falling-off in profits was due to an increased proportion of overseas business in which competition is more severe, leading to lower prices. Owing to the small demand for submarine cables that department of the Woolwich works was idle to a great extent. Meeting: May 27th.

Iron Trades Employers' Insurance Association, Ltd.

The report for the year ended December 31st last records a premium income of £685,543, to which are added interest, &c., £112,396, and a balance of £48,278 brought forward, making £846,217. Compensation and incidental expenses absorbed £505,697, and management expenses, &c., £83,267, leaving a balance of £257,253. Out of this it is proposed to return 20 per cent. of the Workmen's Compensation premium paid for 1928, together with a bonus of 12½ per cent. on which income-tax has already been paid. The report refers with regret to the death of Mr. W. Jackson, a director. At the annual meeting on May 9th the report and accounts were adopted.

The Cable-Wireless Merger.

Last week Cables & Wireless, Ltd., issued to the stock and shareholders of the three telegraph companies and the Marconi Co. full particulars of the terms upon which the exchange of shares is to take place. The broad principles of the scheme were set out in our issue of April 19th, p. 720. The offer remains open until June 28th, but the time can be extended until July 31st if necessary. The circular gives particulars of the directors of the merger company, showing their holdings in the constituent companies.

Last week the Dominion House of Commons, Canada, passed a Bill ratifying the agreement for the sale of the Pacific Cable and associated systems to the merger company.

Sphinx Electric, Ltd.

The statutory meeting was held on May 14th, when Sir A. C. T. Beck (chairman), who presided, said that the company's sales had shown a large advance. Their manufacturing programme included a greatly-increased output in readiness for the coming lamp season. The Quickfix Electrical Fittings Co., had made them sole distributors of its products in the British Isles, with an option on the world rights. Many important contracts had been received and an advanced stage had been reached in negotiations for the acquisition of a large provincial manufacturing house with a factory in Birmingham and branches in the most important industrial centres. Other developments were in contemplation.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to the officially quoted:—

Barcelona Traction, Light and Power Co., Ltd.—237,250 ordinary shares of $50 each, fully paid; 251,934 7 per cent. non-cumulative participating preference shares of $100 each, fully paid; and £1,677,060 5 per cent. first mortgage 50-year bonds within Nos. A1 to A127,500 and A174,501 to A320,000 (£20) and B1 to B25,550 (£100).

Enfield Cable Works, Ltd.—100,000 ordinary shares of £1 each fully paid, Nos. 250,001 to 350,000.

Barcelona Traction, Light and Power Co., Ltd.

The annual meeting was held in Toronto on May 16th. Mr. Miller Lash (vice-chairman), who acted as chairman, said that owing to the increased demand for power, the net consumption for the first four months of the current year showed an increase of 15 per cent. over the corresponding period of last year. The work on the San Lorenzo plant was progressing satisfactorily, but the unprecedented drought which had prevailed throughout Spain during the past year had reduced the company hydro-electric resources considerably, necessitating an unusual amount of steam production, with a consequent increase in the cost of operation. The report and accounts were adopted, and Sir Thomas White was elected to the board.

Telephone Co. of Pernambuco, Ltd.

The report for 1928 states that the period represents the first complete year's working of the automatic system. After charging the full amount of the interest on the 8 per cent. registered debentures there is a loss on revenue account of £5,063, from which is deducted a credit balance brought forward of £732, leaving a debit balance of £4,331. The first zone of toll line extensions was inaugurated in December, and work is progressing satisfactorily on the second zone. A majority of the company's shares having passed under American control, changes have been made in the directorate.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The profit for the year ended December 31st, 1928, was £16,545, as compared with £26,842 in 1927. A balance of £781 brought forward, and £446 net repayment of income tax claimed are added, making £17,772. From this £7,000 is set aside for depreciation. The directors recommend a dividend of 6 per cent. on the ordinary shares, leaving £623 to be carried forward.

Lima Light, Power and Tramways Co.

The gross profit for the year ended December 31st, 1928, was £P164,910; to this is added £P269 brought forward, and after meeting bond interest and preference dividends, there remains £P79,591. It is proposed to place £P36,000 to amortisation of installations fund, 5 per cent. to reserve, 5 per cent. to directors, and to pay a dividend of 75 centavos per share on the ordinary shares (as for 1927), leaving £P1,063 carried forward.

National Electric Construction Co., Ltd.

The profit for the year ended December 31st last was £23,466, and after deducting debenture interest, &c., and adding £5,555 brought forward, there remains £23,605, which it is proposed to distribute as follows:—Special reserve, sundry debtors, £9,000; general reserve, £2,200; dividend of 10 per cent., less tax (as in 1927), £6,800; carried forward, £5,605.

Glenfield & Kennedy, Ltd.

The profit for the year ended March 31st last was £79,296, as against £43,505, to which was added £45,461 brought forward, making £124,757. Of this it is proposed to place £5,000 to the staff pension fund, and £20,000 to reserve. The dividend remains at 10 per cent., a final distribution of 6 per cent. being recommended, and £63,257 is carried forward.

Ransomes & Rapier, Ltd.

The directors report a net profit of £11,888 for 1928, against £2,111 for 1927. A final dividend on the ordinary shares of 3 per cent. is recommended, making 5 per cent for the year (free of tax).

Richard Johnson & Nephew, Ltd.

A dividend at the rate of 8 per cent. calculated from the date of calls to March 31st has been declared on the ordinary shares.

Hydro-Electric Securities Corporation.

An initial quarterly dividend of 25 cents per common share has been declared.

Adelaide Electric Supply Co., Ltd.

An interim ordinary dividend of 6 per cent. free of tax has been declared.

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Melbourne Electric Supply Co., Ltd.

An interim dividend of 5 per cent. free of tax has been declared on the consolidated ordinary stock.

Austrian Companies.

The *Felten and Guilleaume Cable Works Co.* states that it was not possible in 1928 to maintain the level of the production in the previous year, although in general the works were sufficiently occupied. The net profits amount to 1,920,000 schillings (against 1,740,000 sch.), and the dividend is raised from 11 to 12 per cent.

The *Austrian Brown-Boveri Co.* reports an increase in the turnover in 1928. Among the notable orders were those received from the Russian trading representatives on the basis of guarantees given by the city of Vienna. Out of net profits of 974,000 sch. a dividend at the rate of 14 per cent. is being declared, as against 762,000 sch. and 12 per cent. in 1927.

The *A.E.G.-Union Electricity Co.*, Vienna, states that reserve was manifested by the industries in the allocation of orders in 1928, but the company was still engaged on contracts for the Federal Railways, the Vienna station, and various hydro-electric works. A dividend of 7 per cent. has been declared out of net profits of 550,000 sch., as compared with 6 per cent. in 1927.

German Companies.

The *Felten and Guilleaume Co.* states that activity in 1928 was satisfactory, although the orders placed by the Reich postal and railway authorities did not by a long way reach the level of former years. Abroad the company was still faced with severe foreign competition, although steps had been taken with regard to international understanding. The submarine telephone cable between Sweden and Finland was completed. The experience gained and the progress of technical work had rendered it possible for the directors to enter into negotiations concerning submarine telephone cable schemes. Including the German subsidiaries and the Austrian company, the total turnover last year amounted to 225 million marks, and the net profit amounted to 5,580,000 marks, as compared with 4,110,000 marks in 1927. The dividend is increased from 6 per cent. to 7½ per cent.

The *Company for Electrical Undertakings*, Berlin, reports that the growth in the supply of energy from the electricity works, which amounted to 27.5 per cent. in 1927, was only 13.5 per cent. in 1928, reflecting the decline in the general trend of German economic life. As the undertakings in which the company is interested are spread all over Germany, it is assumed that these figures can be treated as a fairly sure indication of the situation. The report records the sale at a good profit of the company's participation in the new shares in the Spanish-American Electricity Company and in a Belgian company. The accounts show net profits of 6,470,000 marks, as compared with 6,220,000 marks in 1927, and the dividend remains at 10 per cent.

The *Lloyd Dynamo Works Co., Bremen*, after providing for depreciation, reports a net profit of 12,000 marks, which is carried forward.

The *Electricity Co. (late Schuckert)*, Nuremberg, reports net profits of 6,523,000 marks for 1928, as compared with 4,637,000 marks in the preceding year. The dividend is raised from 8 per cent. to 11 per cent.

The *North German Sea Cable Works Co.*, of Nordenheim, a subsidiary of the Felten and Guilleaume Co., reports a net profit of 8,000 marks, which is carried forward.

The *Hartmann and Braun Co.* reports a decline in the net profits from 346,000 marks in 1927 to 267,000 marks last year, although the dividend remains at 10 per cent. The directors ascribe the less favourable results to increased salaries and wages, which were not met by a corresponding advance in sale prices.

French Companies.

The *Société des Téléphones Grammont* records profits of 3,139,000 fr. for 1928 (against 1,617,000 fr.). Two million fr. has been applied to depreciation. The share capital is to be increased by 18 million to 30 million fr. in connection with an agreement entered into with the German Berliner Telephone Co., which will enable the French company to embark upon new branches of the telephone industry.

The *Compagnie Générale d'Applications Electriques* records net profits of 453,000 fr. for 1928 and a dividend of 10 per cent. is being paid.

The *Société des Ateliers de Constructions Electriques de Delle* reports net profits of 949,000 fr. for 1928; a dividend of 90 fr. is declared on the fully-paid shares.

The *Compagnie des Entreprises Générales Electriques et Industrielles (G. Giraudon)* records net profits of 4,322,000 fr. for 1928, the dividend being 27.65 fr. per share.

The *Société des Forges et Ateliers de Constructions Electriques de Jeumont* recommends an increase in the dividend from 30 fr. per share to 32.50 fr. for last year.

The *Société de l'Electrification Industrielle* (late *Loustau, Petit et Cie*) reports net profits of 3,019,000 fr. for 1928. A dividend of 14 per cent. is being paid on the registered shares.

The *Compagnie Continentale Edison*, Paris, reports profits of 2,023,000 fr. for 1928 (against 1,880,000 fr.). The dividend is maintained at 8 per cent.

Stocks and Shares.

Tuesday Evening.

The market in the shares of a certain number of provincial electricity supply companies continues to be lively and active, attracting a widening circle of public interest, while the erratic movements in prices offer scope for speculative dealings. A few of the shares in manufacturing companies are also animated—Associated Electricals being the leading feature. It can be said without fear of contradiction that the market for electricity supply shares and electrical equipment issues is one of the very few round the Stock Exchange which is not overborne by the proximity of the General Election. Interest in wireless and cable descriptions has died down to a noticeable extent, dealings in Marconis, for instance, being now considerably less in volume than was the case a month or so ago. New York attention is evidently at the back of the liveliness that characterises the electricity group. There has been a large demand for the up-to-date map, issued by a leading firm of Stock Exchange dealers, that shows in different colours the various areas of the groups which operate a large part of the country's electricity supply industry.

New Issues.

The issue of British Power & Light Corporation 1,600,000 shares of £1 each, received none too ardent a response from the public, underwriters being left with more than half the issue. The price fell to 1s. 3d. discount, at which there was a fair amount of support forthcoming. Lancashire Electric new shares, after being 1s. premium bid, reacted a few pence because of the falling-due of the call that made the shares fully paid. This seemed to restrain further buyers, and it would appear as though some of the stag brigade have not yet completed their sales. Clyde Valley new preferences are better at 13s. 6d. premium. Young Accumulator shares further drooped to 1s. 6d. discount. Demand for Egham and Staines shares, after the list for the new issue at 30s. had closed, has resulted in a rise to 37s. Gossip is busy with absorption possibilities in connection with this company. New issues are said to be in contemplation by several well-known provincial supply undertakings.

Electricity Supply Companies.

Excitement during the past few business days has run principally upon such shares as Northampton Electrics, Associated Electrical Industries, and, to a smaller extent, Metropolitan Electrics and County of London Electrics. The market as a whole, however, has enjoyed a considerable slice of public attention, though, on the intervention of the holidays, profit-taking became very obvious, Northampton, which had been up to 46s. 6d., reacting to 44s. County of London held most of their recent rise, on the expectation of an early issue of new shares at a bonus price. Metropolitans have gone back to 46s. 3d. The offer of 50s. for Shropshire "A" and "B" shares led to the vigorous buying of Northamptons which served to put up the price to the levels just mentioned, but, as soon as the support ceased, it appeared as though local people were selling their shares, and taking what must have been excellent profits. Midland Counties shed 1s. after their last week's advance of 4s.; Midland Electric Power Corporation put on 1s. 9d., advancing to 37s. 6d. Chelsea ordinary moved up to 26s. 6d. Other movements in this department have been confined to a few pence apiece. Atlas ordinary are 27s. 3d.

Cables and Wireless "Plan."

Cables & Wireless, Ltd., has issued a lengthy Plan and Deposit Agreement to holders of Marconi shares, Eastern Telegraph ordinary stock and Eastern Extension and Western Telegraph shares The Plan recapitulates statements the gist of which has been common knowledge for some time past. It contains the offer to proprietors of the ordinary share capital in the three cable companies, and of the ordinary and preference shares in Marconi's Wireless Telegraph Co., to exchange their present holdings for fully-paid shares in Cables and Wireless, Ltd., the capital of which is to be 53 million pounds sterling. To accept the offer, shareholders must deposit their certificates with the Bank of England and their holdings will become "assented" stock exchangeable in due course, after the plan becomes operative, for shares in Cables and Wireless, Ltd.

Waiting for Dividends.

The point upon which there is bound to be some little disappointment in the minds of cable shareholders, is that of dividend payments. For immemorial years, the ordinary holders in the Eastern group have been in the habit of receiving their dividends quarterly. Under the new proposals, those people who exchange will get the preference dividends half-yearly, the first one being split into two instalments, payable in July and September this year. But on the "A" and the "B" ordinary shares, no dividend can be declared before the accounts for the period ending December 31st, 1929, have been passed by shareholders in Cables & Wireless, Ltd., in general meeting to be held about the middle of 1930. It is clear, therefore, that shareholders will have to wait for over a year from now before they are paid any income on their

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"A" and "B" shares. This looks like a serious disability, although closer examination will show that, as the preference dividends are to be met half-yearly, the time of waiting for a return on the ordinary shares is of no very serious importance.

Effect upon Share Values.

Eastern Telegraph ordinary stock has receded 2¼ points to 277½. Eastern Extensions and Westerns remain at 28. Globe ordinary have risen to 29. The Marconi trio is ex dividend, the 10s. shares at 4⅛, the £1 at 4 13/16, and the preference at 4⅝. Canadian Marconis receded to 32s. 6d. Burndept Wireless are dull at 4s. 9d. Last week's gain of 20 points in International Telephone and Telegraph has been followed by a reaction of 14, leaving the price at 266. The company, through its subsidiary the International Standard Electric Corporation, has bought a substantial interest in Ferdinand Schuchhardt's Berlin telephone and telegraph works with the object of obtaining, *inter alia*, a foothold in Germany's national telephone, telegraph and radio business. American Telephone and Telegraph is 10 points lower at 220. The Anglo-Portuguese Telephone is issuing, as rights, one new share at par for every five old shares held. Oriental Telephones are up to 60s.

Lower Profits.

British Electric Transformer preference have fallen to 13s. 9d. on the reduction in the year's profit to £14,700, as compared with £53,700 in the previous twelvemonth. Payment of the last half-year's preference dividend has been postponed. Price-cutting is held largely to blame for the shrinkage in profits. The company has orders in hand that will provide work for the next two or three years. Siemens profits are £21,000 down, against those of 1927, at £335,750. The dividend on the ordinary shares is maintained at 7½ per cent. less tax. At 27s. 6d. the price shows no change on the week. There is on offer a fair line of the company's 10 per cent. cumulative preference shares at 32s. 6d., which at this price yield £6 3s. per cent. on the money. Dividends are due in January and July, and require £55,000 to meet the annual service. On last year's profits of £335,700 the dividend is therefore covered six times over.

Equipment and Manufacturing.

Interest in General Electrics has been almost eclipsed by that which is now aroused over Associated Electrical Industries. The prices of the two shares met, at 55s., General Electrics being ⅛ down, Associated 10s. up, in their reaching of the common level. Henleys are a good market, in spite of the nominal quotation showing no change at 6 1/16. British Aluminium picked up to 51s. 3d. Brush ordinary at 28s. 9d. hold their modest improvement. This price still includes the dividend of 10 per cent. less tax, almost 1s. 7d. per share net, allowing for which Brush ordinary return £7 8s. per cent. on the money. British Insulated have gained 2s. 6d. at 3¾. At last week's meeting of the Anglo-American Telegraph Company, the chairman claimed that the wireless telegraph would never entirely supersede cable telegraphy. He mentioned that the Western Union Company, which controls the Anglo-American Telegraph, had kept the cables in excellent condition.

"Dollar" Stocks.

Hydro-Electric Securities Corporation rose 1¾ to 36¼, upon declaration of a maiden dividend of 25 cents per share, described as a quarterly distribution. This company, and the International Holdings, were the two upon whose shares especial interest focused at the time of Mr. Alfred Lowenstein's death. The prices of the shares in both these companies were the subject of a collapse from the effects of which they have never properly recovered. International Holdings stand at 8½. The company has declared a half-yearly dividend of 10 cents per share. Brazilian Tractions in this section picked up to 56½: the preferred gained several points at 185. Mexican Light and Power common and preferred are heavy. Pennsylvania Water and Power have again given way, being now 85½. Montreal Light and Power moved upwards, to 108. Barcelona Tractions are 2½ down at 50: the chairman in a recent speech spoke optimistically of the prospects for the current year. The Barcelona Exhibition opened last Sunday. The unprecedented drought in Spain last year reduced considerably the company's hydraulic resources, and thereby increased the cost of operations.

Miscellaneous.

Whitsun's lovely weather led to a little inquiry for Home Railways, in which the Undergrounds were included. Metropolitan consolidated rose 1 to 61. Undergrounds are steady. The London tramway issues retain their previous firmness, and attract increasing business. Better tendencies are observable, also, amongst iron and steel shares, Vickers, for instance, being 11s. 1½d. Engineering descriptions are firm. The price of rubber made a valiant effort to attain 1s. per lb., and all but achieved it. The share market developed a mild hopefulness. Power Corporation of Canada shares are 4 points down, at 103½. Kalgoorlie Electric Power and Lighting ordinary shares are 10s.: the dividend of 6 per cent. is the same as that of a year ago, but the profit of £16,540 is about £10,000 lower. British Electric Traction preference is better at 129: the deferred stock holds its last week's advance to the spectacular figure of £1,000.

Share List of Electrical Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price May 21 1929.	Rise or fall	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/6	+6d.	5 5 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1		8	32/6	—	... ...
County of London	1	7½	10	55/-	—6d.	3 12 9
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	57/6	+3d.	3 13 6
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	2 5/16	—1/16	3 18 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	33/-	—1/-	3 18 9
Mid. Elec. Power	1	15	8	1⅞	+1/6	4 5 4
Newcastle-on-Tyne Ordinary ...	1	6	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	—	5 0 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	43/3	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/-	—	4 14 2
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	"	3	3½	61	+1	5 14 8
do. District	"	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	24/-	—	5 13 10
do. do. Income ...	Bonds	6	6	114	—	5 5 2
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	"	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	2½	—	5 18 0
Eastern Extension	10	10	10	28	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	277½	—2½	*3 13 3
Globe Tel. and T. Ord.	10	10	10	29	+½	*3 9 0
do. do. Pref.	10	6	6	11⅜	—	5 5 6
Great Northern Tel.	10	20	—	33	—	... ...
Indo-European	25	10	10	52½	—	*4 11 9
Marconi	10/-	10	20	4⅛xd	—1/16	... ...
Marconi-Marine	1	12½	15	3¼	—	4 12 4
Oriental Telephone Ord.	1	12	12	3	+1/16	... ...
Western Telegraph	10	10	10	28	—	3 11 5
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	3⅝	—1/16	8 0 0
do. do. 5% Deb. ...	Stock	5	5	76½	+2	6 10 9
British Electric Traction Def. Ord.	"	5	5	1000	—	... ...
do. do. Pref. Ord.	"	8	8	129	+1	6 4 0
Brazil Traction	100	7	8	56½	+1	3 10 9
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	94½	—1	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	18/-	—	... ...
London United Tram Deb. ...	Stock	4	4	64	—	6 9 1
Mexico Trams. 5% Bonds	—	5	5	72½	+1	6 19 10
Mexican Light Common	100	Nil	Nil	72½	—5	... ...
do. 7% Pref.	100	7	7	72½	—2	9 13 3
do. 1st Bonds	—	5	5	76½	—	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...
MANUFACTURING COMPANIES.						
		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	55/-xd	+10/-	3 13 4
Babcock & Wilcox	1	13	15	64/6	—	*4 13 0
British Aluminium Ord.	1	10	10	51/3	+9d.	*3 13 9
British Elec. Transformer Pref. ...	1	7	7	13/9	—1/8	9 4 5
British Insulated Ord.	1	15	15	8¾	+1/8	4 0 0
Brush Ord.	1	10	10	28/9	—	7 3 0
Callenders	1	15	15	4⅝	—	8 9 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 3
do. 5% Deb.	Stock	5	5	86½	—	5 15 1
Electric Construction	1	7½	7½	18/9	—	8 0 0
Enfield Cable Ord.	1	20	20	4½	—	4 14 1
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	8/3	—	5 10 3
Gen. Elec. Pref.	1	6½	6½	28/6	—	3 12 9
do. Ord.	1	7½	10	2¾	—⅛	4 1 3
Henley...	1	25	25	6 1/16	—	5 4 0
do. 4½% Pref.	5	4½	4½	4¼	—	... ...
India-Rubber	1	Nil	Nil	18/9	—	5 10
Johnson & Phillips	1	12½	10	36/3	—	5 9 1
Siemens Ord.	1	7½	7½	1⅜	—	*4 13 3
Telegraph Construction	12	10	10	24½	—	

* Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during April.

THE Board of Trade Returns of imports and exports during April show that it was a good month so far as electrical products were concerned. The export total of £1,674,234 was the highest reached since March, 1928, and represented an increase of over £300,000 upon the preceding month's figure. An examination of the items reveals that this increase was very largely due to greater shipments of wires and cables. Insulated wires and cables were £56,799 up, non-submarine telegraph wires and cables rose by £105,043, and submarine cable by £18,650, together accounting for an advance of £180,492. A number of the other items showed considerable rises, however, particularly telegraph and telephone instruments and apparatus (£48,441), unenumerated machinery (£35,495) and unenumerated goods and apparatus (£31,211). It will be noticed that the "unenumerated" items represent over a third of the total. There were only three decreases, that in the exports of railway and tramway motors (£36,383) being the only one of any size. As compared with the corresponding month of 1928 the position was very similar. The same items show the greatest advances, the largest being one of £70,043 in unenumerated goods and apparatus. The net rise in the machinery section was only about £9,000, the rise in unenumerated machinery being offset by falls in the two specified items. There were three other smaller decreases. As a consequence of the rise in exports during April the total for the completed portion of the year is now only £79,717 below that for the corresponding period of 1928. It should be pointed out that Easter fell in April last year and partly in March this year and this, no doubt, accounts for a great deal of the increases in the two comparisons.

So far as imports were concerned there was a fall of £28,787 as compared with the March total. This was attributable mainly to a decrease of £25,725 in glow lamp imports, which no doubt marks the end of the lighting season. Meters and instruments, and telegraph and telephone apparatus also declined. Against these, there were rises in the imports of the two classes of cables and in unenumerated goods and apparatus. As compared with April, 1928, there was an increase of £89,225 in imports due to larger purchases of telegraph and telephone apparatus, insulated wires and cables, unenumerated goods, &c., which were only partly offset by decreased imports of meters and instruments, arc lamps and non-submarine telegraph and telephone cables. For the first four months of the year the increase above the total for January—April, 1928, stands at £199,385.

There was a fairly general increase in the re-export section as compared with March, although the total was smaller than that of April, 1928.

The following table analyses our exports of electrical machinery during April and compares them with the corresponding month of last year :—

Destination.	April, 1928.	April, 1929.	Inc. or Dec.
	£	£	£
European countries ...	86,167	93,891	+ 7,724
Japan	4,832	10,764	+ 5,932
South America ...	34,112	28,847	− 5,265
South Africa	47,043	60,506	+13,463
British India	87,016	146,174	+59,158
Australia	75,337	71,761	− 3,576
New Zealand	38,878	15,242	−23,636
Canada	15,813	18,841	+ 3,028
Other countries ...	112,061	64,318	−47,743
Totals ...	£501,259	£510,344	+£9,085

The increases in exports to Canada, Japan, South Africa and India are satisfactory and it is noteworthy that the exports to the European Continent are being kept up. The decline in New Zealand's purchases probably reflects the slackening-off of hydro-electric development, but this is only a passing phase, for the Dominion is stated to be in a very prosperous condition. Assuming "other countries" to be non-Empire markets, the British Dominions were responsible for £312,524 of the total which points to a general improvement in Empire electrical trade.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for April. 1929.	Inc. or dec. as compared with Mar., 1929.	Inc. or dec. as compared with April, 1928.	Electrical imports for April, 1929.	Inc. or dec. as compared with Mar., 1929.	Inc. or dec. as compared with April, 1928.	Electrical re-exports for April, 1929.	Inc. or dec. as compared with Mar., 1929.	Inc. or dec. as compared with April, 1928.
Electrical goods and apparatus (unenumerated)	£278,159	+ £31,211	+ £70,043	£132,284	+ £7,727	+ £31,277	£6,597	− £814	+ £320
Insulated wires and cables ...	285,241	+ 56,799	+ 55,196	65,814	+ 6,367	+ 14,950	609	− 225	+ 192
Glow lamps	52,638	+ 12,990	+ 11,427	23,376	− 25,725	− 376	697	− 291	− 498
Arc lamps and parts ...	2,040	+ 1,409	+ 469	366	− 465	− 3,743	41	+ 39	+ 25
Batteries and accumulators ...	76,151	− 1,039	− 5,629	42,625	− 2,163	+ 5,036	198	+ 96	− 364
Meters and instruments ...	30,033	+ 3,984	− 3,424	14,525	− 8,402	− 5,848	1,298	+ 526	—
Carbons	698	+ 540	− 21	21,769	+ 3,184	+ 7,902	218	+ 202	+ 156
Switchboards (not telegraph or telephone)	5,057	− 574	+ 1,357	131	− 26	+ 99	6	+ 6	− 13
Electrical Machinery—									
Electrical machinery (unenumerated)	329,092	+ 35,495	+ 57,315	145,977	− 3,826	− 2,348	11,845	+ 5,640	− 2,531
Railway and tramway motors	15,578	− 36,833	− 443	—	—	—	—	—	—
Other motors and generators ..	165,674	+ 25,427	− 47,787	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	145,568	+ 105,043	+ 68,776	6,071	+ 2,540	− 3,420	—		− 89
Submarine telegraph and telephone cable	21,264	+ 18,650	+ 8,964	—	—	—	—	− 4	—
Telegraph and telephone instruments and apparatus ...	267,041	+ 48,441	+ 28,500	90,299	− 7,998	+ 45,666	4,662	+ 2,122	+ 2,039
Totals	£1,674,234	+£301,543	+£244,743	£543,237	− £28,787	+ £89,225	£26,071	+ £7,297	− £763
	Exports			Imports			Re-Exports		
Inc. or dec. for four months ...	− £79,717			+£199,385			−£10,202		

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London's Electricity Supply.

The Joint Authority's Report for 1927-28.

IT is only about six months ago that the London and Home Counties Joint Electricity Authority issued its first report in continuation of the series compiled by the London County Council. We have now received the second report covering the year ended December 21st, 1927, in the case of company undertakings, and that ended March 31st, 1928, in the case of municipalities.* For the first time the report is prefaced with a useful summary of the statistics; this saves a great deal of time and trouble and is to be commended. A coloured map of the area showing its division among the various supply authorities is also supplied.

The Electricity District has an area of 1,797 sq. miles, with a population (1921 Census) of 8,178,166 and an assessable value (April, 1927) of £83,340,000. At the end of the period covered there were 93 supply authorities with 1,254,507 kW of generating plant (against 1,103,647 kW in 1926-27). These authorities are classified as follows, the proportion of generating plant which they own being shown in parentheses:—Metropolitan borough councils, 16 (27.2 per cent.); extra-London local authorities, 28 (15.5 per cent.); London companies, 16 (51.2 per cent.); and extra-London companies, 33 (6.1 per cent.). Of these undertakings only three had a load factor of over 40 per cent.; there were 11 showing between 30 and 40 per cent.; 60 between 20 and 30 per cent., and 16 under 20 per cent. The figures for three undertakings were not available. The total connections rose from 1,907,489 kWh in 1926-27 to 2,170,778 kW in 1927-28; the division of these totals—municipalities 45.5 per cent., companies 54.5 per cent.—was the same in each year.

The total number of kWh sold (excluding bulk supplies to authorised undertakers) during 1927-28 was 1,493,880,881 kWh, as compared with 1,234,462,574 kWh in 1926-27, representing an increase of 21.0 per cent. The following is an analysis of the 1927-28 total:—Metropolitan borough councils, 23.1 per cent.; extra-London local authorities, 15.4 per cent.; London companies, 45.8 per cent.; and extra-London companies, 15.7 per cent. Of the total sales of energy (excluding bulk supplies aggregating 260,426,000 kWh) 39.6 per cent. was for lighting and domestic purposes (an increase of 18.5 per cent. over the previous year); 2.7 per cent. for public lighting (15.1 per cent. increase); 12.7 per cent. for traction (30.1 per cent. increase); and 45.0 per cent. for power (21.3 per cent. increase).

At the close of the period £70,592,497 (against £61,722,210) had been charged to capital account by the undertakings as a whole. This was divided up as follows: Generation, £25,924,300 (36.7 per cent.); main transmission lines, £6,137,305 (8.7 per cent.); distribution, £33,141,792 (47.0 per cent.); apparatus on hire and miscellaneous, £5,389,100 (7.6 per cent.). The working costs of all undertakings (including the cost of energy purchased, but not capital charges) totalled £8,556,020, or 0.82d. per kWh sold. The cost per kWh sold for the various groups were as follows: Metropolitan borough councils, 0.79d.; extra-London local authorities, 0.96d.; London companies, 0.76d.; and extra-London companies, 1.00d. There were reductions in charges for all classes of supply: for lighting and domestic purposes the average price received per kWh fell from 3.75d. to 3.52d.; for public lighting from 1.62d. to 1.47d.; for traction from 0.90d. to 0.74d.; for power from 1.44d. to 1.25d.; and for bulk supplies from 0.96d. to 0.78d. These reductions represented a total saving of £1,240,100 to consumers. The revenue received for each class of supply by each group of undertakings is fully set out in a table. For lighting and domestic purposes the receipts per kWh were as follows: Metropolitan borough councils 2.62d.; extra-London local authorities 2.84d.; London companies 4.30d.; extra-London companies 4.56d. For power the receipts per kWh were 1.18d., 1.19d., 1.41d., and 1.12d., respectively.

The gross surplus on working for all authorities was £7,601,421—municipalities £2,587,856, companies £5,013,605. In the case of the municipalities the following appropriations were made: Interest on loans and deposits, £717,230; sinking funds and loan repayment, £927,123; applied to capital outlay, £311,914; reserve, depreciation and renewal funds, £358,137; contributions to rates, £92,081. The balances on the municipalities' net revenue accounts were increased by an aggregate of £181,301. The figures for the companies are incomplete, but it is shown that interest on loans and deposits absorbed £925,635; reserve, depreciation and renewal funds £1,473,247; preference dividends £535,218; and ordinary dividends, £1,330,395. The aggregate balance remaining was £641,495.

The report gives exhaustive particulars—technical and financial—relating to each authority in the area, and at the end there appears the statement of charges made by the individual undertakers as at January 1st, 1929, which was recently issued as a separate publication.

* Published by the Authority, 5, Millbank, S.W.1. Price 5s.

Patent System Reform

The British Science Guild's Proposals.

A PAPER dealing with "The Reform of the British Patent System" was read last week before the Royal Society of Arts by Mr. R. Burrell, barrister-at-law. In this the author traversed the recent report of the Committee appointed to consider the subject by the British Science Guild, and stated the case for and against the proposals. After pointing out that foreign patent systems had to be borne in mind on account of the International Convention, he said that the development of the British system was always closely watched abroad, and changes in it would possibly be followed by alterations in foreign patent laws which might not be to our advantage. The British Science Guild recommendations aimed at ensuring (*a*) a greater degree of security against the grant of invalid patents; (*b*) the extension of protection to certain inventions which were at present unpatentable; (*c*) a reduction in the cost of patent litigation; and (*d*) the easing of the congestion at the Patent Office and a speeding-up of procedure. Under the present system, the author said, the examination was limited in that it did not extend to all prior documents which might come before the Court if the patent's validity was challenged. It was therefore proposed that such documents should come within the scope of the Patent Office, and also that a patent should not be invalidated by the publication of any document more than 50 years before the date of the patent; the latter was already embodied in the Australian law. The French system of leaving the question of novelty to the Courts would not be likely to appeal to British manufacturers. Another matter for consideration was whether the retention of the principle of granting patents to importers of inventions was desirable. The Guild proposed that prior publication, through inadvertence or ignorance, should not militate against the grant of a patent if it occurred within twelve months prior to the application, but that would run contra to foreign practice, and might make inventors careless. There was, however, a case for protection in the case of prior secret use by the inventor. Extension of the grant of patents of addition, recommended by the Guild, was considered to be open to a number of objections. The grant of a patent in respect of an invention was dependent on its usefulness, and the Comptroller was compelled to accept or reject an application with this in view. It was suggested that the Comptroller might be provided with an intermediate course in the form of an endorsement on the specification if he was not satisfied that the invention had been described in a practical form. The author was rather doubtful whether this could be fairly carried out. The Guild recommended that inventions which were at present unpatentable should be protected and referred to biological patents; the author added some others, such as processes involving electrical action at a distance. That led to the subject of short-term patents, similar to the German "Gebrauchsmuster" system. The proposal was that such articles as utensils, tools, machine parts of a novel and convenient shape, &c., should be protected for a term of not more than seven years by short-term patents which would be cheaply and promptly granted and would not be liable in the same degree as full patents to invalidation on the ground of lack of subject matter. While the author agreed that some such form of protection was desirable, he was not sure that the method proposed was the most desirable. It might lead to abuses which could not easily be guarded against. A very careful inquiry into the operation of the "Gebrauchsmuster" system should be made before any similar system was introduced into this country. With regard to the proposals for reducing the cost of patent litigation, Mr. Burrell agreed that patent actions might be tried before the Comptroller, with an appeal to a special judge in chambers. At present patentees hesitated to incur the costs of a High Court action. There was also room for extension of the remedy against unwarranted threats of legal proceedings to cases taken under provisional or unsealed complete specifications. As to delay in dealing with specifications, the author doubted whether the institution of short-term patents would lead to relief of the congestion in the Patent Office; in fact it might add to that congestion. The only remedy was an increase in the strength of the examining staff. In the last 16 years, in spite of an increase of 26.2 per cent. in the number of complete specifications filed, there had been a decrease of 9.9 per cent. in the staff, and consequently arrears were increasing. The author considered that if the necessity for working were abolished by international arrangement it might be possible for British manufacturers to set up factories in this country for the purpose of working other inventions which it would be uneconomic to establish if working in other countries were necessary. A proposal that the period between the filing of the provisional and complete specifications should be extended to twelve months, to correspond with the priority period under the International Convention, would be of considerable value to British patentees. The author thought that at the same time a time limit should be placed on the Patent Office in dealing with specifications.

After reviewing other suggestions for reform, Mr. Burrell concluded with a proposal that the British Science Guild should convene a conference of the interests concerned.

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The Central Electricity Board.

Extracts from the First Annual Report Covering a period of Twenty Months.

(*Concluded from p. 872.*)

The Electricity Commissioners had to investigate many of the questions which arose in connection with the design and layout of the "grid" in order that estimates might be prepared for consideration with the schemes. This work has lightened the Board's task to a very considerable extent, particularly on the technical side. With a view to taking full advantage of the information which had been accumulated in preparing the schemes and avoiding the creation of a large technical staff to deal afresh with that matter, the Board decided at an early stage to engage the consulting engineers who had been advising the Commissioners, and appointed Messrs. Kennedy & Donkin for the Central Scotland scheme, and Messrs. Merz & McLellan for the South-East England scheme; subsequently they appointed Messrs. Highfield and Roger Smith for the Central England scheme and Messrs. Kennedy & Donkin for the North-West England and North Wales scheme.‡

The Electricity Commissioners' decision in favour of 132,000 volts was influenced to a certain extent by the possibility that at some time in the future short lengths of underground cable might be found to give reliable service at this working pressure where circumstances might warrant the heavy additional capital expenditure involved. Shortly after the Commissioners transmitted the first scheme to the Board the International Electro-Technical Commission, in fixing standards for e.h.p. transmission lines, abandoned 132,000 volts as a standard, and now has no intermediate steps between 110,000 and 165,000 volts. Investigation of the cost of the various kinds of plant required showed that if the voltage was raised from 132,000 to 165,000 volts, the capital expenditure on the "grid" would be increased by 12 per cent. without making it possible profitably to utilise the increased carrying capacity which would thereby be obtained. If the voltage were reduced to 110,000 volts the capital cost of the system would be increased by approximately 5 per cent., as in many instances lines would have to be duplicated in order to provide the necessary capacity. Although the voltage of 132,000 is now no longer a standard of the International Electro-Technical Commission, it is in extensive use in Australia, Brazil, France, India, Italy, South Africa, Spain, Sweden, Switzerland, and the U.S.A. Utilisation of this voltage is, therefore, unlikely to affect prejudicially the cost of apparatus.

For secondary transmission lower voltages than that adopted for the main "grid" will be utilised. Some 93 circuit miles of 66,000-volt single-core cable will be laid in the inner London area, but by far the greatest proportion of the other secondary lines of the Board will be overhead lines carried on lattice steel towers and operating at 33,000 volts. Reinforced-concrete and wood poles are also being used on some sections of the secondary system. Steel-cored aluminium conductors will be employed throughout for the main "grid," and similarly on the secondary lines, unless in the latter instance the price of copper justifies a departure from the Board's standard practice.

The measurement of energy transfer and maximum demand in accordance with the requirements of the Electricity (Supply) Act, 1926, necessitates the installation of new and elaborate instrument equipments at all "grid" stations. Investigations made by a special engineering sub-committee culminated in the formation of standard methods of meeting these requirements. Energy measurements will be made by induction kilowatt-hour meters of the highest accuracy obtainable. Measurements of maximum demand involve algebraic summation of the demands on generators and on the associated grid transformers; special instruments are being developed for the purpose by the principal British meter manufacturers. The regulations foreshadowed in the 1926 Act governing the variations of grid tariff with power factor have not yet been issued by the Electricity Commissioners, but provision has been made for accurate power-factor measurements at times of maximum demand; the method adopted is to utilise summation reactive component meters corresponding with the kilowatt-hour meters installed for energy measurements. The complications introduced by the use of so many instruments is such that only partial duplication of equipment is being adopted. Thus only one complete summation system will be used in each station, and in the event of failure of such meters, recourse must be made to clerical methods for obtaining the data required by the accountants. Summation of maximum demands of different power stations will be done from graphical records of the load curves on the individual stations.

To enable control engineers to supervise the operations in their areas an elaborate system of signalling and communication has been devised, and will be carried out through pilot wires which will be hired from the Post Office. The actual operation of switches at the grid sub-stations will be carried out by the engineers at the individual stations in the first instance, but it is hoped that it will be possible to do this work from the central control rooms, when the complete reliability of the pilot system and apparatus has been established.

The development of communication and supervisory control systems by means of high-frequency current directed by the power lines is being kept in view. At present the line sections in Great Britain are too short to justify the use of "wired wireless" systems, but it seems probable that they may ultimately displace the pilot systems, which consideration is further justification of the policy of hiring pilot wires rather than of laying new ones.

The Board is making arrangements for providing an operating staff for each of the districts; it is recognised that British conditions are such that excessive reliance on previous experience in other countries is not justifiable, but the practice of companies operating large transmission systems in America and on the Continent is being taken into consideration.

The Board invited tenders for the main transmission lines in Central Scotland (the first scheme) in September, 1927; for the transformers in November, 1927, and for the switchgear in January, 1928. In the second and subsequent schemes it was able to proceed more quickly, and by the end of last December contracts had been placed as shown in Table II.

TABLE II.—CONTRACTS PLACED.

Item.	Central Scotland.	South-east England.	Central England.	North-west England.	Total.
	£	£	£	£	£
Primary transmission lines.	439,239	980,084	30,743	—	1,450,066
Secondary transmission lines.	—	14,235	—	37,139	51,374
Primary transforming stations.	649,685	633,038	—	—	1,282,723
Secondary transforming stations.	64,182	32,922	—	13,723	110,827
Totals ...	1,153,106	1,660,279	30,743	50,862	2,894,990

In Scotland the actual erection of towers is in progress on the routes Greenock-Yoker, Port Dundas-Dalmarnock, and Clyde's Mill-Bonnybridge, which are nearing completion. In south-east England work is in progress on the line from Bedford to Little Barford, 46 towers out of approximately 73 having been completed. In north-west England towers are being erected on the secondary line from Stockport to Macclesfield.

The routes of the lines are largely determined by the configuration of the land, and deviations can only be made within small limits and generally at considerable cost. The Board welcomed representations and co-operation from societies and local authorities concerned in the preservation of the amenities of the countryside, and it acknowledges the helpful and public spirit in which the majority of landowners have recognised the need of facilitating the Board's work, even when it has not been possible to make those minor alterations which the owners desired. Up to December 31st last the position was as shown in Table III.

TABLE III.—WAYLEAVES.

	Mileage Surveyed.	No. of Towers to be Erected.	No. of Wayleaves Obtained.
Primary Lines.			
Central Scotland	245	1,442	1,158
S.E. England ...	120¾	730	416
Central England	9½	61	12
Secondary Lines.			
N.W. England ...	12	100	100
S.E. England ...	6¾	86	23

Individual undertakers may require additional supplies before the "grid" reaches them in the normal course. To meet such cases the Board exercises, wherever possible, its powers to make temporary arrangements and, where necessary, to construct portions of the "grid" in advance of its programme. By this means it already claims to have demonstrated the utility of the "grid" in saving authorised undertakers uneconomical expenditure on the extension of small generating stations and in making supplies available in new areas. Arrangements, including the construction of lines, have been made to give supplies at (*a*) Little Barford, for the development of new area in Bedfordshire, Cambridgeshire, and Hunting-

‡ Messrs. Merz & McLellan have since been appointed for the Mid-East England scheme, 1929.

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don; (b) Worthing, to supplement existing supplies; (c) Aylesbury, to supplement existing supplies and open up rural areas; and (d) Macclesfield, Buxton, and the surrounding district. Other arrangements of a similar nature are in negotiation for supplies in and around London, at Kettering, and in the Alderley Edge and Wilmslow district.

In order to provide for expenses during the initial period before the disbursements of the Board become sufficient to justify raising a loan, the Board arranged with the Bank of England for temporary advances and that arrangement still continues. The total amount of such advances up to December 31st last was £339,000.

There are seven appendices to the report, the first of which sets out the advantages and economies to be derived from interconnection; the next four give technical details of the "grid"; appendix 6 is a progress report, and the final one reproduces the Board's standard form of Wayleave consent. In conclusion, attention may be drawn to fig. 2, reproduced last week, which shows standard 66-ft. straight-line towers used for transposition spans in Central Scotland. It is part of the first 20 miles of "grid" line to be switched in at full pressure the week before last, and was erected by British Insulated Cables, Ltd., of Prescot, who also made alive part of another similar line at Bedford, which, however, is temporarily at 33-kV, but is to be increased later to 132 kV. The other illustrations were reproduced from the Board's report and the switchgear works referred to are presumably those of the B.T.H.

The Battersea Power Station.

A statement in defence of the position of the London Power Co., Ltd., relative to recent criticism in the daily Press of its intention to build a large electricity generating station in London.

THE following communication, signed by Mr. W. F. Fladgate, chairman of the company, has been issued by Dr. S. L. Pearce, its engineer-in-chief:—

"The London Power Co., Ltd., has not hitherto intervened in the controversy recently arisen in the Press and elsewhere regarding the erection by the company of a power station at Battersea, but the time has now, I think, arrived when I should state for the information of the public the material facts of the case and explain the views and intentions of the power company.

"The express object of the establishment of the London Power Company, which was incorporated in 1920, was to eliminate inefficient and uneconomical stations, to improve those which were reasonably efficient and economical, to link up the latter, to provide new stations when and where required, and generally to promote economy, efficiency, and reliability in the production of electrical energy for the metropolis. The London Electricity (No. 2) Act, which was promoted by the company, received the Royal Assent on July 31st, 1925. At the same time the London and Home Counties Joint Electricity Authority was constituted under an Order dated July 29th, 1925. The Central Electricity Board was constituted under the Electricity (Supply) Act, 1926, and was actually set up early in 1927.

"It is the statutory duty of the power company to make provision for the supply of energy to that portion of the metropolis which is within the areas of its ten constituent companies, and it was very early realised that a new station towards the centre and west of their districts would be absolutely necessary in the near future. The question accordingly arose of an appropriate site for the new station, and after exhaustive inquiry negotiations were entered into in 1925 for acquiring a site from the Duke of Northumberland at Brentford. A Bill was promoted in Parliament in the autumn of 1925 for the purpose of obtaining the requisite sanction, but was rejected on second reading by Parliament, the proposals for the Government Act of 1926 then being under consideration. Subsequently the Joint Electricity Authority entered into negotiations for erecting a station at Chiswick, and it promoted a Bill for that purpose. That Bill came before Committees of both Houses and was heavily opposed, every possible objection being advanced and, in particular, the nuisance which it was apprehended might be caused by the erection and working of the station. Notwithstanding the objections, both Committees passed the Bill, subject to a recommendation that it should not be proceeded with unless it was 'selected' by the Central Electricity Board.

"In his evidence before the Parliamentary Committees in 1927, on the Chiswick power station Bill, the chairman of the Electricity Commissioners made the following statement:—

> That makes it all the more certain that two stations, indeed even these two stations (referring to Chiswick and Battersea) will be inadequate to deal with the western load in the years to come. Of that there can be no doubt whatever. When I tell you that the rate of growth is such as I have said to require both these stations, and that, curiously enough, when one analyses the growth which is taking place, one finds that 60 per cent. of the total load in the whole area is in the central and western districts, it points distinctly to the erection of stations in the western part of London rather than in the eastern.

"The question of erecting a station on the Battersea site had meantime come before the directors of the London Power Co. in the later part of 1926, and they were advised that from the engineering and economic points of view the site was the very best that could possibly be obtained. They made no secret of the fact that they were acquiring that site, and brought their project prominently before the Committees of both Houses when the Chiswick station Bill was under consideration, not by way of opposing the proposal of the Joint Electricity Authority, but as a complementary proposition. Before definitely deciding on the Battersea site, the London Power Co. gave very careful consideration to the question of an alternative site down the river. In view of the heavy transmission costs it was quite unable to make out an economic case for such a site, and a more recent survey and consideration of this possibility, with estimates based on the use of still higher voltages, has confirmed the correctness of the earlier opinion.

"One of the first steps taken by the Central Electricity Board after its constitution in 1927 was to consider the scheme for the South-East of England prepared and transmitted to the Board by the Electricity Commissioners. The scheme scheduled several stations of the London Power Co. as "selected" stations, and the station which was proposed by the Joint Electricity Authority at Chiswick was put forward in that category. The Central Electricity Board gave the most careful consideration to the scheme which had been prepared, and as the result on February 15th, 1928, it discarded the station at Chiswick and selected for adoption the station at Battersea. The whole of the approved plans for dealing with South-East England and the transmission system in connection therewith are based upon the erection of a station at Battersea. The Power Company, which had acquired the site at a very high price, accordingly proceeded with the completion of its plans for the Battersea station, which had been submitted to and approved by the Electricity Commissioners and had also been approved by the Central Electricity Board. Considerable progress has now been made in the construction of the works and plant.

"So far as the commercial side of the undertaking is concerned, it is right to point out that the London Power Co. is in no sense a commercial undertaking. By its constitution it is precluded from making any profit. It can only pay a fixed interest on its securities. The whole of the saving which the company may be able to make is to be applied in reducing the charges for electricity to its constituent companies, thus enabling those companies to supply the public of London at a cheaper price.

"When, in 1927, the Electricity Commissioners (after consultation with the Office of Works) issued its statutory consent under the Act of 1919 to the erection of the Battersea station, it attached to its consent the condition:—The company shall in the construction and use of the said generating station, take the best known precautions for the due consumption of smoke and for preventing as far as reasonably practicable the evolution of oxides of sulphur, and generally for preventing any nuisance arising from the generating station or from any operations thereat.

"The London Power Co. has always fully recognised the importance of the obligations thus imposed upon it, and from the outset has given careful consideration to the steps to be taken to secure its performance. In particular, as regards the treatment of the flue gases from the boilers, which is the topic to which criticism has recently been chiefly directed, the company has specially invoked the assistance of its own and independent expert chemists in connection with the design and equipment of the station. It is no doubt true that the problem of dealing with sulphur fumes is a comparatively new one in its application to power stations, but it is manifestly unfair to the London Power Co. to pronounce it in advance to be incapable of solution, and to do so casts an unmerited slur on the present state of advancement of the arts of engineering and chemical science. The advice which the company has received from its advisers, to whom it has given the freest possible hand, fortunately belies the pessimistic anticipations which have been so widely circulated, and affords reliable ground for believing

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that by the proper selection and pre-treatment of the coal before burning, and by the adoption of suitable plant of the best design and layout, it is practically possible to render innocuous the fumes which arise in the process of generation. I can assure the public that the company will not be deterred by any considerations of cost from adopting every possible precaution which can be devised. It is in its own interest to do so. Problems of no less difficulty have been surmounted in the past history of the electrical industry, and in the words of *The Times* leader of April 2nd—'There is no reason to take an unduly gloomy view of the future.' Lest the omission by me of any reference to smoke and dust should be construed as evidence of the company's inability to cope with these, I may say at once that not the slightest apprehension is felt by the advisers of the company on this score. There is an abundance of experience to work upon in this connection.

"I turn now to another and different aspect of the matter. I refer to the criticism that the erection of a power station at Battersea would be 'an economic mistake.' Let us examine this question, which, after all, is only a variation of the oft-debated problem whether it is more economical to site a station (*a*) as near as possible to the centre of gravity of its load, or (*b*) at some distant site which may have the advantage of remoteness, but has the concomitant disadvantage of necessitating long overhead, or cable, trunk lines traversing (in great part) congested areas by several divergent routes.

"Careful estimates have been prepared of the transmission capital costs and annual losses which would be involved in dealing with the whole of the energy from a station of the size of Battersea located some 15 to 17 miles down river, as compared with a station on the Battersea site. The estimates are necessarily only approximate in the absence of a detailed survey of the possible routes. They do, however, cover transmission partly by overhead lines, where feasible, and partly by cables, and at the alternative voltages of 66,000 and 132,000 V. Space does not permit me to go into great detail, but, shortly, it may be said that in the case of a station at the suggested distance the extra capital costs on transmission would range from £3,000,000 to £1,850,000, according to the system and voltage adopted. After due consideration and making allowance for all contingent factors incidental to the use of a transmission voltage of 132,000 V, on the most favourable basis it would not appear safe to reckon on a lower figure than £2,100,000.

"Against the incidence of the capital charges on this latter figure, together with the line-maintenance costs, the line losses, and the rating, may be set the saving of sixpence per ton on sea-borne coal direct to both sites, by steamer, amounting in the aggregate and on the ultimate output of the station to some £15,000 per annum. Most careful inquiries have been made before accepting the above figure of sixpence per ton, and the company is assured that although this figure may fluctuate slightly from time to time it is an outside figure and should be accepted by 'anyone who knows the trade.' The advisers of the London Power Co. have come to the definite conclusion that (apart from the difference in value of the respective sites, which, after all, has no very appreciable bearing on this question) there would have to be a difference in the cost of coal of at least six shillings per ton in favour of the down-river site to justify its selection, and to counteract the additional transmission and transformation costs.

"It will, I think, be generally admitted amongst engineers that cables operating at 132,000 volts and upwards are at the present time more or less 'on trial.' They can hardly be said as yet to have emerged from the experimental stage, and experience is very limited. Whatever the future may hold in store in this direction, and it is probably hopeful, a note of caution is surely necessary before London is committed to such a system for the transmission of the entire energy output of a station of the magnitude of Battersea situated on the lower reaches of the river. It is understood that the Central Electricity Board has placed an order for a limited amount of this class of cable. This work is, however, regarded by that body as being of a trial or experimental character, and the order has been placed at the entire financial risk of the contractor, with stringent guarantees of replacement by cables operating at lower voltages.

"It may be convenient to refer at this point to a further observation made by Sir John Snell, when considering the Chiswick Bill before the Parliamentary Committees, which has a distinct bearing on the present case: namely, that owing to the high cost of laying cables through the congested streets of London, and the high cost of reinstatement of the paving, &c., it is not commercially practicable to transmit the large quantities of energy which are, and will be, (particularly *will* be) required in the west-end of London, wholly from the eastern end. In this view the London Power Co. most fully concurs, fortified as it is by its experience of the present condition of the streets in the area in which it has the right to lay cables, namely, the whole of the County of London. In these circumstances, if energy generated at stations on the lower reaches of the river Thames has to be transmitted to the west, it could only be done by devious routes north or south of the metropolis, thus adding very greatly to the transmission costs, which addition has not been fully taken into consideration in compiling the foregoing estimates.

"The London Power Co. does not subscribe to the principle that a generating station should be located near to a particular colliery, or to a particular group of collieries, which is not in its ownership, or under its control. It believes that the best interests are served by selecting a site available, if need be, to all the coal fields of the country. If the Kent coal be all that is claimed by its sponsors, there is nothing to prevent its use at the Battersea site.

"Reference has been made to the practice in other countries with the suggestion that the example should be copied in the case of London. What are the facts? Take Berlin for an illustration: at the present time the bulk of the electrical requirements are supplied from four power stations within the City limits, and a fifth station, also within the City, is under construction. By the year 1932 it is estimated that out of a total demand of 720,000 kilowatts, only some 60,000 kilowatts will be sent in to the City from stations situated on the brown-coal fields, in the form of bulk supply. There is little here, therefore, to support the argument advanced against Battersea in favour of long-distance transmission from remotely situated stations. The position in Paris is similar. The case of Melbourne and the Norwell brown-coal fields has no relevance to the present controversy, as will be admitted by those who have any knowledge of the situation, political and economic, in Victoria, Australia. Again, take the large American cities, *viz.*, New York, Brooklyn, Chicago, Baltimore, Philadelphia, Milwaukee, &c. Their stations are either entirely, or mostly, within the city limits and as close up to the load as possible. This is particularly the case in New York, where huge stations (greatly in excess of Battersea) are located in some of the densest parts of the city, one such new station now in commission being designed for an ultimate capacity of 1,000,000 kW, and be it remembered that American coals, especially those of the Middle West, are much higher in their sulphur content than are British coals, and yet the sulphur problem does not appear to have impressed itself on our American friends.

"It has been stated that a proposal brought forward in 1906 by the London County Council for the erection of a station at Battersea was rejected by Parliament. Agreed! The ground of the refusal was not the unsuitability of the site, but the desirability of bringing forward a more comprehensive scheme for London and the surrounding district.

"The whole object of the building of these new modern stations is to bring about two things: first, the gradual elimination of a number of other stations which are less efficient, which burn more coal per unit generated, which are liable to cause nuisance, and are not in a position to adopt the up-to-date improvements that large new stations can afford to include; and, secondly, the reduction by the increase in the use of electricity of the quantity of coal burnt, both industrially and domestically. On balance, there can be no doubt that a less quantity of deleterious fumes will find its way into the atmosphere under the modern system than under the existing regime. The South-East England Electricity Scheme forms part of a comprehensive scheme for the British Isles, which has been formulated for the express purpose of providing electric light and power in greater quantities and at less cost than hitherto. Any hindrance of the scheme can only be regarded as retrograde and would delay the closing down of less suitable stations.

"This statement has already run to much greater length than the importance of the subject merits. I conclude by summarising the position as it appears to the London Power Co.:—

(*a*) "The principle of establishing a power station on the river within the metropolitan area was before both Houses of Parliament so recently as 1927 and was approved by them after very exhaustive investigation and on evidence for and against, which dealt particularly with the question of the alleged nuisance caused by chimney fumes.

(*b*) "The London Power Co. obtained the statutory sanction towards the end of 1927 for the establishment of a power station at Battersea of the body expressly set up by Parliament in 1919 to decide all such matters.

(*c*) "The Battersea station was approved and selected by the Central Electricity Board in 1928 as an integral feature of its adopted scheme for South-East England after hearing objections thereto, principally on the ground of nuisance.

(*d*) "On the strength of its statutory position the London Power Co. has raised three millions of money for the express purpose of building a station on the site sanctioned.

(*e*) "The London Power Co. has entered into contractual obligations for civil engineering works and plant, including the purchase of the site, amounting to £2,000,000, in every case with British firms employing British labour.

(*f*) "It has not been proved, nor indeed even seriously suggested until quite recently, that it would have been economically sounder to have built the station on the lower reaches of the river.

(*g*) "Neither has it been demonstrated that the disastrous effects upon the atmosphere which have been so freely foretold in communications founded in many instances on an entire misconception of the position, are in the least likely to materialise in actual practice. In this connection, as an example, one has only to refer to a statement made to the effect that with the station completely erected and working at full capacity, then using from 10,000 to 12,000 tons of coal per week, one-third of the total plant will use 2,000 tons per day. Our critics might at least be arithmetically accurate."

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Architectural Illumination.

Some modern tendencies in architectural form with electric light as an integral factor in exterior and interior decoration.

(*A report of a meeting of the* ARCHITECTURAL ASSOCIATION.)

NEGLECTING all aspects of a technical or commercial nature, the illustrated lecture bearing the comprehensive title of the above sub-heading recently delivered by Mr. G. S. Francis, of the British Electrical Development Association, dealt with the subject from the point of view of artistic orientation. It was, in essence, an amplification of the paper read before the E.D.A. Salesmanship Conference in London, by Mr. H. T. Young,* who gave such a useful exposition of the tendencies in illumination development by way of broad masses of light and a departure from lighting by means of single points. Indeed, among the slides shown by Mr. Francis were several of Mr. Young's own very attractive showroom, typifying this development, as well as others that were shown by Mr. Young. At the same time, Mr. Francis dealt with the whole subject in a profound way from the architectural point of view, and judging by the discussion that followed, clearly aroused the interest of architects in one very important direction, *viz.*, the absolute necessity for treating lighting as part of the original design of a building. Actually, the lantern slides were more eloquent of the trend of development than the description given by the lecturer, the slides representing some remarkable effects in theatre lighting on the Continent, notably in Berlin and Dresden, and the lighting of other places of amusement, as well as business premises both on the Continent and in this country. The point was emphasised by Mr. Francis that a renaissance was now visible in the sphere of artificial illumination; that a new spirit had entered the field and had already begun to direct the use of electric light into new and attractive channels. It was shown convincingly by means of the slides that in all the leading countries of the world a departure was being made from convention through the evolution of means to employ electric light in broad masses instead of isolated points, whilst lighting fittings designed in the modern manner exhibited in an interesting fashion the growing feeling for the artistic properties of the line, the angle, and the plane.

In this connection, it was also pointed out how modern feeling for architectural form was undergoing a metamorphosis This was shown by the changing style of buildings, both exterior and interior, and so far as interior illumination was concerned, the lighting fittings must be designed, and the disposition of the light arranged, to harmonise with the general design and spirit of the structure. Whilst, continued Mr. Francis, casual examples of cornice, window, and skylight illumination had been known for ten years or more, the real stimulus towards the bolder and more consistent development of decorative lighting probably dated from the Paris Exhibition of 1925. A significant feature of such development was its bold departure from the use of points of high intensity to the employment of larger masses of low-intensity light as a groundwork upon which higher light values could be used in accord with the designer's plan. With that appeared also a marked restraint in the use of ornament and closer attention to the texture and colour of the transmitting medium. Another feature was the evolution of housing units for the lamps which could be incorporated in the structure of the building in the form of ceiling or wall panels, luminous cornices, lintels, columns, &c. Other effects could be obtained by reflection, by diffusion through some translucent material, and by a combination of both, with added elements of direct lighting placed at strategic points to give emphasis to desired features.

Finally, Mr. Francis, in pointing out that lighting development of that nature was yet in its infancy, readily acknowledged that some of the designs being made use of on the Continent would probably fail to meet the taste of the age and would fall by the wayside, but others would develop on lines that possessed survival value and would live on through progressive metamorphosis until true artistic expression was found.

It may be added that not the least interesting of the slides shown were several differing views of the effective showroom that has been arranged by the E.L.M.A. Lighting Service Bureau, which has been designed specially to demonstrate this new form of electrical illumination in its various phases. Many striking examples were also shown of the flood-lighting of buildings, &c.

Discussion.

The discussion, naturally, was carried on mainly by architects and others than lighting engineers, and was the more interesting on that account as giving the lighting engineers engaged in development work a clear indication of the trend of taste in this matter.

Mr. HOWELL ROBERTSON, who proposed a vote of thanks to Mr. Francis, spoke of the manner in which the development of electric lighting hitherto had been restricted owing to the manner in which methods of applying older forms of illuminant, such as oil and gas, had been followed. At the same time he doubted whether the new form of lighting in broad masses would offer much in domestic fields by reason of its cost, although the manner in which it could be incorporated as an integral part of the architecture was another matter. Even when applied to commercial purposes it seemed to him that the modern form of lighting presented difficulties at the present moment as regarded economy, although no doubt as development took place that aspect would be taken care of. In a recent exhibition of that form of lighting at Messrs. Warings 38 lamps were used to illuminate a wardrobe, which was positively princely! At the same time, the new method could be applied with advantage to architecture on a larger scale than that associated with the domestic problem. The speaker criticised some of the fantastic designs for lighting public buildings and business premises in Germany, which were in such sharp contrast with the more pleasant designs in New York and London. Perhaps that was due in a measure to the fact that the lighting designer had at last been given complete freedom to do what he felt he was justified in doing, without any fear of offending against any particular canons of style. For instance, in shop-window lighting to-day there was no "style." The lighting was arranged purely from the point of view of the function it was to perform, with the result that the kinds of effect produced were almost endless.

Miss C. HASLETT, secretary of the Electrical Association for Women, seconded the vote of thanks. Whilst urging the need for the collaboration of the architect and the engineer, she emphasised the necessity for giving full consideration to the woman's point of view in domestic lighting. There was, first, the difficulty of obtaining servants, and it must also be borne in mind that woman's expression was far more artistic to-day than it had ever been before. A great deal had been heard about Germany and France, but she would like to think that Great Britain would soon lead the way, because there was plenty of scope for true British art and craft in this development.

Mr. GORDON SELFRIDGE said that some of the new lighting schemes on the Continent, as shown by the lecturer, were perfectly terrible and he hoped they in this country would be able to arrive at something definitely more beautiful, because from the architectural standpoint some of the schemes were as bad as they could be. They needed something less eccentric than was too often the case at the moment in France and Germany, and even in some cases in London. At the same time, those on the Continent were to be admired for the manner in which they tried out things, even if they were not so beautiful as might be desired, because out of such trials it was possible to arrive at something which would meet with final approval. They in this country were not fearless enough in taking up new things and trying them out. Expense was allowed to stand too much in the way, and yet from the commercial and business points of view such expenditure was often profitable in the long run.

Mr. STANLEY HAMP, as an architect, expressed satisfaction that at last they had reached a stage at which it was possible to embody lighting in a building in other forms than merely those of the pendant and the bracket. At the same time, there was difficulty in obtaining the necessary materials in this country for carrying out schemes to the new lighting designs that had been illustrated. Was that because British manufacturers were not enterprising enough, or was it because the fittings were so impracticable from the domestic point of view that the manufacturer would not carry a stock? Personally, he thought it was a little of both. So far as arranging public buildings in the manner shown by some of the slides was concerned, there was the point that in the daytime the appearance of the building was spoiled, which was a matter that would have to be taken into consideration. At the same time, to get the best and most economical results, this form of lighting could not be dissociated from the general design of the building.

Mr. HUBERT BAINES, an engineer, who had an architect brother, spoke with some feeling of the manner in which the lighting engineer was too often treated. He was called in after the architect had completed his design, and then told to light the building. In his view buildings must be designed more for use in the future than they had been in the past, and that necessitated early co-operation between the architect and the engineer. Engineers had suffered very badly at

* ELECTRICAL REVIEW, November 23rd, p. 909, and November 30th, p. 930, 1928.

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times at the hands of architects in this respect. In the building where he had his offices the corridors were the best lighted portion, which was a disaster. It could not be too strongly emphasised that artificial light was used for 600 hours during the working year, and therefore demanded the most serious attention on the part of the architect. He specially mentioned that the corridor lighting in the new Imperial Chemical Industries building† had to be in use all the year round, and very careful consideration was given to that fact. With previous speakers, Mr. Baines expressed dislike of some of the bizarre designs exhibited by the lecturer, which, he said, were artistically bad and uneconomic; no sane person would have anything of the kind in his house. He also complained of the cost of the new form of lighting, and called attention to one of the slides of a bedroom, which had no fewer than ten lighting points in it. There was not ten lighting points in his bedroom for the simple reason that he could not afford them; cost was the all-important item when applying such systems to domestic purposes.

Mr. G. S. FRANCIS briefly acknowledged the vote of thanks. As regarded the criticism of the technique and economy of the methods he had illustrated, he reminded his audience that not only had he definitely not dealt with that aspect, but that he had also indicated that he thought some of them would fall by the way. His view was that out of what remained they would evolve something of a more permanent and pleasing character.

† ELEC. REV., March 22nd, 1929.

Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

Vacuum Cleaner Improvements.

A small device which, it is claimed, will add greatly to the attractiveness of the "Cadillac" vacuum cleaner, marketed by METRO-VICK SUPPLIES, Trafford Park, Manchester, is a deodorising attachment called the "Sanit-Aire." This consists of a small perforated aluminium container which fits into the machine in the place of the front cap, and contains a special sanitising compound. It is attached to the suction side of the cleaner, and, without any appreciable loss of vacuum, forms an effective sanitary unit for dispelling moths and bacteria, and for generally purifying the air of the home. The smell of the special "Cedabloc" compound is most refreshing, and the volume of air moving over it quickly forms sufficient vapour to give a healthy and pleasant odour. A new model of the "Cadillac" cleaner embodies two minor improvements, a new design of stirrup, making for easier handling, and a removable handle for simplifying transport and packing. Fig. 1 shows the cleaner complete with the "Sanit-Aire," and fig. 2 depicts the deodorising unit separately.

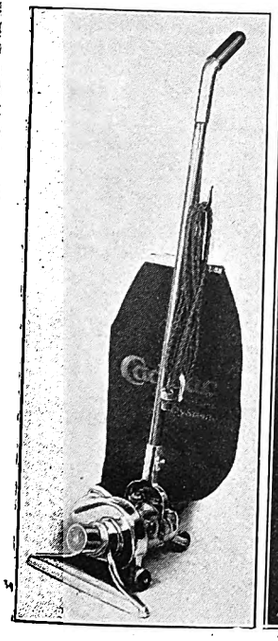

Fig. 1.—Complete "Cadillac" Cleaner.

Fig. 2.—The "Sanit-Aire" Deodoriser.

New and Improved Fires.

A recent production of Electrical Utilities, Ltd., Tudor Works, Park Royal, N.W.10, is the "Riviera" fire, fig. 3. This is a very simply-constructed and compact little fire, measuring 14 in. high, 11 in. wide, and 3½ in. deep; it weighs 11 lb. The resistance wire is supported in the company's "Infra-Ray" refractory reflector. It is claimed that the combination results in an unusually large emission of radiant heat. The fire can be supplied with elements for 1-kW or 1½-kW loadings, and in vitreous- and stove-enamel finishes. There is a choice of three colours, grey, green and brown, in vitreous enamel. The frame is of high-grade cast-iron. The fire is claimed to be a particularly suitable article for hire-purchase or hiring out schemes, because the finish is not easily damaged, all parts are readily interchangeable, and the resistance wire can be renewed without using a screw-driver.

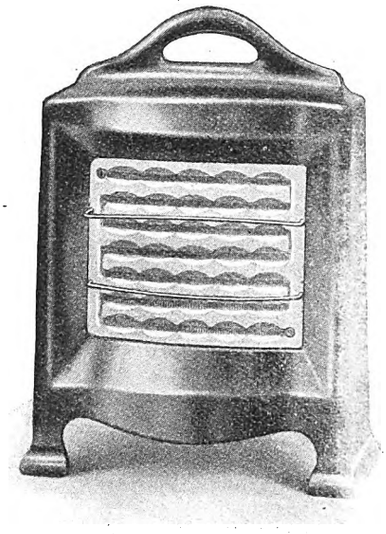

Fig. 3.—The "Riviera" Fire.

Another development of Electrical Utilities is the "Heetrod" (wire) element, which is designed to replace the "Globar" or solid-composition "Heetrod" elements in various fires and cookers designed by the company for the

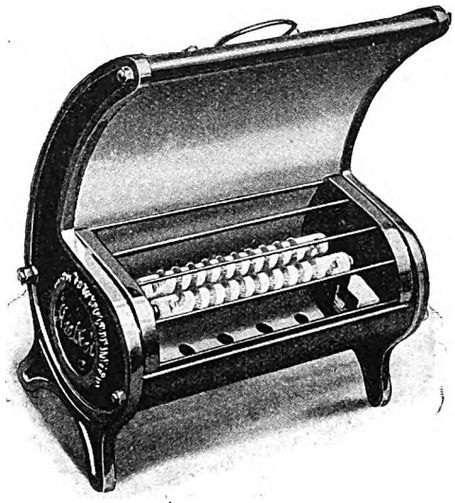

Fig. 4.—"Heetrod" Portable Fire with Wire Elements.

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latter type of elements. The "Heetrod" (wire) element, fig. 5, consists of high-grade nickel-chromium alloy wound on a white refractory. An important feature of the element is the way in which the ends of the wire are brought under the control of the contact screw. This has a hole through it from head to point, and the end of the resistance wire is pushed through this hole. Another piece of metal is then wedged in all the way along, thus making, it is claimed, a solid joint which is not subject to variation in resistance under

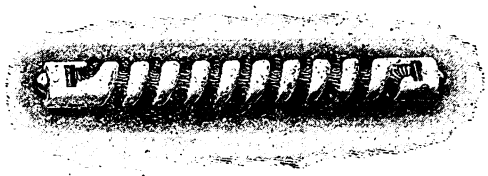

Fig. 5.—"Heetrod" (Wire) Element.

any conditions. The result is that the ends of the element remain comparatively cool, and the spring contacts are preserved. Fig. 4 shows a "Heetrod" portable fire fitted with the new type of elements.

An Electric Water Boiler.

The "Two-Twelve" electric boiler, fig. 6, a product of Messrs. George Marchman, Trinity Street Works, Bury, Lancashire, is designed to store and deliver boiling water for domestic and similar supplies. The equipment is governed so that immediately the whole of the contents of the boiler reach 212 deg. F., the emission of steam from the boiler switches off the main current, leaving a small bye-pass current to maintain boiling point. To ensure boiling water at the tap the final passage of the water is through a tube in which is placed one of the electrical elements. This enables the contents to be drawn off at boiling point until the surrounding water at the top of the boiler falls below 170 deg. F., so enabling large quantities of water to be stored and delivered at 212 deg. F. The boiler is claimed to be safe for use, as it is impossible to generate pressure in the apparatus. It is also claimed that, used in hospitals, the boilers supply boiling

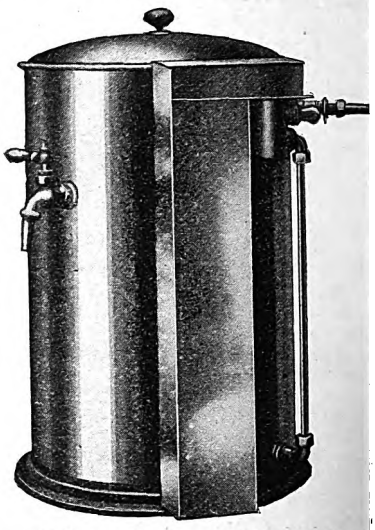

Fig. 6.—"Two-Twelve" Electric Boiler.

water for drinking, cooking, and other purposes to the satisfaction of the medical officers. The equipment is specially designed with a view to easy access for inspection and cleaning purposes.

The North-East Coast Exhibition.

Electrical Features of the General Lay-out and Exhibits.

(*Concluded from p. 892.*)

SEVENTY-five thousand persons attended the opening ceremony of the North-East Coast Exhibition by H.R.H. the Prince of Wales on May 14th. The Prince had a rousing reception. The aim of the Exhibition, he said, was to revitalise existing industries—to discover how they should be adapted, and, if necessary, improved. The march of time might have shown some branches of industry outliving their usefulness, and it was hoped that the great enterprise might serve to discover the weak spots, and, by encouraging the establishment of new works and new methods, provide further channels of labour in a district that had had more than its share of hard times. The North-East Coast had kept abreast of the times, and it must be encouraging to Tynesiders to remember that the turbine, invented by the distinguished President of the Exhibition, still enabled this country to hold the Blue Riband of the Atlantic.

The stand of Messrs. A. Reyrolle & Co., Ltd., is arranged as a lounge in its central part, and interesting exhibits are suitably disposed round its outer border. A model of the world at one end of the stand symbolises the company's widespread activity, and draws attention to the places where "Reyrolle" designs are now being manufactured under licence. There are on this stand selected examples of the company's products, such as mining and industrial switchgear. These include two small oil-immersed flame-proof circuit-breakers, each with a current-carrying capacity of up to 100 A at 660 V. One of these is adapted for either pillar or wall mounting, and the other is mounted on skids, so as to be easily portable. The design is such, it is claimed, that all the regulations made under the Coal Mines Act (1911) are complied with. The oil tank is of welded boiler plate, and the circuit-breaker is well fitted to work under the severest conditions. Two or three series overload trip coils may be fitted to the equipment, and either inverse time-limit dash-pots, or tubes for instantaneous tripping may be included, each adjustable to give a wide tripping range. In the special case of controlling the supply of an a.c. squirrel-cage induction motor of a size suitable for switching direct on, a starting dash-pot may be fitted, so arranged that the operation of closing the circuit-breaker lowers the trip-coil plungers and thus prevents tripping from taking place under the influence of the heavy starting current. The plungers return gradually to their normal position while the motor is running up to speed, and are ready for normal operation under running conditions. A very useful feature of this gear is that one circuit-breaker can be completely removed from the framework, and the dividing box which carries the main cable can be transferred to another circuit-breaker without unsealing the cable. Another "Reyrolle" exhibit is a ring-main circuit breaker, fig. 4, designed especially for underground substations. By virtue of specially designed "bell" joints it will withstand, it is claimed, total immersion in times of flood. This company is also showing a representative collection of the smaller switchgear manufactured especially for use in industry.

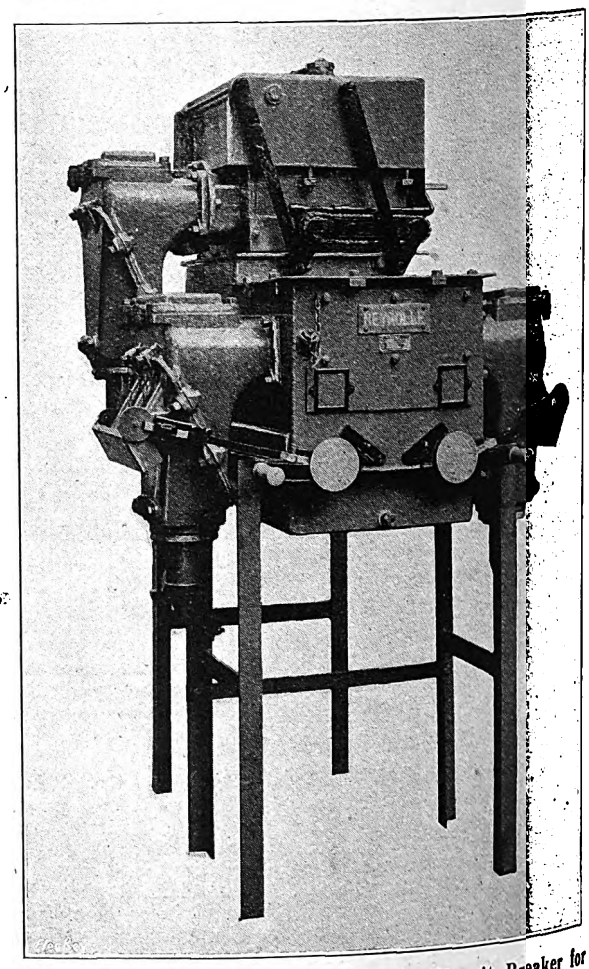

Fig. 4.—"Reyrolle" Ring-main Circuit Breaker for Underground Sub-stations.

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THE SUNDERLAND FORGE & ENGINEERING CO., LTD., is exhibiting a worm-geared electrically driven ship's cargo winch which is capable of lifting 3 tons at 120 ft. per min., 25 cwt. at 250 ft. per min., or, light hook 480 ft. per min. It is driven by a watertight motor, 33 h.p., 275 r.p.m. The winch has a centre barrel, two warping ends, and hand- and foot-operated brakes. There is also a contactor-type control gear suitable for mounting in a deck-house and for controlling the above winch. A similar winch exhibited is equipped with foot and magnetic brakes. A contactor-type control gear suitable for controlling this winch is also shown. Other exhibits on this stand include a worm-geared electrically-driven shipyard winch to lift 3 tons at 45 ft. per min.; a friction hoist fitted with a continuously-running motor and patent reversing gear, capable of lifting 10 cwt. at 200 ft. per min.; three open-type steam driven generating sets for ship lighting, 3¾ kW, 10 kW, and 21 kW, respectively; and two open-type generators for ship lighting and power, specially designed for driving by Diesel engines, 100 kW, 220 volts, 300 r.p.m.

The CAMBRIDGE INSTRUMENT CO., LTD., is exhibiting a representative collection of instruments for ships and engineering

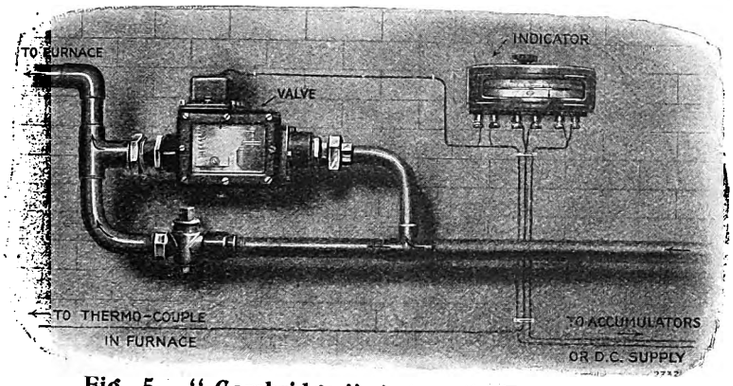

Fig. 5.—" Cambridge " Automatic Temperature-regulation Apparatus.

works, including electrical CO_2 indicators and recorders, apparatus for recording the percentage of dissolved oxygen in boiler-feed water, draught and pressure gauges, temperature-measuring instruments, and other instruments for engineering and electrical measurements. Some very interesting " Cambridge " instruments are also to be seen in actual operation on other stands in the Palace of Engineering. For instance, on the stand of the Newcastle and Gateshead Gas Co., there is an automatic temperature regulator controlling the temperature of a gas-fired furnace. It consists of a thermo-electric indicator, connected by suitable leads to a thermo-couple which is so placed in the furnace that it gives a true indication of the furnace conditions. Near the end of the indicator pointer is attached a light thermo-couple which is electrically connected to a moving-coil relay. A small electrically-heated coil is set to the point on the scale at which it is desired to maintain the temperature of the furnace. When this temperature is reached the small thermo-couple on the pointer is brought beside the coil and becomes suddenly heated, the electromotive force thus set up energising the relay and so completing an electrical circuit which operates the mechanism controlling the supply of heat. As soon as the temperature falls, the thermo-couple leaves the coil and the process is reversed. Fig. 5 shows the arrangement of automatic temperature regulation similar to that installed in connection with the Newcastle and Gateshead Gas Co.'s exhibit. The apparatus is capable, it is claimed, of controlling the temperature to within 1 per cent. of the range of the indicator scale.

A few firms are showing some interesting items of electrical domestic equipment, and included in a range of cookers being displayed by the JACKSON ELECTRIC STOVE CO., LTD., is the No. 24D. cooker, fig. 6. This cooker consists of two standard No. 24 ovens, each with cooking space 19 in. high by 16 in. deep by 16 in. wide, and loaded at 2.7 kW. They are surmounted by a cast hob, containing two 8-in. by 6-in. hotplates, 1.5 kW each, two 12-in. by 7-in. hotplates, 2.25 kW each, one 14-in. by 8-in. hotplate, 3.0 kW, and one 13-in. by 10-in. grill, 2.5 kW. The top of the grill can be used as a simmering or boiling plate. Three-heat regulation is provided on all the above sections. Over the hob, mounted on two cast-iron brackets, are two No. 260-type hotcupboards. The space between the bottom of the hotcupboards and the top of the hob is filled in with a tiled-pattern splash plate. Each hotcupboard is loaded at 350 watts and controlled by a single-pole rotary indicating switch. The total loading of the cooker is 19.1 kW, and the approx. overall dimensions are 57 in. by 25 in. by 69 in. high. The Jackson Co. is also showing a comprehensive range of water heaters.

The REVO ELECTRIC CO., LTD., has an interesting display of watertight electric light fittings, street light fittings, pendants, brackets, hand lamps, bulkhead fittings, cargo lights, brass brackets, brass pendants, winches, hoists, pulleys, electric fires, irons, kettles, hot plates, boiling rings, electric fans, and so on.

Model 700 vacuum cleaner is the chief exhibit of HOOVER, LTD. As does the No. 543 model, this cleaner embodies the deep-beating principle, and with both can be used the " Hoover " floor polisher, a device which is inserted in the machine in place of the agitator.

ELECTROLUX, LTD., have their usual excellent display of the " Electrolux " cleaner, refrigerator, floor polisher, and so on.

An interesting range of domestic and electro-medical apparatus is being shown by IDEAL HOME ELECTRICAL APPLIANCES, LTD., including " Alpine " sunlight ultra-violet-ray apparatus, radiant light and heat apparatus, portable violet-ray high-frequency sets, vitalators and ozonisers, hair dryers, electric heating blankets and pads, vibrators, sewing-machine motors, electric saucepans, hot plates, convertible holders, fans, birum suction cleaners and polishers, parlour 'phones and immersion heaters.

On the stand of BELLING & CO. a wide range of " Belling " fires is displayed, both for domestic and industrial purposes. Amongst the domestic range are some portable designs in several beautiful finishes, and also a wide range of imitation coal fires fitted with a realistic flickering flame effect. For industrial purposes there are totally enclosed and fireproof air warmers, pipe heaters and electric hot-water radiators. A series of electric cookers is also on show, ranging from the well known " Baby Belling " cooker up to full-size models. There are also some electric water heaters suitable for fixing into any existing tanks or cylinders, and for use in conjunction with the ordinary domestic hot-water system. Practical demonstrations are given of the new " Parmotor " relay which is on show for the first time. This is for automatically controlling electrical circuits and is claimed to be more reliable and more flexible and cheaper than a time switch. It has a very wide application, including the thermostatic control of electric water heaters, cookers, electrically heated rooms, street-lighting control, shop-window lighting, night signs, traffic control, and so on.

Messrs. BEATTY BROS., LTD., are exhibiting the " Beatty " electric washer, complete with a reversible wringer. This machine is fitted with a positive agitator which is claimed to be the latest and fastest type of mechanism for the thorough cleansing of clothes. The machine may be connected to an ordinary electric light socket, and costs less than an electric iron to run. An ordinary household washing can be completed, it is claimed, in an hour, with only the aid of hot soapy water. Ball-bearing castors allow easy movement of the machine, which does not take up much room. The reversible wringer can be swung and locked in seven different positions, and is fitted with reversible rubber-rollers. There is also a quick-release which instantly releases the pressure on the rollers.

On the stand of Messrs. Falk, Stadelmann & Co., Ltd., fitings for electric light in the prevailing style form the keynote, but comprehensive arrays of " Nova " and " Efesca " switches, " Hitest " cable, &c., " Ideal " table apparatus, and " Efescaphone " wireless sets give added interest.

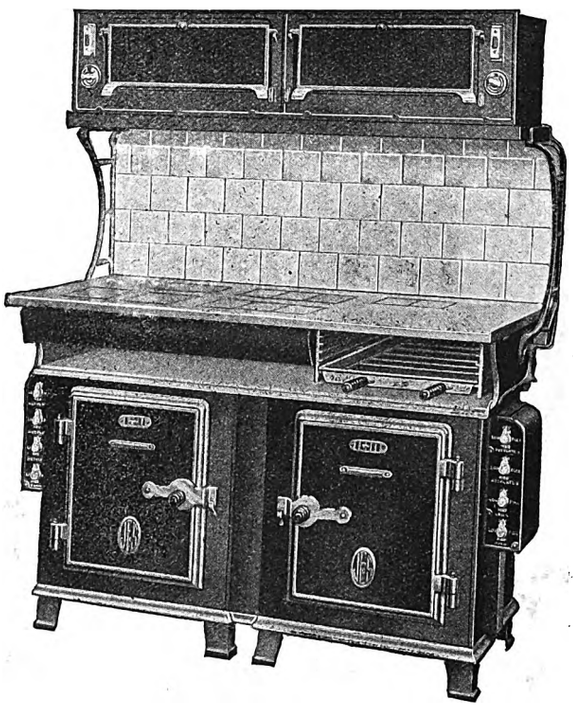

Fig. 6.—" Jackson " No. 24D. Cooker; 19.1 kW.

On the stand of the YORKSHIRE ELECTRICAL DETONATOR CO., LTD., may be seen samples showing various stages in the manufacture of electric fuse detonators. There are also exhibits of submarine electric fuse detonators, electric firing exploders, connecting cables, wire, and testing instruments.

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Messrs. PICKERINGS, LTD., are displaying an electric passenger lift of the push-button control type which has a capacity of four persons and runs at 100 ft. per minute. An electric service lift and a directly-coupled electric friction hoist, 3½ cwt., are also shown.

Among the electrical items which are to be found "burried" in the exhibits of non-electrical firms may be mentioned a Baker Perkins electric oven on the stand of HUNTERS THE BAKERS, LTD. This is a portable 2-deck skip-type peel oven with a baking area on each deck of 6 ft. by 5 ft. The loading is 27 kW. It is interesting to note that an oven of this type has been installed on H.M.S. Cumberland, and that two others are being erected on H.M.S. Medway.

"Artofex" electric ovens may also be seen on some of the stands, including that of Messrs. JUVELS, which is equipped with electric ovens, hotplates, cake mixers and whisking machines.

Exhibits which may be seen on the stand of Messrs. G. & J. WEIR, LTD., include a "Multiflow" feed-water heater; a "Monotype" air pump, 16 in. by 9 in. by 12 in.; a two-throw pump, 7 in. by 7½ in., electrically driven, 16,300 gal. per hour at 75 r.p.m. against 80 lb. per sq. in.; a two-throw pump, 4 in. by 4½ in., electrically driven, 4,250 gal. per hour at 100 r.p.m. against 80 lb. per sq. in.; a 10-ton evaporator with feed regulator and brine ejectors, 10 tons per 24 hours.

Messrs. DAVIDSON & CO., LTD., have an interesting display of "Sirocco" products, including a cupola fan capable of supplying adequate volumes for cupolas, furnaces, &c., up to 30 in. w.g.; a dust fan for handling dust of every description; and a narrow-width dust fan, designed for use with extensive ductwork in which frictional resistance up to 12 in. w.g. has to be overcome. There is also a working model of a Davidson patent flue dust collector, S.P. type, and one of a "Sirocco" dust collector suitable for dealing with dust of every description.

Messrs. H. C. SLINGSBY has on show a range of automatic electric trucks, including load-carrying trucks; elevating platform trucks for loads up to 2 tons; lifting-tiering trucks up to 75 in. for loads up to 2 tons; trackless-tractor-trailer-truck-trains; and industrial engines, trackless and for railways.

Some good examples of electro-plating work are being shown by Messrs. SAMUEL ALLEN & CO., LTD., who are also displaying "Luminad" electric sign lanterns.

Among a number of firms who have displayed small electricity generating sets of the country-house lighting type are MESSRS. ROBSON & COLEMAN, who are showing a 6-kW crude-oil Crossley engine complete with a Holmes dynamo and switchboard, &c., and also a 1½-kW petrol set. The cost of fuel for the crude-oil set is claimed to be exceedingly low, considerably below ½d. per unit. On this stand are also to be seen an electric drill, a sheep shearer and a horse clipper, an all-electric wireless set, a sun-ray medical lamp, and some apparatus suitable for country-house use. A feature of the stand is the ceiling panel lighting employed, and another point of interest is the low-temperature ceiling panels designed for even distribution of heating throughout buildings, everything being concealed.

Included in a representative series of stationary and marine oil engines and electric generating plant exhibited by MESSRS. PETTERS, LTD., is a controlled automatic 5-kW electric lighting set with an 8-h.p. Petter surface ignition oil engine. This set runs on crude fuel oil, and the running cost is said to be approximately one halfpenny per unit. A special starting motor is provided, driving the engine crankshaft through reduction gearing, and the whole is carried on a heavy cast-iron bedplate. The necessary heat for the ignition of the first charges in the cylinder is provided by means of an electric heating plug which serves until the vaporiser in the cylinder head has attained a sufficient temperature to carry on ignition automatically. There is also in operation a Petter "Atomic Diesel" high-compression, cold-starting, airless and springless-injection oil engine, a four-cylinder unit of 100 h.p. The engine operates on the improved two-stroke cycle, and its design is characterised by its extreme simplicity.

FILTRATORS, LTD, are showing a complete "filtrator" plant for dealing with boiler feed water, including the "Filtrator," together with the continuous blow-down and heat-recovery apparatus. The filtrator treatment is entirely non-chemical, and it will deal, it is claimed, with any type of water and also water of varying hardness.

BAKELITE, LTD., are showing a variety of mouldings made from bakelite moulding materials, and also samples of bakelite laminated sheet for switchboards, &c., bakelite tubes and rods for transformer and switchgear insulation, and bakelite varnish for coil-insulation, &c.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., and its associated companies have a particularly interesting show at the Palace of Engineering. Their stands are surrounded by a scale model of a 66,000-V overhead transmission line. In the industrial heating section they have displayed a 27-kW and a 9-kW electric furnaces by the Birmingham Electric Furnaces, Ltd. These furnaces are designed for general heat-treatment purposes, and are shown working up to a temperature of 1,000 deg. C. There is also a 3.75-kW magnetic steel-hardening furnace by Wild-Barfield Electric Furnaces, Ltd., a Vickers-Armstrong hardness-testing machine, an 18-kW immersion-type electric water heater for steam raising by A. Reyrolle & Co., Ltd., and miscellaneous heating apparatus, such as solder bolt heaters, babbitt metal pots, and so on.

The Colliery Machinery Section of the company's stands is equipped with a 2,000-g.p.m. centrifugal pump by Mackley and Co., with a directly-coupled high-torque squirrel-cage motor by Veritys, Ltd., and Ellison control apparatus, working under full-load conditions in conjunction with a waterfall. Other items include an endless rope hauler by John Wood & Sons, Ltd., incorporating a 22½-h.p. slip-ring induction motor and a flameproof mining-type switch panel by the English Electric Co., Ltd., and an airbreak flameproof drum-type reversing controller with independently mounted resistances by Allen West and Co., Ltd.; an explosion-proof portable gate-end sub-station designed for the remote control of coal face machinery; a working model of an a.c. electrically-operated geared winding engine with a bi-cylindro conical drum by Robey & Co., Ltd.; and a working model of a mine-ventilating installation by Davidson & Co., Ltd.

In the Company's General Industrial Machinery Section may be seen in operation an electric shearing machine by Holman and Co., a portable Reavell compressor set, a 3-h.p. Brook-Igranic ventilating fan with press-button control, a "Power Factor" demonstrating model by means of which the effect of power-factor correction in an electrical circuit is shown, a model variable-speed chain drive gear box by P.I.V. Chain Gears, Ltd. (433/1,300 r.p.m.), and portable electric tools and tools operated by flexible shafts by Vidal Engineering Co., and Flextol Engineering Co. Reference should also be made to an ingenious device, Synchro-Vane, which consist of two motors, each fitted with a four-bladed propeller revolving in the opposite plane at a speed of 1,200 r.p.m., thereby producing a peculiar optical effect.

Situated in the tower entrance of the Palace of Industry is a group of the company's exhibits known as "Switchcraft Corner." One stand depicts in a pleasing modern setting the domestic uses of electricity for lighting, cleaning, heating, kitchen work, cooking, ironing, &c., and another stand is devoted to four large tableaux with wonderful lighting effects. These tableaux depict picturesque scenes typifying illumination from early days, the coldness of refrigeration, the modern method of dirt removing and the perfect control of electric cooking. A rest room is beautifully lighted with artificial daylight, and embodies an information bureau. Another exhibit, "Rooms of To-day and Yesterday," is impressive in showing how the "dowdy" rooms of a few years ago—still so common a feature in many homes—may be made artistic and comfortable with modern furnishings and electric fittings. That ultra-violet rays have all sorts of practicable, but unlooked for, applications is being demonstrated in a fluorescence cabinet.

Visitors who like to speculate on "How it Works" will have full scope in such exhibits as "The Mystery Wheel" and "The Mystery Lamp," which are each operated by a photo-electric cell.

Legal.

The Marconi Company's Royalties Appeal.

THE second case in which Marconi's Wireless Telegraph Co., Ltd., is appealing from a decision of the Comptroller-General of Patents in respect of the grant of compulsory licences for the manufacture of wireless receiving sets and valves came before Mr. Justice Luxmoore in the Chancery Division on May 15th. The Order made by the Comptroller-General directed the Marconi Company to grant a licence to the Loewe Radio Co., to manufacture in this country triple and double valves, paying royalties of 10s. and 7s. 6d., respectively; in other forms of multiple valve the royalty was to be calculated on the basis of 5s. for the first, and 2s. 6d. for each additional unitary valve.

Sir DUNCAN KERLY, K.C., for the appellants, said that the Loewe Co. was incorporated in 1927, and had an issued capital of £50. It was the creation of a large German radio company. It was formed to carry on business if it got a licence. If the Judge refused the licence its *raison d'être* would disappear.

Mr. CRIPPS (for the Loewe Co.) denied this, stating that the company manufactured other things.

Sir DUNCAN said the company had acquired a factory with money borrowed from the German company. The German company had an invention in which all the material parts of a three-valve receiving set were contained in one envelope. It was in effect one valve.

Mr. CRIPPS said there had to be coils.

Sir DUNCAN said the Comptroller described the valve as a "very remarkable and beautiful example of ingenious design and high-class workmanship." The Marconi Co. never refused applicants a licence. There was correspondence between them, and when it was pointed out that the Loewe Co. would need a licence for more patents than they had mentioned they said they were not prepared to take more, and they would apply for a compulsory licence, which they did without further ado. He contended that there was absolutely no case for interference by the grant of a compulsory licence on the ground that a licence had been refused. He maintained that the Comptroller was so captured by the invention that his judgment was overborne, and he thought he must do something for its use in this country.

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The Judge was handed a sample valve. Mr. Cripps explained its working, and his Lordship considered that it was "a beautiful piece of work."

Sir DUNCAN contended that on the written evidence before the Comptroller there was absolutely no case for proceeding further. Verbal evidence was given by Mr. Loewe, who said the invention was protected by British letters patent, that the valve was made under licence from the Telefunken Co. at a royalty in Germany of 1s. 3d., and was sold there at the equivalent of £1 19s. There was an enormous sale and a substantial export. It could be put on the British market, allowing for a royalty of 10 per cent. on the wholesale price, at £2 10s., at which it was estimated to supply a demand from half a million people. Mr. Loewe also undertook to transfer the export trade to British Colonies from Germany to this country. But there was nothing before the Comptroller or in his capacity to control to provide for any limitation of the German export trade, and the licence had been granted without any limitation. The Comptroller assumed that the invention was covered by patents, but he had no materials for judging whether the latters patent were worth anything. The case had proceeded on unverifiable assumptions. The Comptroller had assumed that to prevent the patent being worked here was to prejudice the establishment of a new trade or industry. Also, he said that the demand of a royalty high enough to prevent the new article appealing to a new group of purchasers was prejudicial within the meaning of the Act. One aspect that had been lost sight of was the effect of the invention on existing manufacturers under the Marconi patents. There was no condition in the licence limiting manufacture to any particular article, and there was no minimum royalty. He further complained that the Comptroller had fixed the royalty without having any means for deciding what a reasonable royalty would be. He disputed the Comptroller's view that the Loewe Co. desired to establish a new trade here. It wanted to enter an existing trade with a new variety of article which without any preference would enable it to become a formidable competitor. Counsel read the evidence which was given before the Comptroller, and said it was to be noted that though the evidence was that there was a great and growing demand in Germany for the Loewe receiving set, there was no suggestion that the trade in ordinary valve sets was continuing there. There was no evidence that the Loewe Co. was refused a licence, or that the Marconi Co. was at all unreasonable. What did appear was that the speculation in finding a new class of purchaser had no basis of proved probability. What was certain was that the grant of a licence on preferential terms would enable the applicants not only to destroy the existing licences of the Marconi Co., but also enormously to reduce the royalties which it had been receiving. For the suggested royalty of 10s. on the Loewe triple valve there was no basis whatever. Counsel then read the decision of the Comptroller-General.

When the hearing was resumed on May 16th, Sir DUNCAN KERLY said the Comptroller had stated that there was a potential demand for the new apparatus, but this was not provided for by the Act. The establishment of a new trade or industry was not, as the Comptroller seemed to think, the introduction of some variation of something which was already an article of commerce. The Loewe Co. merely desired to enter an established trade with a new variety of attractive goods. There was no limitation in the licence to the manufacture of cheap sets, and there could be no possible case for granting a general licence. The Marconi Co. was desirous of the opportunity of putting the Loewe valves on the English market, and was prepared to discuss terms, but it had never even had a proposal made as to the extent of the limitation of the licence. It was by the protection of the Marconi patents that the English trade had been built up. The Loewe Co. would be in a position to swamp that trade. The only limitation in the licence was that 50 per cent. of the factory costs should be incurred in this country.

Mr. STAFFORD CRIPPS, K.C., on behalf of the Loewe Co., said there was a fundamental distinction between this case and the Brownie case. The position of the applicants in this case was that they were the owners of 12 British letters patent. The Crown had granted them a monopoly, and he submitted that it must be assumed that the Crown did that because it was thought that it was desirable that a new manufacture should be established in this country. It was common ground that the monopoly could not be exercised in this country without a licence and unless the monopolies were worked within a certain time the patents were revokable. The Marconi Co. did not manufacture, and their licencees could not manufacture, the Loewe valve, and if the applicants were not allowed to manufacture the article here the country must inevitably go without it. It could not be for the good of the country that for ten years or more it should be definitely deprived of the use of an article which was sufficiently meritorious for the grant of 12 monopolies in respect of it, whereas other countries in the world were free to use it. The licence included a number of clauses for which he never asked and which he would be glad to see omitted, the 10s. royalty, for instance; it was left to the discretion of the Comptroller, and he settled the matter. The Loewe Co. asked for a licence under five Marconi patents. They were told they could only have it under 13. That, he submitted, was a refusal to grant a licence. Even if he was wrong about that, he contended that the conditions which the Marconi Co. sought to impose amounted to a refusal to grant a licence on reasonable grounds. The Loewe Co. did not claim more for its three-valve set than any other three-valve set. The merit of the invention was that they could make it at a quarter of the price of an ordinary three-valve set. If the public was going to be charged a royalty of £1 17s. 6d. it would largely lose that benefit.

The hearing was concluded on May 17th, when Mr. CRIPPS, K.C., in further argument, said the Loewe valve was more more than a valve; it was a receiving set, and he contended that its manufacture in this country was the establishment of a new trade or industry in the fullest sense of the British patent law, and a factory had been established in London. It was impossible to say that the valve was a mere improvement on, or alternative to, an ordinary valve. The fact that its production required special machinery went to prove that the manufacture of the article was a new trade or industry. If his Lordship did not accept this suggestion, then counsel contended that it was an existing trade. In that case the Loewe Company's trade was clearly being prejudiced. He could not imagine a case in which there was more prejudice to trade than when one had a factory for the production of an article and was prevented from producing it. It was impossible commercially to put the article on the market with such a high royalty as 37s. 6d. There had also to be considered the prejudice to dealers in wireless who would be unable to enjoy the accession of business which would result, and the prejudice to the trade of the country. Moreover, it was contrary to the public interest to refuse the Loewe Co. a licence on reasonable terms. When considering the question of royalty one had to consider what the Marconi Co. had reasonably expended on acquiring its patents, and also the capacity of the public to pay. In Germany in the year prior to the hearing of the case the royalties paid to the Telefunken Company amounted to £35,000, the amount of royalty being 1s. 3d. a set. Here the proposal was 10s. per set, and in the export trade alone, which Mr. Loewe had undertaken to transfer to this country, a very large sum would be payable to the Marconi Co. that it did not now receive. They would be made a present of 8s. 9d. a set. If a royalty of 37s. 6d. had to be paid, it would be impossible to bring the export trade to this country. The Loewe Co. was quite prepared to pay a reasonable minimum royalty. It was also willing that the licence should be limited to the particular form of multiple valve that had been shown, and to any reasonable limitation as regards price. It had been advertised at £3 3s., and that would quite likely be reduced when the factory got fully going.

The JUDGE suggested that it might be possible for the parties to agree a form of licence.

Sir DUNCAN KERLY said he was unable to do that on his present instructions, but he was authorised to say that his clients fully anticipated that there would be a licence, and they were prepared to grant one.

Mr. CRIPPS said that the only difficulty arose from the difficulty of getting instructions.

The JUDGE said he hoped to be able to deal with the matter on the first day of the next sittings. If the parties reached an agreement in the meantime it would not be necessary for him to give his decision. The suggested terms of the agreement were written down and handed to his Lordship, but were not disclosed.

Sir DUNCAN KERLY declared that the whole basis of the case was that a gentleman desired to compete in an existing flourishing trade by operating a cheaper article in competition with articles already sold in the trade. The Marconi Co. denied that that was the establishment of a new trade or industry, or that it was in the public interest he should do so.

Mr. STAFFORD CROSSMAN, for the Crown, said he desired to adopt the observations of the Attorney-General in the Brownie case. The only point which did not arise in the Brownie case was as to the meaning of the expression "establishment of any new trade or industry in the U.K." In this case he suggested that "trade" could not be limited to a particular improvement in trade or detail of manufacture. It appeared to be a question of fact whether this particular work which the Loewe Co. was doing came within the meaning of new trade or industry in the sub-section of the Act.

His LORDSHIP, at the conclusion of the arguments, reserved judgment, and said he would give his decision in both this case and the Brownie case together.

The Gasfilled Lamp Patent.

As was reported in our last issue, this case was concluded on May 14th, when the British Thomson-Houston Co., Ltd., was granted a two-years' extension of its gasfilled lamp patent.

In his concluding address, Sir ARTHUR COLEFAX, K.C., for the company, said that he had no objection to a condition being imposed as part of an extension order making provision for the case of a manufactory established in this country for the manufacture of gasfilled lamps during the interval between the expiry of the patent and the date of the grant of the extension. But he did object to the insertion of any condition which would have the effect of franking the import of foreign-made lamps into this country during the interval. It was not the fault of the applicants that there was any interval. Dealing with the arguments of counsel for the opposition, Sir Arthur said that the patent could not be properly worked during the war. When the applicants and

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their licencees became decontrolled it was only a few months before small gasfilled lamps were put on the market. But for the war the lamps would have been put on the market in 1915. In those circumstances two years was not an adequate period for the prolongation of the patent, which ought to be extended for the full period of the war. An attempt had been made to show that instead of losing by the war the applicants had gained. But even with regard to the large lamps, the evidence was that there was an unsatisfied demand for them in the war period. Owing to their restrictions, the applicants could not make a manufacturer's profit. They had to import lamps, and they were not allowed to import freely. The fact that 70 per cent. of the gasfilled lamps sold were small lamps showed that this type of lamp was preferred to vacuum lamps. There was no evidence that the patentees had done anything improper with regard to licences. They had always been ready and willing to grant licences on suitable terms. Counsel concluded by asking for a prolongation of the patent for a period of four years.

Mr. Justice Luxmoore, in giving judgment, said it was sufficient in the majority of such cases for the manufacturer to show that the working of the patent had been prevented or interfered with by the war. In this case the applicants alleged loss and damage by the war. They did not suggest that they had not made substantial profits out of the invention during its life, but that a large part of the life of the invention had been cut off by the war. The invention was no doubt an important one, of far-reaching effect. The opposition was based on four or five grounds. First, it was denied that the applicants had suffered loss or damage by reason of the war; secondly, that they had since the war recouped themselves for any loss sustained during the war; thirdly, that the applicants had in fact been adequately remunerated; fourthly, that the application had been put forward with a lack of candour. It was said that they charged too high a price for lamps, that they allowed larger discounts to those traders who agreed to take other non-patent articles from them, and that there had been a refusal to grant licences, and generally that applicants had abused their monopoly rights. What were the facts? The patent was granted in 1913. No lamps were manufactured under the patent before the war. The lamps were first put on the market in 1915. From the outbreak of war the applicants were engaged in making machinery and apparatus for the forces of the Crown. In 1915 applicants' works became a controlled establishment, and so continued till late in 1919. The figures of the output of the applicants and their licencees showed clearly that the output was affected during the war. Mr. Gray, in his affidavit, said that the lamps made during the war were lamps of large size required by the Government, and it was impossible to manufacture small gasfilled lamps which formed the bulk of the requirements of the public. He had no hesitation in accepting the evidence of Mr. Gray where it differed from the evidence of the opposition. He was satisfied that there was material interference with the normal life of the patent, due entirely to the war and the restrictions the war imposed. Next it was said that the loss or damage had been more than recouped since the war. He could not see there was any real ground for such a suggestion. Suspended demand did not apply in his view to an article like an electric lamp, which had a comparatively short life. It was next said that the applicants had been adequately remunerated. It was not his province to consider that; the only question was whether the life of the patent had been shortened. If it had the patentee was entitled to an extension. The next objection was to the applicants' methods of trading and the application to the Court. It was said that the figures given did not enable the Court to see what profits had been made. He had not got to consider whether the remuneration was adequate or otherwise, but whether a material part of the life of the patent had been lost to the patentee. He acquitted the applicants of the charge of want of candour. He had no hesitation in saying that the evidence before the Court supplied by the applicants was sufficient. Next it was said that the prices charged were too high. He saw no ground for that. Public demand had been large, and was undoubtedly increasing, and if there were real grounds for the allegation one would expect evidence of a specific nature to support it. The larger discounts, he considered, were not unreasonable in the circumstances, and in his view the so-called "municipal" contracts did not fall within Section 38 of the Act. They were contracts entered into with the Electric Lamp Manufacturers' Association, and not with the applicants at all. The next matter was that applicants had refused to grant licences on proper terms. On the evidence before him the only refusal to grant a licence had been in the case of one man, and after the evidence of Mr. Gray with regard to that he saw nothing unreasonable in the refusal. In considering the question of extension, he was bound to take into consideration that it must necessarily take some time to put the articles made under this patent on the market commercially, and that during the war period some work was done on the patent, mainly, it was true, in connection with large lamps; further, he might take into consideration the fact that the profit on those lamps was probably higher than it would have been on small lamps. Further, the company during the war was making large-sized lamps and was gaining valuable experience. After very careful consideration, he had come to the conclusion that the proper period for extension was two years. In coming to that conclusion he had been assisted by the view expressed by Mr. Crossman, on behalf of the Comptroller. In conclusion, his Lordship said that the applicants must use their best endeavours to obtain the registration of licences forthwith. There would be no order as to costs.

Theft of Electricity.

A case of an unusual nature was heard at the Old Street Police Court, London, on May 14th, when Reginald Hughes, Stepney, was sentenced to six months' hard labour for the theft of electricity. The evidence showed that Hughes was employed by a man who lived next to him. His employer noticed that his electricity bill had become abnormally heavy, and also that when his supply was switched off the defendant's lights went out. It was then discovered that wires had been run from the meter through the dividing wall into defendant's house.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Proposed Technical Society for Meter Engineers.

It would be a thousand pities if the juniors were to feel that their interests were being neglected.

It is without doubt desirable that they should be able to participate freely in any activities organised for the advancement of metering knowledge and kindred subjects. Danger lies, however, in any tendency to scattered effort, as against unity. The late M.E.T.A. did exceedingly good work, and its chief asset was unity of effort. As is known, it became transformed into the Meter and Instrument Section of the I.E.E. What good object would now be achieved by causing disaffection? Why revive arguments on points that were considered in detail and at length during the months preceding the transformation, and were finally settled by a decisive majority approaching unanimity?

The Meter and Instrument Section does (with greater authority and effect) all and more than the old M.E.T.A. did, with the one exception of the publication of the M.E.T.A. *Proceedings*. The quarterly publication of those *Proceedings* used to cost organised effort and, above all, money. A monthly publication would cost still more of both. It is exceedingly doubtful if a new society could support the necessary sustained effort and cost, especially after the first eager enthusiasm had evaporated.

The M. & I. Section holds six meetings during the winter session. Juniors, who are not members of the Institution, are always welcome as visitors. The papers read are separately available in the form of advance copies. The fact that the papers are of a high standard should react to the advantage of the younger men, rather than to their detriment. Papers may, if there is a demand, be read at the I.E.E. local centres in the provinces, thus discounting the disadvantage of the inaccessibility of the London meetings. The late M.E.T.A. was never able to afford this facility, nor, I think, could any new society.

The younger members of the meter and instrument section of the industry will find, I am sure, that it will be best to take the long view, and that their ultimate interests will be best served if they give active support to the M. & I. Section of the Institution and cast out of their minds any idea that the seniors, even inadvertently, are keeping aloof from them. On the contrary, the senior men are only too willing to do all in their power to help the younger men; therefore, it would be a great mistake to weaken the bonds that exist and to establish a definite state of separation by the setting up of a new society. Unity has been gained at some cost; try to retain it.

E. W. Hill.

London, *May 13th*, 1929.

An Old Problem—from a New Point of View.

Will you permit me to comment on a part of the article on the above subject in your issue of May 10th?

"Ric" states, *inter alia*, that "It is the easiest thing in the world to obtain a diploma . . . from a correspondence school."

Within 24 hours of that statement being published I received a letter from a student, referring to "Ric's" article, in which he states: "If this goes unanswered it will be rather discouraging after a chap has put in four years' evening swotting to be told that nothing is easier." I quote in all his bald simplicity of terms.

It is conceivable that the author has taken a diploma from a correspondence school; he may, for all I know, have qualified for and taken his diploma from these schools and found it the easiest thing he had ever done. This merely means that it was easy to him personally and by inference that he is one

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of those exceptional people to whom nothing in the way of scholarship presents any difficulty. Dr. Young, of Rosetta Stone fame, was elected an F.R.S. before he was 20, but surely this does not imply that it is an easy job, and that anyone can do it? Young was an exception, and must be ruled out when considering average cases.

I do not know if "Ric" includes these schools among the four probables "that attempt to carry out the promises of their advertisements," but whether he does so or not, it is certainly by no means an easy job to obtain the I.C.S. Diploma. In one of our courses in electrical engineering there are 112 separate instruction papers, each being a pamphlet of from 30 to 80 pages, and each student has to pass an examination on each paper before he can take the final examination for the diploma. This means that a man has to pass not one, but 113 examinations.

I am unable to see any point in the fact that this work is done in the students' home, and certainly an average time for each test would be five hours' concentrated work on the question paper alone without considering the time spent in studying the instruction matter. It by no means follows that the final examination is taken by the student in his own home. We have an arrangement by which a student may take his final under supervision, and the supervisor has to make a declaration that the conditions of the examination, the time, and so on, have been fully observed. In every case of our students in India, we insist upon this supervision. Apart from this, a large percentage of our students are reading for one of the examinations held by one or another of the public examination bodies—the various professional institutions, the examinations of certain universities, and so on. These men do not obtain a diploma at all from us, but merely a notification that they have received a percentage of marks for the work on the various subjects of their course.

The author states that "The thing can be done by private study, but a tutor of some sort is necessary." I submit that the thing is being done by private study by these men, and that we represent the tutor to whom they can turn, and to whom they do turn, by writing about their difficulties and receiving our explanation. Further, the course is systemised, and the student works to the system.

We should welcome a Central Board of Technical Education, and would willingly co-operate in any scheme which would tend to raise the standard.

I am taking the liberty of enclosing a couple of instruction papers in order that you may see for yourself the scope of our work on the more elementary principles, and if "Ric" cares to call and see me any day during business hours, or will make an appointment to meet me outside business hours, I shall be happy to show him the system in working order, and, I hope, convince him that his statement is exaggerated. I know that correspondence schools have supplanted the mother-in-law in certain types of humour, but at any rate some of them are doing work which cannot be handled by any other school, or college.

Francis Thos. Fawcett,

Chief Examiner, SCHOOL OF ELECTRICAL ENGINEERING, International Correspondence Schools, Ltd.

London, W.C.2, *May 13th*, 1929.

[The instruction papers have been received.—EDS. ELEC. REV.]

The Compulsory Earthing of Prepayment Meters.

If Mr. A. J. Abraham knows as much of electrical matters as he knows of the relationship between husband and wife, his letter should not be taken too seriously. He writes: "In the tenth case, the lady of the house might receive a little shock, when she would probably *give* 1s. to 'hubby' to put in the meter so that he could get one too."

Mr. Abraham can't be married, or he would not suggest such a thing. What might happen is that the lady of the house would say to "hubby": "I have no change, so put a few shillings in the meter, or you will not get any dinner."

Leonard F. S. Sington:

Liverpool, *May 17th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

28,492. "Vibrating electric motor." Traylor Vibrator Co. November 2nd. 926. (280,194.)

31,410. "Regulation of control of alternating currents." G. L. Porter and erranti, Ltd. November 22nd, 1927. (310,296.)

31,773. "Manufacture and production of electrodes for Edison accumu- ators." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). November 25th, 927. (310,383.)

34,949. "Potential supply means suitable for use in wireless receiving pparatus." B. D. Feild and T. C. Standbrook. December 23rd, 1927. Addition to 293,114.) (310,299.)

1928.

1,800. "Electric switchgear." British Thomson-Houston Co., Ltd., M. C. I. Hunter, and F. L. Fletcher. January 19th, 1928. (310,387.)

2,027. "Electricity meters." Siemens Bros. & Co., Ltd., and C. R. Riber. January 21st, 1928. (310,390.)

2,120. "Electrically-operated and controlled means for operating the barriers at railway crossings." A. U. Westfelt. January 23rd, 1928. (310,304.)

2,411. "Loud speakers and the like." O. D. Lucas. January 25th, 1928. (310,441.)

2,610. "Wireless telegraphy and telephony, and aerial systems therefor." C. S. Franklin. January 26th, 1928. (310,451.)

2,639. "Electric remote control systems." Compagnie des Téléphones Thomson-Houston. January 27th, 1927. (284,296.)

3,310. "Primary batteries." J. W. Manley. February 2nd, 1928. (310,570.)

3,343. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. E. Beale February 2nd, 1928. (310,574.)

3,344. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and O. A. Pearce. February 2nd, 1928. (310,575.)

3,449. "Electrical condenser." Leclanché Soc. Anon. February 12th, 1927. (285,079.)

3,682. "Amplifiers for electric circuits." Soc. Industrielle des Téléphones. February 5th, 1927. (284,977.)

3,807. "Telephone instruments." Siemens Bros. & Co., Ltd., and W. E. Goodwin. February 7th, 1928. (310,579.)

4,019. "Thermal electric switches." N. Dennes and Associated Electrical Industries, Ltd. February 8th, 1928. (310,581.)

4,075. "Means for indicating or recording, also applicable to electrical relays." H. J. Buchanan-Wollaston. February 9th, 1928. (310,582.)

4,244. "Mercury or the like switches." British Thomson-Houston Co., Ltd., and C. G. Garton. February 10th, 1928. (310,585.)

4,524. "Clamp for electric current-conducting wires." G. Hammermann. February 14th, 1927. (285,379.)

4,786. "Make-and-break devices for use in electric ignition systems of the combined induction-coil and magneto-ignition type for internal-combustion engines." British Thomson-Houston Co., Ltd., L. Griffiths, and C. J. Morton. February 15th, 1928. (310,592.)

4,811. "Electrical relays." T. W. Ross and Associated Electrical Industries, Ltd. February 15th, 1928. (310,593.)

4,875. "Metal clips and like fastening means for electric cables." J. McCallum. February 16th, 1928. (310,595.)

5,109. "Electric switches." W. J. Charles and A. Watson. February 18th, 1928. (310,597.)

5,923. "Electric lamps." H. S. Cooke. February 25th, 1928. (310,605.)

5,950. "Headlights for vehicles." A. H. Ehrhard. February 25th, 1928. (310,606.)

7,987. "Control systems for electric motors." E. N. Bray, Ltd., and E. N. Bray. March 15th, 1928. (310,615.)

8,075. "Electric connectors." J. B. Taunton and Ranton, Ltd. March 16th, 1928. (310,620.)

8,316. "Thermionic valve arrangements." Marconi's Wireless Telegraph Co., Ltd. March 17th, 1927. (287,463.)

8,735. "Production and application of plates for electric condensers and the like." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). March 22nd, 1928. (310,625.)

8,967. "Electrical relay devices." Westinghouse Electric and Manufacturing Co. March 25th, 1927. (287,578.)

9,257. "Adjusting device for the driving systems of electric measuring instruments of the induction type." Landis & Gyr Soc. Anon. April 25th, 1927. (289,375.)

11,724. "Electric switches." D. Gueron and S. Danon. April 20th, 1928 (310,650.)

12,340. "Wireless direction-finding apparatus." Siemens Bros. & Co., Ltd., S. H. Long, and M. Hodge. April 27th, 1928. (310,658.)

12,771. "Lighting arrangements for power vehicles." R. Frey. May 2nd, 1927. (289,813.)

14,397. "Electric radiators." L. Canard. June 4th, 1927. (291,441.)

14,877. "Telegraph printers." L. C. Eastern. May 21st, 1928. (310,677.)

15,665. "Electromechanical resonance device for distant control." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz and Soc. l'Action à Distance. June 14th, 1927. (Addition to 277,024.) (292,120.)

15,686. "Electrical heating of furnaces." Dr. W. Hammer. June 2nd, 1927. (291,450.)

20,009. "Knee-control mechanisms for portable electric sewing machines." W. Fairweather (Singer Manufacturing Co.). July 10th, 1928. (310,714.)

21,344. "Telephone apparatus." R. L. J. Laurent, De La Vide le Roulx. July 22nd, 1927. (Addition to 274,898.) (294,489.)

21,709. "Arc-welding electrode holders." L. Renault. January 5th, 1928. (303,490.)

23,278. "Speed-control systems for electric motors." British Thomson-Houston Co., Ltd. March 26th, 1928. (308 674.)

23,606. "Electric lamp for illuminating rooms or containers filled with explosive gases or liquids." J. Beckmann. August 16th, 1928. (310,731.)

24,415. "Automobile headlights." H. Harper. August 24th, 1928. (310,734.)

24,859 "Process for the economical treatment of mixtures containing hydrocarbon and nitrogen in the electric arc." Soc. of Chemical Industry, Basle, and H. Andriessens. August 29th, 1927. (296,355.)

25,618. "Method of and apparatus for removing insulation from insulated wire." F. M. Van Gelderen. November 4th, 1927. (299,866.)

26,202. "Electric transformers." International General Electric Co., Inc. September 14th, 1927. (297,087.)

32,102. "Long-distance cable for four-wire working." Siemens-Schuckertwerke Akt. Ges. November 19th, 1927. (Addition to 294,570.) (300,899.)

36,195. "Illuminating arrangements." H. M. Rasmussen. December 10th, 1927. (302,159.)

1929.

1,311. "High-frequency apparatus." W. Otto. January 14th, 1928. (304,148.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 15th:—

B.A.A. No. 500,089. Class 1. Acid for accumulators and batteries.—F. W. Berk & Co., Ltd., 106, Fenchurch Street, E.C.3.

Faraday Radio Gramophones (lettering and design). No. 497,129. Class 8. Gramophones.—Faraday Sound Wave Electric Gramophone Co., Ltd., 8, Bridewell Place, E.C.4.

Amplion Lion. No. 498,850. Class 8. Loud speakers.—Graham-Amplion, Ltd., Slough.

Rabco. No. 501,084. Class 8. Radio-telephonic apparatus and parts thereof, &c.—W. Vincent, 227, Pentonville Road, N.1.

Passport. No. 501,135. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof, &c.—Hart Collins, Ltd., 38a, Bessborough Street, S.W.1.

The Forum (lettering and design). No. 501,291. Class 8. Radio-telephonic apparatus and parts thereof, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Neolux. No. 500,988. Class 15. Lamp shades made of glass, &c.—Louis Dernier & Hamlyn, Ltd., 23, Newman Street, W.1.

Sunblaze. No. 501,261. Class 18. Electric and gas stoves and radiators.—Berry's Electric (1928), Ltd., 85-87, Newman Street, W.1.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHTON-UNDER-LYNE.—Two schools (560 places), for the borough E.C.; F. W. Bromley, clerk.

AYR.—Electric lighting installation, district fever hospital, Old Cumnock, for Ayrshire C.C.; J. E. MacEwan, consulting engineer, 62, Robertson Street, Glasgow.

BARNSLEY.—Premises, Queen Street; F. W. Woolworth and Co., Ltd. Extensions, mill, Old Mill Lane; Yorkshire Paper Mills, Ltd. Workshop, Sheffield Road; W. Goodyear & Sons.

BEDFORD.—Depôt extensions (£21,000); borough engineer.

BEDHAMPTON.—School (350 places); Hampshire Education Committee.

BEXHILL-ON-SEA.—Concert hall, &c. (£11,650), for the T.C.; borough surveyor.

BILSTON.—High school for girls (£44,250), with electrical and heating work; Col. S. C. Lowbridge, architect, Stafford; J. & F. Wootton, Ltd., builders, Bloxwich.

BIRMINGHAM.—Museum, Cannon Hill (£8,000); city engineer.

BLYTH.—School (480 places), for Education Committee.

BOGNOR.—Business premises, High Street and London Road, for Timothy White, Ltd., Chandos Street, Portsmouth.

BRADFORD.—Reconstruction scheme, Sharman's warehouse, Thornton Road; city engineer. Elementary school, Eccleshall estate; extensions, Undercliffe girls' school and Wyke Modern School; city architect. Girls' grammar school, Royde estate; governors. School at Brierley, city architect and trade contractors.

BRISTOL.—Aerodrome, Whitchurch (£23,000); city engineer and Air Ministry. 84 houses, Speedwell estate; city engineer. 32 houses, Somermead; Greenhill & Low, Ltd. 200 houses, Southmead estate; rehousing scheme, Vale Lane, Bedminster; city engineer.

BROMBOROUGH (Cheshire).—Woodslee elementary school (400 places); county architect, Newgate Street, Chester.

BROMLEY.—Extensions, County School for Girls; Kent Education Committee.

CARLISLE.—Offices, Caldcotes, for Carr & Co., Ltd., biscuit manufacturers.

CHATHAM.—Adapting buildings at Fort Pitt for day training school; Kent Education Committee.

CHESTERFIELD.—Estate development off Chatsworth Road; J. H. & F. W. Green.

COVENTRY.—Public abattoir (£33,955), for the T.C.; E. H. Ford, city engineer. Nurses' home (£31,500), with heating and hot-water services, &c., Gulston Road hospital; C. Redgrave, architect, Hallam & Co., builders.

CROYDON.—School, Lodge Road (£32,000), for the borough E.C.; John G. Gray, builder, Coventry. Extensions Waddon schools (£20,350), for the borough E.C.; director of education.

DARTFORD.—Two central schools, for Kent E.C.; W. H. Robinson, architect, Springfield, Maidstone (returnable deposit of £2 2s.).

DONCASTER.—Housing scheme (36), Armthorpe and Rossington; surveyor to R.D.C.

DORCHESTER.—Extensions, isolation hospital; borough engineer.

EDINBURGH.—Employment exchange (£9,000); Commissioners of H.M. Works and Public Buildings. School (700 places), Saughton (£30,000); architect, Education Authority.

EPSOM.—Extensions, Manor Asylum (£29,253); W. H. Gaze and Sons, Ltd., Kingston.

FIFESHIRE.—School, Buckhaven, for Fife Education Authority; master of works, Education Offices, Kirkcaldy.

GLASGOW.—Buildings, for Commercial Union Assurance Co., Ltd., St. Vincent Street and Wellington Street; Frank Burnet & Boston, architects. 744 houses, for Corporation; architect, City Housing Department. Church in Dumbarton Road, for Baptist Union of Scotland; the secretary. Extensions, for Scottish Ice Rink, Ltd., Crossmyloof; the manager. Conversion of Union Bank into county offices, for the C.C.; clerk.

HEBDEN BRIDGE.—New St. John's Church; Sutcliffe and Sutcliffe, architects.

HALIFAX.—Pavilion and extensions to administration block at Shelf sanatorium; borough engineer, Crossley Street. Tenders to P. Saunders, town clerk, Town Hall, June 7th (deposit £1 1s.).

HIGH WYCOMBE.—Cinema, Castle Street, for the Majestic Theatres Corporation.

HODDESDON.—Wesleyan church hall, with electrical and heating work; Smee & Houchin, architects, 58, Fleet Street, London; Ekins & Co., Ltd., builders, Hertford.

HULL.—Extensions, Technical College, Park Street; Education Committee. Warehouse, Foster Street; British Extracting Co., Ltd. Municipal aerodrome, Hedon racecourse; city engineer.

HUNSTANTON.—Cinema; Allflat & Courtney, architects, Hill House, Tuesday Market Place, King's Lynn.

KIDDERMINSTER.—Works extensions, Mill Street; Carpet Trades, Ltd. Park Lane: Carpet Manufacturing Co., Ltd. Birmingham Road: W. R. R. Adam, Ltd.

KNUTSFORD.—Alterations and extensions to hospital administrative block, Bucklow Institution (deposit £2 2s.); W. Kennedy, architect, 14, St. Peter's Square, Manchester.

LEAMINGTON.—Estate development off Wathen Road; Standbridge & Parker. Estate development off Radford Road; Aneley & Son, builders, Coventry.

LEICESTER.—Baptist church, Aylestone; trustees.

LENHAM.—Extensions, sanatorium (£7,000); Kent C.C.

LICHFIELD.—Extensions, grammar school, for Staffs. E.C.; education architect, Stafford.

LONDON (East Ham, E.).—School, Altmore Avenue, for the borough E.C.; director of education.

(Eltham, S.E.).—Shops and dance hall, High Street; G. S. N. Stone, architect, Staple Inn Buildings, W.C.

(Penge, S.E.).—Secondary school, St. Arvans; Kent Education Committee.

(Westminster, S.W.).—Theatre, 44-5, Charing Cross; E. A. Stone, architect.

(St. Pancras, N.W.).—36 tenements, Clarendon Street (£20,000); borough engineer.

MACCLESFIELD.—Institution for mentally defectives; Cranage Hall estate; county architect, Newgate Street, Chester.

MANCHESTER.—Library; city architect, Town Hall. Premises, Market Street; Rylands & Sons, Ltd. Alterations and additions to Moston municipal school (deposit £1 1s.); director, Education Offices, Deansgate.

MARLOW.—Additional 40 houses, for the U.D.C.; H. C. Paine, surveyor.

MILNTHORPE.—Domestic subjects centre, for Westmorland E.C.; A. Knewstubb, architect, St. Andrew's Chambers, Penrith.

OSSETT.—Extensions, Moorcroft Mills; Hepworth Bros., Ltd.

READING.—Shops and offices, Friar Street and Blagrave Street, for H. G. Blagrave.

ROTHERHAM.—Housing scheme (40), Thrybergh, for the R.D.C.; C. O. Rawstron, engineer, Grove Road, Moorgate (returnable deposit of £2 2s.).

ROWLEY REGIS.—Housing scheme (284), for the U.D.C.; surveyor, Old Hill, Staffs.

RUNCORN.—Housing scheme (100), Weston, for the R.D.C.; J. Beckett, surveyor. Houses (40), Halton, for the Chemical and Metallurgical Corporation, Astmoor.

SALISBURY.—Electric lighting installation, municipal offices, for the T.C.; city surveyor.

SOUTHPORT.—Council school, Birkdale (deposit £2); Grayson & Barnish, architects, 606, Royal Liver Buildings, Liverpool.

STOCKTON-ON-TEES.—Houses (63), Norton, for the Synthetic Ammonia & Nitrates, Ltd.

STRATFORD-ON-AVON. — High School; Warwickshire Education Committee.

SURBITON.—Housing scheme (500), for J. Williams, trading as the Allied Building Corporation.

STROUD.—Extensions, central school (320 places), for Gloucestershire E.C.; H. W. Household, secretary, Shire Hall, Gloucester.

UPMINSTER (Essex).—Cinema (£25,000), for Louis Morris; W. F. Blay, Ltd., builders, London and Dartford.

WINCHESTER.—County office extension, for Hampshire C.C.; Winchester Castle Committee.

WREXHAM.—Electric lighting installation, Huntroyde estate housing scheme (36 houses), for the T.C.; J. W. Williams, borough electrical engineer, Willow Road.

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The

Electrical Review

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The I.M.E.A. Convention.

THE annual convention of the Incorporated Municipal Electrical Association is once more upon us. It is the thirty-fourth of the series of assemblies that are looked forward to yearly in pleasurable anticipation by all who are privileged to share in its profits and recreation. Having enjoyed the excursion into the West Country last year on the occasion of the Bath Spa meeting, delegates are to travel further westward this year to the fair Devonshire health resort of Torquay, the amenities of which neighbourhood are briefly referred to on later pages of this issue. The social part of these annual meetings is becoming almost as important as the strictly professional part, and it certainly deserves the prominence given to it in the programme of events, which is outlined on subsequent pages. Not the least of the pleasures of the Conventions is the yearly meeting of acquaintances, often casually met, whose mutual interest in municipal electrical matters quite as often ripens into firm friendship.

As is customary the morning sessions are being devoted to the reading, in abstract, and discussion of papers: the I.M.E.A. Council seeks to ascertain beforehand from members, by means of circular letters asking for suggestions, what subjects they desire to be discussed, and only to gentlemen possessing adequate knowledge of the chosen subjects is the invitation extended to submit papers. Thus are the standard of papers and general tone of the proceedings prevented from depreciating.

The exhibition of electrical appliances, largely of a domestic character, which is arranged each season for the instruction of delegates, has become a popular feature, though limited because all manufacturers are not eligible to stage displays of their products. This year some 37 exhibitors, including the B.E.D.A., E.L.M.A., and E.A.W., are taking part in the show and it is to be hoped that the local public will avail itself of the opportunity of visiting it. A sign of the times is the arrangement of an official "Women's Day" during which members of the Electrical Association for Women will be privileged to take a part in the Convention.

The I.M.E.A. is a very important body, representative of nearly 250 local authorities that undertake the supply of electricity; it is a source of valuable information to local authorities; it protects and advises the

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municipal section of the electricity supply industry through the many intricacies it has to negotiate from time to time. Generally delegations are adequate in the aggregate; this year promises a record gathering, with indications that the ladies and gentlemen attending may exceed four figures in number, though some subscribing authorities do not send their full complement, and a few do not seem to appreciate the unwisdom of remaining unrepresented entirely. They do not appear to consider that there is any obligation on their part to demonstrate their appreciation of the voluntary work done on their behalf by the Council and members of the Association, by supporting the latter's annual assembly.

In the present "Committee Age" municipal councillors are not infrequently elected to committees, not because of any particular desire to serve thereon, but simply because somebody must be nominated. In some cases capable municipal engineers are greatly hampered by the efforts of committees the members of which lack adequate knowledge of the matters on which decisions have to be reached. In other cases the committees leave everything to their engineers so long as all is plain sailing, and then throw them overboard when anything goes wrong.

Careful attention to the subjects discussed, both formally and informally, at such conventions as those held by the I.M.E.A. should do much to assist both the engineers and their committees to work in harmony.

Government Trade Inquiry in South America.

In a leading article on "Export Trading" published in our issue of April 12th, we urged the reorganisation of the Department of Overseas Trade to give it the means to despatch electrical and engineering experts upon visits to various overseas markets for the preparation of specialised reports which the industry at home could use in connection with its expansion efforts. We said: "We certainly believe that if the Department were to send a few real live and energetic engineering men about the world, either supplementing, or co-operating with, the work of Trade Commissioners, more genuine and business-getting help would be rendered than by the peripatetic wanderings of officials at home telling us things we have been told a thousand times before."

We need hardy say that following upon the expression of these opinions, we learn with satisfaction that the Board of Trade has appointed an economic mission to visit two markets which are of the utmost importance to the British electrical and engineering industries, namely, Argentina and Brazil. Viscount D'Abernon, will be president; Sir W. C. Lees will represent the textile industries; Mr. G. E. Rowland will represent the engineering industries generally, and while his specialised branch of engineering work is agricultural, he will find an interesting situation to investigate and report upon in connection with electrical developments; Mr. Julian Piggott will act for the iron and steel industries. The mission will be accompanied to Argentina by the popular Commercial Counsellor to H.M. Embassy, Buenos Aires, Mr. H. O. Chalkley, and Mr. H. W. Wiswould, of the D.O.T., will act as secretary to the mission.

Just as these lines appear the General Election of 1929 will have ended, but whatever the result may be between the Parties, we still hold, as we did in our article of April 12th, that greater importance attaches to the improvement of British trade, by sound and legitimate means, than to any of the "forced growth" proposals that have been advanced as the means for providing work for our great army of unemployed.

May we hope that this Economic Mission to Brazil and Argentina will be successful in the preliminary survey that it is to make before leaving these shores, and that as a result of an investigation made with a foreknowledge of the difficulties, it will be able to render the electrical and other engineering industries of this country much needed assistance, and thus ensure a continuous flow of orders to our factories instead of those of others. We congratulate the Board of Trade upon planning a foreign trade visit so closely similar to that suggested in the Electrical Review.

The Refrigerator Market.

One indication of the scope for the electric refrigerator is provided by the monthly export statistics of the United States. The item "Refrigeration sets up to 1-ton capacity" has been growing during the last two or three years until it is now the largest single specified item in the list. In March the value of exported refrigerators represented about 10 per cent. of the total exports. The item is now subdivided to show sets up to $\frac{1}{4}$-ton capacity and sets of over $\frac{1}{4}$-ton up to 1-ton capacity. In March over 80 per cent. of the exports was of the former class, which indicates that the bulk of the apparatus concerned was of the domestic or small-shop description. The United Kingdom took 18 per cent. of the March exports, and was, in fact, the principal importer of American refrigerators. At this time of year such figures are worthy of attention and should lend added force to the E.D.A. June campaign.

Rural Electrification.

It has been known for some time that the Electricity Commissioners, the Development Commissioners, the Ministry of Transport, and the Ministry of Agriculture, have been collaborating in the formulation of a plan designed with the object of stimulating the use of electricity for all purposes in country districts. Estimates which have been carefully prepared have convinced the Commissioners of the practicability of supplying electricity economically for all farming, village, and domestic purposes in rural areas, and the scheme has been specifically framed to demonstrate that fact on a practical scale.

The area chosen for the experiment is in Bedfordshire, and the scheme is expected to be self-supporting in five years. A statement by the Minister of Transport relative to the financial arrangements will be found elsewhere in this issue, defining the assistance that the Minister has advised the Treasury to afford in the form of annual loans to help cover the losses that are expected to accrue during the initial years of operation. This help, and the sufficiently definite results that have been obtained from similar schemes which have not had the advantage of Government backing, leave little room for doubting the success of the demonstration, which should give a considerable impetus to the cause of rural electrification in general.

It is interesting to note that the Commissioners have framed their plan on the following basis: very careful attention to distribution cost; facilitating installation and the acquisition of apparatus and appliances on the hire-purchase system; and the intention to make supplies of energy available first and then invite all and sundry to avail themselves of the service. The last-mentioned feature is not only of considerable interest in comparison with the hitherto prevailing attitude towards attempts to justify expenditure on laying mains in anticipation of load in areas wherein there is no immediate demand for electricity, but also because it will enable prospective consumers to obtain supplies of electricity when they want them, relieving them of the obligation of demanding a supply and then waiting until sufficient similar applications have been lodged to make the service worth while to the supply authority.

Appropriately, on another page appears a report of a meeting at which Lieut.-Col. W. A. Vignoles told members of the Overhead Lines Association how consumers can be obtained in rural areas, and attempted to enthuse his hearers with some of his own confidence in the future of country area electrification. It must not be assumed, of course, that every case must, of necessity, be profitable; exceptions exist to prove every rule, but the Electricity Commissioners' honest endeavour will emphasise the possibilities of the extended use of electricity in farming localities.

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The I.M.E.A. Convention—I.

In view of the annual convention of the Incorporated Municipal Electrical Association, which is to be held at Torquay next week, the amenities of the district are referred to below, the programme outlined, and the local electricity generating undertaking described.

SHELTERED combes, deep-cut lanes, broad moorlands, fine sands, and delightful examples of old-world domestic architecture are but a few of the attractions of the typically Devonian county in which the Convention will meet this year.

Most characteristic of South Devon is its wonderful colouring: sky and sea contrast with the warm redness of the sandstone cliffs and soil. Prominent are its equable climate and red soil, and the luxuriance of vegetation; the irregularity of the coast, broken delightfully by unexpected creeks, estuaries, and bays, is one of its greatest charms.

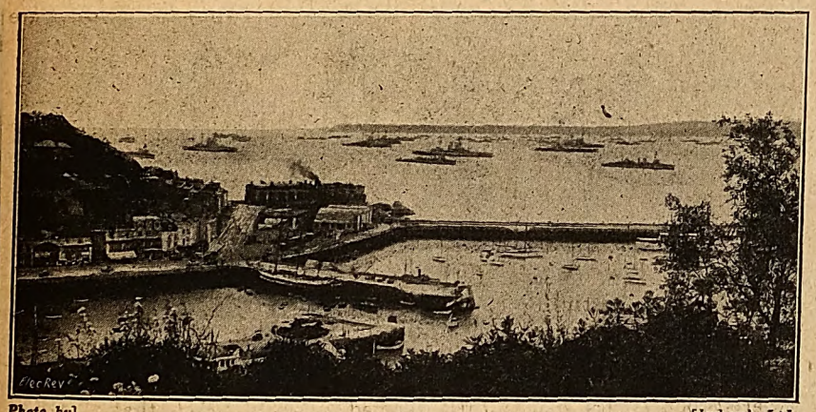

Photo by] [Judges', Ltd.

The Harbour and Warships in the Bay.

Torquay, with its trees and terraces, helped to make the sporting county one of England's playgrounds. Devonshire has played a large part in moulding the destinies of the nation, for the early navigators, soldiers, and colonists were men of Devon, which has, and still continues to, provide literary inspiration. Probably no other English county has richer flora, for what other can claim more streams and rivers and a more even year-round temperature? Semi-tropical plants flourish, as do flowers in abundant variety, and that giant of ferns, *Osmunda regalis*, may occasionally be seen growing in some moist valley to a height of 5 ft.

Of late years much has been done to tempt summer visitors, and winter residents also; but, built on a cluster of hills which jut into the sea, the pleasant Torquay promontory at the head of Torbay, a place of shelter long famed among sailors, has attracted town dwellers from its earliest days. The Roman Legions left good evidence of their occupation of the peninsula at Austey's Cove, Babbacombe, and on Warberry Hill. Norman association, too, is traced back to William the Conqueror's gift of the land of Tor to William de Brewere. However, the earliest records of the town are ecclesiastical, Tor Abbey, founded in 1196, having flourished there; but so late as the nineteenth century it was no more than the quay of the adjoining village of Torre. Fleets of warships found safe shelter in Torbay while awaiting orders during the Napoleonic wars; the vessels being often detained there for months, the officers' wives and families naturally visited the place and the virtues of the climate were soon appreciated. Thus Napoleon may be considered to have been the unconscious founder of this health resort, and when he approached the future town in 1815, standing on the deck of the *Bellerophon*, his prison ship, he exclaimed, "*Enfin, voilà un beau pays!*" That tribute of the tyrant of Europe has never been forgotten.

Few towns in England possess a sea-front to compare with that of Torquay. Given fine weather, this year's Convention should be as successful professionally, and socially too, as it has been in past seasons. The president, Mr. A. Nichols Moore, borough electrical engineer and tramway manager, Newport (Mon.), and Mr. A. C. Cramb, Croydon Corporation electrical engineer, the hon. secretary, have spared no efforts to maintain the tradition of the Convention. Mr. Cramb, who is responsible for the detailed organisation, has this year had to carry it out in difficult circumstances, but has proved himself equal to the occasion. Mr. H. F. G. Woods, borough electrical engineer and general manager, Torquay, has devoted much time to local arrangements, and Mr. Jno. W. Simpson, the new I.M.E.A. secretary, who has succeeded Miss Lanfear since the last Convention, is doing all he can to assist delegates.

On Monday, June 3rd, there will be a reception in the evening by the president, who will be supported by the Mayor of Newport (Councillor W. T. Griffiths), to be followed with music and dancing.

On Tuesday morning members will assemble in the Pavilion, a handsome structure built in 1911-12 at a cost of £25,000. A balcony runs round three sides and a tea room overlooks the sea. An open promenade facing the harbour and gardens runs along the roof and all four corners are surmounted by octagonal open-framed shelters. A civic welcome will be extended to the delegates by the Mayor of Torquay (Mr. H. Geen), after which the presidential address will be delivered; at its conclusion the ladies attending the meeting will take coffee with Mrs. Nichols Moore at the Medical Baths, a group of buildings in the Italian style. They were erected in 1852 on the site of a modest establishment

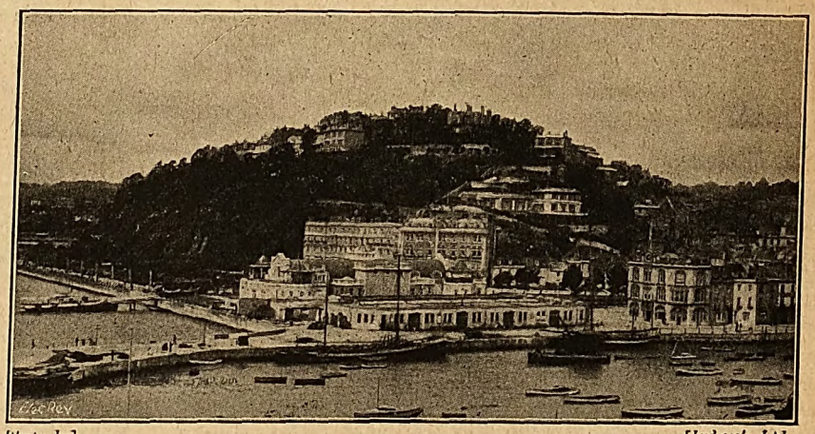

Photo by] [Judges', Ltd.

Waldon Hill, Torquay.

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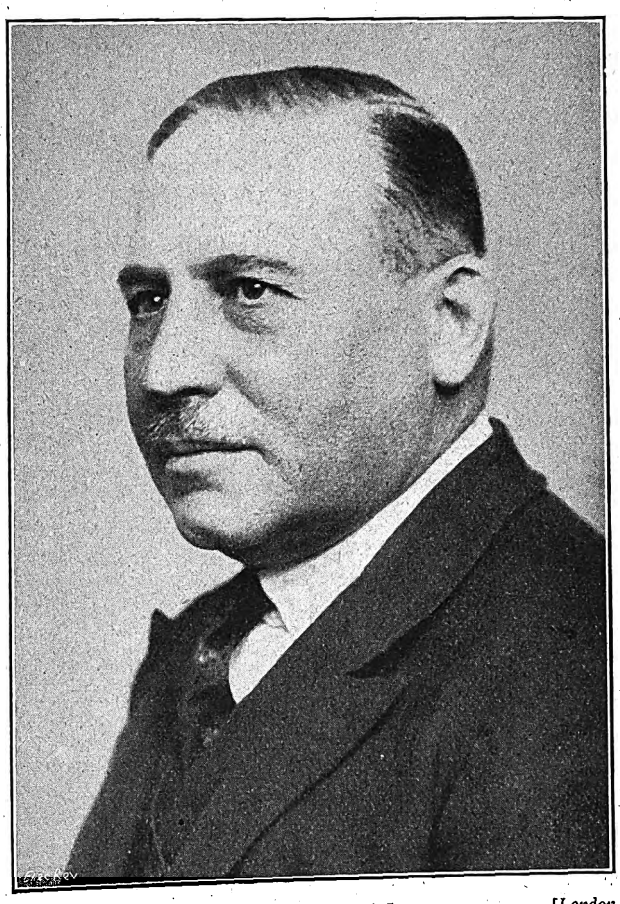
dating from 1817. In recent years the Corporation spent £25,000 on reconstruction, the medicinal baths being of varied character and including light, heat, and electric baths.

The paper to be read in abstract on the first day by Alderman W. Walker (Manchester) and discussed will deal with Whitleyism in the electricity supply industry from a management point of view.



Elliott & Fry] **Mr. A. Nichols Moore,** [*London.*

I.M.E.A. President, 1928-29.

In the afternoon an official visit will be paid to the electrical exhibition which is an annual feature of the Convention. Some 37 exhibitors will display cooking, water-heating, refrigeration, and other apparatus in the Old Torbay Hospital. The exhibition will be closed to the public on Tuesday afternoon and open to women only on Thursday morning.

In the evening there will be a reception by the Mayor and Mayoress (Mr. and Mrs. H. Geen) at the Town Hall, followed by music and dancing.

Wednesday morning's paper, by Mr. J. H. Rothwell (Town Clerk of Brighton, and hon. solicitor of the I.M.E.A.) and discussion will be on the subject of recent High Court cases and current legal problems in connection with the generation and supply of electricity. The afternoon discussion will be initiated by a paper by Mr. G. Porter (borough electrical engineer, Worthing) on the heavy-oil engine and its application to electricity supply undertakings.

At the invitation of the Torquay Municipal Electricity Committee (chairman: Councillor J. Taylor) members will attend a garden party at Tor Abbey in the afternoon and an official photograph will be taken. The Abbey is one of Torquay's links with the past: it was founded in 1196, richly endowed, and became the wealthiest of the Norbertine Order in the kingdom. The existing mansion, owned by the Cary family, embodies some features of the monastic house. The remains of the church and other buildings have been excavated and are worthy of inspection by all who are attracted by historic relics.

In the evening there will be a dance at the Medical Baths by invitation of the Mayor and Mayoress of Torquay.

The paper to be discussed on Thursday morning is to be read by Mr. E. J. Jennings (secretary of the Birmingham Corporation Electricity Department), his subject being the standardisation of methods of charging for electricity. In the afternoon the Local Authority Committee members' annual meeting will take place at the Medical Baths and at the same time the engineers' meeting (members of the A.M.E.E. only) will be held at the Torbay Hotel.

The annual dinner will be served in the Pavilion that evening, after which delegates will be able to dance in the Medical Baths ballroom by invitation of the Torquay Corporation.

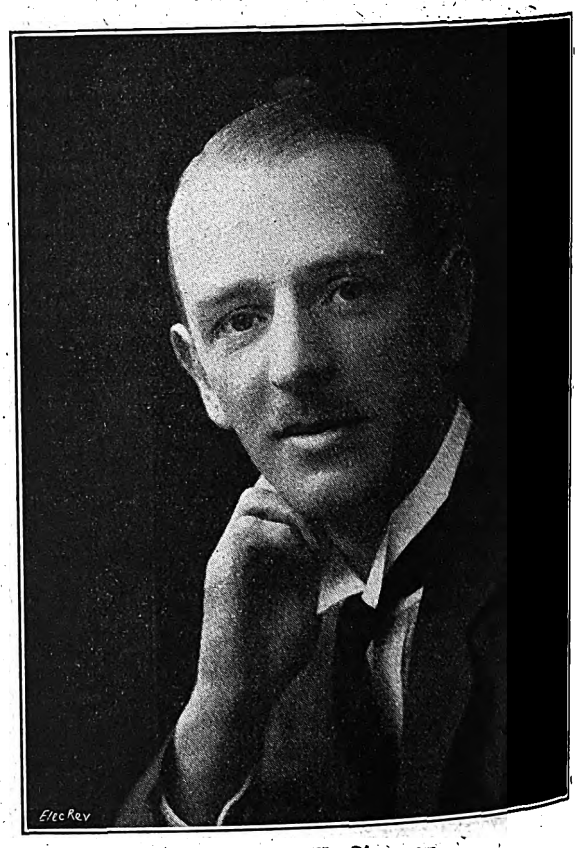
Thursday is to be regarded as "women's day." Miss M. Partridge will lecture in the morning with the aid of charts on women's work in connection with rural electrification in Devonshire, and as before stated only women will be admitted to the exhibition that morning.

During the afternoon the Longpark Pottery Co.'s works, which are driven electrically, will be visited, and there will be a motor coach drive to Widecombe-in-the-Moor (where tea will be served) by way of Bovey Tracey and Hay Tor Rocks, returning by Ashburton. The Torquay Electricity Committee will provide the tea and transport.

Friday next, being the final day of the Convention, the I.M.E.A. Council will meet in the morning and afterwards the annual general meeting will be held. During the afternoon members will have the choice of alternative drives to (*i*) Dartmoor, *via* Dartmeet, Postbridge, Becky Falls and Bovey Tracey, or (*ii*) Widecombe-in-the-Moor, *via* Hay Tor Rocks, returning by way of Ashburton.

Torquay is almost entirely non-industrial; one of the greatest municipal assets is the electricity undertaking, upon which £670,000 has been expended. The electricity generating station is situated at Newton Abbot, and is to be visited by Convention delegates on Saturday, June 8th. A description of the plant will be found on the following pages.

It will not be inappropriate to refer to the local electric tramway system. The Torquay Tramways



Mr. J. W. Simpson,

The New I.M.E.A. Secretary.

Co., Ltd., inaugurated the service towards the end of 1906. There are some 11.5 miles of track in the town and the line was extended to Paignton in 1911, in which year conversion to the overhead system took place. Electric power for operating the system is purchased from the Torquay Corporation and also from the Paignton Electric Light & Power Co., Ltd.

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Electricity Supply at Torquay.

A résumé of the activities of the undertaking at the seat of the I.M.E.A. 1929 Conference, with particular reference to the recently-opened extensions at the Newton Abbot power station.

THE Torquay Electric Lighting Order, 1891, conferred powers upon the Corporation to supply electricity within the borough. At the outset the choice of a site suitable for a generating station presented formidable difficulties on account of the peculiar configuration of the town, and it was eventually decided to establish the works in certain stores and cellars situated on the harbour side at Beacon Quay. The system of supply decided upon was single phase, 50 cycles, 200 volts. The first plant installed consisted of three 150-kW Willans generating sets and two Babcock & Wilcox boilers, 150 lb. per sq. in. and 500 deg. F. The supply was commenced in March, 1898.

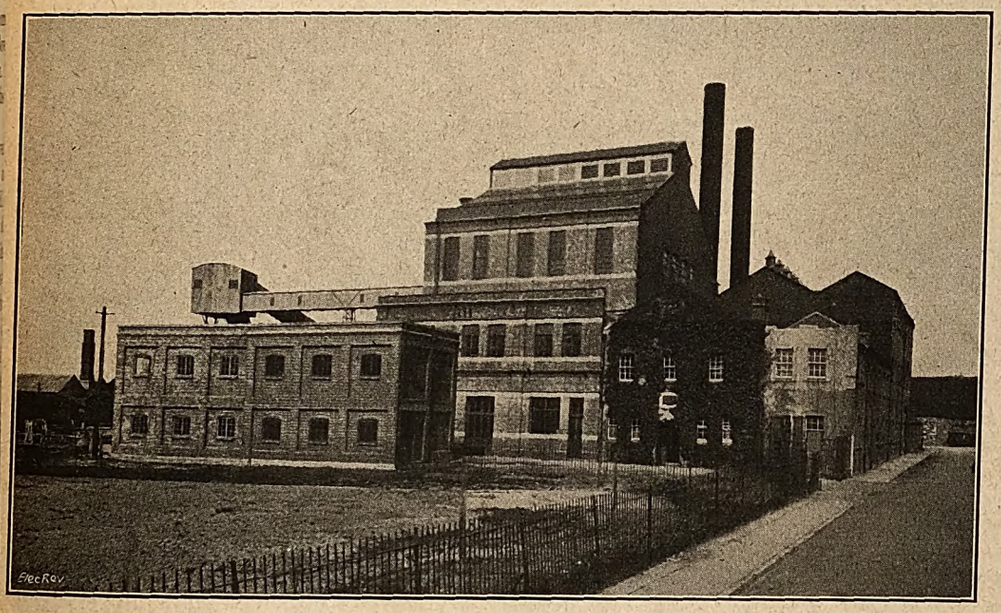

Fig. 1.—Newton Abbot Power Station; 18,000 kW.

From time to time various plant extensions were installed, and by the year 1920 effective generating plant of 3,000 kW capacity, consisting of two B.T.-H. turbo-alternators, each of 1,250 kW capacity, and one 500-kW set, had been installed. Owing, however, to the cramped boiler-house space, the maximum steaming capacity was only equivalent to 1,500 kW, without reserve, and the maximum demand had already reached that limit.

It was evident that no suitable site for a new power station existed within the borough, and therefore attention was directed beyond its boundaries. A site upon the River Teign, adjacent to the Great Western Railway Co.'s main line at Newton Abbot, was eventually selected as offering the requisite facilities for a larger station, and at the same time being situated at a centre suitable for the distribution of energy to neighbouring townships other than Torquay.

The town of Newton Abbot was supplied with electricity from a d.c. station of 520 kW capacity, owned by the Urban Electric Supply Co., Ltd., and situated close to the site selected by the Torquay Committee. It was decided to take steps to acquire the Newton Abbot undertaking, and to utilise the existing site, with certain additional lands, for the erection of the new station.

The purchase was effected and the Newton Abbot undertaking transferred to the Corporation in early 1923. The old Beacon Quay station was finally shut down in July, 1924. The Newton Abbot power station, fig. 1, after the completion of the recent alterations and extensions, which were officially inaugurated by the Mayoress of Torquay, Mrs. C. Geen, on May 1st last (Electrical Review, May 10th, p. 836), now contains generating plant of some 18,000 kW total maximum continuous rating. All the old company's original plant has now been removed, with the exception of the 600-Ah, D.P. battery which is still used with rotary convertors in connection with the works power supply. The original office buildings, which have been slightly extended, now provide accommodation for the fuel-, oil-, and water-testing laboratory, and for the local distribution staff. The new engine room now contains two 3,750-kW, and one 7,500-kW B.T.-H. turbo-alternators, the e.h.p. and l.p. switchgear and control room, and two B.T.-H.

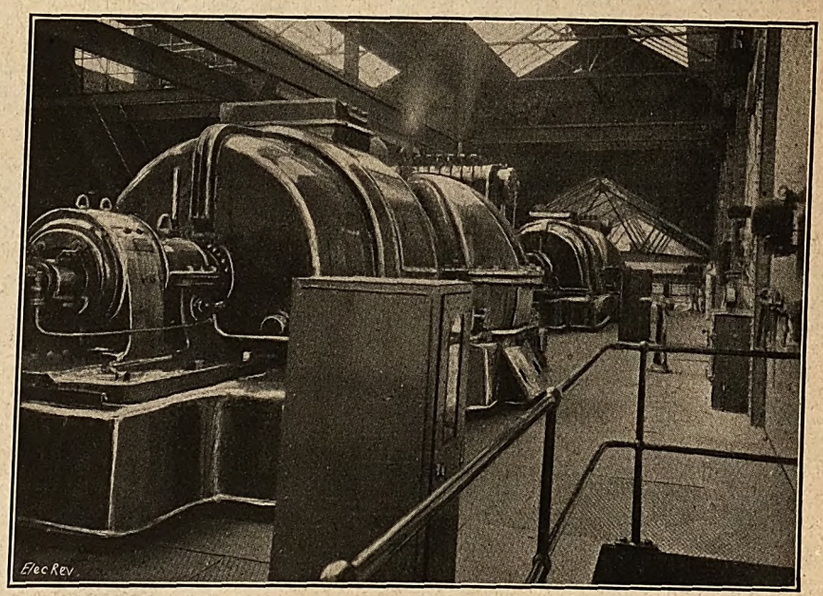

Fig. 2.—The 3,750-kW Turbo-alternators.

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rotary convertors, each of 400-kW rating, for supplying the works power and a portion of the Newton Abbot d.c. network. The first section of the new boiler house parallel to the engine room contains four Stirling boilers with Green economisers, induced-draught plant, coal bunkers, elevator, &c. The working steam pressure for this first section of the new station was fixed at 150 lb. per sq. in., with a superheat of 150 deg. F., in order to obtain the benefit of the considerable saving in capital charges effected by the use of the old Torquay generating plant and the existing Newton Abbot boilers. The latest extensions of both boiler house and engine room are laid out at right angles to the original engine room, and the steam conditions have been raised to 250 lb. pressure and 650 deg. F. temperature. The h.p. and l.p. steam ranges are coupled by means of a Crosby reducing valve. The 3,750-kW turbo-alternators, fig. 2, were originally designed for the higher working steam temperature, and the two smaller machines, which were transferred from Beacon Quay, are supplied through British "Arca" de-superheating plant, which reduces the steam temperature to 500 deg. F.

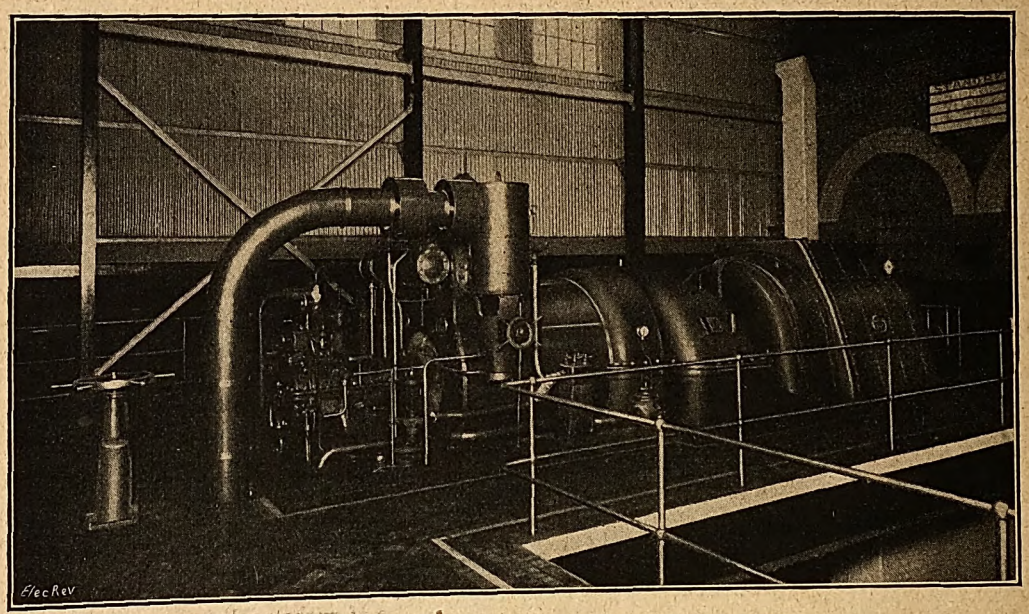

Fig. 3.—New Turbo-generator Set; 7,500 kW.

The latest generating unit, fig. 3, is of 7,500 kW capacity, and, as in the case of the 3,750-kW machines, generates direct at the transmission pressure of 11,000 volts, 50 cycles. The pressure of the two smaller machines is stepped up from 2,200 volts to the transmission pressure. Circulating water is drawn from and returned to the River Teign by vertical-spindle pumps situated in two pump houses on the river bank.

Coal, which is obtained chiefly from the Forest of Dean, is delivered in trucks to the new railway siding, from which it is transferred to stock, or, alternatively, to the overhead bunkers in the boiler house by means of the recently-installed mechanical coal-handling plant. Ashes are removed by trucks from the basement of the boiler house and sold locally for building purposes. The boiler make-up water, which is obtained from the Torquay Corporation Water Department, contains no scale-forming or corrosive constituents, and is, therefore, used direct without any treatment other than the preliminary "boiling" which it receives in the exhaust steam-heated feed tanks.

The whole of the boiler-house plant was supplied by the Stirling Boiler Co., Ltd., and comprises six Stirling boilers of the five-drum type. The latest additions to the plant consist of two boilers, fig. 4, each of 7,437 sq. ft. heating surface, and capable of evaporating upwards of 40,000 lb. of water from feed water entering the economisers at 100 deg. F. to steam at 265 lb. per sq. in., superheated to a final temperature of 650 deg. F. These boilers are arranged as single units facing each other with passage ways on either side. Each of the steam drums is 42 in. in internal diameter by 17 ft. 1 in. long, and the water drums are 36 in. in internal diameter. Each boiler is fitted with a pair of chain-grate stokers by Messrs. Babcock & Wilcox, Ltd., 16 ft. by 6 ft., fitted with special narrow lap links for burning small coal and coke dust, of which latter fuel a considerable quantity is used. The superheaters are of the standard Stirling design.

The furnace arches are of the flat suspended "Liptak" type, and each boiler is provided throughout with "Diamond" jet soot blowers.

An economiser of Messrs. Green's manufacture is fitted immediately behind and adjoining each boiler. Mechanically-operated tube scrapers are fitted to each group.

Each boiler is also equipped with a "Sirocco" induced-draught fan mounted upon a platform situated above and behind the economiser. The speed of the fans is controlled by regulators mounted upon the firing floor. The gases discharged from the fan are passed through a "Sirocco" grit arrester, and thence into a short steel stack 60 feet high above the firing floor level and 4 ft. 9 in. in internal diameter. The steel-framed coal bunkers arranged above and between the two boilers are designed to contain 50 tons of coal when full, and are divided into two compartments with a view to keeping coke dust separate from coal. Each class of fuel is delivered through a separate travelling cylindrical chute into the boiler hoppers, which are divided into compartments to enable the two classes of fuel to be fired on the "sandwich" system. Soot, ashes, riddlings and grit are delivered into their respective hoppers

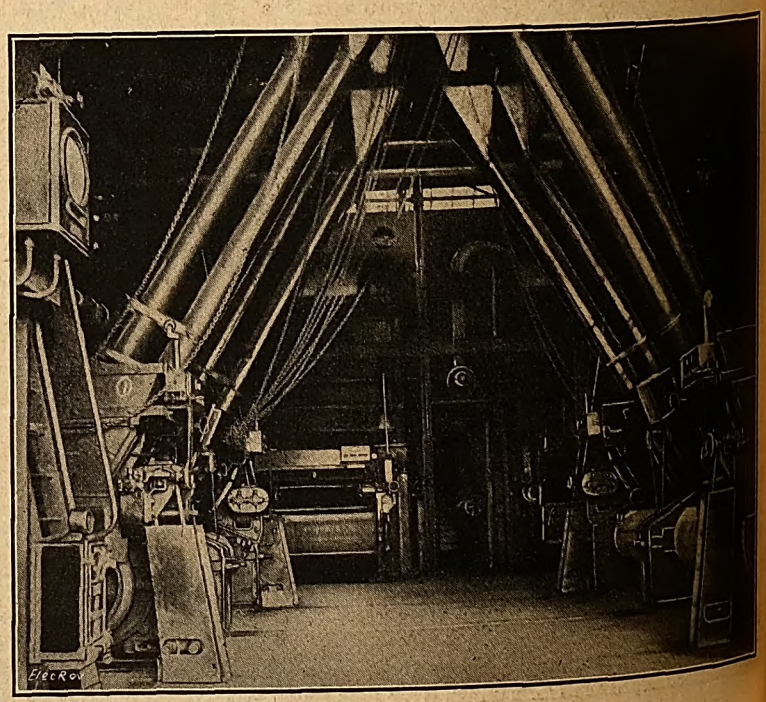

Fig. 4.—H.P. 40,000-lb./hr. Boilers.

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below the firing floor, and are removed from the basement in steel wagons. A special instrument panel equipped with a Bailey boiler meter, distance thermometers and draught gauges is provided in connection with each boiler. Each boiler is provided with an automatic feed-water regulator of the Crosby pattern. The

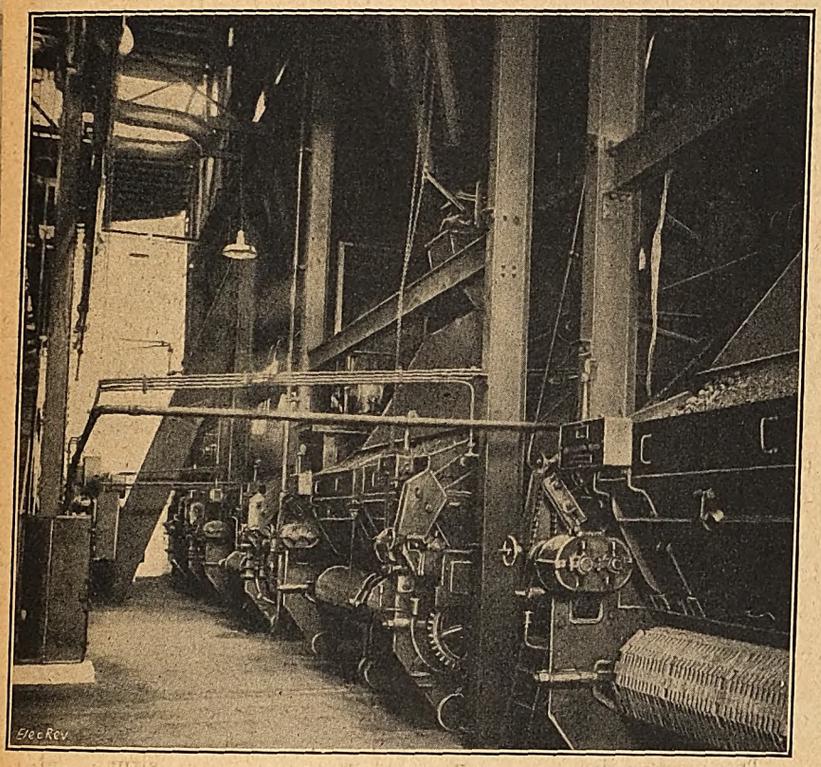

Fig. 5.—25,000-lb./hr. Boilers; 165 lb./sq. in.

remaining four low-pressure boilers, fig. 5, were installed in pairs, respectively, in 1924 and 1926. They are generally of similar design to the high-pressure boilers and are rated each at 25,000 lb. per hour evaporation. Each pair of boilers is served by one steel stack 90 feet high and 5 feet in internal diameter. The induced-draught fans for these boilers are situated in a special fan house in the basement below the economisers, and

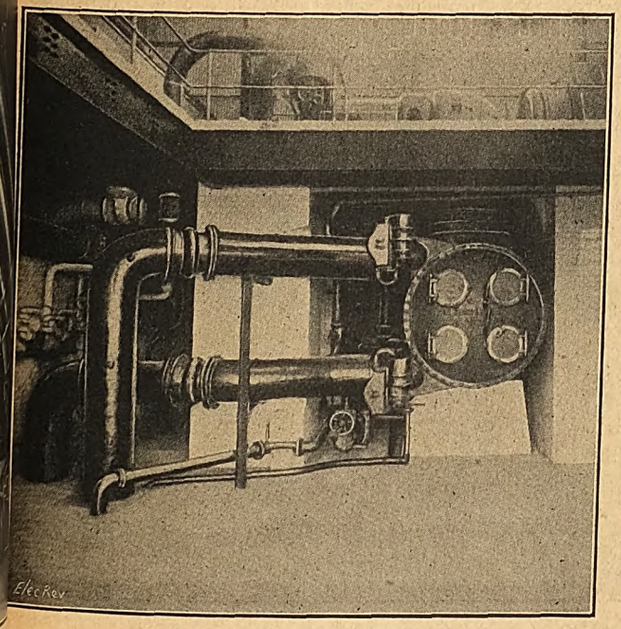

Fig. 6.—Condenser for 7,500-kW Turbine.

each is designed to deal with the gasses of two boilers at full load. Each of the four boilers is equipped with "Liptak" arches, soot blowers and instrument panels, as in the case of the two new boilers.

Telegraphs of the Chadburn ship type are installed for the purpose of conveying orders from the main control room to the boiler house and engine room. The feed pumphouse, which is situated in a bay between the boiler house and the latest engine-room extension, contains two sets of feed pumps and feed tanks for serving, respectively, the high- and low-pressure boilers.

The two turbine pumps which serve the h.p. boilers are of Messrs. J. P. Hall & Co.'s manufacture, and each is designed to deliver upwards of 120,000 lb. of hot water per hour. The two l.p. turbine pumps are of Messrs. J. & G. Weir & Co.'s manufacture, and each is designed to deliver upwards of 100,000 lb. per hour.

A 3-phase motor-driven pump by Messrs. Mather & Platt, Ltd., designed to deliver up to 80,000 lb. per hour, is so arranged as to be interchangeable between the h.p. and l.p. feed ranges.

The recently installed turbo-alternator was manufactured by the British Thomson-Houston Co., Ltd. Its maximum continuous rating is 7,500 kW, 90 per cent. p.f., 3,000 r.p.m., 3-phase, 11,000 volts, 50 cycles.

The guaranteed full-load steam consumption of the turbine is 10.7 lb. per kW at 250 lb./sq. in., 194 deg. F., 100 per cent. p.f. The total weight of the machine, exclusive of the condenser and auxiliary plant, is 95 tons. For the purpose of withstanding accidental short-circuit, the alternator has been designed to have an inherent protective reactance of 15 per cent. The voltage of the alternator is maintained constant within 1.0 per cent. variation by means of an automatic voltage regulator of the Tirrill type. The turbine is of the Curtis impulse type. The turbine casing at the h.p. end is of cast-steel, and at the l.p. end of cast-iron. The turbine is steam bled and the extracted heat is passed on to the condensed steam and then to the boilers in the usual manner.

The alternator is of the closed-circuit air-cooled type, the ventilating air being circulated by means of fans on the electrical rotor, and cooled by passing over a cooler of the surface type supplied with cold water from

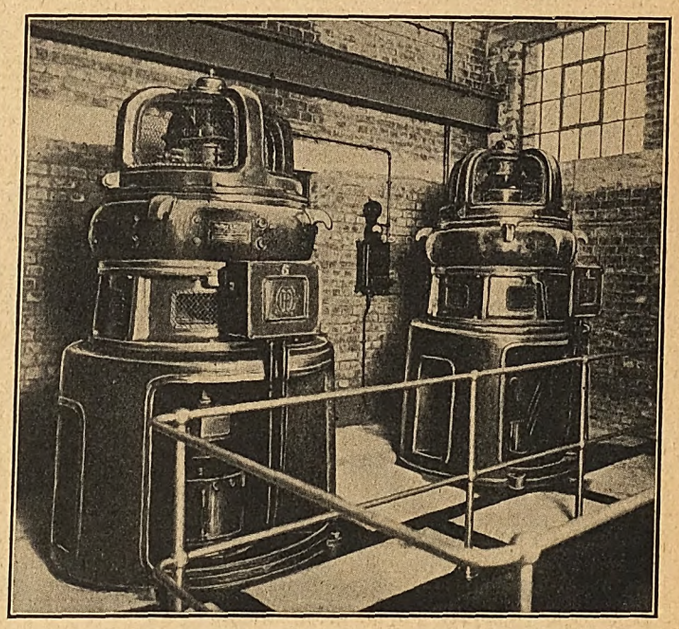

Fig. 7.—No. 2 Pumphouse Motors; 160 h.p.

the condenser circulating system. A thermostatic alarm device is fitted to prevent overheating of the alternator in the event of failure of the cooling water. The exciter is of the shunt-connected commutating-pole type, and is mounted upon an extension of the bedplate.

The two 3,750-kW turbo-alternators which were in-

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stalled, respectively, in 1924 and 1926, as well as the two earlier 1,250-kW machines, are also of the British Thomson-Houston Company's manufacture. The rate of steam consumption of each of the 3,750-kW machines at full load is 12.89 lb. per kW (100 per cent. p.f.).

The condensing plant in connection with the new 7,500-kW machine, fig. 6, is of the horizontal surface type, and was manufactured by Messrs. Hick, Hargreaves & Co., Ltd. The air extraction is performed by a Hick-Breguet "ejectair," which consists of two steam jet ejectors working in series with an intermediate condenser. The "ejectair" is fitted with a special stabilising valve which automatically prevents the ejectors from becoming unstable at light loads. Extraction pumps are in duplicate and of the centrifugal type. They are directly-coupled to d.c. electric motors. The cooling-surface area of the condenser is 6,780 sq. ft., and the circulating water required to condense the necessary 64,100 lb. of steam per hour is 405,000 gallons per hour.

Fig. 8.—E.H.P. Control Board at Newton Abbot.

The condensing plant in connection with the 3,750-kW machines was manufactured by Messrs. Cole, Marchant and Morley, Ltd. The condensers of the two smallest machines are by Messrs. Mirrlees, Watson & Co.

Circulating water is drawn from and returned to the River Teign. The design of the circulating system presented considerable difficulty on account of the great seasonal variation of the depth of water in the river (amounting, according to flood, drought and tide, to as much as 17 feet) and also to the intervention of the confluent River Lemon between the main river and the power station. Two pumphouses situated on the river bank deliver circulating water to the condensers. No. 1 pumphouse, put into commission in July, 1924, contains three 40-h.p. vertical-spindle pumps by Messrs. Mather & Platt, Ltd., so installed as to be 3 feet below the deepest part of the river bed, and No. 2 pumphouse, which forms part of the recently-completed extensions and is situated up-stream of and adjoining No. 1 pumphouse, contains two 160-h.p. Mather & Platt vertical pumps, fig. 7, each capable of delivering upwards of 500,000 gallons of water per hour against a head of 50 feet.

Rotating-band screens by Messrs. Brackett & Co. are employed in conjunction with both pumphouses.

The railway siding and coal-handling and conveying plant (ELECTRICAL REVIEW, December 21st, 1928, p. 1,076) also forms part of the recently-completed extensions. There are three conveyors which elevate the coal to a total height of 70 ft. and convey it through a horizontal distance of 620 ft. The whole of the coal-handling plant was supplied by Messrs. Ed. Bennis & Co.

The e.h.p. switchgear which controls the generators, rotary convertors, and outgoing feeders is of the cellular type designed and manufactured by the British Thomson-Houston Co., Ltd., and is mounted in moulded stone cubicles erected on the engine-room basement floor; with sheet-steel hinged doors giving access at both front and back. Duplicate busbars mounted on compression-type insulators are provided, and the oil circuit breakers which are fitted with welded boiler-plate tanks for each phase are electrically operated from a vertical-type control board installed on the control room gallery above. The two main outgoing feeders to Torquay are fitted with the latest form of B.T.-H. balanced-current parallel-feeder protective gear, with definite time-limit overload relays. The neutral of the system is earthed through limiting resistances of the cast-grid type mounted on suitable porcelain insulators and enclosed in expanded-metal housings. These resistances can be isolated by means of oil circuit breakers which are electrically operated from the main control board. The d.c. switchboard is of the B.T.-H. vertical flat-back type and is installed on the same gallery as the e.h.p. control board, fig. 8. It is arranged to control the d.c. side of the rotary convertors, the 250-kW generator, the Newton Abbot town supply and the various auxiliary circuits of the power station. An illuminated board at one end of the control room shows diagrammatically the e.h.p. system supplied from the power station and the switching at all sub-stations.

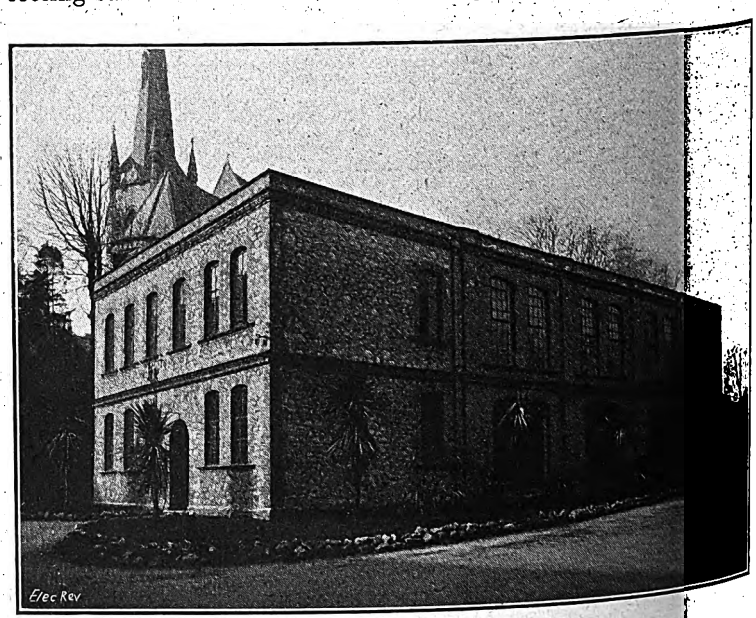

Fig. 9.—Upton Valley Sub-station.

The area over which the Torquay Corporation has distributing powers totals 193 sq. miles, including the area covered by an Extension Order now pending. In addition, supplies in bulk are given to the Paignton Electric

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Light and Power Co., Ltd., and to the Teignmouth Electric Lighting Company, which together cover an area of some 150 sq. miles. The primary e.h.p. transmission is at 11,000 volts, and in consequence of the h.p. having been fixed originally at 2,200 volts at Torquay, that pressure has been retained for secondary transmission in the towns and adopted for local distribution in the rural areas. The borough of Torquay is supplied from the main sub-station situated in the Upton Valley, fig. 9.

The e.h.p 11,000-volt switchgear at the Torquay sub-station is of the B.T.H. compound-filled draw-out truck type. Automatic shutters are provided to enclose the live contacts when the truck portion is withdrawn. The equipment comprises 14 panels which control the two incoming feeders from Newton Abbot, the two incoming-outgoing ring-main feeders to Paignton, three rotary convertors for supplying the Torquay Tramways Co., and the various 3-phase-2-phase transformers which supply the Torquay 2,200-volt single-phase system.

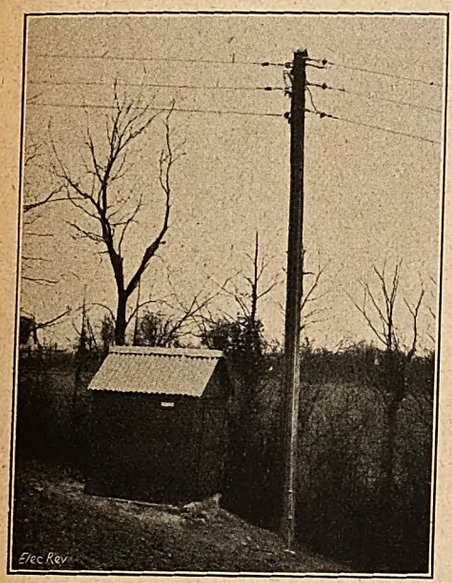

Fig. 10.—Kiosk at Barton Village; 100 kVA.

Fig. 11.—Milber Village Kiosk; 100 kVA.

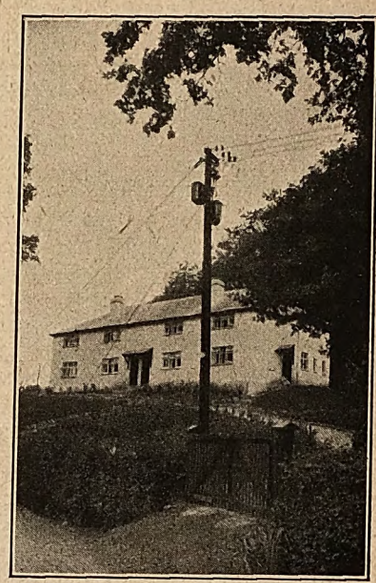

Fig. 12.—5-kVA Transformers off 2,000-V Line.

The e.h.p. feeders are fitted with B.T.H. parallel-feeder protective gear, and the transformers are provided with circulating-current protective gear. The 2,200-volt two-phase and single-phase switchgear at the sub-station consists of a moulded stone cellular structure mounted on a gallery on the opposite side of the building to the 11,000-volt gear. There are 12 outgoing single-phase feeder panels—six to each phase—and six two-phase transformer panels. The oil circuit breakers are remotely mechanically operated from a vertical black-

Fig. 13.—75-kVA Scott-connected Pole Transformer Station.

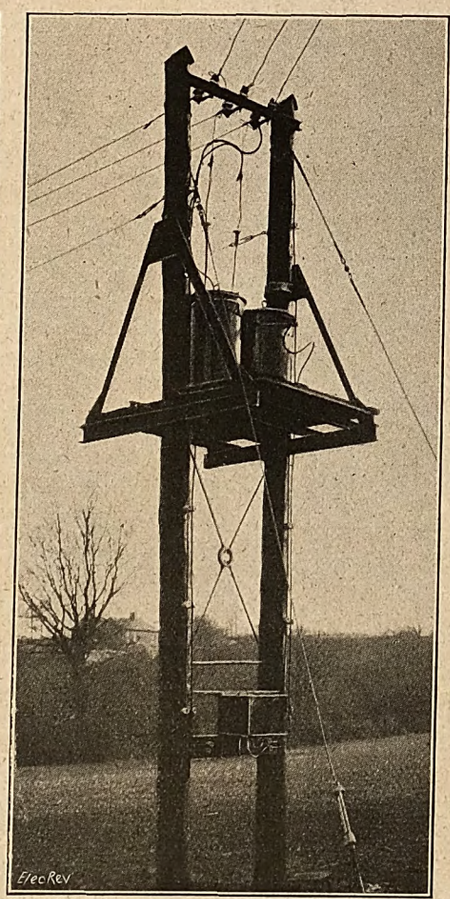

Fig. 14.—A Pole-type Transformer Station; 60 kVA.

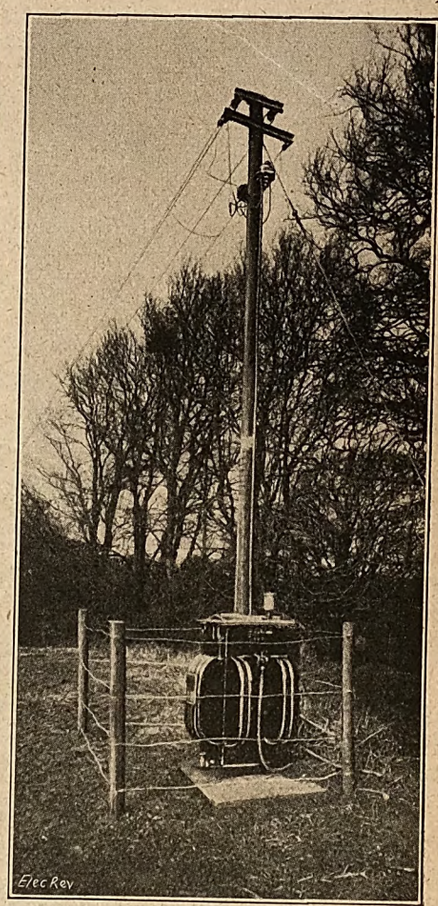

Fig. 15.—Supply Sub-station at Shiphay Village; 100 kVA.

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enamelled control board mounted directly in front of the cells. The total installed capacity of 3- 2-phase transformer plant is 7,000 kVA, and of rotary-convertor plant 1,100 kW, in three units.

Distribution in the town of Newton Abbot was originally on the 3-wire d.c. system. With the exception of the main shopping centre, in which d.c. has been retained for special reasons, the distribution has now been converted to a.c., which is supplied from two main substations, one at the power station and the other at the opposite end of the town, each of which delivers energy into the 2,200-volt, 3-phase network. The remaining d.c. network is supplied through mercury-arc rectifying plant, and from the rotary convertors in the power station.

Extensive developments have already been made in respect of the supply of electricity in the rural areas, and the results already achieved are very encouraging. Supplies are ever being pushed further and further afield into more remote districts, and it is confidently anticipated that within three years from the present time supplies will be available throughout the Corporation's extensive and thinly populated rural area. Figs. 10 to 15 depict examples of the distribution work in the rural districts.

The whole of the scheme referred to above was carried out in accordance with plans and specifications prepared by Mr. H. F. G. Woods, M.I.E.E., borough electrical engineer, to whom we are indebted for the information and photographs.

Immersion Water Heaters.

Some practical results of the author's experience which are likely to be of value to contractors and electricity supply engineers who are anxious to improve their business.

By R. H. RAWLL, A.M.I.E.E., A.M.I.Mech.E.

IN order to improve their load factors most supply undertakings during the last few years have paid particular attention to the development of the domestic load. In the vast majority of cases this has been mostly confined to heating and cooking, but it is now being realised that this class of load possesses unfortunate peaks, which often coincide with the periods

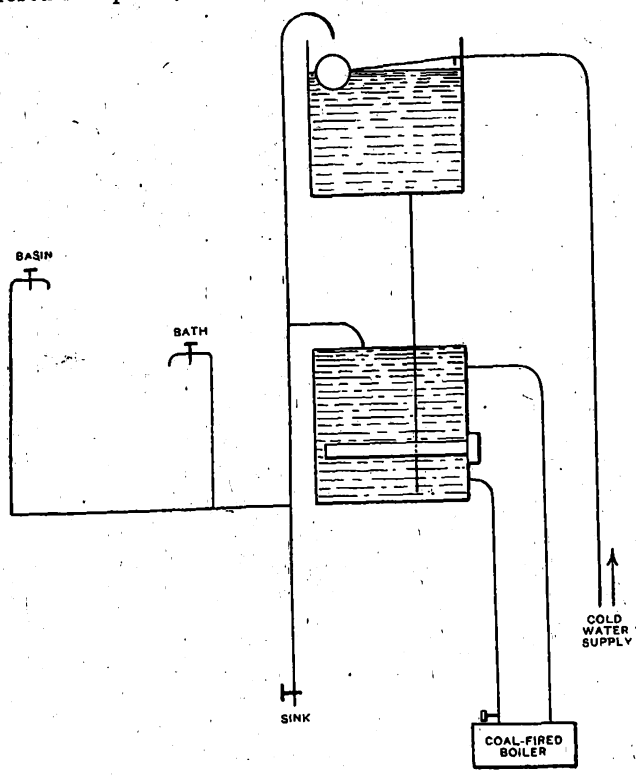

Fig. 1.—Domestic Hot-water System.

of maximum demand on the undertaking as a whole. Consequently, little or no improvement in load factor has been experienced.

For this purpose a load is obviously required which is more or less constant throughout the twenty-four hours of each day, especially during the night hours. It is well-known that low-loaded electric water heaters of the storage type admirably fulfil these conditions. Since an adequate supply of hot water is an absolute necessity in every home, it is obvious that here is a potential load which is not only ideal in character, but also capable of enormous development if the whole question is resolutely and courageously tackled on sound commercial lines.

Many supply undertakings are charging a very low rate per unit, being merely a fraction over the actual costs of distribution and generation, for current supplied to thermostatically-controlled water-storage heaters, which are often let out on hire. Such apparatus falls into two categories, viz., local and central storage. In the case of the former the heater is installed at the point at which the hot water is required, *e.g.*, over the kitchen sink or in the bathroom, while with the latter it is placed at a convenient central point and furnishes a supply to all the hot-water taps in the house.

In order to obtain maximum service with the local storage method in the average household it is necessary to have at least two such heaters installed, one at the sink and the other in the bathroom. With regard to the central storage arrangement, this usually necessitates a considerable amount of plumbing work and alterations to pipework, although, of course, this difficulty does not arise if such a method is decided upon while the house in question is being built.

It will be seen, therefore, that although these storage heaters are excellent as regards efficiency and performance, yet to the average middle-class household (and after all this is the class of the community to which electricity can be of the greatest service) both these methods involve considerable installation costs or alterations to the existing hot-water system, the latter being a very important point with the ladies, who usually have the last say in such domestic matters.

Now it is possible to apply electric heating to an existing coal-fired hot-water system in such a way that either method of heating can be put into commission separately or conjointly at will, and this also at comparatively small cost and inconvenience. The method referred to, of course, is to insert one or more immersion heaters into the hot-water storage tank, which is usually situated in the airing cupboard in the bathroom. Although admittedly not so efficient in performance as the properly designed storage tank, yet it is capable of giving surprisingly good results. By reason of the fact that either the old coal-fired or new electric heating systems can be worked independently of the other, the householder feels he is not definitely and irrevocably committed to the new method should the results not be satisfactory. In addition, where a coal-fired range with a boiler attached

thereto is utilised, it is usual to let the fire go out during the night, with the result that only a lukewarm supply of water is available in the morning on rising. In such a case if a low-loaded immersion heater is employed, which is put in circuit on retiring at night and switched off first thing in the morning, an adequate supply of really hot water is available for a morning bath or other domestic purposes. Also this alternative method of water heating has the advantage in that, although the average house may have an abundant supply of hot water

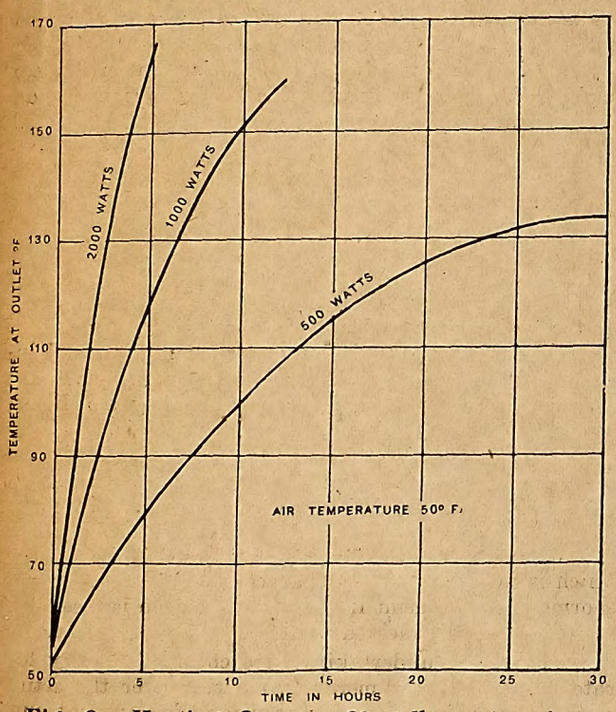

Fig. 2.—Heating Curves; 20 gallons at various Loadings, Tank Unlagged.

in the winter from coal-fired sources, yet often this convenience is denied to the housewife during the summer on account of the oppressive heat given out by such fires at this time of the year. In such a case the immersion heater can be utilised for the summer months only. The supply undertaking will also benefit by such an arrangement, in that a load of this character at such a period of the year would be most useful.

Fig. 1 shows diagrammatically the hot-water system in the average house. The position in which the immersion heater is fitted in the tank depends upon a number of factors. It must be remembered that only water *above* the heater will be heated. Consequently, the lower the level at which it is fixed the greater the quantity of water to be heated, and also the time required to raise it to a given temperature. The electrical loading of the heater and the possibility of lagging the tank are additional questions which must be carefully considered.

The best way to tackle the problem is to ascertain the maximum quantity of hot water which may be required at any one time. This quantity fixes the point in the tank at which the heater should be inserted, while the temperature rise required in conjunction with the period of heating at disposal will determine the loading of the heater.

Obviously each household has its own individual requirements as regards its hot-water supply, but the author has found that with a 20-inch cube unlagged tank of 30 gallons capacity, if an immersion heater with 3-heat control (2, 1 or ½ kW at will) is fixed one-third from the bottom of the tank, that is, at the 20-gallons level, it will give very satisfactory results. The rate of rise of temperature of the water for each of these loadings with such an arrangement is shown in the curves in fig. 2. The temperatures in these tests were taken at the hot tap on the wash-basin in the bathroom about 6 ft. from the storage tank.

Another method sometimes adopted is to have a low-loaded heater, about 500 watts, fixed fairly low down in the tank and another heater, about 2 kW, installed midway between this and the top of the tank. The former is normally in use, while the latter acts as boost heat for times of heavy duty. Usually the supply undertaking stipulates that the special low rate for water heating only applies to low-loaded apparatus which is on circuit for a considerable number of hours, including the night. In that case the low-loaded heater can be connected to the special water-heating meter, while the booster is fed from the ordinary house heating circuit and charged accordingly.

There are various types of immersion heaters. For example, there is the flat-blade variety, which consists of an element wound on mica and then inserted in a metallic water-tight envelope. The disadvantage of this type is that usually the water joint into the tank has to be broken in order to withdraw the heater should a fault take place in the element. Then there is the cylindrical type, which comprises a spiral element wound round a porcelain former, the whole being placed in a nickel-plated copper container. The advantage of this type is that by removing two nuts the heater portion can be drawn out for inspection without breaking the water joint, and without the consequent inconvenience of having to drain the whole hot-water system.

With regard to the actual fixing of the immersion heater into the tank, unless the electrical fitter doing the job has had previous experience of installing such apparatus, it is the wisest policy to call in a proper plumber to carry out this part of the work. First of all, the storage tank must be emptied of water. To do this, the water supply to the cold-water cistern is first turned off, and then all the hot water taps in the house are opened (it is assumed, of course, that the fire in the range is not alight.) When the water ceases to flow from these points it is a mistake to assume that the storage tank is empty. It will be seen from fig. 1 that the hot-water delivery pipe to the various taps is connected to the top of the storage tank, and, consequently, as soon as the water falls below this level, due to no make-up water flowing in from the cold-water cistern immediately above it, no more water can escape. The next step is to remove the draining plug fitted for this purpose, usually at the lowest point of the circulation pipes adjacent to the range boiler. This is often fixed in a most inaccessible position, near the skirting board, for instance. It must be remembered that there is still a considerable quantity of water present, about 30 gallons, with a head depending upon the difference in level between the range and the storage tank, which is usually upstairs. Persons in ignorance of this fact have been treated to a regular aquatic display on removing the draining plug, particularly when it is situated in a living room. The easiest method of tackling this is to procure a length of hose-pipe, one end of which is placed by a convenient drain, while the other has a large funnel attached to it which is placed against the plug, which is then removed.

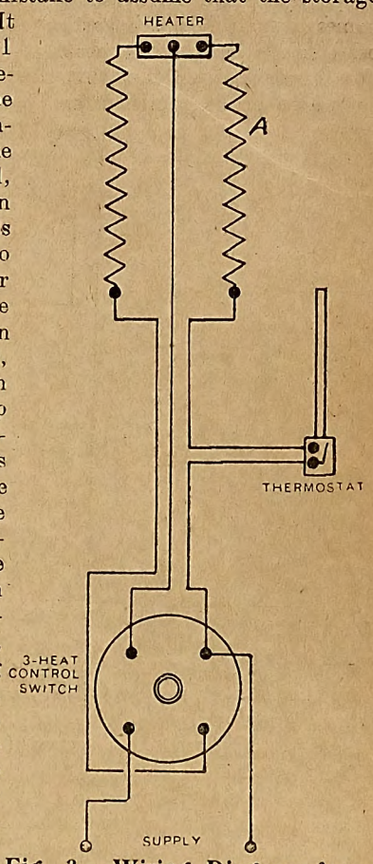

Fig. 3.—Wiring Diagram for Immersion Heater with Thermostatic Control.

It is a wise plan to take this opportunity of substi-

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tuting the ordinary draining plug by an adjustable valve or tap, so that in future if any further draining operations have to be carried out for any cause, such as cracked pipes due to frost, &c., they can be effected quite easily and conveniently. The cock of such a valve or tap should require a removable spanner or key to operate it, in order to prevent accidental opening of the valve.

It may be mentioned here in passing that in some old houses it is the practice to feed the hot-water tap in the kitchen or scullery from the circulation pipes to the range boiler. Since with the immersion heater method of water heating no circulation takes place in these pipes, no hot water will be available at this point, so care should be taken to ascertain this information before deciding to instal an immersion heater in such circumstances.

The storage tank having been emptied, it is now necessary to cut a hole in it to receive the immersion heater. With some makes of heaters it is necessary to remove the manhole cover in order to do this. In the case of tanks which have been in commission a number of years, there is often considerable difficulty in doing this, and in any case the cover must be recaulked when replaced. There is, however, available a patent flange, into which the immersion heater is screwed, which can be fitted into square or round tanks without necessitating the removal of the manhole cover.

With regard to the wiring, it is best in the interests of safety to fix the control switch, whether plain "on and off" or 3-heat, outside the bathroom. Owing to the fact that the terminal blocks of immersion heaters when in use generally attain a fairly high temperature, this often causes the rubber insulation of the conductor wires to perish and become brittle where they are in close proximity to the blocks. For this reason it is most advisable to strip the conductors bare a few inches from the terminal block, and thread over them heat-resisting porcelain beads. As regards earthing, *all* the pipes emanating from the storage tank should be securely bonded together and to the water supply pipe which feeds the cold-water cistern, by means of stout copper wire and proper clips. It is very advisable to ascertain that this supply pipe is metallically continuous to the main, and its efficiency as an earth connection should be tested if any doubt exists on this score.

In order to increase the thermal efficiency, this can be greatly improved by lagging the storage tank. The lagging should be of such a nature that it does not encourage moths, on account of the clothes in the airing cupboard. Also, in order to provide sufficient heat for the airing process, it will usually be found necessary to leave the top of the tank unlagged.

The practical results of the author's own experience may possibly be of interest. The heater is switched on at low heat (500 watts) on retiring at night and switched off after luncheon the following day. This provides sufficient hot water (130 deg. F.) for toilet purposes on rising and for other domestic uses during the morning, and the water is still sufficiently hot for washing up after the evening meal. By working the element at "low" heat means that it is running at a black heat, which prolongs its life. The average consumption per week is 52 units. (If the tank was lagged and thermostatically controlled a considerable economy in current consumption and increased temperature could, of course, be obtained.) The cost of the installation was approximately £5 15s.—heater £2 10s., and wiring, fitting, &c., £3 5s.

If a thermostat is utilised, this should be fixed near the top of the tank. Fig. 3 shows a 2-kW immersion heater with 3-heat and thermostatic control. Since that portion of the element marked A is always in circuit whether "high," "medium" or "low," if the thermostat is connected in its circuit automatic temperature control is obtained on either 1 kW (medium) or ½ kW (low) loading. The 2 kW (high), of course, is only for use when the temperature is required to be raised rapidly.

It is hoped that these few remarks may be of interest and use to those contractors who wish to take advantage of this new business outlet, and also to supply engineers who are anxious to develop their water-heating load.

Textile Plant Electrification.

Some aspects of mill and factory driving, for which purpose the electric motor is particularly advantageous.

By CLIFFORD CARTER.

THE axiom has been formulated that schemes for the electrification of textile mills and factories which are old, but compact and well planned, are not as a rule worth while; but that if extensions of any magnitude are called for, or in the design of a new factory, electrical transmission should be employed. The correct choice of drive for any particular situation depends entirely on the circumstances surrounding it. Every case must be considered individually if the best results in efficiency and reliability are to be obtained. Points to be considered include the peculiarities of the machines to be driven and also external conditions, such as climate; in India, for instance, an increase in temperature often influences the power required by altering the tension of ropes, belts, and spindle-driving bands.

An objection which is sometimes raised against electric driving is that the efficiency of a mechanical drive is considerably higher than that of an electrical one, which is a very difficult accusation to disprove. The actual efficiency of an electrical system of driving may be easily ascertained, but the efficiency of a mechanical system under running conditions is impossible to obtain with accuracy. It has been found, however, that when a textile mill has been converted from a mechanical drive to an electrical one, the indicated horse-power of the prime movers has been reduced with the same machinery running, which fact certainly tends to show that the efficiency of the mechanical drive is not usually so great as is stated to be by its advocates. The probability is, however, that as between a well laid-out electrical drive and a perfectly modern mechanical drive there is very little difference indeed in the actual efficiency of transmission; that is to say, as regards the total power delivered to the machines by the driving mechanism. This does not dispose of the fact that the motors deliver the power in a better manner; that is, at a more constant speed.

Steam-turbine Mill Drives.

The prime mover is, of course, the starting point of all transmission schemes. When the textile manufacturer of to-day decides to put down his own power plant he has, in practice, three types of prime movers to

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choose from: (*a*) the modern reciprocating steam engine; (*b*) the steam turbine; and (*c*) the Diesel or semi-Diesel engine, which is ideal for small and moderate loads. For installations above, say, 300 b.h.p., the choice lies between the steam engine and the turbine. The latter is a prime mover particularly well adapted to the requirements of a mill driven electrically; it is smaller and lighter than the reciprocating engine; it can be housed in a smaller building and requires lighter foundations than its rivals; assuming that a good vacuum is maintained and that the size of the set is not too small, its power costs are lower also. The steam turbine is a prime mover which possesses the property of utilising a high vacuum far more efficiently than can be done by a reciprocating engine. In existing mills and factories the conditions may be such that both smoothness of drive and convenience of operation may be obtained by the installation of a steam turbine connected to the main driving shaft, or rope pulley, by means of double helical reduction gear. In some instances such sets are fitted with a generator, connected to the low-speed shaft, from which electricity may be fed to motors arranged to drive machinery in outlying buildings. A feature of the turbine drive which frequently proves of great importance is the facility with which the turbine may be arranged to pass out a quantity of steam, after it has done work in the higher-pressure stages, to be used for heating or manufacturing purposes.

If desired, the arrangement may be such that all the steam used in the turbine may be utilised. As an alternative, steam-turbine sets are sometimes installed to relieve overloaded steam engines. The turbine takes exhaust steam from the engine, and the arrangement is such that the engine is relieved of its overload, the overall output of the plant being increased considerably.

It should be noticed that both turbines and electric motors invariably give a fine steady rotary drive, thus doing away with the cyclically jerky uneven turning moment that is unavoidably characteristic of the reciprocating engine. It has been found that a small cyclical irregularity of 2 to 3 per cent. in a reciprocating engine is quite commonly increased in mechanical transmission by gears, ropes, belts, chains and shafting, between the engine and the driven machine to as much as 20 per cent. Turbines have a good starting torque, and in the case of mills are quite capable of starting the Monday morning friction load.

Briefly, so far as power production on a large scale is concerned, the steam turbine is supreme, although under certain conditions water-turbine drive may be a serious competitor. With a plentiful and constant supply of water there are instances of textile machinery being driven by separate small water-turbines, neither belts, ropes, nor electric motors being required. Usually the development of water power involves a disproportionate capital expenditure and the power developed is frequently subject to seasonal variations which seldom synchronise with the load.

Generated versus Purchased Power.

In many instances the power required for a mill *must* be generated on the site, whilst in a steadily increasing number of cases a public supply undertaking is available from which electrical energy may be purchased. An analysis will show that in most cases a mill of moderate size can generate and apply its own power more cheaply than it can purchase it in the form of electrical energy. On the one hand, when energy is purchased from a supply station, the prices charged must naturally cover a profit, both on the cost of the steam plant for generating the electricity and the heavy outlay on cables for transmitting it, in addition to the losses due to transmission through cables from the generating station to the customer's works. On the other hand, the convenience and indirect economies of purchasing the ready-made article become daily more obvious, and the decision might be in favour of a public supply for a new mill near to a large power station requiring motive power only. The ultimate decision should only be made after the fullest investigation, preferably carried out by an independent consultant who is in a position to give equal consideration to all factors without bias.

Group or Individual Driving.

To obtain the maximum benefits from electrical driving, it may be said generally that separate motors should be installed to drive each individual machine. Undoubtedly this is the modern tendency, particularly so in the case of new mills in which the absence of shafting makes possible a much lighter and less costly construction of buildings. In many cases, however, the extra cost of individual motors may be considered commercially inadvisable, and group driving may be resorted to. This practice is frequently adopted when steam-driven mills are converted to electrical drives, existing line shafting being retained. If the group system is adopted, it should be so arranged that each group requires approximately the same power. If possible, the motors should be coupled direct to the line shaft, while where long line shafts are employed the motor should be placed in the centre. Motors may be actually located upon the machines, thus eliminating all belts and flexible factors in the power system, and applying direct and positive power to the machines at a constant rotative speed. Where motors are directly applied to the machines the improvement in the quality and the amount of the product, as well as the decreased attendance, is very marked. The design of many jute mills is such that it is possible and practicable to place motors over the centres of the shafts they have to drive, connecting them to these shafts by chains, the motors themselves being suitably housed in a simple superstructure raised on a flat roof. If placed at the ends, the motors are in the clean atmosphere of the alley-way, but the speed irregularity of the shafts may be excessive, particularly if the shafts exceed, say, 300 ft. in length, as they do in many Calcutta mills where at least one shaft 700 ft. long is installed. The modern method of driving jute preparing and spinning machinery rooms is to run the shafts at 485 r.p.m. (softener and card shafts being sometimes run at a lower speed) and to couple the motors direct to the shaft through flexible couplings. In a modern drive, the motors are often placed on masonry piers connected together by a platform, with motor starters on the ground.

It is submitted, as a general rule, that if a textile or other machine runs intermittently or requires complicated shafting to drive it, individual driving is to be preferred. Individual electric driving should thus be applied to dressing machines and to damping machines which run intermittently, and to calenders and mangles which provide an irregular load. Cropping machines, measuring machines and calenderoys, and, indeed, all machines which do not run continuously should also be put on single-motor drives. The individual electric driving of calenders with chain transmission has proved very successful in practice, as has also a similar motor arrangement with gear or worm drive.

Modern Mill Motors.

Very special consideration is required in the design of motors for spinning mills, and a great deal of experiment has been necessary for the evolution of the best prevailing types. Three-phase squirrel-cage motors as first used to drive spinning and twisting frames when electric driving was first introduced were not satisfactory, as they started in much too jerky a manner, causing yarn breakages. A further disadvantage of these motors was their big initial current rush, equivalent to approximately six times the normal current. This current rush brought about undesirable pressure fluctuations, especially where the system had to supply both light and power.

The so-called star-delta connections for reducing the starting current could not be employed, as the direct operation of spinning and twisting required a starting torque of nearly twice the normal, and motors initially connected in star do not, of course, start satisfactorily. Three-phase squirrel-cage motors with pole change-over devices for two speeds employed later showed the same

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defects. The two speeds obtained by the pole change-over principle lay too far apart, so that these motors also did not suit the technical requirements of the spinner. These disadvantages have now been eliminated, however, and motors have been introduced which give a wide variation in spindle speeds to suit start up, finishing and yarn changes. The bearings of motors supplied for preparing and spinning rooms should be absolutely fly proof. For wet spinning-room work the motors should be fully enclosed machines with air-ducts circulating the outside air and not the humid atmosphere of the room. The windings are thus kept dry and fully insulated.

Independent driving has been especially satisfactory when applied to spinning frames, which machinery must usually be started slowly. Useful variations in speed may be obtained with an individual direct current motor, the regulation of speed being left to the spinning master, who may be given a bonus on turn-off. Thus if the weather is propitious for spinning, or if he has a good spinner on a frame, he may increase the speed and consequently the production. A higher speed than the normal might also be given to the frame when the bobbin is half-full, as it is at this time that the spinners' work is lightest. An individual direct current motor drives a spinning frame most conveniently through a small pinion upon the end of the armature spindle, meshing into an internally toothed wheel upon the end of the cylinder shaft. Motors for spinning frames should have twice the normal torque.

Weaving-factory Drives.

In determining the best type of drive to be adopted for any loom, it is desirable to consider briefly the duties to be performed. First comes the duty of starting from rest, when to overcome inertia of the moving parts and to impel the shuttle smartly across the loom, up to or over three times full-load torque may be required. Next may be taken the operations of shedding, picking and beating up. During each cycle of these operations the torque required from the motor shaft has been found by careful investigations to vary from zero to a maximum, when picking up two or over more than three times full-load torque. Another important condition which must receive careful consideration is the "bang-off" or sudden stoppage of all moving parts that occurs automatically should the weft break, the supply of thread in the shuttle give out, or should the shuttle for any reason fail to get across the warp shed in time. When a loom bangs off, the momentum of the moving parts is so great that the sudden stoppage throws a heavy shock upon the loom frame and upon the driving motor and upon the belt, chain or gears. To prevent damage being caused by this shock, provision must be made either by allowing the belt to slip, or, in chain- or gear-driven looms, by including a slipping clutch. Also in the heavier looms a brake is usually fitted that is applied automatically when a loom "bangs off." A final condition to be noted is that the picking action of striking the shuttle across the warp, say, some 200 times a minute, is liable to cause vigorous vibration in the loom when gear drives are employed, and is liable to affect the gears detrimentally unless adequate precautionary measures are taken to the contrary. From the above analysis, which outlines the principal difficulties to be overcome, it will be seen that to provide a satisfactory combination of a suitable motor with a suitable drive to suit each different type of loom is by no means a simple problem.

In a belt-driven shed the speed of any particular loom will be dependent upon the number of looms working from the countershaft at any instant. Thus, due to risks of broken ends such a loom cannot run at the highest possible speeds, but must be operated at an average number of revolutions to allow for its speeding up when other looms are shut down. With individual drive, however, the speed of any motor is independent of the starting or stopping of other motors, consequently a loom so driven can run at a higher speed than a loom driven from a countershaft, the output of the loom being thus increased. In fact, as the looms run at their theoretical maximum speed their output will be a maximum. This is the greatest advantage to be obtained from the use of an individual drive, and although very extravagant figures have sometimes been put forward, it has been found that as a rule the adoption of such a drive will increase the shed's output by approximately 10 per cent. Again, due to the constant speed, the fabric will be more evenly woven than would be a fabric produced from a mechanically-driven loom. Mr. J. F. Crowley has published comparative tests taken over a period of twelve months between some hundreds of looms running on hessians and sackings, and driven mechanically by a modern reciprocating engine and a similar number of looms driven by individual electric motors. The individually driven hessian looms showed an increase in production of 13 per cent., and the sacking looms an increase of 8 per cent. over their mechanically driven neighbours. The jute loom requires a high starting torque usually from two to two and a half times the normal torque, and has a particularly irregular power cycle. The speeds of jute looms vary from 90 picks per minute to 180 picks per minute, depending on the reed space. The average power taken by a group of looms, allowing the usual load factor for weaving sheds, varies from 5 b.h.p. to 2 b.h.p. per loom. The load factor or weaving efficiency of a jute shed varies from 45 per cent. to, in the very best cases, slightly over 70 per cent., depending upon the class of material woven and the type of operator.

Two-loom Belt Drives.

In some weaving sheds a single continuously running motor is installed for each pair of looms, belts being taken from double-width pulleys at both ends of the motor to fast and loose pulleys arranged on each loom, so that the belts are nearest the motor bearings when on the fast pulleys. Compared with the individual drive this arrangement requires a smaller capital outlay, but involves greater losses, because of the continuous running and less even loading of the motor, and does not give the maximum output obtainable with the individual high speed clutch drive, using either chain or gears.

Individual Chain Drives.

In some instances, chains are substituted for driving belts using an adjustable frame motor, but omitting the spring and adding adjusting nuts above and underneath the projecting lug on the motor body. Chains may be used for speed reductions up to 6 or 7 and give the important advantage of a positive drive. They avoid the slip experienced with belts that occurs every time the loom is started, and so avoid a consequent important loss of production. On the other hand, in order to protect both the chains and the driving teeth against risk of injury when looms bang off, some definite slipping device must be introduced. This requirement is met by the provision of friction clutches. The best arrangement is to have a high-speed clutch mounted directly on the shaft of the motor. This is to be preferred to a clutch mounted on the low-speed driven shaft.

Integral Mounting.

In practically every type of loom it is possible to fit brackets whereby both motor and starting switch can be mounted as part of the loom itself. This arrangement not only avoids encroaching upon the floor space of the shed, incidentally making for greater cleanliness, but also minimises the injurious effect of vibration upon the teeth of the gears. Having in mind the hammer-like blows given to the shuttle, say up to two hundred times a minute, and the inevitable consequent vibration, the advantage of having the motor with its driving pinion bolted securely to the same framework that carries the driven spur wheel will be at once apparent.

In some looms a low-speed mechanically arranged clutch is incorporated by the makers in the structure of the loom, when the driving pulley or individual motor must run continuously. This type of loom drive has the disadvantage that the motor consumes electrical energy when running unloaded whenever the loom is

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stopped, and as stoppages frequently aggregate 30 per cent. of the total working hours, the cost of idle running may amount to an appreciable total per annum.

Group Drives for Looms.

Whilst to obtain the maximum benefits from the electrical driving of looms it is necessary to install individual motors, there are frequent instances where this course is considered commercially inadvisable, and where some form of group driving is adopted. This practice applies particularly in the conversion of some factories from steam to electric driving, when the individual drive would necessitate expensive rearrangement of existing looms. Various types of motor can be supplied for group driving, the types most commonly employed being either ordinary or high-torque high-efficiency squirrel-cage motors, or slip-ring motors, and arranged either as enclosed-ventilated or pipe-ventilated machines, according to circumstances. In some instances, however, it may be possible to use either slip-ring motors in conjunction with phase advancers, or, alternatively, synchronous induction motors, in order to obtain reduced charges for electrical energy by improving the power factor of the system. The more intermittently machinery works the greater the advantage of a direct electrical drive. For instance, with Jacquard looms, where there are often prolonged stoppages to tie up new harnesses, there is more advantage in individual drive than with looms weaving plain staple goods. For the latter, group driving would be more acceptable.

Electrical Devices.

That there is a great future for the application of electricity to the requirements of the textile industry cannot be denied. It is certain that as electricity is increasingly used for driving purposes its application to other mill uses will increase through the efforts of the user quite as much as through those of the electrical engineer. In practically every branch of the industry, from the treatment of the raw fibre to the finished fabric, there is a tendency towards the application of electricity in some form. Electrical means have been proposed to remove metal from raw material, as it has been proved by statistics of fire insurance companies that a large percentage of mill fires is attributable to pieces of iron in the fibre. To remove them an electro-magnetic cylinder is rotated over the feed sheet in such a way that the surface speeds are similar. As soon as the pieces of iron come within range of the magnet they are attracted to the magnetic cylinder and carried away and automatically dropped into a receptacle by the sudden cutting off of the current.

A good British electrically-driven yarn tester which is now widely used is operated by an electric motor with direct drive by means of suitable reduction gear. Regularity of the stress load is maintained throughout the test by this method, thus eliminating any possibility of jerky revolutions which place a sudden strain on the yarns, and make a true and accurate test impossible.

Apart from electrical driving, electric warp and weft stop motions have been known for several years. In a recent patent, for instance, the loom handle is normally prevented from being pushed by a spring-actuated lever into the off position by an armature attracted to an electro-magnet which is constantly energised by a winding in circuit with the mains. A reverse winding on the electro-magnet is normally in a circuit interrupted by the attraction of an armature to an electro-magnet having a winding fed from the low-pressure secondary side of a transformer.

When a warp thread breaks the corresponding detector closes a circuit including a neutralising winding, whereby the second armature is allowed to make contact to allow current to pass through the reverse winding. The other armature is thus released from its electro-magnet and a spring moves a plunger to move the handle into the off-position to stop the loom.

In the ordinary electric stop motion the breaking of a thread causes the flow of an electric current to an electro-magnet, and the movement of the armature of this magnet draws together the jaws of an arrangement for gripping the broken thread. Owing to the vibration of the machine these jaws are frequently shaken apart and the thread released. A new device has been patented in which by means of a spring and an elastic band connected with the electro-magnet, a bolt is made to pass through a hole in a paddle attached to the movable jaw, and the gripping device is thus locked mechanically. At the same time the current circuit is broken and overheating prevented. Several attempts have been made to perfect electrically-operated jacquards, but the difficulty is that an electrical contact sufficient for operating a part cannot be obtained from a mere touch. By the use of single-phase current the Carver electrical jacquard has been improved into a practical device, which has been adopted in Belfast damask factories.

Electric baling presses, cloth cutters, conditioning ovens, hydro extractors, pumps, cranes, winches and hoists, are but a few examples of electrically-operated mechanism now in use in modern textile mills. There is still a great deal to be learned with regard to mill and factory electrification, but there is no doubt that every new mill and factory will be electrically equipped, and it is equally certain that these mills and factories will be able to pay dividends when a good many steam-driven plants will be unable to do so.

Empire Mica Production.

A correspondent in the special Empire Products Section of last week's *Times Trade and Engineering Supplement* states that although the world's principal supplies of mica still continue to come from India, Canadian and South African production during the last few years has rapidly approached the Indian output. Fifteen years ago India was responsible for some three-fifths of the world's total production, most of the remainder coming from the United States, Canada, and what was then German East Africa. The East African deposits are still worked, though without any great influence on world output. Other sources are Ceylon, Australia, and Southern Rhodesia. In 1928 exports of mica from India totalled 4,774 tons (against 3,874 tons in 1927). Canada's production amounted to 4,040 tons (against 3,005 tons), and South Africa's to 3,629 tons (against 1,660 tons). The Canadian mica is the variety known as "phlogopite," or amber mica, which is softer, more flexible, and a better insulator than the "muscovite," or white mica, found generally in other countries. The main deposits are in Ontario. Nearly all the Indian mica which comes on the market is muscovite of the highest quality, the principal areas of production being in Bihar and Orissa and Madras. The mica from the Bihar belt is generally of a ruby colour, while that from Madras is green. Canada, Ceylon, and Madagascar are the only countries in which amber mica is found in economic quantities. The Northern Transvaal has a muscovite mica field of great promise, extending over some 300 square miles in the Pietersburg district, but its development has been retarded in the past owing to its remoteness. A small railway which now connects the mica-bearing belt with Delagoa Bay has already made possible a great increase in exports, which may make South Africa the world's most important source of muscovite mica.

A Committee on Patent Procedure.

The President of the Board of Trade has appointed the following committee to report whether any, and, if so, what, amendments in the Patents and Designs Acts, or changes in the practice of the Patent Office, are desirable:—The Rt. Hon. Sir Charles H. Sargant (chairman), Mr. Horatio Ballantyne, Mr. H. A. Gill, Mr. E. H. Hodgson, C.B., O.B.E., Sir Herbert Jackson, K.B.E., F.R.S., Mr. W. S. Jarratt, Mr Fearnley Owen, Mr. J. G. Weir, C.M.G., and Mr. James Whitehead, K.C., with Mr. R. W. Luce, Patent Office, 25, Southampton Buildings, Chancery Lane, W.C.2, as secretary.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The A.S.E.E. Apprenticeship Scheme.

It may be recalled that in October last we published some details of an apprenticeship scheme evolved by the Association of Supervising Electrical Engineers. It was proposed that the scheme should operate under the control of a Central Apprenticeship Board representative of the various interests in the electrical industry. The training suggested linked up practical and technical work, and the co-operation of employers was essential to its success. It was pointed out at the time that it would be necessary for many conversations to take place between the promoters and those organisations in the industry which would ultimately control the scheme. We are now informed that a number of the organisations concerned have expressed their deep interest in the fundamentals of the scheme, and meetings are being arranged with those who have not yet arrived at a definite decision. Three of the six bodies have signified their favourable attitude. It was to be expected, however, in view of the many schemes which are already in operation, that difficulty would be experienced in finding common ground for the linking-up of the ideas underlying present schemes, with the new suggestions. One of the reasons behind the suggestions of the A.S.E.E. was to bring about, by co-ordinated effort through the co-operation of all who had the question of apprenticeship at heart, a scheme which would relieve the industry of the unfortunate position in which it is placed in regard to apprenticeship systems. Headway has been made, and, providing all interests are prepared to sink their individual outlook for the good of the industry, there is no reason why such a scheme should not be evolved from the suggestions put forward by the A.S.E.E. which would guarantee, in the future, a supply of fully-qualified men for the electrical industry.

Government Mission to Argentina and Brazil.

Last week the Board of Trade announced the appointment of an economic mission to visit Argentina and Brazil and consider the industrial, commercial and financial relations of those countries and Great Britain with a view to their development in the general interest. The members of the mission are Lord d'Abernon, president; Sir William Clare Lees, representing the textile industries; Mr. G. E. Rowland (president of the Agricultural Engineers' Association), representing the engineering industries; and Mr. Julian Piggott, iron and steel industries. The mission will be accompanied by Mr. H. O. Chalkley, Commercial Counsellor at the Buenos Aires Embassy, and Mr. H. W. Wiswould, Department of Overseas Trade, will act as secretary. Prior to leaving this country the mission will make a preliminary survey in this country of questions affecting trade between Great Britain and Argentina and Brazil. For this purpose the co-operation is sought of Chambers of Commerce, trade associations, firms and individuals interested in the subject. Communications for the mission should be addressed to Mr. Wiswould at 35, Old Queen Street, S.W.1.

New Electrical Showrooms.

New showrooms and offices erected in Parliament Row, Hertford, by the North Metropolitan Electric Power Supply Co., were opened on May 10th by the Mayor, Sir Lionel Faudel-Phillips.

The Portsmouth Corporation Electricity Committee is recommending the acquisition of property at London Road, North End, at a cost of £5,300, for the provision of showrooms for the department.

Employment during April.

According to the May *Ministry of Labour Gazette* employment in the engineering industry remained quiet on the whole during April, but showed a further improvement in most districts. It was fairly good in electrical engineering, although there was a decline in that section. The number of persons unemployed in the engineering industry at April 22nd was 78,181, the proportion falling from 8.1 to 8.0 per cent. The number of unemployed in the electrical engineering branch was 3,878, and the proportion rose from 4.7 to 4.9 per cent. There was a slight increase in the percentage of unemployed in the electric cable, wire and lamp manufacturing group—from 6.0 to 6.1 per cent., the number of unemployed being 5,289. In the electrical wiring and contracting industry the number of unemployed fell to 1,095, and the proportion from 8.0 to 7.9 per cent.

Westinghouse Agreement with French Company.

The Westinghouse Company has concluded an agreement with Schneider & Co., one of the leading French industrial concerns, for the formation of a joint electrical manufacturing company in France, with a capital of $4,000,000 (£800,000).—*Reuter* (New York).

The Economic Mission to Australia.

On Thursday last week members of the Economic Mission which recently returned from Australia were entertained at luncheon by Mr. G. E. Rowland, president of the Agricultural Engineers' Association. The toast of "The British Economic Mission" was proposed by Sir Edward Crowe, Controller General of the Department of Overseas Trade, who congratulated the members of the Mission on their work, which, he emphasised, was not for themselves but for the Empire. In the course of his reply, Sir Arthur Duckham (leader of the Mission) said that Australia possessed tremendous possibilities for development which, if realised, would mean more trade for the whole of the Empire. He made particular reference to the place of agricultural machinery in that development, and expressed the hope that British, and not American, lines would be followed. He believed that Australians wished to develop along British lines, and British manufacturers should do their utmost to secure a position in the market. Sir Hugo Hirst, who also responded to the toast, said that a thorough study of Australian conditions on the spot was essential. Single handed efforts would be ineffective; there must be a combined effort to help Australia and fight the foreigner.

The South African Electrical Market.

In the course of a recent review of electrical power development in South Africa, Mr. E. B. Lawson, United States Assistant Trade Commissioner at Johannesburg, says that commercial imports of electrical machinery have been substantial for several years, and have maintained a fairly consistent upward movement, the total values for 1927, the latest available figures, having advanced considerably over those for the several years immediately preceding. The value of electrical machinery, not including certain fittings and materials, imported during 1927 amounted to more than £1,500,000. The United Kingdom controls the major part of the trade, with the United States and Germany furnishing a limited amount of competition. "The strong position of British manufacturers in South Africa is influenced by a number of factors, including the practice of maintaining factory representatives or branch offices in that country, the effect of considerable sums of British capital invested in local enterprises, and the fact that a considerable number of technical advisers and engineers have been trained in English universities."

An American Delegation to Russia.

What is perhaps intended as an offset to the recent visit of English industrial delegates to Russia has just been arranged. It has been decided to send a party of representative American business men to Russia in the summer to study economic, commercial, and industrial conditions there. The visit is being sponsored by the American-Russian Chamber of Commerce of which Mr. Reeve Schley, of the Chase National Bank, is president. The party will muster in Berlin on July 15th and return from there on August 16th.—*Reuter* (New York).

Electrical Imports of Angola.

The latest available figures of the trade of Angola (Portuguese West Africa) are apparently those for 1925. In that year the imports of electrical apparatus amounted to 170 tons, valued at 1,185 contos (£9,300). Great Britain supplied the bulk of this, 155 tons, valued at 650 contos (£5,000). These facts are included in a Department of Overseas Trade report on economic conditions in Angola by Mr. R. T. Smallbones, M.B.E., British Consul-General at Loanda (Stationery Office, 1s. net).

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United States Electrical Exports.

The exports of electrical equipment from the United States during March last were valued at $14,337,158, as compared with $9,675,491 in March, 1928, raising the total for the first quarter of the year from $25,548,648 to $35,719,342. The principal increase occurred in the case of refrigerators up to 1-ton capacity—from $417,307 to $1,417,920. Exports of unspecified apparatus increased from $624,940 to $1,351,539. Other notable increases were: Bare copper wire, from $159,610 to $406,646; insulated copper wire, from $432,989 to $692,085; radio apparatus, from $858,302 to $1,486,898; accessories and parts for motors, from $214,585 to $369,911; ignition equipment, from $208,742 to $535,603; and fractional h.p. motors, from $244,878 to $353,498. The decreases were few in number and comparatively unimportant. Canada, as usual, was the principal customer for American electrical equipment, her share amounting to $3,320,621. The United Kingdom ($1,053,144) took second place, and Argentina ($1,010,498) was third. Other leading importers were Japan ($765,995), Brazil ($682,607), Australia ($614,627), Cuba ($502,969), and British India ($471,361). Imports of electrical equipment by the United States were valued at only $230,286, of which Sweden was responsible for $87,453, and Japan for $72,182 (mainly lamps).

New Indian Companies.

Among the electricity supply companies recently formed in India are the Jalgam Electric Supply Co., 47, Apollo Street, Fort, Bombay, capital 500,000 rupees, and the Jalparguri Electric Supply Co., Jalparguri, Bengal, capital 175,000 rupees.

The North-Midland E.D.A. Committee.

Arrangements have been made by the North Midland Area E.D.A., for the third area sales conference to be held at the Corporation Electricity Offices, Sunbridge Road, Bradford, on June 4th. Mr. C. E. Allsopp, A.M.I.E.E. (Bradford Corporation) will speak on the subject of "The Development of the Electric Cooker." The chairman will be Alderman W. Illingworth, Bradford.

Recent Contracts.

A-S Refrigerating Machines, Ltd., one of the associated companies of the General Electric Co., Ltd., has received an order from Messrs. Boots, Cash Chemists, Nottingham, for 14 sectional refrigeration cabinets, each fitted with the hermetically-sealed, leakage and explosion-proof "A-S" automatic refrigerating machine. These cabinets will be installed in the various cafés controlled by Messrs. Boots.

Plymouth Corporation has placed an order for phono-electric trolley wire with the Equipment & Engineering Co., Ltd. This company has also received an order from Bradford Corporation for an electric heater for shrinking on tramcar tires.

Hungarian Electrical Imports.

The value of the electrical machinery and appliances imported into Hungary during last year amounted to approximately £765,030, as compared with £472,390 in 1927.

Bankruptcy Proceedings.

H. Peover, Market Lane, Newcastle-upon-Tyne, electrical apparatus and tool merchant.—The first meeting of creditors was held on May 22nd, at the Official Receiver's office, Newcastle. A statement of affairs was submitted showing liabilities of £1,869, against assets of £235. The debtor's stock, which had been valued at £612, had realised only £140. It was reported, in support of the debtor's statement that the stock had been "sacrificed," and that the Official Receiver had in his possession a letter from a business friend of the debtor, who had been prepared to offer £300. The case, being a summary one, remained in the hands of the Official Receiver as trustee of the estate.

E. R. Millward, trading as "West of England Radio," 67, High Street, Barnstaple, Devonshire, wireless engineer.—The first meeting of creditors herein was held on May 14th at the Official Receiver's offices, Exeter. No statement of affairs was lodged as the debtor was too ill to prepare one or to attend the meeting. The matter was left in the hands of the Official Receiver as trustee.

S. E. Hunt, electrical engineer and contractor, 8a, Torwood Street, Torquay.—Receiving order made May 17th, on debtor's own petition.

J. Westnutt (J. V. Westnutt), electrical engineer, High Street North, Dunstable.—First and final dividend of 9s. in the £, payable May 31st, at the Official Receiver's offices, The Parade, Northampton.

E. C. Jenkins, wireless dealer, 124, Cheltenham Road, Bristol. —Last day for proofs for dividend, June 4th. Trustee, Mr. H. Ashton, Official Receiver, 26, Baldwin Street, Bristol.

Company Liquidations.

F.E. Industrials, Ltd., electrical appliance manufacturers, London and Glasgow.—The statutory meeting of creditors was held recently in Glasgow, when Mr. J. M'Connell, the liquidator, reported that the liabilities were £8,628, and the net assets £2,941, leaving a deficiency as regarded the creditors of £5,687. The company was formed rather more than a year ago for the purpose of selling washing machines and vacuum cleaners. It purchased the patent rights of a certain machine, and efforts were made to sell the Continental rights to a German company, but the matter fell through. The company had agreed to pay £2,000 for the Continental patent rights, but only £1,000 had been paid. A sales manager was appointed, but when he submitted his scheme to the directors, there were not sufficient funds to carry it through. Negotiations for the sale of certain rights took place, but they proved abortive, and liquidation took place. The issued capital was £6,500, and the deficiency of £12,187 as regarded the shareholders was accounted for by a number of items, including a loss of £8,187 on trading. A resolution was passed confirming the voluntary liquidation of the company, Mr. T. D. Galbraith, accountant, Glasgow, being appointed to act as joint liquidator.

Thermit, Ltd.—A meeting of creditors was held on May 29th at Imperial Chemical House, Millbank, S.W. Particulars of claims by May 29th to Mr. R. W. Liddell, liquidator, Imperial Chemical House.

Irish Hydro-Electric Syndicate, Ltd.—A meeting of members is called for June 26th at 18, St. Swithins Lane, E.C., to hear an account of the winding up from the liquidator, Mr. W. Pocock.

Electric Factors (Blackpool), Ltd.—Winding up voluntarily. Liquidator, Mr. J. Todd, 18, Birley Street, Blackpool.

Private Arrangements.

G. N. Jenkins, 195a, Earl's Court Road, S.W.5, electrical engineer, &c.—A meeting of creditors was held on May 22nd at the offices of Messrs. Fincham, Partridge & Co., 3, Warwick Court, Gray's Inn, W.C.1, when a statement of affairs was presented showing ranking liabilities of £963 and net assets of £710, leaving a deficiency, subject to costs of realisation, of £253. The debtor commenced trading on his own account about 1918, having been previously employed in a business. He started with a capital of £1,200, and accounts showed that in the first year he made a net profit of £24. In 1920 he sustained a loss of £128, and in 1921 a loss of £228. The following three years he made profits of £37, £185, and £38, respectively. In 1925 he incurred a loss of £222, and in 1926 a loss of £305, the drawings in that year being £534. In 1927 there was a profit of £13, the drawings being £549, and in 1928 there was a profit of £8, and the drawings were £536. It was decided that the estate should be dealt with under a deed of assignment in favour of Mr. A. S. Partridge as trustee, with a committee of inspection.

Dissolution of Partnership.

W. H. Trace & Son, electrical engineers, 26, Upton Road, Birkenhead.—Mr. W. H. Trace and Mr. H. G. Trace have dissolved partnership. Mr. H. G. Trace will attend to debts and continue the business in conjunction with Mr. W. T. Trace and Mr. G. A. S. Trace.

Social Event.

The association football team of the Sports Club of William Geipel, Ltd., has had a successful season. It was joint winner of the championship of the Harrow and District Football League, and also won the Wembley Hospital Cup. A celebration dinner was held at the Bell Hotel, Ealing, on May 17th, at which the cups and medals were presented to the team by Mr. Kenneth Geipel.

Conditions in Russia.

An interesting description of his recent journey to Russia with the British Trade Delegation was given at Yeovil on May 16th to a large audience by Mr. E. M. Benjamin, secretary of Messrs. Petters, Ltd. The bulk of the address dealt with the life of the people under Soviet rule, but the speaker concluded with a reference to trade possibilities. He said that between 1922 and 1927, the dates when "Arcos" was established in London and when it was raided, the Soviet authorities purchased from us material valued at no less than £204,000,000, which figure included exchange contracts and goods for re-export, such as wool, cotton and white metal. M. Piatakov, President of the Soviet State Bank, was therefore not talking "astronomically" when he spoke of orders between £150,000,000 and £200,000,000 in exchange for political recognition, long trade credit, and a big loan to Moscow. Undoubtedly Russia's needs are enormous. The great stumbling block to trade with Russia is the question of credit. They will not and cannot pay cash. At the present time their vast industrial programmes are proceeding slowly. They are making every effort to build up their own internal industries and make themselves self-supporting in every way. They aim in the course of years to make themselves a second United States. Whilst we stand aside Germany and the United States are supplying them.

Foreign Loans in the United States.

The following were among the foreign capital flotations publicly offered in the United States during the first quarter of 1929: The Copenhagen Telephone Co., $3,575,000; the Berlin City Electric Co., $9,651,000; the Prussian Electric Co., $4,000,000; the Unterelbe Power and Light Co., $600,000; the Utilities Power and [illegible] (Great Britain),

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$5,000,000; the Pirelli Co. (Italy), $3,000,000; the United Electric Service Co. (Italy), $2,350,000; the Intercontinents Power Co. (Argentina), $1,485,000; the International American and Foreign Power Co. (Argentina), $100,827,200; and the following Canadian undertakings: International Power and Paper Co., $10,000,000; the Montreal Tramways Co., $250,000; Bell Telephone Co. of Canada, $7,500,000; International Hydro-Electric System, $13,000,000; Power Corporation of Canada, $2,500,000; and the Shawinigan Water and Power Co., $4,000,000.

Unemployment.

A decrease of 28,005 in the number of unemployed persons on the registers of the Employment Exchanges was shown for the week ended May 13th. At that date the total was 1,104,700, as compared with 1,132,705 on May 6th, and 1,118,390 on May 14th, 1928.

Trade Announcements.

The Devon Radio and Electrical Co. has opened, at 331, Torquay Road, Paignton, a showroom and workshop under the management of Mr. E. White.

The head office of Austinlite, Ltd., has been transferred to the company's Smethwick factory. The address is:—Austinlite, Ltd., c/o Chance Bros. & Co., Ltd., Electrical Department, Lighthouse Works, Smethwick, near Birmingham.

Mitcham Works, Ltd., electrical and radio manufacturers, has acquired works at New Road, Mitcham Junction, from the Mullard Radio Valve Co., Ltd.

Owing to expansion of business, Lighting Trades, Ltd. (which incorporates J. & W. B. Smith, Ltd.), has removed its trade counter to larger premises at 17-19, Farringdon Road, E.C.1, the old address of J. & W. B. Smith, Ltd. The head office and showrooms will remain at 30-31, Farringdon Street, E.C.4.

The Glasgow office of the English Electric Co., Ltd., has been removed to 200, St. Vincent Street.

Messrs. F. W. Cook & Co. (Southampton), Ltd., have opened new electrical showrooms at Russell House, Hanover Buildings, Southampton.

The new London address of Messrs. Wm. McGeoch & Co., Ltd., is 48, Berners Street, W.1. (Telephone: Museum 9423; telegrams: "McGeoch (Wesdo) London."

The name of the Greenwich Cable Works, Ltd., has now been changed to the Croydon Cable Works, Ltd., consequent upon its removal to larger and more up-to-date works in Mitcham Road, Croydon. The new works is equipped with modern machinery for manufacturing paper-insulated lead-covered cables and the "Pernax" cables in connection with which the company was founded in 1902.

Messrs. Hosken, Trevithick, Polkinhorn & Co., Ltd., Truro, have opened new showroom premises in connection with their electrical department.

Messrs. Frank V. Collins & Co., electrical engineers and contractors, Wimbledon, are opening a new branch at 333, High Street, Sutton, Surrey, on June 1st, and ask for fittings catalogues, showcards, &c.

Messrs. Simkin & Co., electrical and mechanical engineers, are opening a new showroom at 58a, Islington, Liverpool, on June 3rd; they ask for catalogues and price lists of electrical fittings, domestic appliances and accessories.

German Foreign Electrical Trade.

The imports of electrical machinery, apparatus and fittings into Germany during the first two months of the current year attained a value of £427,950, as compared with £403,850 in the corresponding period of 1928. There was also a marked increase in the exports of similar material from Germany—from £3,928,900 to £4,602,900.

A Wiremen's Guide.

A linen-mounted folder of convenient size, containing information of use to wiremen has been produced by British Insulated Cables, Ltd. This includes a comparison of the old and new standards for annealed circular copper conductors, and gives such information as current-carrying capacity, resistance, weight, &c.

Electric Lighting Contracts.

In our issue of May 10th we included among recent lighting installation contracts carried out by Messrs. Best & Lloyd, Ltd., the Ritz Palais de Danse, Manchester, and the Manchester Ship Canal offices. The company asks us to state that the work was carried out on behalf, and to the instructions, of the Edison Swan Electric Co., Ltd., Manchester.

New Catalogues and Lists.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—An illustrated booklet showing d.c. and a.c. switchboards installed at various works.

Wholesale Fittings Co., Ltd., 23, 25, 27 & 37, Commercial Street, E.1.—Catalogue No. E.229, illustrating the company's electrical accessories. Priced.

Messrs. L. Weekes (Luton), Ltd., Luton, Beds.—A well-produced brochure describing, with illustrations, switchgear and fuses, including a change-over and four-pole switch-fuse contained in one case. A tab bearing the company's name, affixed to the booklet facilitates reference after it has been filed.

Messrs. S. G. Brown, Ltd., Western Avenue, North Acton, W.3.—The "Brown Budget" for May contains interesting articles on new activities at the company's works at Acton, its loud speakers and electro-megaphones.

Accumulators of Woking (1928), Ltd., Maybury Hill, Woking.—A booklet giving a general description of "Woking" stationary batteries, together with instructions for handling and preparing for installation, first charge and working. A price list of house lighting and power station batteries is included.

Messrs. J. J. Eastick & Sons, Eelex House, 118, Bunhill Row, E.C.1.—A comprehensive and well-arranged catalogue of wireless receiving sets and accessories, and gramophones (pp. 243). The sections include valves, complete sets, transformers, condensers, gramophones, gramophone pick-ups, &c. An alphabetical index is provided, and the list is fully illustrated and priced.

Martindale Electric Co., Ltd., The Hyde, Hendon, N.W.9.—A three-page folder describing the company's undercutters, "Commulac" insulating liquid, and commutator stones, illustrated and priced.

Nelson Electric Co., Ltd., Kingston Road, Merton Park, S.W.19.—A price list of the company's electric lamps.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—Leaflet No. 287, giving particulars of 2- and 3-speed squirrel-cage motor starters.

British Insulated Cables, Ltd., Prescot, Lancs.—Descriptive booklets, illustrated, dealing with "Prescot" seam and spot welders, and a circular drawing attention to the company's armoured cables.

Willmott, Son & Phillips, Ltd., 124-127, Minories, E.1.—A pamphlet describing the "Sbik" lightning arrestor, and a price list of "Fybros" vulcanised fibre rods.

British Thomson-Houston Co., Ltd., Mazda House, Newman Street, Oxford Street, W.C.1.—A card drawing attention to reduced prices for "Mazda" pearl lamps.

American Tariff Alteration.

Recommendations originally included in a report prepared by the Tariff Committee of the National Electrical Manufacturers' Association (United States) have been followed in general in the Bill which was introduced into the Federal Legislature on May 7th. The proposed changes in the electrical clauses of the present tariff law were made with a view to correcting certain inequalities. A new paragraph, designed to provide more adequately for electrical equipment and related articles, reads as follows:—"All articles suitable for producing, rectifying, modifying, controlling, or distributing electrical energy; electrical telegraph, telephone, signalling, radio, welding, ignition, wiring, therapeutic, and X-ray apparatus, instruments and devices, and articles having as an essential feature an electrical element or device, such as electric motors, fans, locomotives, portable tools, furnaces, heaters, ovens, ranges, washing machines, refrigerators and signs; all the foregoing and parts thereof, finished or unfinished, wholly or in chief value of metal and not specifically provided for, 40 per cent. *ad valorem*."

Electricity Meter Approved.

The Electricity Commissioners have approved of the construction and pattern of the "Ferranti" Type F.C.c, single-phase watt-hour meter, rated sizes 10, 12½, 20, 25, 40, and 50 A, 200 to 250 V at 50 cycles per second.

Austrian Lamp Manufacturing.

The Elin Gesellschaft für Elektrische Industrie, Vienna, has recently acquired the controlling interest in the Allgemeine Gluhlampenfabrik Gesellschaft, Floridsdorf, Vienna, and is proceeding with an extension of the works with the object of increasing the output of incandescent lamps.

Local Exhibitions.

Cold Ash.—In conjunction with the inauguration of an electricity supply at Cold Ash, an electrical exhibition was held by the Western Electricity Supply Co., Ltd., recently. At the official opening, Mr. A. J. Bridge, Publicity and Development Manager, gave a short address outlining the uses of electricity in the home and explaining the tariffs for domestic purposes. Cookery demonstrations given by Mrs. Peterson (Credenda Conduits Co., Ltd.), were well attended. The exhibition was very successful, resulting in a number of sales.

Otley.—The Electrical Distribution of Yorkshire, Ltd., opened on May 24th an exhibition of electrical appliances—especially domestic—at the Nelson Street Drill Hall, Otley, where demonstrations are being given until June 3rd.

Book Notices.

We have received for review a book entitled "The Economic Effects of Monopoly on British Power Stations," written by Mr. A. H. Swain, Chairman of the City of Leicester Electricity Committee. It consists almost entirely of a reprint of the matter which has been published during the past eighteen months after certain British electricity supply authorities had purchased generating plant from abroad. It endeavours to show that members of the B.E.A.M.A. have so grouped themselves that a monopoly is being, or has been, created with regard to the supply of heavy electrical apparatus. The cases which form the background of the book would be better forgotten. In the hasty endeavour to prevent the ingress of

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foreign plant, B.E.A.M.A. has undoubtedly made, and has admitted that it has made, mistakes which should now be relegated to the past.

We do not know whether the author wishes to see us return to the conditions of 1913 when cut-throat competition was rapidly reducing the majority of British electrical firms to bankruptcy. He apparently regards the fixing of prices by members of the group as something almost criminal; yet he must know that almost every staple commodity of life is so regulated. Some form of price regulation must, we think persist and if manufacturers will assure themselves that the prices which they quote are reasonable we do not think that the municipality or company which adheres to British plant will have much cause for regret, even though in some instances it may still be possible to purchase more cheaply abroad.

"Kelly's Directory of the Merchants, Manufacturers and Shippers of the World." Two vols. (Pp. 4,648.) London: Kelly's Directories, Ltd. Price 64s., post free.—This is the 43rd edition of this useful directory, which has been revised and brought up to date. In addition to the inclusion of more than a million and a half names covering over 20,000 places, it contains numerous facts and figures of value to the business man. Reference is facilitated by a concise explanation of the arrangement of the various sections.

"Aluminium: its Production and Application," by E. T. Painton. London: British Aluminium Co., Ltd.—This well-illustrated booklet is a reprint of a lecture delivered before the Rugby Engineering Society.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVIII, May, 1929. No. 5. New York: The Institute. Price $1.

"The A.T.M. Telegraph Engineers' Handbook." First Edition. Pp. 116, illustrated. Liverpool: Automatic Telephone Manufacturing Co., Ltd. Price 2s. 6d.

For Sale.

First Garden City, Ltd., has for disposal one 500-b.h.p. 4-cylinder, 200-r.p.m. Diesel engine, direct coupled to a 437-kVA, 2,000-V, 3-phase, 50-cycle alternator, complete with exciter on combined bedplate. By order of the L.P.S. Electrical Co., Ltd., Messrs. Henry Butcher & Co., will sell by auction on June 18th, the freehold factory in Avenue Road, Acton, W.3. Henry J. Shaw will sell by auction at 13, High Holborn, W.C. on June 4th, wireless apparatus, accumulators, and electrical apparatus. Colne Corporation has for sale one 21.5-h.p. motor-generator, together with motor, generator and charging panels. Fuller, Horsey, Sons & Cassell will sell by auction at the depôt adjoining the main entrance of the Wembley Exhibition grounds, on June 19th, electrical plant and stores removed from the exhibition. (See our advertisement pages to-day.)

The Marking of Imported Glassware.

The hearing of the Application for an Order-in-Council requiring the marking of imported illuminating glassware was resumed by the Board of Trade Committee under the Merchandise Marks Act, 1926, on Monday last.

Mr. R. W. Buckingham, giving evidence against the application, said that 95 per cent. in volume of the decorative lighting glassware used in this country was imported because British makers could not meet the demand. He had been informed that marking would add appreciably to the cost. Moreover, the marking of the glass would convey an impression that the whole fitting was foreign. Difficulty would be experienced where a number of panels of imported glass were used in a fitting. Witness was shown samples of marked glass made by Hailwood & Ackroyd, Ltd., and agreed that the marking was well done; he was surprised that the cost was so small. Mr. Barnes, a member of the Committee pointed out that although the opponents had said that British firms did not make suitable illuminating glassware, their exports were valued at £41,000 last year. Witness replied that the demand of the home market was far greater than £41,000 a year. Mr. J. H. Cresswell (Revo Electric Co., Ltd.) opposed the application on the ground that his company would be greatly handicapped in competing with Continental suppliers of street-lighting fittings if the cost of imported glass was increased by marking. He, too, said that the marking of the glass would brand the whole fitting as foreign. He produced figures showing that the price of British glass was from 72.7 to 189.3 per cent. higher than the foreign prices. With regard to existing stocks he agreed that the exclusion of glassware imported before the date of the Order would avert any trouble in that direction. He also stated that in Government contracts when British goods were stipulated his company employed British glass.

A Russian-American Electrical Agreement.

The announcement is made of an agreement between the Soviet Government and the International General Electric Co., providing for an exchange of patents, as well as an exchange of designing, engineering, and manufacturing information for a term of ten years beginning on July 1st next. American engineers will be sent to Russia to assist the Soviet Electro-technical Trust in carrying out plans for the expansion of the electrical industry in that country. Soviet engineers will likewise go to the United States to study American methods in the manufacture of electrical machinery and equipment.—*Reuter* (New York).

The Timber Market.

Our Timber Trade Correspondent reports that wood consumption is proceeding on brisk lines, the building trade being fairly busy, with a promise of considerable improvement after the turn of May, and onwards throughout the summer. Arrivals of the usual European descriptions have been somewhat heavier, but altogether the season's imports will be about normal, and at a lower range of wholesale prices, compared with recent years. For hardwoods inquiries are by no means excessive, and stocks of prime quality woods are small; prices are very firm, especially for the fancy woods. Sawn hardwoods from the States are still in fairly good supply, but the tendency is towards more moderate shipments this year owing to shippers' firm rates. Plywood is increasing in imports and consumption. It is remarkable how this "featherweight" wood has found its way into many large and small industries.

Aluminium and Copper Prices.

Speaking at the recent general meeting of the Compagnie Générale d'Electricité, M. P. Azaria said that at the same time as the American Cartel was imposing on the foreigner an unjustifiable increase of 80 per cent. in the price of copper, the association of European producers of aluminium was maintaining its price steady, and thereby placed the price of aluminium at a level of about half that of copper when measured by equal electrical capacity.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price May 28th.	Fortnight's inc or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£18 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	⅛d. inc.
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£180	£2 dec.
	Grade II... ... ... ,, ,,	£127	£1 dec.
	Grade III ... ... ,, ,,	£71	...
c	Brass (rolled metal 2" to 12" basis) per lb.	10½d.	...
c	,, Tubes (solid drawn) ... ,,	1/1 to 1/1¼	...
c	,, Wire, basis ... ... ,,	11⅛d.	...
c	Copper Tubes (solid drawn) ... ,,	1/8½	...
c	,, Bars (best selected) ... per ton	£112	...
c	,, Sheet ... ... ,,	£112	...
c	,, Rod ... ... ,,	£112	...
d	,, (Electrolytic) Bars ... ,,	£84 10s.	10s. inc.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£94 10s.	10s. inc.
d	,, ,, H.C. Wire per lb.	11⅝d.	...
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	11½d.	¼d. dec.
l	Iron, Pig (Cleveland No. 3.) ... per ton	68/6	...
l	,, Wire, galv. No. 8. P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£25	5s. dec.
g	Mercury ... ... per bot.	£22 2s 6d. to £22 5s.	...
e	Mica (in original cases) small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3¾	...
p	,, ,, wire... ... ... ,,	1/6½	...
o	Platinum ... ... per oz.	£13 17s. 6d.	...
d	Silicium Bronze Wire ... ... per lb.	1/8	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton	£197 to £197 10s.	£2 5s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	3d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated May 25th, Messrs. James Forster and Co. stated that very quiet conditions prevailed in the lead market last week and, with only a small demand from consumers, prices sagged daily and closed at the lowest. The general position is unchanged, consumers' demand continues to be very slack both in this country and on the Continent, while supplies are arriving in a steady stream. This state of affairs seems likely to continue until the General Election is out of the way and the reparations problems solved, when a revival in demand should be seen.

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Lighting and Power Notes.

Australia.—CANBERRA.—According to the *Industrial Australian and Mining Standard*, an agreement between the Commonwealth and New South Wales Governments, providing for the supply of electricity from the Burrinjuck hydro-electricity works to the Federal Capital Territory, has been ratified by the New South Wales Parliament. By the terms of the agreement the Federal Capital Commission has undertaken to utilise power from Burrinjuck for a period of ten years, with the option of renewal by the Commission for a further ten years. The arrangement may, however, be terminated by either party after 12 months' notice. Power may not be purchased by the Commission from any other source during the period of the agreement, although the Commission is still permitted to generate electricity at its existing plant. The transmission line will extend over 80 miles of country between Burrinjuck dam and the power house at Canberra. In preparation for the service, the switching apparatus is at present under construction, and the two transformers of 3,250 kVA each for reducing the pressure for local distribution are expected to be in readiness on August 1st next. The main transmission lines will operate at 66,000 V, which will be reduced to 5,500 V for distribution in Canberra, while the voltage for the line to the Cotter pumping station will be raised to 11,000 V. The switchgear used will be manufactured in Australia, the transformers of British manufacture, and the 66,000-V insulators of American make By the agreement, the supply of electricity from the Burrinjuck works will commence on September 1st, 1929.

Braunton (Devon).—SPECIAL ORDER.—The Minister of Transport has confirmed the Special Order made by the Electricity Commissioners authorising the Braunton Electric Light and Power Co., Ltd., to supply electricity in the parishes of Braunton and Heanton Punchardon, in the rural district of Barnstaple.

Brighton.—CHANGE-OVER.—The Corporation Lighting Committee is seeking sanction to the alteration of the system and pressure of the electricity supply to properties in the streets at Patcham from 460/230 V d.c. to 400/230 V a.c., 50 cycles.

LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to a loan of £17,590 for works in connection with the enlargement of the North Road sub-station.

Bury (Lancs.).—LOANS SANCTIONED.—The Town Council has received sanction to loans of £20,000 for mains, and £10,000 for sub-station equipment.

Canada.—ELECTRICAL DEVELOPMENT.—The Manitoba Legislature, by a large majority, has adopted a resolution recommending the Dominion Government to grant priority rights for the development of the White Mud Falls as a power site to the British Dominions Power Syndicate, of London, England. This renders it almost a certainty that the company will obtain the concession, as the Dominion Government, in accordance with the recent resolution of Parliament, is arranging to hand over the water resources of Western Canada to the Provincial Government. The White Mud Falls are situated on the Nelson River about 400 miles north of Winnipeg, and are estimated to be capable of developing 300,000 h.p.

The Provincial Hydro-Electric Power Commission plans to extend its rural service considerably during the present year to meet the demands of the farmers in many sections who are anxious to obtain power. It is proposed to construct, in addition to the 4,000 miles already in operation, more than 1,000 miles of primary lines serving over 6,000 new consumers, and costing approximately $2,500,000.

ONTARIO.—The annual report of the Hydro-Electric Power Commission of Ontario shows a net surplus for the year 1928 amounting to $2,016,000 from its provincially-operated system, which serves 225 municipalities. This surplus is an increase of 58 per cent. as compared with 1927.—*Reuter* (Toronto).

Cartmel.—ELECTRICITY SUPPLY.—A public meeting was held recently to explain to residents details of the proposed electricity supply to the district by Barrow-in-Furness Corporation. Mr. Burnett, electrical engineer to Barrow Corporation, explained the scheme, and said the charge for lighting would be 8d. per kWh (9d. by prepayment meter). Mr. Smith, of the Barrow Electricity Department, said the cost of house wiring would be from 20s. to 25s. per point.

Chester.—YEAR'S WORKING.—The report of the city electrical engineer (Mr. S. E. Britton) on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £85,062, and working expenditure of £43,424, leaving a gross profit of £41,638. The figures for the preceding year were:—Income, £83,276; working expenses, £42,389; gross profit, £40,887. After providing for capital charges, there was a net surplus of £16,120, as compared with £15,726 in the previous year. The capital expenditure during the year was £41,417, including £32,660 spent on mains. The total sum now spent on the undertaking amounts to £509,096. During the year 1,021 additional consumers were connected (488 in Chester and 533 in the rural area), an increase of 221 on the record established in the previous year. It has been recommended that the following reductions in the charges for electricity be made within the city:—Lighting: From 4½d. to 4d. per kWh. Late shop-window lighting: 50 per cent. of the lighting rate. Domestic rate: The standing charge of 12½ per cent. of the rateable value of the premises reduced to 10 per cent., with a charge of ¾d. per kWh instead of 0.7d. Factories: "Unit" charge from 0.7d. to 0.6d. Factories off-peak demand: "Unit" charge from 0.75d. to 0.6d. Similar reductions have been proposed for the rural area.

Chesterfield.—YEAR'S WORKING.—We have received from Mr. D. H. Davies, borough electrical engineer, a copy of his report, together with the statement of accounts for the year ended March 31st last. The total revenue amounted to £71,235, as compared with £66,276 in the preceding year. Working expenses, &c., totalled £61,730, as compared with £54,504, and there was a net surplus of £9,514, as against £11,772 in 1927-28. The sales of electrical energy rose from 10,700,751 kWh to 11,485,130 kWh, an increase of 7.3 per cent., and the maximum load carried was 5,857 kW, an increase of 9 per cent. The capacity of the plant was increased from 8,025 kW to 14,025 kW by the installation of new 33,000-V bulk supply plant. The operating cost shows a slight decrease from 0.67d. to 0.66d. per kWh. The total number of consumers now connected is 8,618. New installations to the number of 1,306 were connected under the hired-wiring scheme, bringing the total number of hired-wiring consumers connected to 3,949. Capital charges increased during the year by £3,475, due to extensions of mains, 33 miles of which were laid during the year. The average price received for whole supply was 1.35d. per kWh, as compared with 1.36d. for the previous year.

Congleton.—ELECTRICITY SCHEME.—In anticipation of the Electricity Commissioners granting an Order, Mr. A. Ellis, consulting electrical engineer, has been authorised to prepare specifications and estimates for a proposed electricity scheme. The main from which the supply will be taken will form part of the main transmission line to be established from Stoke-on-Trent to Leek, and thence to Congleton.

Continental.—SWEDEN.—According to a Government return issued recently, the output of electricity from the State power stations reached a total last year of 1,561 million kWh, as compared with 1,519 million kWh in 1927, an increase of nearly 3 per cent.

SWITZERLAND.—Construction work will shortly be commenced in preparation for the erection of a power station near Champsec. It is proposed to form an artificial lake containing about 150,000,000 cu. ft. of water by the building of a dam across the higher part of the Val des Dix, to the south of Sion. The water from the lake, together with that supplied from the Liscence torrent, after being led through pipes to the valley of the Rhone, will fall 5,300 ft. to drive the turbines. The power station, which is expected to cost nearly £2,400,000, will take three years to construct and, when completed, will have a capacity of approximately 120,000 kW.

SICILY.—A scheme to utilise the water from the Southern Imera River for hydro-electric development, prepared by the engineer of public works of the Province of Palermo, comprises the construction of the second largest artificial lake in Italy and the erection of a hydro-electric plant capable of the production of approximately 200,000,000 kWh per annum. The enterprise, which has received official approval, will be undertaken by the European Hydro-Electric Co., of London.

Dronfield.—BULK SUPPLY.—The Urban District Council has decided to ascertain if the Sheffield Corporation will provide a supply of electricity in bulk. The Staveley Coal and Iron Co. recently offered a supply, but later withdrew the offer.

Ealing.—SHOP LIGHTING.—The High Street (Ealing) Traders' Association has asked the Electricity Supply Committee for a quotation for the supply and installation of electric lanterns, fitted with 1,000-W lamps, outside the business premises in the High Street, including the maintenance and supply of electricity for 1,000 hours per lantern per annum.

Irish Free State.—ELECTRICITY SUPPLY BOARD.—The *Irish Independent* recently published a report of an interview with Dr. T. A. MacLaughlin, the managing director of the Irish Free State Electricity Supply Board, on the subject of unauthorised undertakings. Dr. MacLaughlin said that under the Electricity (Supply) Act, 1927, the Board was empowered to acquire authorised supply undertakings compulsorily, the compensation payable being the value of the undertakings as going concerns. The Board has made valuations of 64 private undertakings which it desires to incorporate in the national system, and has offered to purchase them on the same basis as it is acquiring the authorised undertakings. Some of the owners maintain that the offers are not reasonable, but the Board considers that they have put an excessive value on their properties.

KILKENNY.—The electricity supply was recently formally switched on by the Mayor. This is the first town in the Free State to benefit by the Shannon scheme, but the supply is at present being obtained from the Pigeon House, Dublin, pending the completion of the general scheme.

London.—ST. MARYLEBONE.—The Finance Committee has reported that the Electricity Commissioners have granted sanction to a loan of £25,000, on account of the £93,000 required for the provision of three sets of 3,000-kW rectifiers and convertors. Sanction has also been given to a loan of £5,600 for the provision of two additional cables to be laid to Blandford Street sub-station in connection with the bulk supplies of electricity from the Central Electric Supply Co., Ltd.

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BATTERSEA.—The Borough Council Electricity Committee has considered reports of the electrical engineer with reference to the increasing demand for electricity in certain parts of the borough, and the necessity for laying additional mains and installing further sub-station plant, and has set aside £20,000 for this purpose. The Committee has also decided to improve the lighting in The Avenue, Clapham Common, and Nightingale Walk, at a cost of £1,116.

The Borough Council is seeking sanction to the following loans:—Additional plant for Lavender Hill and Chatham Road sub-stations, &c., £10,208; changing-over from d.c. to a.c. in Albert Bridge Road and Prince of Wales Road, £12,665.

FULHAM.—The Borough Council has approved the following expenditure:—Sub-stations and equipment, Nursery Garden, Bishop's Park, £2,934; Harwood Road school, £2,214; and premises of Messrs. Peugeot (England), Ltd., £1,885. Messrs. Joseph C. Mount & Co. have also agreed to the erection of a sub-station at their works, the firm to bear the costs of erection and also to pay £250 to the Council for the provision of equipment. Mains extensions are to be carried out by the Lighting and Electricity Committee at a cost of £1,480.

Macclesfield.—REDUCED CHARGE.—The Board of Guardians has accepted the offer of the Macclesfield Electricity Co. to supply electricity to the Poor Law institution at the reduced charge of £5 per kW and 1½d. per kWh up to 5,000 kWh per quarter, with a further reduction beyond.

Northern Ireland.—BANGOR.—A proposal has been made to take a bulk supply of electricity from the Corporation of Belfast. According to the proposed scheme, electricity will be delivered at Bingham Street, the centre of the area, at 22,000 V, and there transformed down to 6,000 V, at which pressure the Corporation will receive it and transform it to the consumers' pressure. The Corporation has announced its intention of lighting the sea front, which extends over a distance of three miles.

Nuneaton.—YEAR'S WORKING.—At a recent meeting of the Town Council, the Electricity Committee presented a report on the working of the electricity undertaking for the year ended March 31st last, which showed a net profit of £2,234. A return was also presented showing the costs of all municipal electricity undertakings having outputs under six million kWh, and in this list Nuneaton took sixth place.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LONDON.—*St. James' and Pall Mall Electric Light Co., Ltd.*—Lighting: From 4d. per kWh for first 4,000 kWh to 4d. per kWh for first 2,000 kWh of annual consumption. For all energy in excess of 2,000 kWh 3d. per kWh. The minimum charge is 10s. per quarter. The reduction will operate as from Christmas, 1928.

Welshpool.—NEW CABLES.—The North Wales Power Co. has decided to extend its h.p. cable from Oswestry to Welshpool at an early date.

Wing.—ELECTRICITY SUPPLY.—The Rural District Council has decided to ask the Aylesbury Town Council if a supply of electricity can be given to the parishes of Ivinghoe, Pitstone, Marsworth, and Cheddington. In 1924 Luton Town Council was granted an Order to supply electricity in the Wing rural area and, as the supply has not been given within the stipulated time, the application mentioned above has been made. The Council has also decided to ask the Luton Corporation if it will be possible to supply electricity to the parishes of Soulbury and Wing.

Tramway and Railway Notes.

Burton-on-Trent.—PROPOSED TRAMWAY ABANDONMENT.—At the last meeting of the Town Council, the Tramways Committee stated that it was seriously considering the question of abandoning the tramway and extending the 'bus service.

Continental.—SPAIN.—The Sociedad de Tramways de Sevilla has recently secured a concession for the construction of an electric railway between Gelves and Puebla del Rio, in the province of Seville.

Coventry.—TRAMWAY EXTENSION.—The Corporation Transport Committee has recommended a short extension of the Binley Road tramway.

Croydon.—LOAN SANCTIONED.—The Corporation Tramways Committee has obtained sanction to a loan of £4,000 for reconditioning and providing tops for nine bogie cars.

Glasgow.—PINKSTON STATION.—It is announced that the Electricity Commissioners have refused permission to the Corporation to proceed with its scheme for the extension of the power station at Pinkston in connection with the Tramway Department. It was proposed to expend £237,000. Regarding the future a section of the Corporation, it is reported, thinks that Pinkston will continue as a separate station only during the life of the present plant, and that eventually the energy required for the tramway will be taken from Dalmarnock power station. On the other hand, some of the members hold that, as the Corporation has already given authority, a commencement will now be made with reconditioning the Pinkston plant at a cost of approximately £160,000. The whole position is to be reviewed by the Tramways Committee which will make recommendations to the Corporation.

Greenock.—TRAMWAY ABANDONMENT.—An agreement has been concluded by the Corporation and the Greenock Motor Services Co. for the abandonment of the tramcar service at an early date. The Corporation has accepted the offer of 2s. 6d. per sq. yd. for the removal of the tramway track, and is to receive for disposal the rails, cables, &c. In addition, the 'bus company is to pay the Corporation £2,000 in settlement of all claims against it. The question of increasing the 'bus fares has been delayed for three months, and the Corporation has decided not to place any obstacle in the way of the withdrawal of the trams at an earlier date than originally intended.

Japan.—RAILWAY ELECTRIFICATION PROGRESS.—A report issued recently by the Japanese Government Department of Railways for the year ended March 31st, 1927, states that the Department at that date was operating 8 power stations and 37 transformer sub-stations. Altogether there were 14 prime movers, representing 30,992 h.p., 201 dynamos and convertors, totalling 108,114 kW, and 186 transformers, representing 116,754 kVA. The length of transmission lines totalled about 3,300 miles. The number of electric motors for car propulsion numbered 1,404, representing 127,800 kW, while the number of motors for operating electric locomotives was 318, with an aggregate capacity of 69,196 kW. An announcement made early last year gave the cost of new electrification plans at about £2,000,000 spread over a period of four years. Since then, states the *Far Eastern Review*, the Department has announced a programme for the electrification of nine sections of five trunk lines at a cost of £4,000,000, spread over a period of six years. The new plan, to be brought into effect next year, is to electrify all the sections of the railways throughout the country that include tunnels or heavy gradients. The scheme also includes the construction of a new elevated electric line about 1½ miles in length, to connect the present Ochanomizu station of the Yamamote line, which is the inner loop of the line encircling Tokio, with the Ryogoku railway station, the terminus of the Boso and Hojo lines, and of laying parallel tracks between Ryogoku and Kameido.

London.—BREAKDOWNS.—The failure of cables on the westbound track at Bond Street station, Central London Railway, on May 21st, caused a delay from 3.50 to 4.27 p.m. Smoke filled the station, and it was thought advisable to close the station for the above-mentioned period. Trains reversed at Oxford Circus and Marble Arch stations. As a result of the fusing nearly all the lights on the trains and platforms were extinguished and the escalators stopped. By the time the fire brigade arrived the flames had been already got under control. No one was injured, and passengers were able to leave by way of the escalators. A delay of from eight to twelve minutes' duration also occurred about 3.30 p.m. on most of the Underground railways owing to a defect at Euston sub-station.

Reading.—YEAR'S WORKING.—The profit on the operation of the Corporation tramways and motor omnibuses during the past year amounted to £2,464, as compared with £7,182 for the preceding year. The decrease is attributed to the petrol tax and to the increased price of petrol.

Telegraph and Telephone Notes.

International Telephony.—GREECE.—An Italian proposal is under consideration for the establishment of direct telephone communication between Rome and Athens, the cost of installing the cable to be shared, says the *Financial News*. Telephone communication with Belgrade is also being examined in Athens.

Irish Free State.—AUTOMATIC TELEPHONY.—The whole of the Dublin telephone system is to be converted to automatic working towards the middle of next year. The Minister for Posts and Telegraphs, who on many occasions has shown the great importance he attaches to a highly-developed telephone system as an aid to the prosperity of the Irish Free State, has now decided upon this change, for reasons unusual in a Government service. At his suggestion, a vote of automatic subscribers was taken with a view to gauging opinion. No less than 65 per cent. replied to the Post Office interrogatory, and of them 95 per cent. were in favour of automatic working.

Radio-telephony.—BERLIN—SYDNEY.—After the wireless telephone conversations between Berlin and Bangkok last month experiments were begun between Germany and Australia, and on May 23rd communication was tested with, it is claimed, success between a house in Berlin and a house in Sydney—a distance of over 11,000 miles—by short-waves from Nauen.

Switzerland.—LEAGUE RADIO STATION.—The Secretariat of the League has announced that in reply to a request for information concerning the cost of building a League wireless station made to various companies with a view to obtaining

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the supplementary data asked for by the last Assembly, the Secretary-General of the Transit Committee has received a joint proposal from the Compagnie Générale de Telegraphie Sans Fil in Paris and the Telefunken Company of Berlin. The proposal is accompanied by a detailed description of a radio-telegraph and radio-telephone station for the League of Nations, and provides for close technical co-operation between the German and French wireless industries. The companies consider that in view of the international character of the League services such co-operation would be useful, says *The Times*. The wireless telegraph station at Nyon, on Lake Geneva, which will probably be in service by the time of the League Assembly in December, is being constructed for Radio Suisse by the Marconi Company of London. The Swiss Government has already offered to place this station at the disposal of the League in times of emergency.

Switzerland.—TELEPHONY.—The 1929 Budget of the Swiss Telephone and Telegraph Department includes a sum of £466,620 to be expended on new equipment.

The Telephone Service.—MANX CABLE.—The last section of the 130 miles of cable built by Messrs. Siemens Bros. & Co., Ltd., at Woolwich for telephone communication between the Isle of Man and England and Ireland was coiled on board the cable ship *Faraday* during the night of May 24th. By the middle of July it should be possible for the first time for London to talk to Manx towns.

Radio Notes.

Holland.—THE PRAGUE PLAN.—It is understood that the popular Hilversum broadcasting station is provisionally retaining its present wave length of 1,070 metres, as Norway, which was allotted this wave-length by the recent official Prague Conference, does not require it for the present. The decision of the Prague Conference to allot Holland only two wave-lengths from June 30th, namely, 1,875 metres and 298 metres, thereby necessitating a change in Hilversum's wave-length, caused an outcry throughout Holland and a monster petition, bearing nearly half a million signatures, was presented to the Ministry of Public Works.—*Reuter's* (Amsterdam).

Irish Free State.—FINANCE.—The estimate for wireless broadcasting is £26,510 for the current year, but other expenditure in connection with the service brings the total up to £31,385, says the *Irish Independent*. The receipts from licence fees and advertisements are estimated at £15,040. Last year the receipts from licences amounted to £13,382, while the import tax on sets realised £27,500. Deducting the cost of collection, there was on the year's working a surplus of £9,258, reduced, to £6,658 after capital charges had been defrayed. The Parliamentary Secretary to the Minister for Finance has informed the Dail that 26,000 licences were issued during the year. Licencees in Britain represent more than 6 per cent. of the population; licencees in the Irish Free State are well below 1 per cent.

Madeira.—FUNCHAL STATION.—A short-wave transmitter has been erected at Funchal, on the island of Madeira, of a power of 0.3 kW. The inaugural broadcast will take place on June 1st. The station is working on a wavelength of 47 metres, and its call sign is CT3AG.

Railway Radio. — CONTINENTAL INSTALLATIONS. — "Radio-Fer" Société pour la Radiophonie dans les Gares et Sur les Reseaux de Chemins de Fer is the name of a new company which has lately been formed in Paris, with a capital of 100,000 fr., to install radio receivers at the railways stations and on passenger trains in France. The new concern is working in conjunction with the Hungarian company which is responsible for similar installations on the trains running in Hungary. In Rumania and Germany similar installations are being carried out.

Sweden.—NEW STATION.—A big new broadcasting station for Stockholm is to be erected at Spaanga, near Stockholm. The designs for masts, 150 metres high, have been approved and tenders for their construction are invited by Kungl. Telegrafstyrelsen before June 1st. A beacon to assist aviators will possibly be fitted at the top of one of the masts.—*Reuter's Trade Service* (Stockholm).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 15th. State Electricity Commission of Victoria. Two 750-kVA transformers and spares. (B.X. 5325.)*

July 23rd. Posts and Telegraphs Department. Telegraph instruments. (B.X. 5323.)*

Belfast.—June 17th. Electricity Department. Manufacture, supply and delivery of h.p. combined cubicle and truck type switchgear and transformer kiosks, and the manufacture, supply, delivery and erection of one 1,000-kW rotary convertor, one 500-kW rotary convertor, c.c. switchgear, h.p. armourclad switchgear, and h.p. truck-type switchgear for sub-stations. (See this issue.)

Colwyn Bay.—June 14th. Electricity Department. Supply, laying and jointing of e.h.p. and l.p. cables. (See this issue.)

Croydon.—June 3rd. Electricity Department. Supply, delivery, and erection of one 20/25,000-kW turbo-alternator, with auxiliaries, boiler-house extensions with two 100,000-lb. boilers, coal-handling plant, &c., engine room extensions, switchhouse, bridges, and pump house, and 6,600-V switchgear, transformers, &c. (May 10th.)

Dundee.—June 5th. Town Council. Electrical installation at housing scheme. Particulars from Mr. G. Baxter, director of housing.

East Grinstead.—June 17th. Electricity Department. Supply, laying and jointing of a system of l.p. cables, complete and ready for use. (See this issue).

East Ham.—June 12th. Education Committee. Installation of electric lighting at Salisbury School. Specification 10s., from Mr. F. H. Thompson, secretary, Town Hall, East Ham.

Egypt.—CAIRO. August 13th. Ministry of the Interior. Supply of an electric power station with underground and overhead network for the town of Maghagha. (B.X. 5318.)*

Farnworth.—June 15th. Electricity Department. Supply of l.p. cables. (See this issue.)

Halifax.—June 7th. Health Committee. Electrician's work required in erection of pavilion and extension of administrative block, Shelf Sanatorium. Form of tender from Borough Engineer. Deposit £1 1s.

London.—CENTRAL ELECTRICITY BOARD.—June 17th. Supply, delivery and erection of 33-kV and lower voltage switchgear for the North-West England and North Wales Electricity Scheme, 1928. (May 17th.)

ST. PANCRAS.—June 6th. Electricity Department. Supply of one 1,000-kW motor convertor. (May 17th.)

COMMISSIONERS OF H.M. WORKS.—June 3rd. Supply of fuseboards and switches. (May 24th.)

METROPOLITAN ASYLUMS BOARD.—June 12th. Installation of two electric passenger lifts at Colindale Hospital, fire-alarm system at High Wood Hospital, and electric bell system at Wandsworth casual ward. (May 24th.)

CENTRAL LONDON SCHOOL DISTRICT. June 8th. Four motors, switchgear equipment, steel shafting, leather belting, &c. (May 24th.)

New Zealand.—WELLINGTON.—June 16th. Posts and Telegraph Department. Telephone bells. (B.X. 5272.)*

August 7th. Enamelled and silk-covered resistance wire. (B.X. 5322.)

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

September 4th. Government Railways. Motor generator. (B.X. 5308.)*

AUCKLAND.—August 19th. Auckland Electric Power Board. Single-phase transformers. (B.X. 5324.)*

Sheffield.—June 7th. Sheffield Education Committee. Installation of electric wiring and fittings at eight Council schools. Mr. W. G. Davies, city architect, Town Hall, Sheffield (deposit £1).

South Africa.—PRETORIA.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. (B.X. 5273.)*

PIETERSBURG, TRANSVAAL.—August 13th. Municipal Council. Steam-raising plant, engine alternators, and switchgear. (A.X. 7983.)*

August 13th. H. and l.p. cable, lamps and sundries. (B.X. 5312.)*

Stockton-on-Tees.—June 11th. Electricity Department. Supply and delivery of two 1,250-kVA 3-phase transformers and l.p. 3-phase switchgear. (May 24th.)

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Uruguay.—PORT AUTHORITIES.—July 22nd. 300-kilo electro-pneumatic drop-hammer. (A.X. 7974.)*

Walthamstow.—June 12th. Electricity Department. Supply, delivery and erection of two cooling towers and one ferro-concrete tank. (May 24th.)

West Ham.—June 17th. Education Committee. Installation of electric lighting at Fyfield open-air school extension, and installation of water-heating apparatus at Balaam Street School, Plaistow. (May 24th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bolton.—Tramways Committee. Accepted:—
Vehicle-washing plant.—Equipment & Engineering Co., Ltd.

Brighton.—Lighting Committee. Accepted:—
Erection high-pressure switch rooms, with cable basements, &c., at North Road works (£15,081).—J. Crewdson (Horley).
De-aerating plant (£976).—Vickers-Armstrong, Ltd.
Works in connection with reconstruction of boiler-house roof, bunkers, &c., at Southwick power station (£4,234).—Heenan & Froude, Ltd.

Chertsey.—Board of Guardians. Accepted:—
Installing electric light at the Institution (£525).—Woking Electric Supply Co., Ltd. Thirty-six tenders were received, the highest amounting to £1,600.

Devizes.—The Rural Council has received the following tenders for installing electric light at 42 houses:—

EDWARDS & ARMSTRONG, LTD. (Accepted.)	£213
A. R. Fox	197
Tower Electrical Supply Stores	203
H. Rossiter & Co.	215
James Bros.	219
W. Drysdale	227
Harden & Chinnery	232
Ramsay & Sons	233
D. Henderson	240
T. Humphries	261
Cross Bros.	261
H. H. Burrows	277
J. W. E. Simpson	294
Webb & Rogers	300
V. H. Dipple	320
F. Wadman	420
Marsh & Yeomans	480

Dumfries.—CORRECTION.—The Town Council, on the recommendation of the Electricity Committee and electrical engineer, at a recent meeting, unanimously agreed to accept the tender of the British Thomson-Houston Co., Ltd., for turbo-alternator plant, and not that of the Brush Electrical Engineering Co., Ltd., as stated in our issue of May 24th.

Durham.—County Education Committee. Accepted:—
Electrical installations at various schools: Jarrow Secondary School (£222), Law & Burns; Ludworth New Council School (£102), and New Seaham Council School (£262), F. Reid Ferens & Co.; Ryton New Council School (£220), Robson & Coleman.

Essex.—County Council.
Laying underground electric mains at sanatorium, Harold Court (£510).—Christy Bros., Ltd.

Government Contracts.—The following Government contracts were placed during April, 1929:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

Motor alternators.—Mackie & Co., Ltd.; Haslam & Newton, Ltd.
Batteries.—Ever Ready Co. (Great Britain), Ltd.
Supply boards.—Whipp & Bourne, Ltd.
Ring main breakers and pushers.—Whipp & Bourne, Ltd.
Electric cable.—Connollys (Blackley), Ltd.; Hackbridge Cable Co., Ltd.; India Rubber, Gutta Percha & Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Condensers.—Dubilier Condenser Co. (1925), Ltd.; Telegraph Condenser Co., Ltd.
Electric crane.—Wharton Crane & Hoist Co., Ltd.
Portable electric fan units.—Electro Dynamic Construction Co., Ltd.
Electric fuses.—Pinnacle Switchgear & Fuse Co.
Motor generators.—Haslam & Newton, Ltd.
Insulator fittings, boards, &c.—Micanite & Insulators Co., Ltd.
Magnetic keys.—Park Royal Engineering Co., Ltd.; H. W. Sullivan, Ltd.
Telephone leads.—London Electric Wire Co. & Smiths, Ltd.
Electric lift.—W. Wadsworth & Sons, Ltd.
Main and auxiliary propelling motors.—General Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Switch-fuse panels, &c.—Whipp & Bourne, Ltd.
Turbine blading material.—J. Wilkes, Son & Mapplebeck, Ltd.
W.t. valves.—Mullard Radio Valve Co., Ltd.

WAR OFFICE.

Electric cable.—Enfield Cable Works, Ltd.; India Rubber, Gutta Percha & Telegraph Works Co., Ltd.
Leclanché cells, blocks, &c.—Siemens Bros. & Co., Ltd.
Copper rings.—T. Bolton & Sons, Ltd.
W.t. valves.—General Electric Co., Ltd.
Wireless telegraph sets.—Plessey Co., Ltd.

AIR MINISTRY.

Milliammeters.—Everett, Edgcumbe & Co., Ltd.
Valves.—Edison Swan Electric Co., Ltd.
Voltage control boxes.—Johnson & Phillips, Ltd.
Aluminium sheets.—British Aluminium Co., Ltd.

POST OFFICE.

Extending main supply cables, Rugby Radio Station.—Leicestershire and Warwickshire Electric Power Co.
Telephone exchange equipment.—Llandudno, Sketty, East Grinstead, Sheffield Multi-Exchange Area: Siemens Bros. & Co., Ltd. Romford: Ericsson Telephones, Ltd. Sub-contractors: Crompton Parkinson, Ltd., for charging machines; W. Jones & Sons, Ltd., for ringing machines; Pritchett & Gold & E.P.S. Co., Ltd., for batteries. Foleshill: General Electric Co., Ltd. Nottingham Central, Arkwright, Carlton: Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Electric Construction Co., Ltd., for charging machine; Alton Battery Co., Ltd., for batteries. Synthetic Ammonia & Nitrates, Ltd. (Norton); Automatic Telephone Mfg. Co., Ltd.
Telephone repeater station, 2-wire repeater equipment, Glasgow.—Standard Telephones & Cables, Ltd.
Protective and measuring apparatus.—Ericsson Telephones, Ltd.; Phœnix Telephone & Electric Works, Ltd.; E. Turner.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; Plessey Co., Ltd.; Siemens Bros. & Co., Ltd.; Telephone Mfg. Co., Ltd.
Battery stores.—Chloride Electrical Storage Co., Ltd.; Fuller Accumulator Co. (1926), Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Connolly's (Blackley), Ltd.; Enfield Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones and Cables, Ltd.; Union Cable Co., Ltd.
Castings (joint box).—United Steel Companies, Ltd. (Thos. Butlin & Co. Branch).
Compound.—Dussek Bros. & Co., Ltd.; W. W. Keys, Ltd.; Wilkins, Campbell & Co., Ltd.
Cords for telephones.—Standard Telephones and Cables, Ltd.
Earthenware ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Firebrick Co., Ltd.; Doulton & Co., Ltd.; H. R. Mansfield, Ltd.; J. Oakes & Co. (Riddings Collieries), Ltd.; Oates & Green; Standard Brick and Terra Cotta Co., Ltd.
Generators.—Telephone Mfg. Co., Ltd.
Erinoid pegs.—B. W. Johnson.
Lead sleeves.—G. Farmiloe & Sons, Ltd.
Insulated staples.—Tower Mfg. Co., Ltd.
Wood troughing.—Calders, Ltd.
Wireless valves.—Standard Telephones & Cables, Ltd.

CROWN AGENTS FOR THE COLONIES.

Alternators.—British Thomson-Houston Co., Ltd.
Cable.—British Insulated Cables, Ltd.
Electrical apparatus.—Revo Electric Co., Ltd.
Electric welding accessories.—Quasi-Arc Co., Ltd.
Fans.—Crompton Parkinson, Ltd.
Generating plant.—Belliss & Morcom, Ltd.; Blackstone and Co., Ltd.; Ruston & Hornsby, Ltd.
Lightning protectors.—Siemens Bros. & Co., Ltd.
Line materials.—Bullers, Ltd.
Meters.—Ferranti, Ltd.
Pole line materials.—J. Spencer, Ltd.
Telephone materials.—Ericsson Telephones, Ltd.; General Electric Co., Ltd.; Standard Telephones & Cables, Ltd.
Train lighting spares.—J. Stone & Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

India (BOMBAY).—Corporation Standing Committee. Accepted:—
Electrical goods (Rs. 4,729).—Greaves, Cotton & Co., Ltd.; (Rs. 532).—Sharma Trading Co.
Electric lamps for 12 months:—

	Rs.
Trinity Electric Syndicate	3,376
Eastern Electric Light and Power Co.	4,162
Sharma Trading Co.	5,152
Ditto, alternative	3,330
BALMER, LAWRIE & CO., LTD. (Accepted.)	5,392
Turner, Hoare & Co., Ltd.	5,392
General Electric Co. (India), Ltd.	5,392
F. & C. Osler, Ltd.	5,392
Yasin Bros.	5,582

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Grimsby.—Electricity Committee. Recommended:—
Electric capstan (£252).—Stothert & Pitt, Ltd.
Overhead transmission line to Louth (£5,477).—Johnson and Phillips, Ltd.
Feeder cable and pilot cable in connection with ring main between Old Clee and Tetney (£3,593).—Metropolitan Electric Cable and Construction Co., Ltd.

Manchester.—Health Committee. Accepted:—
Electrical bed lift at Abergele Sanatorium.—Etchells, Congdon & Muir.

Maryborough.—Board of Health.
Installing electric lighting, &c., at the County Hospital:—

Electricity Supply Board. (Accepted.) ...	£144
Brook, Thomas & Co.	156
Haden's Engineering Co., Ltd.	184

—*Irish Builder and Engineer.*

Portsmouth.—Electricity Committee. Accepted:—
Pumping plant at the Camber (£4,117).—Mather & Platt, Ltd.
H.p. cable (£3,168); l.p. cable (£6,552).—Johnson and Phillips, Ltd.
Two 75-kVA transformers (£110); 12 50-kVA ditto (£505).—British Electric Transformer Co., Ltd.

Reigate.—Rural Council. Accepted:—
Underground main and accessories for the supply of electricity for power to the Merstham outfall works.—County of London Electric Supply Co., Ltd.
8½-h.p. motor and star-delta starter and necessary valves.—Gwynnes Pumps, Ltd.

Seaham Harbour.—Housing Committee Accepted. Electrical wiring at 140 houses £41 14s. 8d. per block of eight, £20 17s. 4d. per block of four and £10 8s. 8d. per block of two.—Harrison Bros.

Shenstone.—
Sub-station equipment.—Crompton Parkinson, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Fourteen heavy traction poles (£168).—British Mannesman Tube Co., Ltd.
Three miles of trolley wire (£364).—Frederick Smith and Co.
Materials for repairs to battery at Chalkwell Park (£992).—Chloride Electrical Storage Co., Ltd.
Pistons and cylinder heads for Diesel engines (£660).—John Le Boutillier, Ltd.

Walton-on-Thames.—Urban Council. Accepted:—
Changing-over apparatus (£388).—Messrs. Hopkinson.
Special apparatus for wireless installations affected by the change-over.—Mr. Blandford.

Forthcoming Events.

Incorporated Municipal Electrical Association.—June 3rd to 8th. Torquay. Annual Convention.

Illuminating Engineering Society.—Tuesday, June 4th. Royal Society of Arts, John Street, Adelphi, W.C. 7 p.m. Annual general meeting. "Some Further Applications of Synchronously Intermittent Light for Revealing Moving Machinery" Mr. J. F. Crowley.

E.H.P. Conference.—Paris. June 6th to 15th.

Institution of Electrical Engineers.—Summer meeting in France. June 11th to 22nd.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

A bracket lamp for use over bakers' ovens. The light is switched on automatically when the bracket is extended, and switched off when closed.

The Holborn Explosion.

The Holborn Borough Council, London, has instructed the town clerk to take legal action against the Gas Light & Coke Co. and the Post Office for damage to property of the Council caused by the street explosions last December, due to gas accumulation in a P.O. cable tunnel. As the Postmaster-General is an officer of the Crown, action cannot be taken against him, but the solicitors to the Post Office have agreed to submit the name of an individual against whom proceedings can be instituted.

Notes.

The Paris E.H.P. Conference.

A copy of the programme of the 1929 Conference, which is to be held in Paris, France, from June 6th to 14th, has just been issued. As usual, the papers to be discussed will be divided into three sections, dealing with (i) power production and transformation; (ii) the construction and insulation of lines; and (iii) the operation of networks. The Institution of Electrical Engineers' summer meeting commences on the fifth day of this Conference, and facilities will be afforded for English members to attend the sessions on the last two days. During the following week the members of the E.H.P. Conference will take part in a similar extension to that of the I.E.E. party, by visiting the Pyrenees. This year there are to be only three official British delegates, instead of the eight who could have been appointed. Mr. P. V. Hunter will be the chief British delegate, and he will be supported by Messrs. J. R. Beard and Johnstone Wright. The authors and titles of British papers are as follows:—

Messrs. E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce, "An Introduction to Researches on Circuit Breaking."

Mr. J. E. T. Cogle, "The Effect of Impurities on the Electrical Strength of Insulating Oil."

Mr. S. A. Stigant, "Transformer Inter-Turn Insulation."

Mr. H. S. Holbrook, "The Co-relation of Line and Transformer Insulation."

Messrs. B. D. Goodlet and J. B. Mitford, "The Influence of Atmospheric Conditions on the Performance of Insulators."

Messrs. H. W. Clothier and C. A. Stephens, "High-Tension Switchgear Developments."

Mr. J. R. Beard, "The British 132,000-Volt 'Grid.'"

Mr. R. Borlase Matthews, "Sawn-Timber Supports for Rural Overhead Lines."

Messrs. W. B. Woodhouse and E. B. Wedmore, "Overhead Electric Lines: An Account of the Work of the British Electrical and Allied Industries Research Association."

Messrs. P. D. Morgan and S. Whitehead, "A Study of Methods of Laying a Three-phase System of Single-Conductor Cables."

Mr. L. C. Grant, "Lightning and Surge Propagation in High-Tension Transmission Lines."

Mr. Reginald O. Kapp, "The Selective Protection of Transmission Lines."

Messrs. P. V. Hunter and J. Francis Watson, "Certain Aspects of the High-Tension Distributing Problem."

Mr. W. Fennell, "Supplying Large Areas from the 'Grid System.'"

Mr. G. R. Falkiner-Nuttal, "Load Dispatching on Large Electric Systems in the United States."

A Russian Power Station.

In the article under the above heading in our issue of February 22nd, 1929, in which is described the 80,000-h.p. hydro-electric power station on the River Volchov, credit is given to the Swedish General Electric Co., Ltd. (A.S.E.A.), for having supplied the greater part of the electrical equipment for the installation. It was also suggested that the Metropolitan-Vickers Electrical Co., Ltd., supplied some of the equipment. We understand that the apparatus supplied by the latter firm consisted of phase compensators for the sub-station in Leningrad (ELECTRICAL REVIEW, May 17th, 1929, p. 861).

Appointments Vacant.

Assistant consumers' engineer for the West Gloucestershire Power Co., Ltd. Assistant telegraph engineer for the Government of Hong Kong. Mains engineer for Gillingham (Kent) Corporation. Electrotechnical assistant to the city electrical engineer for Salford Corporation. (See our advertisement pages to-day.)

A New Insulator.

According to the *Morning Post*, what is claimed to be one of the best insulating materials yet evolved is included in the exhibition of postal equipment, organised in connection with the Postal Union Congress, at the Grafton Galleries, W. The new insulator is stated to be unbreakable, and makes it possible to dispense, in rural areas, with the unsightly cross-pieces and swan-neck insulators of telegraph-poles. The new method of carrying wires consists in passing them through the poles, the holes being fitted with specially designed insulating plugs. Poles used in this way cannot carry a great number of wires, but, both from the practical and artistic points of view, the idea should recommend itself, at least, to the promoters of rural electricity schemes. These poles appear to be similar to those used by the Aylesbury electricity undertaking.

Electrical Traffic Control at Canterbury.

The electrical automatic control system for road traffic recently introduced by SWITCHGEAR & COWANS, LTD., has, with the consent of the Corporation of Canterbury, been erected at the junction of St. Lawrence Road with New Dover Road, and was to be put into operation on Wednesday last. The appara-

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tus is specially intended for the purpose of giving to motor traffic on subsidiary side roads joining a main thoroughfare similar protection to that which is afforded by clockwork "robots" at the intersection of main thoroughfares with dense traffic, as is successfully operated in many of our large cities. These robots hold up each cross stream alternately for a fixed time period, while the other stream is allowed to proceed, and obviously are only applicable where the cross streams of traffic are of practically the same density. The S. and C. control is intended to be operated when, and only when, a car is emerging from the side road and allows the main road traffic to proceed without interruption at any other time.

The Installation of Electric Ovens.

The E.D.A. Industrial Heating Sub-Committee notifies the following modification of the London Building Act, 1894, the effect of which is to put the regulations concerning the installation of electric ovens, coppers, boilers, &c., on the same basis as that of similar appliances heated by gas. The Act was passed before the use of electricity for heating was contemplated, and the only exception to that section of the Act that requires special fire-resisting floors under ovens, &c., was made in favour of gas-heated appliances. As a result of representations that Lt.-Col. W. A. Vignoles has made, this exception will now be given to electrical as well as gas appliances. The relative section of the Act reads as follows: *The London Building Act*, 1894, *Section* 66 (1): "The floor under every oven, copper, steam boiler, or stove, which is not heated by gas and the floor around the same shall, for the space of 18 in., be formed of material of a non-combustible and non-conducting nature not less than 6 in. thick." The amending resolution passed at the meeting of the London County Council held on March 26th, 1929, reads: "That the Council do not object to the fixing of ovens, coppers, steam boilers and stoves heated by electricity without complying with the provisions of Section 66 (1) of the London Building Act, 1924, and that the district surveyors appointed under that Act be informed accordingly."

Fire at the Engineers' Club, London.

A fire which broke out at the Engineers' Club, Coventry Street, W., on May 27th, caused considerable damage. The fire started in a kitchen on the second floor, and spread upward through a service lift, causing damage to each floor and culminating in more damage at the top. The fire was quickly got under control, but the premises was considerably damaged by water.

The "Radioscope."

The "Radioscope" of Mr. G. V. Dowding is shortly to be demonstrated before engineers of the Post Office, who asked Mr. Dowding to allow them to witness a test of the apparatus, and arrangements are being made for equipment to be installed at the Post Office. This move on the part of the Post Office was taken at the suggestion of the B.B.C., which is interested in the invention. The Dowding "Radioscope" comprises a simple home talkie system, whereby any ordinary gramophone can be linked to a small home projector. By means of another simple attachment, the wireless set can be coupled up so as to enable broadcast sound to be supplied in place of the gramophone.

Association of Mining Electrical Engineers.

The South Wales Branch of the Association of Mining Electrical Engineers recently held its annual general meeting at Porthcawl, the retiring branch chairman, Mr. T. S. Thomas, presiding. A large number of members and friends from the parent branch and the western sub-branch assembled at the Esplanade Hotel and combined business with pleasure.

In his annual report the hon. sec., Mr. H. J. Norton, said the membership of the branch was 396, and it still occupied the premier position in the Association. During the year 57 new members were accepted by the Council. Seventeen candidates had sat for the examinations.

Mr. E. D. C. Owens, hon. sec. of the western sub-branch, reported an increase in membership to 102, which was considered satisfactory in view of the difficulties experienced in the district during the year.

The hon. treasurer, Mr. A. C. MacWhirter, reported on the financial position of the branch, and the chairman welcomed the incoming branch president, Mr. W. W. Hannah, A.M.I.E.E., Tredegar, in whose hands he felt sure the affairs of the branch could be left with confidence. Sir A. Whitten Brown, K.B.E., M.I.E.E., Swansea, and Major W. Roberts, A.M.I.E.E., Cardiff, were elected branch vice-presidents, and a ballot for four members of Council resulted in favour of Messrs. J. B. J. Higham, Treforest; G. Probert, Abercorn; F. E. Pring, Pontypool; and H. Pritchard, Aberaman.

A New Electric Totaliser.

Automatic indication of totals of various accumulating quantities is now possible, it is claimed, by the use of electrical equipment recently perfected in the United States. The equipment, developed for the totalisation of electric power demand originating from a large number of sources, can be applied to the quick and accurate totalling of units of several different numerical values. The totals involved may be indicated in several places, by means of large or small indicators. A typical application might cover the sale of tickets of different monetary values, from perhaps 50 different ticket windows. Whether the sales occur successively or simultaneously, the totalising equipment will function and correctly total all sales. Such a ticket-totalling equipment has been designed and built, and involves the use of a motor-driven ticket machine. A key is depressed in the usual manner to issue a ticket of a specified value. This starts the motor, which runs until the ticket is cut off and ejected through an opening in the top face-plate of the machine. During this operation an electric circuit to the totalising machine is momentarily interrupted. Each key is associated with two registers of the "Veeder" counter type, one registering continually while the other can be re-set to conform with the serial number of tickets issued. An impulse-collecting device responds to the ticket machine operation, and operates to place an impulse in the totalising device. The impulse is registered in the totalising device with a definite numerical value equivalent to the ticket value. Indication of the totals can be made on small indoor-type indicators for totalising in various numerical units. Indication may also be given on large scoring-board signs, where the figures are formed by electric-light bulbs. An interesting application of this equipment is being considered in connection with some pari-mutuel race meetings in the United States.

Rural Electrification in Australia.

Commenting on a letter in *The Age* regarding the supply of electricity to dairy and other farmers in Victoria, Australia, the Electricity Commission said appreciable progress had been made. The Commission was the only electrical authority which had extended supplies beyond the boundaries of any particular town; the supersession of small generating undertakings by a comprehensive system of transmitted energy was the only chance for farmers to obtain supplies of electricity, and the continued existence of small generating undertakings would militate against the electrification of the State, especially in small and scattered farming communities. Each extension of transmitted energy, such as that arranged for Ballarat, Bendigo, and other places, brought whole districts within range of supply. At present the Commission supplied 200 farmers, nearly 50 butter factories were using energy, and in the Western district 114 farmers were using electrical energy. This number represented 29 per cent. of farms within one-eighth of a mile of the feeder lines in the district. All the supplies had been given by the Commission in four years. In the aggregate 32 motors totalling 87 h.p. were employed by the farmers for milking, separating, wood cutting, chaff cutting and other duties, and extra power was being added every year. Between the townships of Terang and Mortlake 48 farms out of a possible 57 were supplied with electricity from the Commission's mains. In the Gippsland district Tyers was a completely electrificed farming community. The consumers, which included a butter factory and a saw mill, numbered about 30.

New Zealand had a long start of Victoria in transmitted supply, as well as in intensive rural co-operative activities. Settlement was much closer and the farming more intensive, thus facilitating greater extension of supply. Supplies to farmers in New Zealand were given under revenue guarantees as they were in Victoria, but any loss on lines was a charge against rates, so that, apart from the ready facilities available, the urge to use electricity was much greater on ratepayers than in Victoria, where the Commission had to bear losses.

Some farmers in Victoria had complete electrical installations, including heaters for the hot water used in their dairies. One farmer in the Western district had shown extreme ingenuity in arranging his line shafting, with the result that one 3-h.p. motor did milking, separating, wood cutting, chaff cutting and corn grinding. He also had a heater of five gallons capacity, which, for a cost of 7s. per month, met all the hot-water requirements of his dairy. These services included lighting for the house, and the whole cost was approximately £23 per annum. The cost, however, varied for different farms. In the Western district the average cost over the number supplied was £17 a year. In some parts of New Zealand a charge of £20 per annum was made for a 2-h.p. motor for milking purposes only. The Commission gave every assistance to a farmer in erecting his private service line, which might extend for some distance across his property, and would give a firm quotation for the erection of the line, or would supply and erect the cable upon the consumer's own poles; or the consumer could build the line himself, or obtain the services of a private contractor.

The W. E. Highfield Shield Competition.

The Association of Supervising Electrical Engineers announces the seventh annual competition for the W. E. Highfield Shield. In addition, five prizes will be offered, three to members and two to associates; the value of the prizes will range from £1 1s. to £4 4s. Papers to be of about 1,000 words. Subjects of papers must refer to the electrical industry and/or the Association. All papers must reach the head office not later than 12 o'clock, noon, on September 2nd, 1929.

The Electrical Association for Women.

At the invitation of the Great Western Railway a party of 100 members of the Electrical Association for Women inspected the electrically-operated machinery at Cardiff Docks on May 22nd. Among the appliances inspected were the hydro-electric power house, movable coal hoists, cold stores, merchandise, and food-handling machinery.

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Institution Notes.

Institution of Electrical Engineers.

METER AND INSTRUMENT SECTION.—The Committee of the Section has made the following nominations to fill the vacancies which will occur on the Committee on September 30th, 1929:—*Chairman:* Mr. E. W. Hill (Aron Electricity Meter, Ltd.). *Ordinary members of Committee:* Messrs. E. Fawssett (Newcastle-upon-Tyne Electric Supply Co., Ltd.); A. J. Gibbons (London Power Co., Ltd.); E. H. Miller (British Sangamo Co., Ltd.); and R. S. J. Spilsbury (National Physical Laboratory).

Institution of Mechanical Engineers.

About 80 members of the Yorkshire branch of the Institution visited the works of Messrs. Hopkinsons, Ltd., Huddersfield, on May 16th, and inspected the plant, which ranks amongst the finest of its kind in the world.

The inspection of the works lasted exactly two hours, and demonstrations were given of the new Hopkinson centrifugal separators. The visitors were entertained at tea by the firm at the conclusion of their tour. Mr. Robert Hopkinson, who presided at tea, welcomed the delegates. Prof. F. C. Lea, of Sheffield University, president of the Institution, thanked the firm, and Prof. A. J. Margetson, in seconding, said that it was interesting to see in the works the notices urging the avoidance of waste of both materials and time. Engineering firms, he added, did not make profits—they saved them out of possible losses—and that was the only way in which they could keep their heads above water in engineering. Major F. L. Watson, in supporting, said that in these days when everyone was saying that England, particularly in engineering, was fast asleep, it was interesting to visit an establishment where it was obvious that everyone's eyes were very wide open to anything which might improve the product, or the work of its production, or find a new outlet for their energies. Mr. Robert Hopkinson returned thanks.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. C. O. BRETTELLE, M.I.E.E., has been appointed Technical Editor of the ELECTRICAL REVIEW in succession to the late Mr. Arthur Hinton Allen. Mr. Brettelle received his general education at Clifton College and his technical training at the Merchant Venturers' Technical College, Bristol, and at Bristol University College. His subsequent career included positions with the Bristol electricity undertaking, the North-East Coast Group of Power Companies, and also with Messrs. Merz & McLellan, consulting engineers, Westminster. He was at different times chairman and hon. secretary of the Tees-side Sub-Centre of the I.E.E., and for many years held the position of honorary assistant editor of the *Electrical Power Engineer*. Mr. Brettelle was entertained at luncheon by his former colleagues on Saturday last, and was the recipient of a case of pipes and other useful instruments suited to his new position.

The marriage took place on May 23rd of Mr. G. M. PEARSON, B.Sc., and Miss MARY VERNON, Nelson. For some years the bridegroom was employed by a Manchester firm of electrical engineers. He has since secured an appointment as engineer for an electrical scheme at Rio de Janeiro.

Mr. ROBERT BLACKMORE, who has been appointed engineer by the Central Electricity Board for the North-West England and North Wales Electricity Scheme, on resigning the position of engineer-in-chief to the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board, was presented last week with an illuminated address by the members of the Board and with a canteen of cutlery by the Board and staff.

The *Sydney Morning Herald* recently announced the appointment of Mr. V. J. F. BRAIN, B.E., as chief electrical engineer to the N.S.W. Public Works Department, in succession to Mr. H. G. Carter. Mr. Brain is an Australian by birth and received his electrical training in the United States. His last position was that of assistant electrical engineer in the Electrical Engineering Department of the New York Edison Co.

Mr. G. W. ESSEX, assistant secretary, has been appointed assistant general secretary of the Electrical Power Engineers' Association, consequent upon the resignation of Mr. J. W. Thomas (*vide* ELECTRICAL REVIEW, May 3rd, p. 796). Mr. Essex will have control of all negotiations and propaganda work. Mr. J. F. WALLACE, regional secretary, takes the place of Mr. Essex, while Mr. G. E. LOVE, late deputy chief engineer at Halifax, is appointed an additional district secretary. Mr. J. W. Thomas has accepted the position of hon. secretary of the North-Western Centre of the I.E.E.

The marriage took place in the Cathedral, Singapore, on February 23rd, of Mr. G. B. PAGE, son of Mr. and Mrs. D. G. Page, of Sutton Coldfield, Eastern representative of the Macintosh Cable Co., Ltd., to Miss DOROTHY MURIEL RICHARDSON, of London.

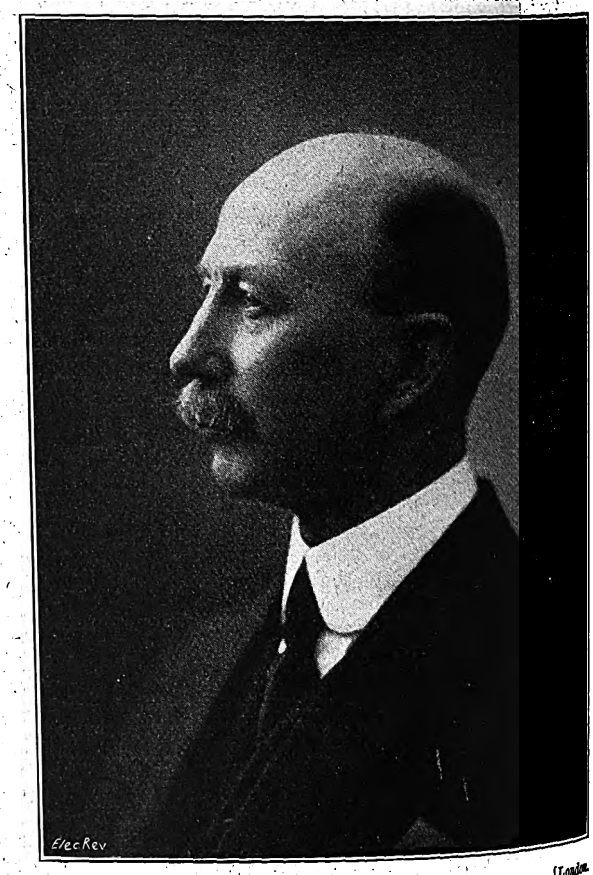
At the annual meeting of Sir W. G. Armstrong, Whitworth and Co., Ltd., last week, it was announced that Maj.-Gen. G. P. DAWNAY would become chairman as from June 1st, and Lt.-Col. P. D. IONIDES, D.S.O., vice-chairman.

Mr. WALTER T. YOUNG, the Halifax borough tamway manager, has been appointed also as manager for the newly-established joint committee of the L.M.S. and L.N.E. Railways and the Halifax Corporation, running motor-bus services in the district.

As we briefly reported in our last issue, Mr. W. A. VALENTINE, C.B.E., is retiring from the position of Controller of the London Telephone Service. Mr. Valentine, whose portrait accompanies this note, has been connected for 43 years with the British telephone system. With the National Telephone Co. he filled various positions at Stirling, Kirkcaldy, Inverness, Manchester, and Glasgow. When the telephones were taken over by the General Post Office on January 1st, 1912, he transferred to the State service, and shortly afterwards became a provincial superintendent at the London headquarters. In 1916 he was appointed deputy-controller in the London Telephone Service, and upon the retirement of Mr. G. F. Preston, C.B.E., six years ago, became Controller.

Mr. Valentine has seen a great expansion of the service during the last ten years, including the commencement of the conversion of the London System from manual to automatic working. This is a gigantic undertaking on the part of the Post Office engineers, as the service has to be maintained in a high state of efficiency during the change-over, which may be spread over from ten to fifteen years. Other departments in which there has been notable development are the Anglo-Continental telephone service and the radio service between this country and the North American Continent.

We trust that Mr. Valentine will enjoy many years of rest after laying down the great responsibilities which he has carried so well during a long period of national service.



Miles & Kaye [London.

Mr. W. A. Valentine, C.B.E.,

who is relinquishing the Controllership of the London Telephone Service.

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The appointment of Mr. F. W. Purse as chief engineer to the London and Home Counties Joint Electricity Authority hardly comes as a surprise, for Mr. Purse has acted as technical adviser to the Board for nearly a year, while his 30 years' experience and undoubted merit have qualified him for a bigger job than his present one, although to be borough electrical engineer of West Ham is no mean task.

While Mr. Purse has been in municipal service during the whole of his career, he has done a tremendous amount of work in many branches of the electrical industry. He is

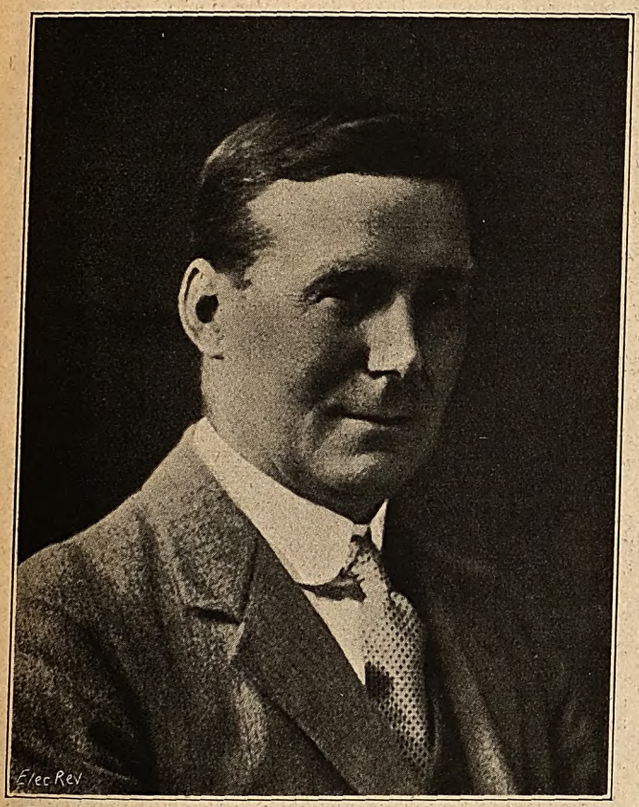

Photo by [*Russell*

Mr. F. W. Purse, M.I.E.E., M.I.Mech.E.

The New Chief Engineer to the London and Home Counties J.E.A.

a past-president of the I.M.E.A., and on the occasion of his election to that position we published a biographical sketch (Electrical Review, June 17th, 1927, p. 959). Other bodies which have benefited from his advice and assistance are the Institution of Electrical Engineers, the British Electrical Development Association, the National Register of Electrical Installation Contractors, the British Electrical and Allied Industries Research Association, the Institute of Fuel, the Illuminating Engineering Society, the British National Committee of the World Power Conference, the British Engineering Standards Association, and several other institutions. His standing in the electricity supply industry was officially recognised by his appointment to the Electric Fittings Statutory Committee (1926 Act) and the Commissioners' Special Committee on Tariffs. He has acted as adviser to a number of municipal supply authorities and is an active Rotarian. We reproduce Mr. Purse's portrait herewith and extend to him our heartiest congratulations upon his new appointment. The Joint Authority can also be congratulated upon its wise choice.

The Council of the Birmingham Chamber of Commerce has appointed Mr. C. Elliott, B.Sc., A.M.Inst.C.E., A.M.I.Mech.E., general manager of the Birmingham Section of the British Industries Fair in the place of Mr. C. Stanley, whose death was reported in our issue of March 22nd (p. 530).

Mr. W. E. Warrilow, A.M.I.E.E., has been appointed by Edison Storage Batteries, Ltd., to the position of assistant manager to Mr. Maurice E. Fox, managing director. Some of our readers may remember that in 1913 Mr. Fox and Mr. Warrilow advocated the revival of storage battery traction in this country, and brought an Edison battery pleasure car under its own power from Dumfries to London, taking boosting charges along the road. Mr. Warrilow's address will be Victoria House, Vernon Place, Southampton Row, W.C.2.

Mr. W. M. Selvey, of 64, Victoria Street, Westminster, is proceeding early in June to the United States and Canada for a tour of inspection of power stations, &c. One object of his visit is to obtain first-hand information as to the available American experience in the problems of the emission of dust grit and fumes from power station chimneys.

Mr. James Gray, M.A., M.C., has been elected a Fellow of the Royal Society. Mr. Gray is son of the managing director of the Electric Construction Co., Ltd.

Dr. Ing. Alexander Meissner, chief of the research laboratory of the German Telefunken Co., has been awarded the Ernst Abbe memorial prize and medal for his work in connection with the development of radio transmission and reception. He has also been made a vice-president of the Medal of Honour Institute of the American Institute of Radio Engineers.

The Darlington Gas, Water and Electricity Committee has recommended the appointment of Mr. W. N. Smithson, of Hurworth-on-Tees, as hiring and sales superintendent for a period of 12 months, at a salary of £250 per annum, plus commission. Subject to satisfactory service, the appointment is to be made permanent, with a salary of £300 a year, plus commission.

The Birkenhead Town Council, at a recent meeting, confirmed the appointment of Mr. F. W. Brecknell, A.M.I.E.E., as deputy borough electrical engineer. For the past two years Mr. Brecknell has held the position of chief assistant engineer in the Birkenhead undertaking, and prior to that was for many years power station superintendent.

Obituary.—Mr. C. H. Higgins.—We regret to record that Mr. C. H. Higgins, engineer-in-charge at the Islington Borough Electricity Works, passed away after a long illness on Saturday, May 18th. The funeral took place at Finchley Cemetery on May 23rd.

Mr. H. J. Marshall.—We learn with regret of the death of Mr. Herbert J. Marshall, chairman and managing director of Messrs. Marshall, Sons & Co., Ltd., the well-known Gainsborough engineers.

Will.—The late Mr. Bernard A. Firth, chairman of Thos. Firth & Sons, Ltd., and a director of a number of other companies, including the English Electric Co., Ltd., left £476,992 gross and £367,396 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Acme Electric Welding and Marine Scaling Co., Ltd.—Private company. Registered in Edinburgh on May 18th. Capital, £2,500 in £1 shares. Objects:—To carry on the business of electric and oxy-acetylene welders, boiler makers and repairers, braziers, ironfounders, metallurgists, ship scalers, engineers, boat builders, &c. The directors are:—W. R. Sneddon, 225, Auldhouse Road, Newlands, Glasgow, electric welder; R. Brown, 82, Aros Drove, Mosspark, Glasgow, electric welder. Registered office: 59, Govan Road, Glasgow, S.W.1.

Ideal Wireless Co., Ltd.—Private company. Registered May 24th. Capital, £6,000 in 5,000 8 per cent. cumulative preference shares of £1 each and 20,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in all kinds of radio apparatus or parts thereof, gramophones, &c. The subscribers (each with one preference share) are:—Nancy S. Perkins, 92, Leeside Crescent, Golders Green, N.W.11; and Marie Dreyfus, 5, John Street, Bedford Row, W.C.1, solicitor's clerks. The first directors are to be appointed by the subscribers. Solicitors: Richardson Sowerby, Holden & Co., 5, John Street, Bedford Row, W.C.1.

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Electric Carbons and Supplies, Ltd.—Private company. Registered May 15th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical, mechanical, and automobile engineers, manufacturers of and dealers in radio receivers, television instruments, kinema apparatus, carbons, projectors, &c. The provisional directors are:—T. J. Nesbitt, 554, Scott Hall Road, Chapel Allerton, Leeds; and N. Hill, 9, Park Spring Gardens, Bramley, Leeds, accountant's clerks. Secretary: T. J. Nesbitt. Registered office: 73-5, Albion Street, Leeds.

British Filograph Co., Ltd.—Registered as a public company May 22nd. Capital, £125,000 in 2s. shares. Objects: To adopt agreements with Filograph (Parent) Co., Ltd., W. F. Croll, and W. E. Adolph; to acquire patents and patent and other rights relating to inventions for recording and reproducing sound by means of a thread; to manufacture and distribute machines for recording and reproducing all forms of thread and other records, and to carry on the business of manufacturers of and dealers in gramophones, phonographs, kinematograph films, radio instruments, telephones and appliances for the recording, production and reproduction of sound of every description, theatre proprietors, &c. The subscribers (each with one share) are:—L. G. D. Croft, St. Audries, Purley, articled clerk; W. E. Furby, 11, Owens Row, E.C.1, clerk; and five others. The first directors are to be appointed by the subscribers. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, Strand, W.C.2.

Orchestrian Products, Ltd.—Private company. Registered May 22nd. Capital, £4,000 in 3,000 ordinary shares of £1 each and 20,000 deferred shares of 1s. each. Objects: To carry on the business of manufacturers of, and wholesale or retail dealers in radio and electrically amplified gramophones, amplifiers and apparatus, kinematograph machines, &c. The subscribers (each with one deferred share) are:—W. Clark, 45, Church Street, Leigh, incorporated accountant; J. Cohen, 9, Carlisle Place, Bradford, jeweller; H. G. Ascher, 8, Acomb Street, Chorlton-on-Medlock, Manchester, glass manufacturer; P. Cohen, 9, Carlisle Place, Bradford, gramophone manufacturer. Secretary (*pro tem.*): W. Clark.

Auto Call Co., Ltd.—Private company. Registered May 22nd. Capital, £1,000 in £1 shares. Objects: To carry on business as electrical engineers, to let on hire, hire-purchase, sell, deal, and manufacture articles of an electrical, mechanical, industrial or decorative character, &c. The subscribers (each with one share) are:—S. C. Russ, Hillview, Brockham Green, Betchworth, and C. R. Bates, Rosecroft, Hare Lane, Claygate, electrical engineers. Registered office: 27, Martin Lane, Cannon Street, E.C.4.

Electric Spelling Signs, Ltd.—Private company. Registered May 22nd. Capital, £5,000 in £1 shares. Objects: To acquire from W. Stafford the benefit of certain patents and foreign rights relating to electric sign controllers, &c. The first directors are:—H. H. Llewellyn, Inglemere, Arnside, Northumberland; F. Seyffert, 26, Hayter Road, S.W.2; R. Collier, 1, Elm Park Road, South Norwood (technical director). Registered office: 11, Southwark Street, S.E.1.

Chasetown & District Electricity Co., Ltd.—Registered as a public company May 25th. Capital, £100,000 in £1 shares. Objects: To acquire the business of electricity distribution authorised by the Chasetown and District Electricity Special Order, 1924, and carried on by the Cannock Chase Colliery Co., Ltd. Purchase consideration £62,130 in fully paid shares. The directors are:—Capt. W. M. McClean, 1, Onslow Gardens, S.W.7; Lt.-Col. Sir Frances K. McClean, A.F.C., Huntercombe Place, Henley-on-Thames; Lt.-Col. H. F. Bidder, D.S.O., Ravensbury Manor, Mitcham, Surrey; Major J. M. Griffin, Bourn Hall, Cambridge; Sir Nicholas E. Waterhouse, K.B.E., 2, Swan Walk, Chelsea, S.W.3; G. P. Bidder, D.Sc., Cavendish Corner, Cambridge; S. F. Sopwith, Chasetown, near Walsall. Registered office: Parliament Mansions, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

William Maxwell & Co., Ltd.—Charge on Tudor Lodge, 204, Goldhawk Road, Shepherd's Bush, dated April 12th, 1929, to secure £2,000. Holder: S. T. Hurley, Briar Lodge, Askew Road, Shepherd's Bush.

British Shade Manufacturers, Ltd.—First mortgage debenture, dated May 2nd, 1929, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital and book debts. Holder: Miss E. de la Haye, 71, Bromsgrove Street, Birmingham.

J. J. R., Ltd.—Satisfaction in full on May 6th, 1929, of debentures dated February 3rd, 1928, securing £250.

L.P.S. Electrical Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated April 29th, 1929, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Flexible Electric Cords, Ltd.—Satisfaction in full on January 21st, 1929, of debenture dated September 8th, 1927, securing £500.

Debenture dated May 13th, 1929, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. C. H. Polter-Mackenrot, 60-64, Artillery Lane, E.C.1.

Symper & Evershed, Ltd.—Particulars filed of £500 debentures, authorised April 23rd, 1929, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Viozone, Ltd.—Second debenture dated April 24th, 1929, to secure £148 4s. 5d. charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Expert Marketing Co., Ltd., 19, Cursitor Street, E.C.4.

New Lowca Engineering Co., Ltd.—H. Mossop, Ramsden Square, Barrow-in-Furness, ceased to act as receiver on May 3rd, 1929.

Surrey Wholesale Electrical Co., Ltd.—Capital, £1,000 in 500 "A" shares of £1 each and 10,000 "B" shares of 1s. each. Return dated November 14th, 1928. 451 "A" and 8,600 "B" shares taken up. £275 paid on 101 "A" and 3,600 "B" shares. £6 in arrears. £600 considered as paid on 350 "A" and 5,000 "B" shares. Mortgages and charges, nil.

H. D. Douglas & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 28th, 1928 (filed March 14th, 1929). Two shares taken up. £2 paid. Mortgages and charges, nil.

Looe Electricity Co., Ltd.—Return dated April 24th, 1929. Capital at date of return, £6,000 in £1 shares (increased April 26th, 1929, to £8,000 in £1 shares). 5,900 shares taken up. £5,900 paid. Mortgages and charges, £1,451 16s. 3d.

Johnson & Murrell Electric Co., Ltd.—Capital, £5,000 in 1,000 preference and 4,000 ordinary shares of £1 each. Return dated December 31st, 1928 (filed April 4th, 1929). 1,000 preference and 2,200 ordinary shares taken up. £1,700 paid on 250 preference and 1,450 ordinary shares. £1,500 considered as paid on 750 preference and 750 ordinary shares. Mortgages and charges, nil.

A. Franks (Wholesale), Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1928 (filed April 20th, 1929). 4,000 shares taken up. £4,000 paid. Mortgages and charges, nil.

Sennybridge Electric Supply Co., Ltd.—Capital, £1,500 in £25 shares. Return dated June 30th, 1928 (filed March 22nd, 1929). 48 shares taken up. £1,200 paid. Mortgages and charges, nil.

Reason Manufacturing Co., Ltd.—Capital, £52,500 in 200,000 preference and 10,000 ordinary shares of 5s. each. Return dated March 25th, 1929. 93,260 preference and 10,000 ordinary shares taken up. £2,664 5s. paid on 10,657 preference shares. £23,150 15s. considered as paid on 82,603 preference and 10,000 ordinary shares. Mortgages and charges, £22,217 (bank overdraft).

K.T.B. Manufacturing Co., Ltd.—Particulars filed of £4,000 debentures authorised April 4th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £600.

City Notes.

Siemens Bros. & Co., Ltd.

The annual meeting was held on Monday last, Lord Queenborough, G.B.E. (chairman) presiding. In proposing the adoption of the report (*vide* our last issue, p. 930), the chairman, dealing first with the balance-sheet, said, *inter alia*, that materials, manufactured goods and work in hand at £1,013,970 were up by £108,468, due to there being more work in progress and to the provision of an increased stock of component parts to deal more quickly with orders. The net assets of the Colonial agencies—£439,955—had increased during the year by £21,180, due to a larger volume of overseas business. The investment in Caxton Electric Developments remained at £670,000, and was represented largely by assets which could be quickly converted into cash. Proceeding to deal with the manufacturing and trading activities of the company, his lordship said that there had been an almost entire absence last year of any labour difficulties. Moreover, they might regard the future hopefully in this respect owing to the steps that were being taken towards establishing and maintaining industrial peace. With regard to submarine cables, the year had been characterised by the growth and development of "rationalisation." Great combinations or groups of companies had been and were being formed in order

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to secure the benefit of economic production and administration, thus strengthening their competitive power in the world's markets. He quoted as an example the Wireless-Cable merger. So far as their company was concerned, as they had for more than 50 years contributed largely to the advancement of the art of telegraphy, it was not unreasonable to assume that they would continue to play their part and secure their share, as manufacturers of submarine cable and apparatus, in any development of overseas communications which the new Communications Company might initiate. During the past year they manufactured a submarine telegraph cable for the Philippine Islands. The company had always been intimately associated with the development of submarine telephone cable; during the past year further progress had been made with new designs to meet the ever-increasing demands for long-distance submarine telephonic transmission. They were entrusted by the Government with the manufacture of the new submarine telephone link between this country and Northern Ireland, *via* the Isle of Man. That cable would shortly be laid by their c.s. *Faraday*. They had also manufactured other submarine telephone cables of unique construction so far as this country was concerned, one being laid from the mainland to the Isle of Wight, the other being intended for service in the Gulf of St. Lawrence. With regard to underground power cables, the screened type of "super-tension" main for the transmission of power, introduced by the company into this country a few years ago, had now, in one form or another, become a standardised type for many purposes, and their plant for its manufacture had been fully occupied throughout the year. Amongst contracts carried out for electricity supply undertakings in different parts of the world, he might mention that an order of considerable magnitude for 33,000-V cables received from the Bristol Corporation had recently been duplicated. A number of "super-tension" cables which the company supplied and laid across Sydney Harbour were the largest cables which had ever been made for any purpose. Although the output of underground telephone cables was considerably greater than in the preceding year, the plant was not working to its fullest capacity. There was still much leeway to be made up in this country before we reached the high level of telephonic facilities provided in other countries. There had been a considerable demand during the past year for manual and automatic telephone exchanges and apparatus both at home and overseas. Among contracts received from the Post Office were those for three exchanges in connection with the conversion of the London system to automatic, and in the provinces exchanges and extensions in the Dudley, Brighton, and Edinburgh areas, besides exchanges or extensions for Ardwick (Manchester), Winchester, Deal, Mumbles, Kirkcaldy, Stockport, West Bromwich, Swansea, Sketty, and Hitchin. Abroad, contracts for exchanges or extensions had been secured, among others, from Canada, South Africa, China, India, Australia, and Japan. The exchanges for China for the Hong Kong area had a total of 13,000 lines and represented by far the largest automatic exchange equipment supplied to the Far East. The important automatic exchange at Kensington, known as "Western," for which the equipment was manufactured and installed by the company, came into operation in the first week of this year. The change-over from manual to automatic was effected successfully, and the exchange had continued to function satisfactorily. The company had recently developed a rural exchange system for one of the Dominions. This exchange had been specially designed for the particular conditions obtaining among sparsely-populated rural communities, often 20 miles removed from the nearest township. Regarding prospective business, they had substantial contracts for exchange equipment and apparatus on their books both for home and overseas customers, but unfortunately, owing to severe competition, much of the work had to be taken at unremunerative prices. The company had developed, in co-operation with the Post Office engineers, a new type of telephone instrument, known as the "Neophone." An initial contract for 50,000 of those instruments had just been placed with them by the Post Office which, after exhaustive tests, had found them to be a real advance in transmission efficiency and articulation. It was also hoped, in consequence of its use, to achieve considerable economies in the copper section of the local distribution systems by the use of this one universal type of transmitter throughout all the different areas, which feature was hitherto only achieved by using different patterns for different zone distances. There had been a very great increase in the demand for radio batteries, which had led to growing imports from the Continent, but the public was learning the advantage of using the higher class of batteries such as the company specialised in. As a consequence, their output of batteries was much larger and the cost considerably lower, which had enabled them to reduce their prices. Their marine specialities were being increasingly adopted by the larger shipping companies and shipbuilders, in particular, their electrical ships' telegraphs and marine pyrometers, and the Ford torsionmeter maintained its popularity on British and foreign ships; in marine wireless they had introduced a reliable device for ships which had been approved by the G.P.O. and the Board of Trade, for which there was a satisfying demand. The increase in the proportion of foreign business which entered into their turnover was referred to in the report. Such an increase was necessary for the prosperity of the country, but the competition for the business was extremely keen, and prices had to be very low indeed to secure an adequate share of it. But it was indispensable that they obtained such a share in order to be able to spread their overhead charges over a sufficiently high output. Important negotiations had taken place during the last year with two large foreign concerns interested in the same line of business as the company. Those negotiations had reached their final stages, and the agreements could be executed as soon as certain changes in their articles of association, now long overdue, had been made. He would have to defer any announcement of details until necessary formalities had been completed. The proposed changes in the articles of association did not in any way affect the percentage of foreign holding and voting power; and the safeguards provided in the articles to ensure that the control of the company could not pass into foreign hands were not only fully maintained, but even strengthened by the proposed changes.—Sir W. R. Lawrence, Bt., seconded the motion, and the report was adopted without discussion. An extraordinary general meeting followed, at which a resolution was passed for effecting the alterations in the articles referred to by the chairman. These provided, *inter alia*, for the deletion of words referring to "enemy states."

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Bank of England "Certificates of Registration" representing:—

Ordinary stock of the Eastern Telegraph Co.
Ordinary shares of the Eastern Extension, Australasia and China Telegraph Co. of £10.
Ordinary shares of the Western Telegraph Co. of £10.
7 per cent. cumulative participating preference shares of £1 of Marconi's Wireless Telegraph Co.
Ordinary shares of £1 of Marconi's Wireless Telegraph Co.
Ordinary shares of 10s. of Marconi's Wireless Telegraph Co.

Anglo-Portuguese Telephone Co., Ltd.—113,002 new ordinary shares of £1 each, fully paid, Nos. 465,061 to 578,072. 5,000 ordinary shares of £1 each, fully paid, Nos. 578,073 to 583,072.

Hydro-Electric Securities Corporation.—$20,000,000 5 per cent. "B" cumulative participating preferred stock in shares of $10 each fully paid (ex option).

The undermentioned securities have been ordered to be officially quoted:—

Barcelona Traction, Light and Power Co.—287,250 ordinary shares of $50 each, fully paid; 251,934 7 per cent. non-cumulative participating preference shares of $100 each, fully paid; and £1,677,060 5 per cent. first mortgage 50-year bonds, within Nos. A1 to A127,500 and A174,501 to A320,000 (£20) and B1 to B25,550 (£100).

Enfield Cable Works.—100,000 ordinary shares of £1 each, fully paid, Nos. 250,001 to 350,000.

Ferranti, Ltd.

The Manchester correspondent of the *Financial Times* reports that the directors propose to capitalise £40,000 of the general reserve and to distribute it in the form of ordinary shares to the present holders of ordinary shares in the proportion of two new shares for each three held.

British Electric Transformer Co., Ltd.

The annual meeting was held on May 21st, Mr. A. F. Berry (chairman) presiding. In proposing the adoption of the report (*vide* Elec. Rev., May 17th, p. 887), the chairman said that in the balance-sheet there was an addition of £5,408 to freehold land, premises, &c., which was mainly made up by expenditure on special testing plant, sundry further plant and machinery, together with a new building to house some special apparatus in their works at Hayes. There was a decrease of £30,292 in the gross profit on trading, which was due to the difficulties and price-cutting encountered during the year and referred to in the report. That decrease was again reflected in the decrease of the net profit for the year under review. In view of the position generally, it was decided to postpone further consideration of the payment of the preference dividend for the latter half of the year pending the sale of some of the company's properties; the dividend was cumulative. There was no possibility of considering the payment of an ordinary dividend, but as he had told them last year, in view of the difficulties ahead they were fortunate in then receiving a dividend of even 5 per cent. Last year he said that the depression of industry had caused a competition which had practically destroyed co-operation, and that although they had received considerable orders, the prices were very poor. In the past three years they had each year turned out apparatus capable of dealing with more horse-power. It was clear, therefore, that they had done a great deal of additional work for a very poor return. Neither home orders nor those for export showed an adequate profit. Some of the work carried out was of the very highest character and class. In export work, he might mention that done in connection with the electrification of the Great Indian Peninsula Railway. A visit was paid last year by their secretary (Mr. Wrist) to Australia in connection with the affairs of the Australian company, which was now about to commence manufacture. Mr. Wrist visited a number of other countries with which they did business, and it was anticipated that the company would in due course reap the benefit of those visits. In spite of the lack of reward, it would be unwise to under-estimate the

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value that such a period of test and cleansing conferred upon an old-established business such as theirs. There were indeed several benefits of a lasting order that had accrued to the company thanks to the intense efforts on the part of directors, staff, and all concerned in meeting such stern competition. In the first place, methods of manufacture, design and similar matters had to be overhauled with a view to enforcing the strictest possible economy. In the second place, there was a tendency, when competition became so fierce, for weaker competitors to fall behind and even drop out altogether. Above all, there was a fitness and strength to go ahead in more prosperous times that was born of the struggle for the survival of the fittest. He hoped that the step back which they were now taking might prove to be preliminary to the biggest jump forward in years to come that they had ever known. The manufacture of special lamps for "Sun-ray Tricity" radiators, which they produced, was made necessary by the growing popularity of this section of the business. Consequently they now controlled an electric lamp business in addition to their older-established transformer, heating and cooking businesses. Incidentally, they were all doubtless aware that the manufacture of electric lamps had proved most profitable generally—so profitable in some cases that manufacturers of popular lamps had been able to invade their transformer business and cut prices seriously. With regard to the future, he could see definite signs which led him to believe that years of great promise lay ahead of them. The large additional orders referred to in the directors' report were of themselves an indication of great national activity, and they might expect in the next year to begin to share in that national prosperity which should come to the electrical and allied trades. Mr. F. E. Berry seconded the motion, which was carried unanimously.

Electric Furnace Co., Ltd.

The first annual report of this company, covering the year ended March 31st last, has been published. It shows that of an authorised capital of £200,000, £158,043 has been issued. The accounts record a profit of £16,047, and the directors recommended a dividend at the rate of 7 per cent. per annum on the preferred ordinary and ordinary shares from the date of incorporation to March 31st last. From the balance (£9,577) it is proposed to transfer £5,000 to reserve and to write £2,416 off preliminary expenses, leaving £2,161 to be carried forward. The report states that the past year has been marked by great activity in the development of high-frequency metal melting and numerous orders for equipment have been received. In many cases the installations are subject to tonnage royalties, which represent an important future source of income. The patent position has been fortified by working agreements with Associated Electrical Industries, Ltd., and important groups in France, Germany and Sweden. The contracts have been widely distributed, and the company's French connection has produced a large proportion of the revenue. Premises for demonstration, development and service work have been acquired in Birmingham, and a great deal has been spent on fruitful research. The outlook for the current year is encouraging. Lt.-Col. the Hon. O. H. Stanley, D.S.O., has been appointed a director. Meeting: To-day (Friday).

The Central Electricity Board Issue.

On Saturday last the Central Electricity Board offered for subscription, through the Bank of England, £3,000,000 of 4 per cent. stock at £83 per cent., redeemable at par on May 1st, 1989, or at any interest date after May 1st, 1959. Interest is to be paid half-yearly on May 1st and November 1st. The stock and interest are a first charge on the whole undertaking and net revenues of the Board, but power is reserved to create and issue further stock ranking *pari passu* with the present issue. The stock will be redeemed by a cumulative sinking fund, to be commenced not later than 1935. The prospectus briefly outlines the history and objects of the Board, and states that, subject to the consent of the Electricity Commissioners, the Board can borrow £33,500,000. The Commissioners' sanction has already been received in respect of £13,900,000, of which £5,400,000 relates to standardisation of frequency, and £8,500,000 to the construction and acquisition of main transmission lines and other purposes. The proceeds of the present issue will form part of the sum of £13,900,000. The prospectus quotes figures showing the rapid progress of electricity supply in this country, and mentions the five schemes already adopted by the Board. The list was to be closed on or before Tuesday this week.

Potteries Electric Traction Co., Ltd.

The report for 1928 shows a total revenue of £266,145, as compared with £254,753 in 1927, and a net revenue of £28,618 (including £3,400 brought forward). Debenture and loan interest absorbs £18,636, £5,000 is placed to reserve, and £4,982 is carried forward. The reserve now stands at £133,139, and the renewals fund at £43,539. The arrears of dividend on the 5 per cent. cumulative preference shares now amount to £59,719. In pursuance of the agreement with the Stoke-on-Trent Corporation, omnibuses have been substituted for tramcar services on all tramway routes. The last tramcar services were discontinued on July 11th last. The removal of the overhead equipment, and in some cases tramway track, is proceeding, together with the adaptation of the car sheds and workshops for use with the omnibus undertaking. An abandonment Order has been made by the Minister of Transport in respect of the tramways and light railways, as from March 31st, 1929. Mr F. W. Chanter has resigned from the board, and Mr. W. Thom, who has resigned his position as general manager, Mr. H. Kingsbury, the secretary, and Mr. O. C. Power have been appointed directors.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The annual meeting was held on May 23rd. Mr. G. C. Howard (chairman), who presided, said that he gathered from information issued by the Golden Horse-Shoe Mine that this mine in the Kalgoorlie district expected to treat 40,000 tons of residues per month out of their total of 2,500,000 tons. If this programme was carried out, the installation of the necessary plant would take some time, the work would be spread over five years, and a substantial amount of power would be required, which the company would be in a position to supply. During the past few years the policy of the Federal Government in levying high tariffs on machinery imported into Australia had threatened to throttle industry. Recent advices, however, indicated that the Minister controlling tariffs had adopted a more encouraging attitude towards the primary industries. The report and accounts were adopted.

Great Northern Telegraph Co., Ltd., of Denmark.

The directors' report for 1928 states that, apart from improvements of the Trans-Siberian route, its activities in Russia are more or less stagnant, and do not, for the time being, promise to give any positive result. In China the Radio Corporation of America is to erect two wireless stations near Shanghai for the exchange of traffic with Europe and America. When these stations are opened in about 18 months' time, the competition may make itself felt. The accounts show that there was a rise in net revenue from £360,295 to £441,903. The addition of £219,308 brought forward makes available £661,212. The reserve and renewals fund receives £33,333, dividends and bonus (totalling 20 per cent.) absorb £400,000, and directors' fees £3,000, and a balance of £224,823 is carried forward.

Kolster-Brandes, Ltd.

Speaking at the statutory meeting on May 24th, Lt.-Cdr. E. W. Stone (U.S.N.R.), presiding in the absence of the chairman, said that he believed the company had one of the best laid-out and equipped radio factories in Great Britain. To provide for further expansion 20 acres of land had been acquired adjoining the Sidcup works. The parent American company was securing an increasing share of the American radio business, and that success would be reflected in expanded activities for the English company.

Prospectus.

British Filograph Co., Ltd.—On Thursday last week this company, which has a capital of £125,000 in 2s. shares, made an issue of 600,000 shares at par. It has been formed to acquire patent rights in respect of inventions for recording and reproducing sound on a thread. The prospectus stated that the device could be employed for a number of purposes for which gramophone disk records were now employed, and one of the articles to be produced was an adapting device to enable "Filograph" records to be reproduced on the ordinary gramophone. The registered office of the company is at 1, Museum Street, W.C.1. Further details appear in the "New Companies" section of this issue.

Isle of Wight Electric Light and Power Co., Ltd.

The revenue for 1928 was £32,193 (as against £30,087), and after providing for interest, sinking fund, &c., and including £1,035 brought forward, there is a balance of £16,932. It is proposed to place £1,500 to reserve, £500 to staff benevolent fund, and to pay a final dividend of 4 per cent. (making 8 per cent., free of tax, for the year) on the fully-paid and partly-paid ordinary shares issued during the year, leaving £1,032 carried forward.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The report covering the three months ended March 31st, 1928, shows a gross revenue of £517,779, and after deducting ordinary expenses, &c., there remains £298,734, from which income tax payable in England, and interest on mortgage debenture stock are met, leaving £243,516, to which is added £653,622 brought forward, making £897,138. A dividend of 2½ per cent., free of tax, has been paid, leaving £797,138, which is placed to reserve.

Dundee, Broughty Ferry and District Tramways Co., Ltd.

The profit for the period August 1st, 1927, to December 31st, 1928 (including £495 brought forward) was £2,759. Interest absorbed £1,611, leaving £1,168, which it is proposed to carry forward. A Provisional Order has been presented to Parliament to secure proper joint working of the line from Montifieth to Dundee by the Corporation and the company. Meantime, the directors have been compelled to suspend payment of the dividend on the preference shares, which have received no dividend since October, 1927.

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Callender's Cable and Construction Co., Ltd.

The profit for the past year was £360,581, as compared with £357,378 for the preceding year. From this £50,000 is allocated to depreciation, £10,000 to income tax, £13,500 to debenture interest, £5,000 to capital expenses, £10,000 to pension fund, and £56,000 to preference dividends, leaving £216,081. The addition of £474,165 brought forward makes available £690,246. It is proposed to pay a final ordinary dividend of 10 per cent., again making 15 per cent. for the year, and £570,246 is to be carried forward. The report states that the past year was marked by the absence of large cable contracts, but the general business remained steady, and improved materially in many directions. Since the commencement of this year the outlook has distinctly improved, and the volume of business is increasing at both the Erith and the Anchor works. The directors propose to capitalise part of the reserve, and issue it in the form of fully-paid ordinary shares to the ordinary shareholders in the proportion of one new share for each five held. Reference is made to the purchase of the business of W. T. Glover and Co., Ltd., and it is stated that as a decision in the matter had to be taken immediately, the only means of carrying the transaction through was by the sale of sufficient shares in the company to a leading firm of bankers. Meeting: June 6th.

Buell Combustion (Foreign), Ltd.

The first annual meeting of this company was held on May 23rd, Mr. S. H. Menzies (chairman) presiding. In presenting the report and accounts, the chairman said that they had effected a union with the firm of Loy & Aube in respect of the pulverised fuel section of their business, which had resulted in the formation jointly with them of the first subsidiary—Compagnie Française Buell Combustion. The new company represented the combination, in so far as concerned either land or marine pulverised fuel combustion, of the Buell burner and the Rex pulveriser of Messrs. Roy & Aube. Since commencing operations, the prospects of the Compagnie Française Buell Combustion had developed, and it was anticipated that before the close of the year important contracts now offering would be secured. Tentative negotiations were in hand in two other of the most important countries within this company's territory, and in one of these an important trial of the Buell system was about to be made. The report and accounts were adopted.

Eastern Telegraph Co., Ltd.

The revenue for the three months ended March 31st, 1928, amounted to £789,957, from which is deducted £571,710 for ordinary expenses, leaving £218,247. After providing for income tax payable in England, &c., there remains a balance of £149,673, to which is added £525,765 brought forward, making £675,437. A dividend of 2½ per cent., free of tax, has been paid on the ordinary stock, leaving £550,437 to be carried to reserve. The vice-chairman, Mr. J. C. Denison-Pender, has been appointed chairman in succession to the late Sir John Denison-Pender.

Hydro-Thermal Power, Ltd.

In the note regarding the registration of this company which appeared in our issue of May 17th (p. 883), two errors occurred. The name of Brig.-Gen. E. L. Spears, C.B., was incorrectly spelt, and the name given as "Granville (?)" should have been Sir Edward Manville, J.P. These gentlemen and the other subscribers named have signed the memorandum for their qualification shares—2,500 of 2s. each, and constitute the board of the company.

Electric Construction Co., Ltd.

The net profit for the year ended March 31st last was £8,739 (against £20,593 in 1927-28). To this are added £8,043 brought forward and £10,000 from the dividend equalisation fund, making £26,782. A final ordinary dividend at the rate of 5 per cent. per annum is proposed, making 5½ per cent. for the year (against 7½ per cent.).

United Light and Power Co.

An offer was made on May 23rd of $50,000,000 of stock of the United Light and Power Co. This was one of the largest financial issues of this nature of the year. The offer consisted of 500,000 $6 convertible preference shares priced at $100. The company has important holdings in the Middle West, in the South and in Canada.—*Reuter* (New York).

Richard Johnson & Nephew, Ltd.

The profit for the period from May 24th, 1928, to March 31st, 1929, is £37,056. A dividend on the ordinary shares for the period at the rate of 8 per cent. per annum is recommended, leaving £10,835 to be carried forward.

Reduction of Capital.

ELECTRICARS, LTD.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £138,000 to £18,000, and will be heard in London on June 4th.

Shawinigan Water and Power Co.

A dividend of $0.5 per share has been declared on the common shares for the quarter ending June 30th.

Para Telephone Co., Ltd.

The accounts for 1928 show a net profit of £7,442, as against £6,833 in the previous year. A dividend of 5 per cent. is paid, and £5,296 is set aside for depreciation, &c., leaving £1,963 to be carried forward.

Consolidated Gas, Electric Light and Power of Baltimore.

A dividend of $0.75 per share has been declared on the common shares for the quarter ending June 30th.

Burma Electric Supply Co., Ltd.

An interim dividend of 2½ per cent., less tax, has been declared on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

THE quietude imposed upon Stock Exchange business by politics, in advance of the General Election, became accentuated by a further flurry in the money market, on account of a somewhat threatening state of affairs that developed in American financial circles. Money in New York and in other American cities has been for some time past growing dearer Pressure continues to be brought to bear upon the general situation by American authorities bent upon putting an end to the over-speculation in stocks and shares which, they contend, is having a serious effect upon the trade of the country. The position became acute at the end of last week, when there seemed to be a fair prospect of the Bank of England having to raise the stiff rate of 5½ per cent. that came into operation on February 7th last. A 6 or 6½ per cent. Bank Rate is about the last thing that people who are interested in financial matters on this side desire to see. It would lead, inevitably, to curtailment of Stock Exchange business, and to a general reduction in prices. A downward movement started some few days ago, when prices of gilt-edged securities were depressed, and the quotations for industrials came under the influence of a wave of weakness caused by a good deal of actual selling. The electrical supply shares which have been recently so popular yielded a certain amount of ground, though the depression in these turned out to be less than that which affected a good many other sections. As soon as the Election is over, and, in popular phrase, we know where we are, business conditions are likely to settle down into a more normal state. When the suspense is removed, it does not seem unreasonable to look for a recovery in prices, provided that the monetary influences which govern the Bank Rates in this country and in America become more elastic.

Falls in Eastern Cables.

Eastern Telegraph ordinary stock has shed 5 points, and the prices of Eastern Extensions and Western Telegraph shares have given way. This is in accordance with the usual Stock Exchange tradition which looks for reaction in prices as soon as any event materialises upon which attention has been focused for a long time previously, and upon the strength of which a considerable rise has occurred. Publication of the full details of the plan put forward by Wireless & Cables, Ltd., leaves little more to imagination. Therefore the speculative prospects which have attached hitherto to the stocks are replaced by other considerations. These latter, affected as they are by money, had the effect of bringing in sellers, with the results already mentioned. Moreover, as was pointed out here last week, holders are a little disappointed by the statement that those who exchange their interests into the new Corporation will receive no dividend upon their ordinary shares until some time after June, 1930. Other cable stocks and shares are quiet. Great Northern Telegraphs went a little easier on a report which shows the net profits for the year to be down by some £52,000, although the dividend is maintained at 20 per cent. This has been rendered possible by crediting to revenue account £133,333, transferred from accrued interest on the reserve fund. The report states that so far as the Great Northern Telegraph is concerned, the directors feel there is no reason to think that the fusions amongst wireless and cable companies will have any adverse influence on the friendly relations which now exist between the Great Northern and other cable companies.

Wireless Weaken.

Marconis have given way to £4, which is, of course, ex dividend, the £1 shares at 4⅝ and the preference at 4½ also being easier, for much the same reasons as those which account for the heaviness in the Eastern Cable group. Curiosity is expressed in regard to the likely action of shareholders in the various companies concerned, in connection with the assent to the plan for amalgamation. A 60 per cent. assent is required from holders of the various stocks and shares to which the plan applies. Various rumours are afloat in regard to the total assent that is said to have been received by the Bank of England, but no definite figures have come to hand up to the time this was being written. Canadian Mar-

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conis remain dull at 1⅝, and Burndepts at 4s. 7½d. International Telephone and Telegraph capital stock at 250 is 16 points down. American Telephone and Telegraph at 215 has fallen five points.

Central Electricity Board Issue.

The Central Electricity Board is issuing £3,000,000 of 4 per cent. stock at 83, dated 1959-1989. There is a sinking fund attached to the loan for the purposes of redemption. The price of issue looks high, affording, as it does, a flat yield of no more than £4 16s. 5d. per cent. The issue made its appearance at an unfortunate time, for had it come, say, a couple of months earlier, it would have been assured of ready over-subscription. The stock is not issued under the Trades Facilities Acts, as a good many people expected would be the case, nor is it available for investment under strict trusts. The security is regarded, of course, as being first-rate, and the effect of issuing a stock carrying a comparatively low rate of interest, at a considerable discount, is to attach to the price the possibility of advance in value when money becomes cheaper.

Dollar Stocks.

Brazilian Tractions have fallen back 3½ to 53, and the Anglo-American group is dull as a whole. Hydro-Electrics, in spite of the maiden dividend announced last week, have dropped to 34¼. International Holdings at 7½ are a point lower. Dealings started a few days ago in the "B" shares of the Hydro-Electric. These are 5 per cent. cumulative participating preference shares of $10 each, and the price is about $7½. British Columbia Power "A" and "B" shares are dull at 46¼ and 27½, respectively. A little interest is being taken in Utilities Power and Light Corporation shares, the "A" standing at 42, and the "B" at 48. Neither has a par value. The company controls the ordinary shares of the Greater London and Counties Trust, the company which has lately bulked largely in the public eye through the purchase of various British electricity undertakings. In particulars issued officially by the Utilities Power and Light Corporation, it is stated that the "British companies and their subsidiaries" (owned by the Utilities Power) "serve exclusively 95 cities and towns in England and Scotland with electricity. This 100 per cent. electric service is increasing at double the rate of corresponding American cities and towns."

The American General Electrics are undergoing wild price fluctuations in Wall Street. A rise, one day last week, to 283 was succeeded by a fall of 9 points within the same session of the market. On the same day, Electric Auto-lites touched extremes of 158 and 150.

Electricity Supply Shares.

Newcastle and District Electrics rose to 28s. 9d., and Clyde Valleys to 33s. 9d. Llanelly and District ordinary hardened to 15s., Yorkshire Electrics to 34s. 6d. Other changes in this section are to slightly lower figures. Midland Counties and Urbans show trifling declines. At one time Northamptons dipped to 42s. 6d., but the price rallied to 45s. British Power and Light Corporation remain heavy at 1s. 3d. discount. There are sellers about who, expecting the issue to be very popular, wrote for more shares than they wanted, and, upon getting allotments in full, now find themselves stale stags. Altrincham deferred shares have gained a few pence, at 18s. 3d. Atlas sagged to 26s. 9d. Burma Electric Supply shares remain at about 20s.; the interim dividend payable on June 1st is 2½ per cent., against 3 per cent. a year ago. There are on offer 2,000 Charing Cross City Undertaking 4½ per cent. preference shares of £1 each, obtainable at 17s. 10½d., carrying a dividend due next month. The yield is 5⅛ per cent.

Manufacturing and Equipment Shares.

Callenders at 4⅜ are unaffected by the proposal to make a bonus issue of one new share in respect of every five shares now held. This announcement is in accordance with anticipation. The Philips Glow Lamp Co., which recently offered new capital, on bonus terms, to its shareholders, is stated to have in contemplation the erection of a factory in Austria for the supply of wireless apparatus to the Balkan countries. General Electrics are another 1/16 lower, at 53s. 9d., and Associated Electrical Industries, which stood with General Electrics at 55s. this time last week, are back to 51s. 3d. Henley's hardened to 6⅛. British Insulated retain their gain at 3¾. The Electric Furnace Co. declares a profit of £16,000 and dividends of 7 per cent. on its preferred and ordinary shares. Automatic Telephones have gone back to 2 1/16.

Railways and Traction.

Home Railway stocks are heavy. Underground incomes fell 2, to 112, the £1 shares also being easier at 23s. 6d. The London Tramway descriptions have not moved. British Electric Traction deferred ordinary put on 50 points, advancing to 1,050; the preferred ordinary is 1½ better at 1,302. Iron and steel shares attract but scant public attention. At the meeting of the Armstrong, Whitworth Co., the chairman described the competition in shipbuilding as being intense. Vickers keep at 11s.; Babcocks at 64s. 6d. The rubber share market pursues an erratic plane, within which the movements in prices are narrow and uninteresting. Efforts are being made to establish an association for the voluntary restriction of the output of tin.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price May 27 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8¼	8¼	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/6	—	5 5 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1		8	33/9	+1/16	... ...
County of London	1	7½	10	55/-	—	3 12 9
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	57/6	—	3 18 8
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	2 5/16	—	3 18 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	32/6	−6d.	4 0 0
Mid. Elec. Power	1	15	8	1⅞	—	4 5 4
Newcastle-on-Tyne Ordinary ...	1	6	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	—	5 0 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	42/-	−1/16	... ...
Westminster Ordinary	1	8⅜	8⅜	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/6	+6d.	4 12 9

HOME RAILS.

	Nom.	Approx. Dividend. 1927.	1928.	Price May 27 1929.	Rise or fall	Yield p.c.
Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	"	3	3½	61	—	5 14 8
do. District	"	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	23/6	−6d.	5 19 2
do. do. Income ...	Bonds	6	6	112	−2	5 7 2

TELEGRAPHS AND TELEPHONES.

	Nom.	Approx. Dividend. 1927.	1928.	Price May 27 1929.	Rise or fall	Yield p.c.
Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	"	1½	1½	24½	—	6 2 6
Automatic Telephone	1	10	12½	2⅛	−1/16	6 1 1
Eastern Extension	10	10	10	27¼	−¾	*3 13 6
Eastern Tel. Ord.	Stock	10	10	272½	−5	*3 13 6
Globe Tel. and T. Ord.	10	10	10	28½	−½	*3 9 0
do. do. Pref.	10	6	6	11⅝	—	5 5 6
Great Northern Tel.	10	20	—	33	—	... ...
Indo-European	25	10	10	50½xd	—	*4 19 0
Marconi	10/-	10	20	4/-	—	... ...
Marconi-Marine	1	12½	15	3⅝	−⅛	4 16 0
Oriental Telephone Ord.	1	12	12	3 1/32	+1/32	... ...
Western Telegraph	10	10	10	27¼	−¾	3 13 6

HOME AND FOREIGN TRAMS, &c.

	Nom.	Approx. Dividend. 1927.	1928.	Price May 27 1929.	Rise or fall	Yield p.c.
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	3¾	—	8 0 0
do. do. 5% Deb. ...	Stock	5	5	76½	—	6 10 9
British Electric Traction Def. Ord.	"	5	5	1050	+50	... ...
do. do. Pref. Ord.	"	8	8	130½	+1½	6 3 7
Brazil Traction	100	7	8	53	−3½	3 15 6
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	94½	—	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	18/-	—	... ...
London United Tram Deb. ...	Stock	4	4	64	—	6 9 1
Mexico Trams. 5% Bonds	—	5	5	72½	—	6 19 10
Mexican Light Common	100	Nil	Nil	72½	—	... ...
do. 7% Pref.	100	7	7	72½	—	9 13 9
do. 1st Bonds	—	5	5	75½	−1	6 13 6
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

	Nom.	Approx. Dividend. 1926.	1927.	Price May 27 1929.	Rise or fall	Yield p.c.
Assoc. Elec. Ord.	1	—	6	51/3xd	−3/9	2 16 6
Babcock & Wilcox	1	13	15	64/6	—	*4 13 6
British Aluminium Ord.	1	10	10	51/3	—	*3 12 9
British Elec. Transformer Pref. ...	1	7	7	13/9	—	9 6 8
British Insulated Ord.	1	15	15	3¾	—	4 0 0
Brush Ord.	1	10	10	28/9	—	7 8 8
Callenders	1	15	15	4⅜	—	3 9 8
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 9
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	18/9	—	8 0 0
Enfield Cable Ord.	1	20	20	4¼	—	4 14 1
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	8	Nil	8/3	—	5 10 7
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 14 1
do. Ord.	1	7½	10	2 1/16	+1/16	4 1 1
Henley	1	25	25	6⅛	—	5 6 0
do. 4½% Pref.	5	4½	4½	4¼	—	... ...
India-Rubber	1	Nil	Nil	18/9	—	5 10 0
Johnson & Phillips	1	12½	10	36/3	—	5 9 1
Siemens Ord.	1	7½	7½	1⅜	—	*4 19 0
Telegraph Construction	12	10	10	24¼	—	... ...

* Dividends paid free of Income Tax.

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The Chinese Position and Outlook.

The Need for Co-operation.

IN the April issue of *World Trade*, the journal of the International Chamber of Commerce, there appeared an article on "China: from Revolution to Reconstruction," under the pen-name "Celticus Aper." In this the author outlines recent events in China, and deals with the aspirations of the country's leaders. After emphasising the immensity of the Republic and its unlimited wealth, he mentions the part played by foreigners in Chinese trade and industry. A list is given of the foreign establishments in the country in 1927: Japan is predominant, being credited with 4,446 establishments, employing 239,339 persons. Soviet Russia comes second with 964, employing 74,089 people, while Great Britain is third with 714, employing 14,670 people. Next follow the United States, Germany and France, and six other European countries. Except for official mints, arsenals and ancient manufactures of silk and china, these foreigners have under their direction, or control by their capital, nearly all modern industries, silk and cotton mills, glass factories, electrical plants, and many other branches. The Kuomintang has at its head men young and efficient, trained by western methods, and under their *ægis* financial and economic programmes have been drawn up for the reconstruction of China to bring the country up to a higher standard than ever before. The financial programme includes the unification of administration, the reorganisation of the taxation system, and the reduction of the military expenditure. In the economic scheme there are included the improvement of railways, navigation and communications, the encouragement of national industry, and the adoption of a central banking system.

Above all, the Kuomintang aims at the revision of unequal treaties as a prior condition to undertaking economic reconstruction. The author believes that the Nationalist leaders are not unmindful of what China owes to foreigners. He points out that whatever industrial prosperity exists is due to foreigners. The treaty ports and their hinterland are the only zones of prosperity. Foreigners laid down the plans and provided the capital and rolling stock for China's railways. To foreigners China owes her system of administration which enabled her to raise the necessary revenue, and in 1928, when the powers of administration were withdrawn from foreigners the revenues vanished. It is not only with regard to foreigners that the Chinese masses need to change their views. They stand in dire need of education, and so long as they remain undisciplined and so long as their leaders place politics before economics, no government will be powerful enough to carry reconstruction to a successful issue. The men at the head of affairs must realise that they can never by their own unaided efforts and financial resources within the limits of their own territory, create the means of restoring China to economic prosperity. The three fundamental factors of the problem of reconstruction are: Intellectual revolution to prepare industrial revolution; a unified republic with a strong central government; and foreign co-operation.

Foreign collaboration must not be furnished by any single nation. The predominant influence of any one country would, in the opinion of competent Chinese, be a serious menace to the national sovereignty of China, as well as being a danger to the world. A vast effort of international co-operation is essential; any selfish or narrow vision of the future would be fatal alike to China and to the countries willing to contribute to her reconstruction. It has to be remembered that the needs of China are so numerous and varied that no one country alone could satisfy them. When the Government commences its reconstructive works this will become even more true.

The writer urges the foreign Governments to have faith in the Nationalist Government. Their second duty is a duty of information towards their national organisations. Business leaders and the public must be kept informed of the exact needs of China. They must be encouraged to manufacture goods for the Chinese markets; train new men who will carry to China western ways and methods; and encourage bankers to interest themselves in the Far East. Above all, it is necessary that the business interests of the world, the foreign merchants, manufacturers, traders, bankers, shipowners and insurers shall prepare, in co-operation with Chinese business interests, the vast programme of Chinese reconstruction. Working together, they must compile accurate, clear statistics, comparable with the statistics of other countries. They must obtain a clear view of the great public works to be undertaken —railways to be built, ports to be improved, &c.; of the industrial equipment necessary to China for the exploitation of its raw material and the organisation of its economic equipment; they must estimate the amount of capital required and investigate means of providing it, and so forth. The reconstruction of China means prosperity to the nations which have the courage to undertake it, for the industrialisation and modernisation of China must inevitably increase the volume of international trade. In conclusion, the author considers that a very valuable contribution to the solution of the problems can be made by the International Chamber of Commerce by virtue of its constitution, its independence of Government control, and its practical knowledge of international affairs.

Domestic Appliances in Australia.

An American Survey of the Market.

IN a recent issue of *Commerce Reports*, Mr. L. R. Miller, United States Assistant Trade Commissioner at Sydney, made a review of the market for domestic electrical appliances in Australia, the gist of which is reproduced below, each class of appliance being dealt with separately.

Cookers.

Mr. Miller says that a steadily-increasing number of new apartment houses and residences in Australian cities are being equipped with electric cooking stoves, especially in Sydney, where the charge for supply is favourable. Several American and Canadian models are on the market at prices varying from £20 to £44. The manufacture of electric cookers has recently been commenced in the Commonwealth; a leading firm of gas-cooker manufacturers is now making them, using American elements under agreement with one of the large American companies. The import duties are 40 per cent. for foreign and 27½ per cent. for British appliances.

Refrigerators.

An increasing demand for electric refrigerators is reported. This is created by the long, hot summer which coincides with the American (and British) winter, providing a good "off season" market. Last year Australia imported American refrigerators valued at $692,997. Two models are now being made in Australia, but they are said to be not equal in quality and performance to the American patterns. The average domestic plant costs between £80 and £100, but the price is expected to fall with increased sales.

Washing Machines.

Electric washing machines are becoming more and more widely used; practically all the ten types on the market are American, and some of them are purchasable by instalments. The centrifugal drier is preferred to the wringer, and there is a demand for a machine in which the water is electrically heated. Retail prices range from £40 to £50. Business in this line could be developed by placing a competent factory representative in the field to organise a sales force, although a local company might be formed for distribution purposes.

Heaters.

The mildness of the climate renders central heating unnecessary in most buildings, and electric fires are widely used. Many houses and apartments are now built without fireplaces, and in the winter months small electric heaters are depended upon. It is stated that while many of these heaters were formerly imported from England, appliances of local manufacture are gradually supplanting imported articles. Only one American device, a heater of the reflector type, has a fair sale. The local product is well designed and satisfactory in performance, and opportunities for increased sales of American heaters are limited.

Irons.

Electric irons are a necessity in Australian homes, and there is an increasing demand for automatically-regulated patterns which are imported from the United States or Great Britain. The Australian subsidiary of an American company is manufacturing non-automatic irons, and there are several other local factories. Recent importations of German irons have tended to lower the competitive price level.

Fans.

Owing to the exceptionally hot summer which Australia has experienced, stocks of electric fans have been practically exhausted, although the normal demand is only moderate. It is stated that no fans are made in Australia, and it is unlikely that local manufacture will be undertaken. Imports of fans come principally, and in almost equal proportions, from the United States, the United Kingdom, and Italy. The demand is mainly for the oscillating type of fan, there being almost none for the fixed patterns. One American company having an Australian subsidiary has recently notably increased its volume of business by reducing prices and providing service.

Other Appliances.

There is an increasing demand for "oven" type two-slice toasters with three elements, which type is not made locally. Automatic toasters are also popular. Ordinary toasters are made in Australia, and most of the imports are from the United States. Prices range from £1 to £2. The electric tea-kettle is being gradually superseded by the carbon-electrode jug; this is made and patented in Australia, and is said to be used in no other country. The jugs require about six amperes, and should last indefinitely. The electric kettles on the market are of British, American or local manufacture, and retail at from £2 to £3. There is a fair demand for dish-washing machines. These are imported from America, but generally the price is prohibitive. Machines retailing at £15 or less should find a market.

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A Control Gear Manufactory.

Some impressions of a recent visit to one of the British Thomson-Houston Co.'s factories at Rugby, which is devoted to the production of industrial electric motor controlling apparatus.

THE contention that the design and manufacture of control gear calls inherently for wider general knowledge and experience of electrical machines and their applications in industry than any other branch of electrical engineering will be readily acknowledged if one contemplates the onerous functions which such gear has to perform. Not only has it to control and protect an electric motor, generator, or transformer, as the case may be, but it must also essentially protect the operator and protect and control the plant with which it is used. It is accordingly quite evident that only by years of intimate contact with, and experience of, the many problems associated with these three essentials can sound principles and practice be established.

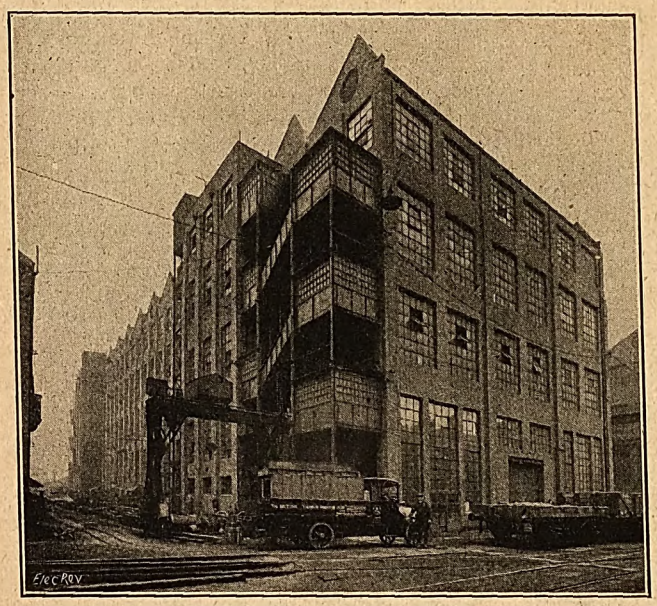

Fig. 1.—Control Gear Factory of the British Thomson-Houston Co., Ltd., Rugby.

It is interesting to recall that the British Thomson-Houston Co., Ltd., published its first price list of Rugby-built motor starters in 1902, and supplied the first contactor equipments to the London Underground Railways in the same year. The Company claims also to be a pioneer in the introduction of contactors for industrial applications, and installed the first equipment of this kind at the works of Messrs. Scott's Shipbuilding and Engineering Company at Greenock in 1910.

The frequent application of electricity to fresh uses and the improved machinery which is continually being made available to other branches of engineering as a result of such application, daily creates new requirements that necessitate the employment of a considerable staff of engineers and draughtsmen, as fig. 2 indicates; it is a view of a section of the drawing office, the whole of which is devoted entirely to control gear. The engineering staff is accommodated in a separate office and each individual specialises in some particular branch of design or industrial application, such as d.c. starters, a.c. starters, resistances, contactor gear, pillar-type starters, controllers, automatic sub-stations, traction, ship propulsion, colliery winders, rolling mills, &c. Switchgear of the generating-station type is not handled at Rugby, being the product of an entirely separate factory at Willesden, on the outskirts of London.

The building shown in fig. 1 is a part of the main works at Rugby, and is entirely devoted to control gear. The tinsmiths, press shop, foundry, and the sections dealing with resistances, insulation, and coil winding are situated in other buildings. In the factory illustrated the machine shop occupies the whole of the second floor, with an area of 22,500 sq. ft. It is thus situated between the two floors on which the majority of the assembly work is done, the component parts of the smaller apparatus being sent up to the top floor, while parts for the larger types of apparatus go down to the first and ground floors. The ground floor is used for the assembly of contactor panels, automatic sub-station panels, transformer tap-changing "on load" devices, and ship-propulsion equipment. In the foreground of fig. 3 can be seen a number of panels for a paper mill in course of construction and testing; also a flame-proof oil-immersed reversing contactor. On this floor are special tools for the edgewise bending, drilling, forming, cutting, and sweating of bus-bars, which up-to-date equipment enables heavy con-

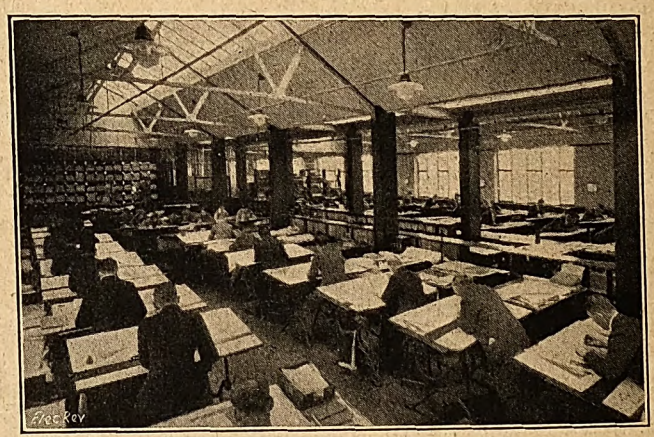

Fig. 2.—Section of Drawing Office for Motor Control Gear at Rugby.

Fig. 3.—View of the Panel Assembly Section.

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nections to be made neatly and with few joints. The first floor is devoted to smaller contactor panels and to traction equipment, &c., and on the second floor is the machine shop which affords plain evidence of keen management and organisation. Interesting devices and machines have been developed for the quantity production of the many peculiarly-shaped parts which are common to control gear. This floor has been laid out with a view to keeping the material flowing continually in one direction; raw material enters by a lift at the north end, and the finished part is finally delivered to the Inspection Department at the south end, where a second lift carries it to the assembly sections, on which floors the material flows in the reverse direction, *i.e.*, south to north, thus resulting in a uni-directional flow throughout the building.

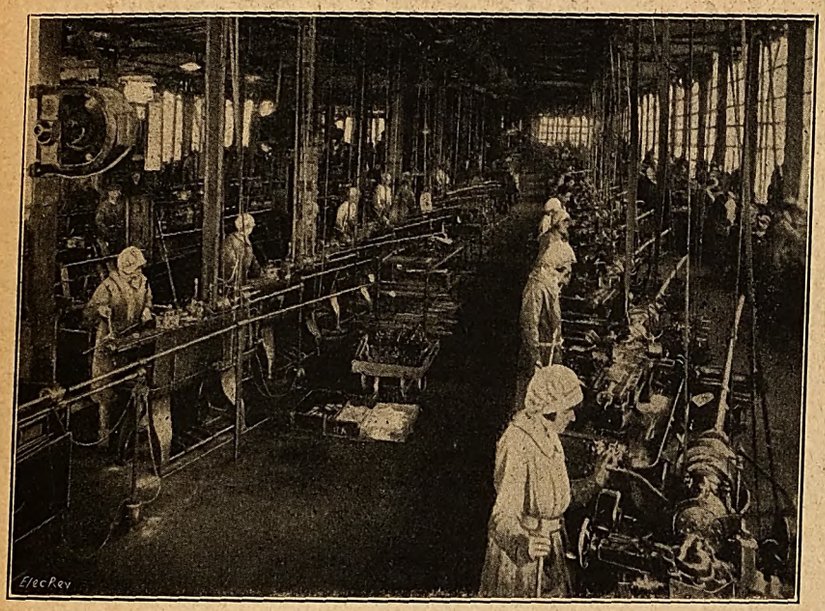

Fig. 4.—Machine Shop, Lathe and Turret Section.

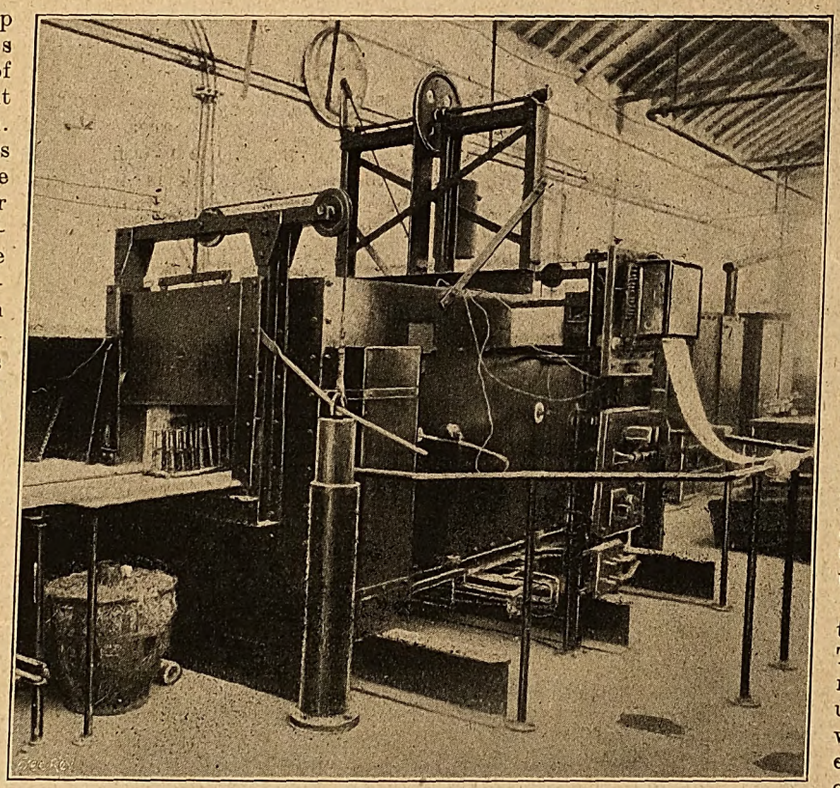

Fig. 5.—Electrically-heated Oven, with Automatic Temperature Control.

The turret lathes and multi-spindle drilling sections are shown in figs. 4 and 6, respectively. The simultaneous drilling of several holes in tramcar controller cap-plates is illustrated in fig. 8; the jig bears runners and tennons fitting into the table-slots and, when loaded, the operator pushes it straight back to a stop, which ensures the location being correct for the drills to enter the bushes. Another application of this machine is of special interest; two sets of tools are set up, so that the holes are first drilled with one set and the jig is then reversed and the holes are reamered with the second set, the spindles being so disposed that when the drills are cutting, the reamers pass clear of the jig, and *vice versa*.

Special milling fixtures and multiple cutters are used whenever possible; for example, the first milling operation on cast-iron magnet frames of railway contactors is a gang one, and half of the external machining is done thus; the casting is then reversed, and a further gang of cutters completes the job. For the milling of operating arms for railway contactors on an automatic machine, the index table method is employed. The operating arms are of malleable cast iron and the six bosses have to be machined outside, and the pairs at each end are machined inside as well; the arbor carries a gang of cutters to machine two castings side by side, and by using the index table no time is wasted, as the operator loads one jig while the cutters are working on the other one. The machine table is automatically controlled by dogs, so that the operator has only to raise the starting lever each time, the motion of the table being quick forward, feed, quick return, and stop. This particular operation has one or two special features. For instance, it is impossible, due to the shape of the centre of the casting, to machine right through at one operation, and the jigs have been so designed that four bosses are machined outside and one pair inside in a jig at one end of the table, the remaining pair of bosses being machined inside and out in a jig at the opposite end of the table, the two jigs being so aligned that the two operations are "complementary" to one another. This arrangement makes it possible to use the index table with only one jig of each kind, instead of a pair of each as is the usual prac-

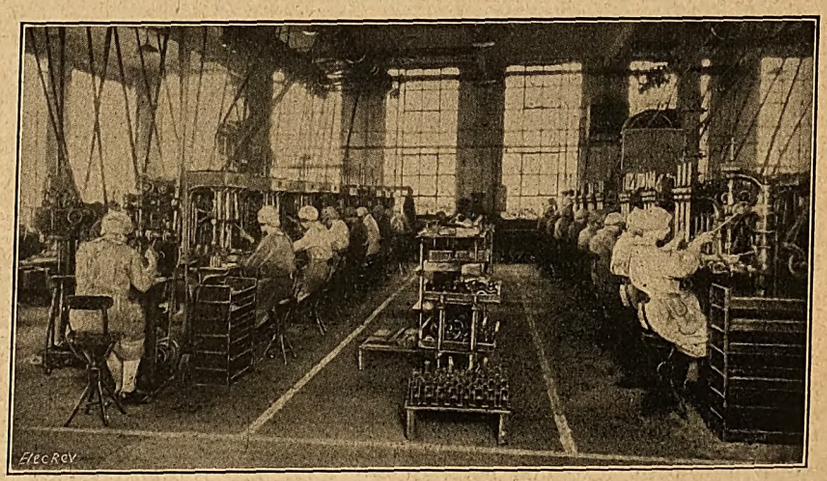

Fig. 6.—Machine Shop, Multiple-spindle Drilling Section.

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tice, so that each casting only pays one visit to the machine before being finished. If two pairs of jigs were used, it would mean machining one end of all the castings first and then going over them all again to machine the second end. Owing to the fact that the large cutters pass the outside of the end bosses before the small cutters reach there, springing took place. To overcome it, the large cutters were made with large-diameter bosses slightly greater in diameter than the small cutters. These bosses reach the outside and the bosses which have already been machined before the small cutters start to cut on the interior, and so hold the whole job perfectly steady. Production for the complete cycle of two operations is about 30 per hour with gird operator.

An interesting special device is used for the rapid drilling of parts in which is a single hole, such as contactor tips. The main principle is that the downward movement of the spindle as the drill approaches the work is used to clamp the work in position. The general housing is common to a number of parts, interchangeable blocks being inserted for each separate article. The barrel attached to the spindle contains a spring plunger to which are pinned two pairs of links that are pivoted on the top of the fixture; on the links is an adjustable block carrying a further spring plunger which bears against the work as the drill descends and engages with the work, and thereafter further downward movement of the drill is taken up by the spring in the barrel. The machine is foot operated, so that the operator has both hands free, and uses her right hand to insert the work and her left hand to operate an ejector lever. This method of drilling such parts is exceedingly rapid and has also been applied in cases of two-spindle work.

A very large variety of drum-controller segments has to be drilled, and a machine has been designed in the controller factory to accommodate all these parts. The two spindles can be set at any angle between 18 and 180 degrees, the angle being plainly marked on a sector on which they are mounted. Adaptors of various sizes can be inserted at the centre of the circle to accommodate segments of varying widths and diameters, the segments being mounted on their respective adaptors by means of two arms, which are also set to a scale of degrees. The drive is taken from the motor by a belt passing over two pulleys, and is transmitted to the spindles through two pairs of mitre wheels. A combined drill and counter-sinking tool is used, so that only one operation is necessary to drill and counter-sink both holes in their correct positions. The

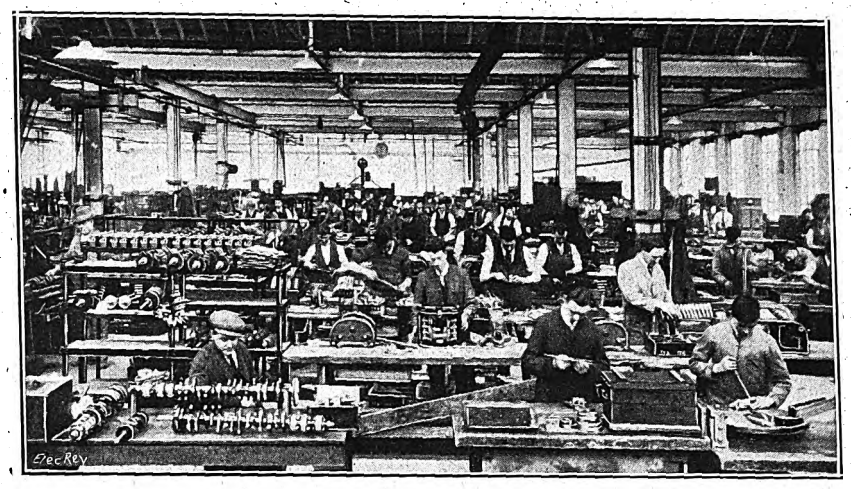

Fig. 7.—View showing Assembly of Controllers, Hand- and Pillar-type Starters.

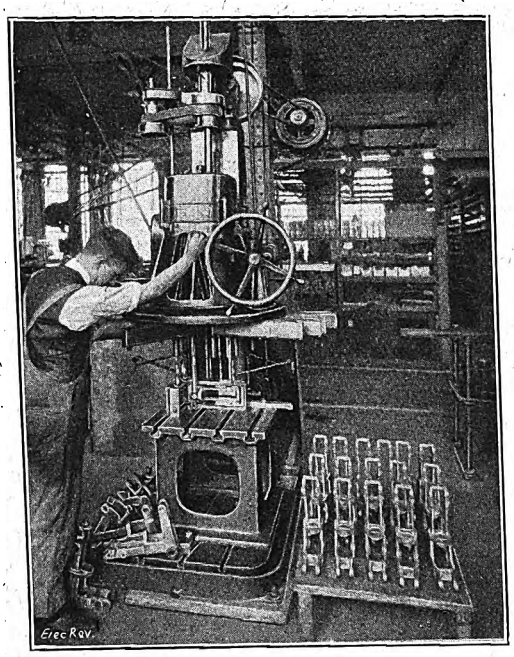

Fig. 8.—Multi-spindle Drill and Reamer.

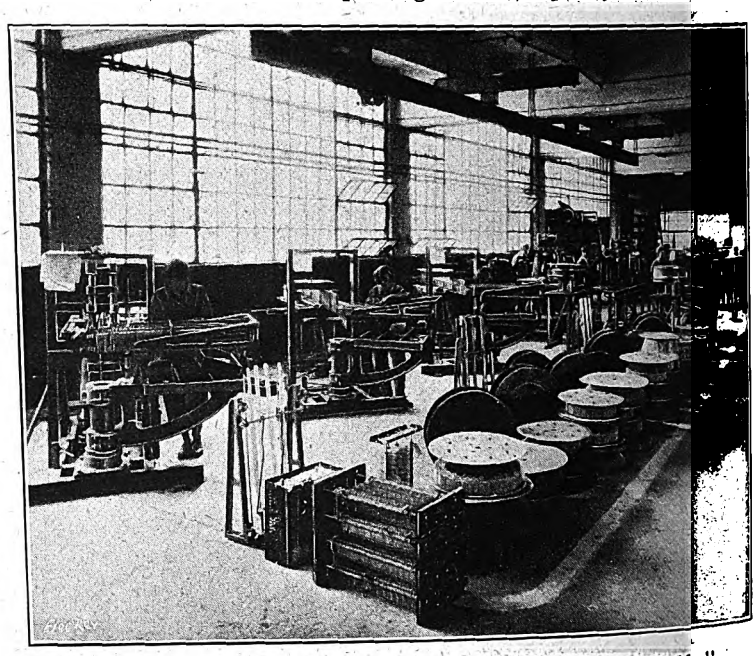

Fig. 9.—Winding and Assembling "Unbreakable" Resistances.

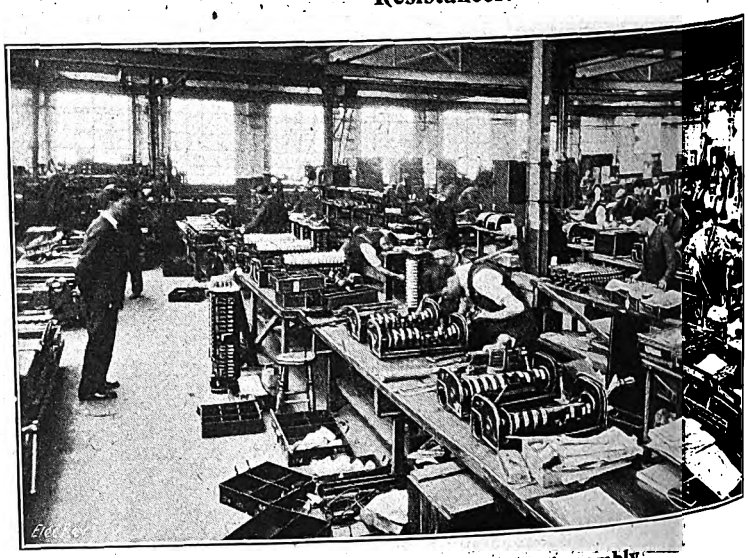

Fig. 10.—Drum Controller Assembly.

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top floor of the factory, a general idea of which can be obtained from fig. 7, is devoted to the assembly of controllers, hand starters, and pillar-type starters, and the winding of resistance tubes. Vitreous-enamelled units are wound on porcelain tubes and then enamelled in an electrically-heated oven, fig. 5, the temperature of which is automatically kept within certain predetermined limits and is continuously recorded on a chart by a Leeds & Northrup recorder, seen on the right in the illustration. This plant is capable of baking 9,000 resistance tubes per week. The units are enamelled at red heat, and on completion will, it is claimed, withstand over-loading to a similar temperature for comparatively long periods without permanent injury. As the wire is coated with a thick glaze, it is impervious to moisture, and appears to be a good form of construction for high-resistance units. Fig. 10 is a view of a section of this floor that is devoted to the assembly of drum-type starters.

An important product of this floor is pillar-type starters for both a.c. and d.c., and the faceplate as well as the drum-type are manufactured: d.c. pillars, comprising a drum-type starter with a step-by-step ratchet motion are supplied up to 1,200 amperes capacity; a.c. pillars, equipped with similar drum-type starters for rotor circuits and triple-pole contactors with overload relays in the stator circuits are supplied up to 500 amperes per phase.

Owing to the greater quantities required, d.c. faceplate starters necessitate special handling by the straight assembly line method, starting with the switch base at one end and finishing with the complete starter at the other. The number of operations to be performed by each worker is planned to occupy the same time, so that there should not be any accumulation of work between the operators. The necessary parts required by each operator are stored in suitable receptacles, so that they are handy to the operator with a minimum effort. At the end of the line the complete starter is tested and is ready for packing and dispatch.

Cast-grid and "unbreakable" resistances for crane controllers, trolley 'buses, tramcars, traction, neutral earthing, &c., are made in a separate building. Machines for producing and assembling the "unbreakable" resistances are shown in fig. 9; they are completed by fitting terminals and assembling in frames, final testing taking place in the enclosure seen in the background. The "unbreakable" resistance is composed of a continuous wire formed into grids on the machines seen in the background of fig. 9. The wire strip comes into the works in a continuous coil: it is first cleaned and then electro-plated to render it proof against corrosion; then it is fed to the grid-forming machine, from which it emerges as a continuous series of grids, which are coiled directly on to drums seen in the foreground of fig. 9. The next operation is that of building the grids into resistance banks, mounting them on mica-insulated tie rods with the necessary spacing and insulating washers, and then passing the product to the section in which the terminals and covers are fitted. If necessary, a number of boxes are bolted together to form a complete unit. They are finally tested for checking their resistance values and also their insulation values.

Obtaining Consumers in Rural Areas.

An outline of the propaganda that can be carried on by the E.D.A. and individual undertakings, and the salesmanship required to convert prospective clients into consumers.

By LT.-COL. W. A. VIGNOLES, M.I.E.E.

(*Abstract of a Paper read before the* Overhead Lines Association.)

The economic supply of electricity from public mains depends largely on the demand in the area to be supplied, and an indication of the possible demand is the density of the population. We may get a glimpse of the nature of the problem if we consider that 78 per cent. of the population lives in cities, towns, or urban districts, which only occupy 7.7 per cent. of the area of Great Britain, the remaining 22 per cent. of the population occupying 92.3 per cent. (this figure is reduced to 57 per cent. if we exclude woods and forests, deer forests, mountains and heathlands) of the area of the country; in other words, the average density of population in the towns is nearly 5,000 per square mile, while in rural districts it averages only 115 per square mile.

The problem is, however, not only one of density of population; it is in fact very complex, no two areas presenting exactly the same conditions. It is possible, however, to classify areas into at least three broad types: (1) villages, or districts, suburban in character, where the majority of the male population works in the town and earns wages on the town scale; (2) villages where the bulk of the population works on the land, and (3) rural areas with isolated farms and cottages. The first class of districts should respond well to propaganda and sales efforts, as the inhabitants will appreciate town amenities and will be anxious to secure them in their homes. The demand for electricity should be good, and the revenue be sufficient to make the supply of electricity a paying proposition. The second and third classes are definitely "rural areas."

The supply of electricity in rural areas has the advantage, as compared with supply in towns, that usually there is no competition from gas, while, owing to the cost of transport, coal is usually more expensive than in towns. Apart from coal our sole competitor is usually oil, used for lighting and to a considerable extent nowadays for cooking, but electricity for lighting at 9d. per kWh is as cheap as oil, while electricity at 1½d. is as cheap for cooking as coal at 50s. per ton, and in most cases cheaper than oil, while the use of electricity reduces labour, promotes cleanliness, and is altogether more convenient.

In towns it is possible to sell electricity at prices above the cost of competitive methods, as the greater convenience and the reduction in labour frequently represents a definite money value to the town dweller. In rural areas, among those with the smaller incomes, this is by no means the case; the rural dweller frequently does not spend money to meet his needs, but makes his needs match his pocket, while labour-saving devices make no appeal whatever. Even so, however, a cottager may easily spend 1s. per week on oil for lighting and 2s. 6d. per week for coal; that figure for lighting, while small, approaches the amount used in some small houses in towns.

In any kind of country the principal factor in obtaining success will be to secure the large houses, or farms, as consumers; if they can be obtained, it will be possible as a rule to supply the smaller premises in their vicinity.

I must not omit to remind you of the traditional nature of the rural dweller, slow of speech, and slow to make up his mind; such a man, or woman, will require much talk and persuasion before he, or she, will venture on a new piece of business. We must remember that he, or she, may never have purchased gas, or water, and that to buy electricity from a public undertaking is a great event.

Our problem of obtaining consumers in rural areas is really two-fold: (1) To create in the mind of the probable consumer the desire to use electricity, and (2) to convince him that he can afford to buy it. The ways in which we can tackle these problems can be divided broadly into (*a*) national propaganda, such as is carried out by the E.D.A.; (*b*) local propaganda; and (*c*) personal salesmanship. It will be an advantage to include urban as well as rural districts, as while the propaganda and sales efforts may have to be varied in the rural districts the greater return obtained in the urban areas will enable a more complete organisation to be developed. The first stage should be the circulation of propaganda in the area to be developed, before any decision to bring a supply into the district is announced. This can be linked with the work that the E.D.A. is doing, and should be followed by a series of lectures to women's institutes and other organisations. Such propaganda

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and lectures, it has been suggested to me, is best carried out by an organisation other than the undertaking which is actually going to sell the electricity (the cautious rural dweller looking with suspicion at anyone trying to sell him something), and the E.D.A. will very willingly carry it out when desired. Finally, there should be public meetings in the area, it being explained that unless sufficient support is forthcoming it will not be possible to supply the area. At such meetings all questions of cost should be discussed, answers given to would-be consumers, and efforts made to obtain actual signatures to supply agreements. It is desirable to secure the attendance of some prominent local man as chairman, while the attendance of the chairman of the electricity committee concerned, or a director of the company, as the case may be, will be appreciated. It will be found helpful to state clearly in the first instance the number of consumers required to enable the scheme to proceed; from time to time the number of signatures can be stated and, if properly worked, it will be found that the inhabitants of the area who want a supply will themselves assist to obtain the necessary signatures. As part of the propaganda in the early stages, small exhibitions of apparatus and kinema displays should be arranged in various suitable centres. Travelling exhibits arranged on lorries are useful, with a small petrol-driven set to supply the electricity required for the projector and for demonstrating small apparatus when exhibiting in districts where public supplies are not available.

When the necessary number of consumers has been obtained and the scheme is proceeded with, there will still remain a great deal of "selling" to be done. An undertaking that is well established should spend not less than one per cent. of its revenue on publicity and propaganda. An undertaking developing a new area would have to spend more than that as the revenue might be very small. In such a case the amount to be expended should be based on the revenue anticipated at the end of, say, six years. Perhaps I may say in passing that out of that amount of one per cent. my Association asks that one-tenth should be handed to it as subscription, to be expended on behalf of the undertakings on national propaganda. In other words, undertakings are asked to contribute £1 per £1,000 of their revenue towards a national propaganda scheme on which about £35,000 per annum is being expended.

Whatever scheme is adopted, each undertaking should have an adequately paid man in charge of the sales, with sufficient assistance and necessary transport facilities to cover the area.

Table I indicates the detailed scheme of expenditure on propaganda of an undertaking covering a rural and urban area, the total expenditure proposed being £1,000 per annum. It would be necessary to consider the character of an area before settling the exact allocation of expenditure between the various items.

TABLE I.

Item.	Expenditure per annum.
Local newspaper and parish magazine advertising ...	£200
Poster publicity on permanent boards (see E.D.A. booklet "Say it with Posters")	100
Booklets and literature for distribution	75
Direct mail	75
Travelling van with kinema and display of apparatus, hired, for a portion of the year	150
Exhibitions, allowance per annum; a portion might be accumulated and spent every few years on a large exhibition	200
Lectures, entertainments and film displays	100
Subscription to E.D.A., say, one-tenth of 1 per cent. of revenue	100
Total	£1,000

Travelling vans would cost a substantial amount, fitted ready for use, and must be adequately staffed, but it is thought that undertakings might be glad to have one for a part of the year and if there was sufficient demand for such a van the Council of the E.D.A. would be willing to provide one.

It is probable that selling efforts will be even more necessary in rural areas than in urban ones, owing to the lack of knowledge of the rural dweller. A good salesman suited to this particular work will be invaluable, but how is he to be found? Let us select a man for training who has some knowledge of country life; or, if he has no such knowledge, let us set about remedying the omission. A man who can discuss the crops and the seasons with the farmer, who can stay to tea and can keep his end up in the general conversation, who can handle a gun and join the farmer in a little shoot, will, if he knows the remainder of his job, go a long way. On the domestic side women demonstrators will be helpful, especially if they also understand country folk and can give an acceptable talk at a Women's Institute. These institutes are likely to be extremely valuable in the future. It is undesirable, however, that lectures should be given until there is some prospect of a supply being taken to the district.

The tariff and the provision of hire and hire-purchase facilities will have a great effect on the business done, and I hope all undertakings will introduce a two-part tariff with a charge per kWh not exceeding one penny; all undertakings should provide hire facilities.

What business is one likely to obtain in rural areas? The report of the Electricity Commissioners' Conference on Electricity Supply in Rural Areas indicates potential loads of the order indicated in Table II.

TABLE II.

Type of farms.	Yearly consumption, kWh. Farm house.	Farm power.	Total.
A. Arable and stock farm, 300 acres (with threshing)	7,000	1,800	8,800
B. Arable and stock farm, 100-150 acres (without threshing) ...	3,000	1,000	4,000
C. Large dairy farm, 300 acres (with milking plant)	7,000	7,000	14,000
D. Medium dairy farm, 100 acres (with milking plant)	3,000	2,600	5,600

Appendix 6 to the report of Sub-Committee No. 1 shows that 1,007 farms in rural districts in Great Britain in 1927 used on the average 1,400 kWh each. Appendix 9 shows the consumption on a 300-acre dairy farm with 300 cows to be as follows:—

Dairy use	7,700	kWh per annum
Lighting	500	,, ,,
Farmhouse, cooking, heating, washing, machinery, &c. ...	7,000	,, ,,
Lighting cottages	200	,, ,,
	15,400	,, ,,

I am inclined to think that we might estimate that where gas is not available we should, at 1d. per kWh, plus a fixed charge, or on a prepayment meter, be able to secure a revenue of, say, £2 per annum from the smallest cottages, and of from £5 to £10 per annum from a normal farm, while supply to large farms and houses may run into very large figures.

I have recently received information from the U.S.A. about progress with rural electrification in that country. At a conference held there recently it was stated that in many cases it had been shown that electricity supply "cost nothing at all"; in other words, by using electricity the farmer had increased his net earnings by more than the cost of the electricity.

In this country, as in the U.S.A., there appears to be ample evidence that at anything like a reasonable price electricity can be shown to be a paying proposition for the farmer, at least to those engaged in dairy and poultry work. I want to enthuse my hearers with some of my confidence in the future of rural electrification. However, I do not want it to be assumed that I think every case must, of necessity, be profitable.

In the important question of rural industries there are enormous possibilities. With the aid of electricity the village craftsman and worker should be able to compete against the town.

Discussion.

Mr. G. F. MORRIS (Farmers' Union) said that three years ago he agreed to poles being placed on his land for the purpose of a public supply of electricity, on the understanding that he would receive a supply himself; but, although he was suffering the inconvenience and loss occasioned by the presence of the poles, he had not yet been given a supply, neither had he received any compensation in any shape or form for the poles being placed on his property. That was hardly the way to encourage the development of electricity supply in the countryside. It was necessary to prove to the farmer that if he was to sacrifice his internal-combustion engine, it was going to be replaced by something which was at least as good, if not better; but from figures which the Farmers Union had collected they were not yet convinced that a public supply of electricity would be cheaper than the power provided by the internal-combustion engine. Further, farmers and those in rural areas would be much more quickly convinced of the advantages of electricity by practical examples of what could be done and a little less propaganda. Moreover, too much reliance must not be placed upon the immediate return from any particular area; rather should the matter be looked at from the possible ultimate position. Therefore, electricity must be cheap at the very beginning, so that power on farms would be at any rate not more costly than that at present obtained from internal-combustion engines.

Mr. ANDREW MCDOWALL said he had always regarded the greatest use of electricity on the farm as being for ploughing, and in that connection the price was all important. At present in the Lothians power was charged for at 2½d. per kWh, and at that charge a day's threshing cost 16s., as against 9s. or 12s. with a paraffin-oil engine. Farmers were asked to scrap oil engines costing £150, and of which the second-hand value was probably £30, and then to spend another £100 on electrical equipment which cost more to run than the original oil-engine equipment. When he first approached the Lothians Electric Power Co. for a supply he was told it would cost £1,600 to bring it to his farm, and the matter was allowed to drop for some years. Subsequently he collaborated with some other farmers, and by providing the power company with all the necessary unskilled labour for putting up the poles, &c., and giving wayleaves free of charge (so long as the power lines were kept to the fences) he was able to get the line laid at a cost, to him, of only £35. It was only by working on that basis that economical distribution could be ensured. At the moment arable farming was an absolutely hopeless proposition, and it was only by obtaining cheaper tillage by the use of very cheap electricity for ploughing that arable farming could be maintained. Electrical engineers as a rule knew nothing whatever about tillage, however, and

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that was the difficulty. At the moment he was building his second tractor, but he had only been able to do it with the assistance of the General Electric Co., Ltd., and W. T. Henley's Telegraph Works, Ltd. Those two companies had considerably assisted in building an experimental tractor for electric ploughing, which he regarded as the real sort of propaganda that was essential. It was no use talking about what electric ploughing could do; farmers would only believe it when they saw it, and he suggested to the electrical industry that the biggest market for electricity on farms was in arable farming. As to the low-voltage lines the farmer required, he had been able to use timber cut in the district with the assistance of the people owning the "Cobra" system of impregnation, and in that way had been able to erect very cheap overhead construction, using green local poles.

Mr. R. Borlase Matthews, who said he shared the author's confidence in the future, objected to the suggestion that two-part tariffs would be used; he preferred multi-part tariffs because of the need for providing for water heating at times when other loads were not on. He would also like to see a tariff based on a standing charge per acre of arable land, say, 2s. 6d., plus 1d. per kWh. In addition to the various suggestions of the author for publicity, good use could be made of monthly propaganda magazines. One of the serious troubles of farmers was to find capital to purchase electrical machinery, but the farmer was in a more favourable position than the average person inasmuch as he could borrow on very reasonable terms from the Agricultural Credit Corporation, or from other organisations, such as the Land Improvement Scheme, on the basis of 15 years' purchase at about 7½ per cent. per annum, whereas ordinary hire purchase amounted to a great deal more, although people often did not appreciate that fact. Another difficulty was linking up high-speed motors with low-speed farm machinery, and speed-reduction gear that was simple and cheap was required. It was also necessary to get back to the individual drive, because experience showed that where portable motors had been used on farms they were being given up in favour of an individual motor connected to each machine, owing to the saving in time and labourers' wages. Comparison should not be made between the actual cost of fuel of an oil engine and the cost of electricity; there was also the time taken in starting an oil engine on a cold winter's morning to be taken into account, together with the cost of lubrication, depreciation, maintenance, &c. He was convinced that the oil engine on the farm would disappear as surely as it had gone from the town. He was pleased to hear what Mr. McDowall had said with regard to electric ploughing; the Royal Agricultural Society was proposing to arrange for some tractor trials on a scientific basis in the autumn of next year, when he hoped Mr. McDowall's tractor would be seen, together with other electric ploughs. Electric ploughing involved the use of about 30 kWh per acre, which indicated the possible demand from the supply authority. An acre could be ploughed for a current cost of 2s. 6d., against 25s. for the ordinary horse plough, so that there was ample margin for depreciation, capital cost, &c. Moreover, farmers who had had experience of electric ploughing were enthusiastic about the better crops that could be grown, owing to the greater uniformity of the ploughing.

Major T. Rich remarked that in looking at the activities of the E.D.A. it seemed to him that they started at the wrong end. There was too much propaganda and advertisement, instead of taking up a particular matter in a practical way and showing what could be done. Why was it not made clear also that one of the reasons why electric lighting was not developing in the manner it should was that electric lamps cost 1s. 11d. in this country, whereas in America, where the labour cost was greater, lamps could be bought for 1s. In France 21,000 villages and small towns were served with electricity, and that had been done without covering the place with posters, &c. It had all been done by the electrical engineer, the farmer, the Department Genie Rurale, and the farming co-operative societies. That type of development, however, could never take place in this country under present conditions. If a supply authority wanted to erect a transformer kiosk on some village green it meant months of correspondence, and all sorts of people talked about spoiling the countryside. As regarded what Mr. Borlase Matthews had said about individual motors, he did not think it was advisable to talk too much at the early stage of a separate motor for each machine. The portable motor was an extremely useful thing, and there was one company on the Continent which made nothing but electrical apparatus for farms. It had made 15,000 portable farm motors, and at the last Agricultural Machinery Exhibition in Paris there were about 15 makes of portable motor for farms. The electric ploughing problem was a very different one in this country, compared with other countries. In this country there were tiny farms, whereas on the Continent big rolling lands lent themselves to electric ploughing much more effectively and economically. There need be no difficulty with regard to reduction gears, as there were plenty that had been found satisfactory abroad, where he had also seen a little motor which could be carried about and set up on a tripod and applied to any particular operation. One firm had made 1,500 of them for French farmers. At the Ideal Home Exhibition there were wooden washing machines which, alone, cost £7, but when a small motor was added the charge was £24, and their makers could not understand why people would not buy them. In France there were 20, or more, makes of cheap electric washers, none of which cost more than £14, and they were made of copper. It was absurd to expect the ordinary working man to pay £30 or £40 for all kinds of gadgets. It was for those reasons that he contended there was too much poster, too little effort, and too little genuine manufacturing.

Mr. W. Fennell, president, who proposed a hearty vote of thanks to the author, said there could be no complaint of the liveliness of the discussion, but he would pay the author the compliment of devoting his attention to the paper. As regarded future development in districts bordering on towns, he looked forward to "ribbon" building, *i.e.*, houses built alongside the main roads and not clustered in districts as at present, and electric supply must be laid out with an eye to that development. Cities, as they knew them, would begin to decay, a process, indeed, that had already started. As a matter of fact, he was designing his system with that end in view, taking high-pressure mains right through to the consumers. From that point of view it would seem possible that Col. Vignoles had been looking backward rather than forward. It would be interesting to know if there had been any tests of electric cooking with electricity at 1½d. per kWh, compared with oil stoves. Undoubtedly one of the best advertisements for electricity was electricity, *i.e.*, the satisfied user was a centre for beneficent contagion. He had found a stall at the local agricultural show to give good results, but the suggestion to advertise on sub-stations by posters was open to objection in the country by the Society for Rural Preservation. One system for dealing with the cottager adopted for the past ten years in his area was to install two lamps in small cottages for an all-in charge of 1s. per week, without any meters, and that had gone very well.

Miss B. Swire, as one who had to try and sell apparatus, said there was little doubt that the public was enthusiastic for electricity, but the cost of such apparatus as washing machines was much too high to be within the means of the ordinary householder. She advocated such local exhibitions as that held last year at Aylesbury.

The President expressed appreciation of the suggestion made in the paper that the Council of the E.D.A. would provide a travelling van, if there was a demand. Engineers must see to it that there was a demand.

Mr. W. A. Turnbull (Aylesbury) said that the ordinary type of propaganda did not go very well when dealing with rural districts, and he suggested having stalls in the local market place on market days as a very useful method of attracting the notice of the rural population. He claimed that at Aylesbury he had been able to show that it was possible to make a success of rural electrification, although in doing that he had had some assistance from the Government. He was getting 2½ per cent. of his interest paid, but that was on condition that he used unemployed miners and also British cable. The latter meant an increase of 50 per cent. over the price paid for foreign cable, and therefore it became questionable whether there was any advantage in having Government assistance in that matter. He looked forward to considerable development in the use of electricity for poultry farming.

Mr. W. Napier Prentice suggested that the workpeople employed by the supply companies should be encouraged to become shareholders, a principle that could also be applied to the consumers. That was good propaganda, because, being shareholders, those people advocated the use of electricity among their friends, and so helped the undertaking along. The establishment of district committees consisting of local inhabitants to assist the supply authority was another method which had been found to have useful results.

Mr. F. M. Long (Norwich) suggested that it was not advisable to do a lot of canvassing before the supply was available in any particular district, because people became disheartened when a supply was talked about a long time before it became available. His experience was that as soon as a supply was available in a village, the consumers came along quite rapidly. He also made it a point to get on friendly terms with members of parish councils, and to hold exhibitions, &c., locally, all of which made things easier. There was no difficulty in getting lighting into a village, but he regarded that as only a beginning. It would never pay to carry a line any distance for lighting only, and efforts must be made to develop the cooking and heating load and also water heating. General national propaganda was very useful, and the work done by the E.D.A. in that connection was extremely valuable.

Mr. J. N. Perks expressed his dislike for advertising in local papers and preferred the direct mail method. Therefore, he suggested that the sums proposed to be spent on those two items by the author should be reversed.

Lt.-Col. Vignoles, replying to the discussion, referred specially to Major Rich's comments that there was too much "eye-wash" and propaganda about the E.D.A., and not enough work. However, Major Rich had asked that the E.D.A. should assist in obtaining wayleaves for the supply authorities, which meant propaganda. As a matter of fact, the E.D.A. had done a great deal to obtain wayleaves by showing the farmers the advantages of electricity supply and allowing lines to cross their property. A great deal in the same direction had also been done by appropriate Press articles. Major Rich had given a great deal of useful information about what was being done on the Continent, but his experience was that people in this country did not take much notice of what was being done elsewhere. They could not impress the English farmer by telling him what was being done in France. It was necessary to prove to him that electricity would help him in the

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problem of making his farm pay, and that was the salesman's problem. The E.D.A. could induce that frame of mind by national propaganda and make people talk about things, but the final work must be done by the salesman. The suggestion of Mr. Napier Prentice to make consumers shareholders was a method which was practised very largely in the United States and had been very effective, as a matter of fact, as a method of countering municipal control of electricity supply there.

Rural Electrification.

A Government Demonstration Area in Bedfordshire.

LAST week it was announced officially that in view of the increasing opportunities for the spread of the use of electricity which will follow upon the coming into operation of the schemes framed by the Electricity Commissioners under the Electricity (Supply) Act, 1926, and now being rapidly adopted by the Central Electricity Board, the Minister of Transport had for some time past had under consideration means whereby the advantages of electricity supplies to typical rural communities could best be demonstrated and the demand therefore tested.

He has been impressed with the desirability of initiating an experiment with the object, primarily, of ascertaining what results may be expected from the development of electricity supply in a typical rural area if proper methods of canvassing and of demonstrating the advantages of the service are adopted, and if facilities are afforded to enable the prospective consumer to wire his premises and obtain the necessary electrical apparatus under some system of deferred payments.

After careful consideration of various districts in Great Britain which might suitably be selected for the experiment, an area of approximately 100 square miles in extent, lying to the north and west of Bedford and within the area of supply of the Bedford Corporation, has been selected and, as a result of an application made by the Bedford Town Council to the Development Commissioners, the Treasury has agreed that for a period not exceeding 10 years advances shall be made from the Development Fund to the Town Council of such sums (not exceeding £8,000) as may be required to meet 75 per cent. of the actual annual deficits on the working of the scheme, if any, such advances to be subsequently repayable out of surpluses.

In order that the progress of the scheme may be facilitated and its results closely watched, it has been arranged that the advice and assistance of the Electricity Commissioners and of the Development Commissioners will be available to the Bedford Corporation, which has agreed to co-operate in every way.

It may be explained that the scheme alluded to above is being undertaken experimentally with the object of demonstrating how electricity may be brought within the reach of everybody living in a strictly rural area in which mixed farming is the main industry. The area to be covered by the proposed scheme, according to the 1921 census, has a population of 17,937, with 4,573 dwellings.

The estimated cost of the work is understood to be £129,385, of which, however, £28,901 has already been expended by the Corporation during the last four years. The estimates are based on the assumption that at the end of six years 75 per cent. of the dwellings in the area will have been connected, and that by then the average revenue from every village connection will be £6, from every farm £18, and from each country residence £30. It is primarily on the realisation of these assumptions that the financial success of the scheme rests. The estimates also provide for the suspension of repayment of capital, or of payments to the sinking fund, during the first five years on a portion of the capital. It is estimated that during each of the first three years there will be a deficit, namely, in the first year £1,816 (constructional year), second year £2,845, and that from the third year onwards there will be an excess of income over expenditure, and that the accumulated deficit will be wiped off at the end of the fifth year.

It was in recognition of the fact that the adoption by the Corporation of the scheme is estimated for a period of three years to entail an annual loss that the Minister of Transport recommended the Treasury year by year to advance loans to the Corporation out of the Development Fund, subject to payment of interest, but not repayable until the scheme becomes self-supporting.

The experiment will be watched closely by all who have already initiated similar schemes, or contemplate doing so, in other parts of the country. It will be carried out under favourable and attractive conditions, which is an additional reason why the venture should be successful and thus vindicate those engineers who have long contended that the electrification of rural areas is a practical proposition, and remunerative, when undertaken in the proper spirit, and adequate facilities are provided for doing the preliminary installation work.

Electro-plating Equipment.

Some notes on plating vats and methods of heating the solutions in them.

(*Extracts from a Paper read before the* ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY.)

AT the last meeting of the Electroplaters' and Depositors' Technical Society, Mr. J. W. Perring read a paper on the above subject, in the course of which he said there were a number of materials that could be used for making vats, or containing vessels, for electro-plating solutions; their use was determined by cost, ease of manufacture, and suitability for the solutions they were to contain. They ranged in size from a few gallons to 50 feet or more in length, as follows: wood vats without linings; slate vats; stoneware and glass, round and rectangular; cast-iron, enamelled and plain; iron, rivetted and welded; lead-lined wood vats; asphalte or hard rubber; ebonite lined; concrete, or brick.

Heating Solutions.—There were a number of methods of heating solutions: by steam, gas, thermosyphon, and electricity. Solutions were usually required to be worked at about the following temperatures: cold 15 deg. C., warm 100 deg. F., hot 40-50 deg. C. Cold solutions could be maintained at fairly constant temperatures by keeping the shop at an even temperature, especially at night; if more attention were paid to this, many of the troubles attributed to the weather might be eliminated. Warm solutions could be heated in various ways, but for hot solutions electricity was too costly, and steam or gas was usually used.

Steam heating was probably the cheapest method. Steam could be allowed to pass direct into the solution, and the noise prevented by means of a special fitment. That method was convenient for hot-water tanks, but not solution, as the steam condensed and gradually filled the vat. Steam coils should be designed to bring the solution up to temperature quickly, and the steam then be regulated to maintain the required temperature.

Gas could be burnt under a suitable steam boiler, but would probably be dearer than coal. Iron tanks were usually heated by means of rows of Bunsen flames, the top of the luminous cone being level with, or just below, the bottom of the tank. Lead-lined vats could be heated by means of a lead tube, with a sealed bottom containing an inverted Bunsen burner, the tube being suspended vertically in the solution, actually a gas immersion heater.

Electric Heating.—Usually electric heaters were of the immersion type, the outer casing being made of a material not affected by the solution. That was an ideal method of maintaining the solution at a constant temperature throughout the 24 hours, especially when only about blood temperature was required, *e.g.*, for building up with nickel. Immersion heaters with special casings, such as silica, were fairly expensive.

In designing electric heaters one met with the following difficulties: the actual element must be insulated electrically from the solution. Unfortunately, most suitable electrical insulators were also good thermal insulators; thus one had to force heat through a poor conductor, which meant that the element could not dissipate its heat so quickly; if one chose an insulating material of high dielectric strength one could make the insulation very thin. Mica answered that requirement, even when the element had to run much hotter than the solution. A number of nickel-cased immersion heaters gave trouble due to corrosion; they were placed in larger containers containing oil, and were still in use after some years.

Thermostats.—When accurate control of temperature was required thermostats could be obtained to open and close a valve, or operate a switch in case of electric heating. Even when accurate control of temperature was not required, they would soon pay for themselves, as they prevented waste of energy.

Discussion.

Mr. E. A. OLLARD said that when iron vats were used for chromium solutions, if the work tended to approach the sides of the vat sheets of glass could be hung round the sides, rough glass containing wire netting being very suitable for the purpose. With regard to immersion heaters, filling them with oil prevented much trouble. It was necessary to see that they were not earthed, since if the anode side of the circuit were also earthed they would be likely to corrode anodically.

Mr. F. MASON said that electrical measuring instruments were still not as much used in the plating shop as they might be, while occasionally they were misunderstood. In the case of silver-plating plant, often the water which was allowed to run to waste contained appreciable quantities of recoverable silver; in one plating shop where that water was collected and evaporated by means of waste steam, the cost of the plant was recovered about twice over in the course of a year's working.

Mr. S. E. WEILL said that wood, if properly prepared, for example, pitch pine free of knots and thoroughly soaked in water, was the best material for vats. The chief objection was the expense, about three times that of lead-lined vats

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One of the best ideas for strengthening tanks was an American one, the trussed-beam method being used instead of upright supports.

Mr. A. E. Boulter said a very necessary plating requisite which had yet to be produced efficiently was a false bottom which made it possible to recover dropped work quickly.

Mr. R. Hammond could not agree that earthenware vats were ideal. Generally they failed through being porous, or due to the separation of the glaze in large flakes from the outside.

Mr. H. Lovelock said that match linings to nickel vats often resulted in brittle and cracked deposits in thick nickel deposition. Electric heaters, though giving good results, were much dearer usually than any other means of heating.

The author responded to the discussion, and was accorded a vote of thanks.

Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

Portable Meter Box-Seats.

For use in hotels, boarding houses, and the like, the Brompton & Kensington Electricity Supply Co., Ltd., 254, Earl's Court Road, has introduced in its service a range of portable meter boxes, figs. 1 and 2, consisting of readily portable boxes or box-seats fitted with electricity prepayment meters. Each box-seat is fitted with a plug base of a certain size, into which

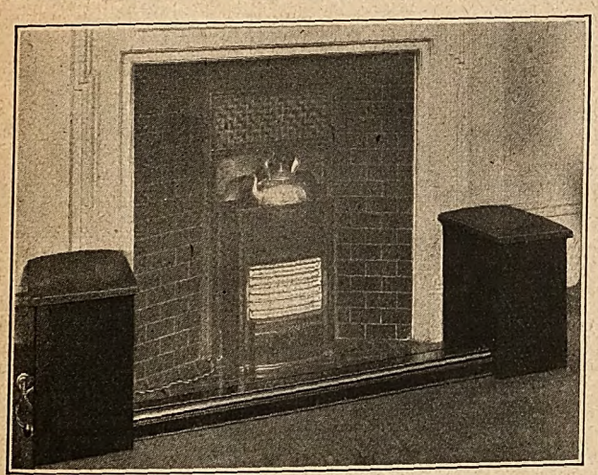

Fig. 1.—Curb Fender Incorporating Meter Box.

the plug attached to the flexible cord of the electric fire fits. A flexible cord is taken from the meter box with a plug top attached, which fits into the plug base on the skirting of the room in which the electric fire is used. This latter base is of a different pattern or gauge to that on the box-seat, so that it cannot be plugged directly into the wall plug base, but must be connected through the medium of the meter box. The meter box-seat is usually supplied in the form of an upholstered seat, but it can be made up in any convenient size, shape or material, to match furnishings, and is thus as unobtrusive as possible. Fig. 1 shows a curb fender with one end fitted as the meter box. The other end can be used for storing the kettle and utensils for heating water, &c., used on the boiling ring of the hotel-pattern radiator. The

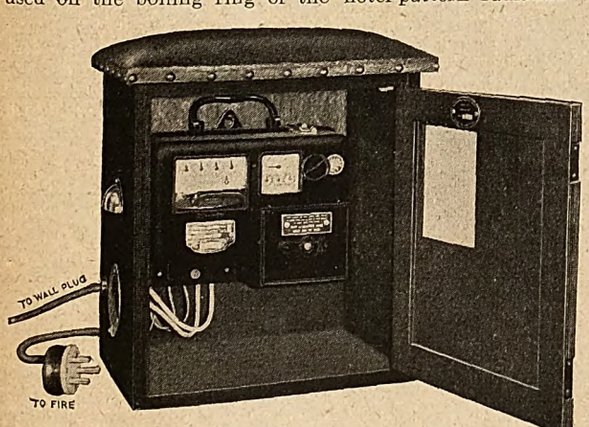

Fig. 2.—Meter Box, Open.

advantage of the device is that, when a guest desires to have an electric fire, it is sent to the room (with prepayment meter) all ready for use. Further, when the electric fire is not required it can be removed complete with the meter box. In this way the proprietor need only provide as many meters as the fires actually required, with a consequent saving in cost.

Electric Baking in Cape Province.

The exceptional benefits which accrue from the adoption of electricity for purposes of cooking are realised to-day in unexpected places. While we are familiar at home with the practice of baking bread and confections by means of electric ovens, it is not so usual to find similar methods employed in what is tantamount to an English village right in the

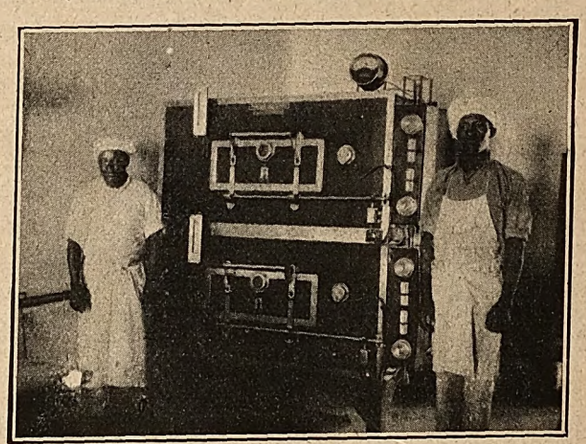

Fig. 3.—"Magnet" Oven under "Coloured" Control.

heart of the "Dark Continent." Yet a "Magnet" double-deck oven, fig. 3, manufactured by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has recently been installed in Worcester, in the Cape Province, providing an example of enterprise and an appreciation of modern efficiency in baking processes, which might well be regarded as a striking commentary on the nonchalance to be observed in many directions at home in this particular phase of activity. The oven is working to the entire satisfaction of the proprietor as to quality of output and economy in running costs, and apparently the coloured bakers concerned in the baking operations have already proved adept at their work.

An Automatic Electric Iron.

The "Embob" electric safety iron, fig. 4, which has been introduced recently in this country by Mr. Maurice Bobin, 15, Farringdon Avenue, E.C.4, is fitted with an automatic safety device designed to cut out the element when its tem-

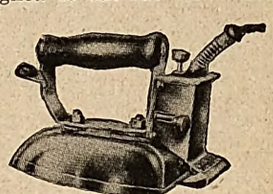

Fig. 4.—The "Embob" Automatic Iron.

perature reaches 200 deg. C. The automatic switch is operated by the expansion of a brass rod. The switch, which is carried at the back of the handle, can also be switched on and off by hand by means of the buttons at the top and side, respectively. The iron is highly plated, and weighs about 6 lb. The loading is 450 W.

An Electric Washer with a Heater.

Our attention has been directed to the "Locomotive" electric washing machine marketed in this country by the Sloan Electrical Co., Ltd., 8, 10 & 12, Golden Lane, E.C.1. By means of a crank on the shaft of the driving motor the main copper tank is moved to and fro, and by reason of this and

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the shape of the tank the water is given a "figure 8" motion, and is swirled through the clothes. Beneath the tank is fitted a 600-W heating element which can be switched on a reasonable time before washing is commenced, to boil the water.

Electric Cooking Experiments.

"Electro-cooking" may become popular among housewives of the future if experiments now being conducted in the laboratories of the Iowa State College in the United States prove successful. For some time now experiments have been made in cooking foods by passing electric currents directly through them, and it is said that the method is economical in both the time taken and the current used. It is possible, it is claimed, by this method, to cook five potatoes in about 14 minutes, using half as much current as by the ordinary method of baking. It is said that the foods are cooked simultaneously all the way through, and that potatoes, when examined under the microscope, show that the starch grains have been actually exploded by the intense heat.

A Panel-warming System.

It is claimed that just as a modern lighting installation provides for evenly-diffused illumination, free from glare, so the Dulrae (electric) panel-warming system, a production of Messrs. Grierson, Ltd., 4, Bloomsbury Place, W.C.1, provides an evenly-diffused warmth, free from hot-spots, by means of relatively large areas of ceiling warmed to a low temperature, 85/95 deg. F. with an outdoor temperature of 35 deg. F. In buildings and rooms where this system has been adopted, it has been found by test that all walls, ceilings, floors and furniture attain a temperature either equal to or slightly higher than the air temperature.

The standard panels for use on 200/250-V systems are manufactured in 400-W units, having an area each of 12 sq. ft. Convenient sizes are 6 ft. by 2 ft. or 4 ft. by 3 ft. Small panels, 3 ft. by 1 ft., for use four in series, are also provided to meet special requirements, such as long shallow panels, the provision of space for lighting outlets, and so on. A feature of the system is the automatic temperature control adopted, and the patentees emphasise the desirability and the economy of operating the system continuously during the heating season, *i.e.*, 24 hours per day for seven months in the year.

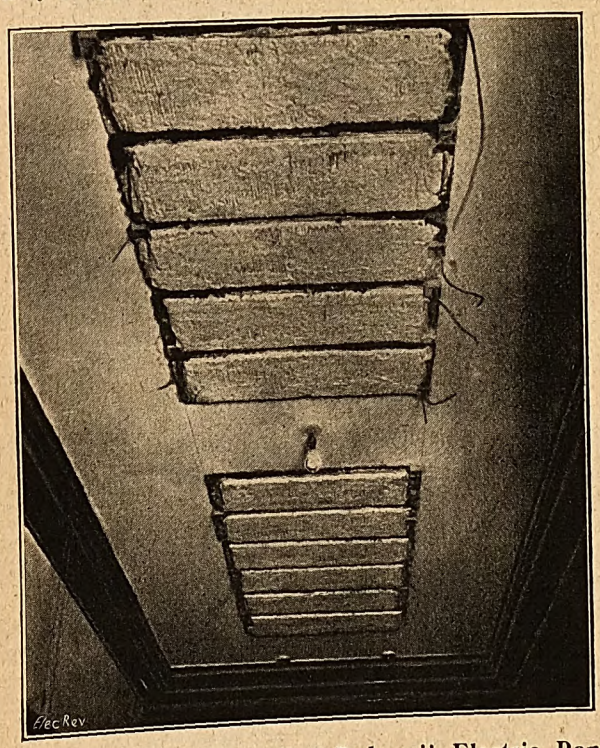

Fig. 5.—Group of Small "Dulrae" Electric Panels fixed to Hall Ceiling.

An interesting proof of the heat storage of a building is shown by the following figures taken during a week in February, when the outdoor temperature varied between 27 and 42 deg. F. The figures are reduced to units per deg. rise in the final column, and indicate the economy of continuous use; they are for the first weeks run of a new installation:—

Day.	Mean outdoor temp.	Mean indoor temp.	Mean temp. rise.	Units used.	Units per deg. rise.
Tues. ...	31.5	60.0	28.5	282	9.9
Wed. ...	30.5	59.1	28.6	232	8.1
Thurs. ...	34	58.6	24.6	196	8.0
Fri. ...	35.5	60.0	24.9	190	7.65
Sat. ...	39	60.6	21.6	149	6.9
Sun. ...	37.5	60.5	23.0	155	6.75
Mon. ...				155	

Regarding cost of operation, a room on the first floor of an old London square house, facing north, containing a cube of 3,320 feet, and averaging one occupant, shows the following result on automatic temperature control:—

Month.	Days.	Units used.	Total cost at 1d. per unit.	Cost per day.	Cost per day per thousand cubic feet.
March ...	23	241	20/1d.	10½d.	3.16d.
April ...	26	310	25/10d.	1/-	3.61d.
May ...	15	68	5/8d.	4½d.	1.35d.

Another interesting feature of the system is that due to the heat storage of the building, materials and furniture, after the installation is switched off, the fall in temperature is very low, *e.g.*, 1½ to 2 deg. per hour for a substantially-constructed building. This indicates that time switches can be installed to ease peak loads on systems where they only persist for a short period and occur at a definite time each day. It is desirable that each room should be provided with its own temperature-control device, so that the occupants can adjust the temperature to the degree desired. A feature of interest to supply engineers who are concerned regarding the abnormal increases in the maximum demands, is that installations on this system clearly consume the maximum number of units during the cold night period. A reply to the criticism that the system is topsy-turvy, for heat rises, and therefore the floor is the right place for the panels, is that warm air rises because it is lighter than cool air; radiant heat waves, just as radiant light waves, can be directed in any direction desired, and the patentees claim that the panels "spray" the occupants of the room with low-temperature radiant heat rays, both directly from the panels and indirectly from walls, windows and furniture.

Fig. 5 shows a group of 12 small parcels, each 36 in. by 12 in., fixed to an existing hall ceiling. The panels are shown, of course, after erection, but before plastering.

Selected Radio-telephone Apparatus.

Recent Developments and Improvements.

The "Hypermu" Transformer.

An interesting recent addition to the range of products marketed by Radio Instruments, Ltd., is an inter-valve transformer in the construction of which one of the new nickel-iron alloys is employed. We are informed that the National Physical Laboratory test curves indicate that not only is the amplification of the new component very great, but that it is also maintained at an approximately uniform rate over the whole range of useful frequencies. Although this is by no me ns the first inter-valve transformer using nickel-iron alloy, it is claimed to be the first to be fitted with an iron screen enclosed in a bakelite case. The remarkable curve obtained with this iron is largely due to the arrangement of the magnetic circuit, allowing the use of a small number of turns to give high primary inductance. An additional useful factor in the design is that the primary effective resistance and inductance produce the exceptionally straight-line curve when the whole of the d.c. component is shunted by a 30,000-ohm resistance. The curves are very good for a commercial inter-valve transformer of its size and weight, and reflects credit on British research and enterprise.

The "Ethogram."

The handsome instrument marketed under the above name by Burndept Wireless (1928), Ltd., is self-contained, and needs no external connections. As its name implies, a four-valve radio receiver, gramophone, and loud-speaker are combined complete in the one cabinet. The screened-grid and power valves work with a frame aerial and the gramophone reproduces electrically, of course; 30 records can be stored alongside the turntable, which is driven silently and controlled by a push button. A single switch controls wavelengths of from 235 to 540 and 900 to 2,100 metres, and the tuning dials are calibrated in wavelengths.

A Philips Receiver.

Not often does one hear of a receiver designed for both short- and long-wave reception with high-frequency amplification from 10 to 2,400 metres. Messrs. Philips Lamps, Ltd., now supply a set (type 2802) that is intended for loud-speaker reproduction over that range. The circuit consists of a screened-grid high-frequency valve, a detector, a low-frequency amplifying valve and a pentode output valve; the latter can be switched out of circuit if desired. Six interchangeable coils are used to cover the tuning range, and tuning controls are the same on all wave-lengths; below about 100 metres the tuning is necessarily critical, but calibration curves are given for wave-lengths below 160 metres. A feature is that there are no flat spots (when oscillation suddenly stops), and no threshold howl when tuning near the oscillation point on the ultra short-wave lengths. The low-frequency part of the set can be used in conjunction with a gramophone pick-up for

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reproduction by means of a loud-speaker. Any ordinary aerial may be used, but on the shortest waves an indoor aerial of a few feet of wire is often all that is necessary. The receiver is enclosed in a metal and bakelite case built to withstand extremes of temperature, and it is claimed to be possible to use a mains h.t. supply unit without hum on wave-lengths down to 10 metres, which feature has hitherto been unobtainable with an ultra short-wave receiver.

Ferranti Transformers.

Messrs. Ferranti, Ltd., recently advised us that in future all audio-frequency and output transformers manufactured by them will have their primary and secondary terminals reversed from what has hitherto been their standard positions. Looking at a transformer from the primary side the plate terminal will in future be on the right-hand side, and in the same way observed from the secondary side the grid-bias terminal will be on the right-hand side. This alteration, whilst in no way affecting the performance of the component, should lead to an appreciable simplification of wiring.

A Testing Instrument.

The Standard Wet Battery Co. has sent us a sample "Wates' Volt-Amp. Meter." This useful little instrument, in a strong leatherette case, is of pocket size, and should enable the user to detect many of the common faults to which radio receivers are subject. It has a triple reading dial: 0 to 6 volts, 0 to 150 volts, and 0 to 30 milliamperes, its resistance being of the order of 5,000 ohms. It is quite simple to adapt the meter for many purposes, including the testing of battery eliminators, and the copious instructions supplied with it are helpful. Simple periodical check tests cannot fail to improve reception.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Automatic Motor-starting Device.

Various patents taken out by Mr. R. LAGNIEZ, of Neuilly-sur-Seine, have resulted in an unusual device for the automatic starting of electric motors which is about to be introduced in this country by Mr. Grunwald, 112, Strand, W.C.2. The apparatus is designed for attachment to the motor shaft, with

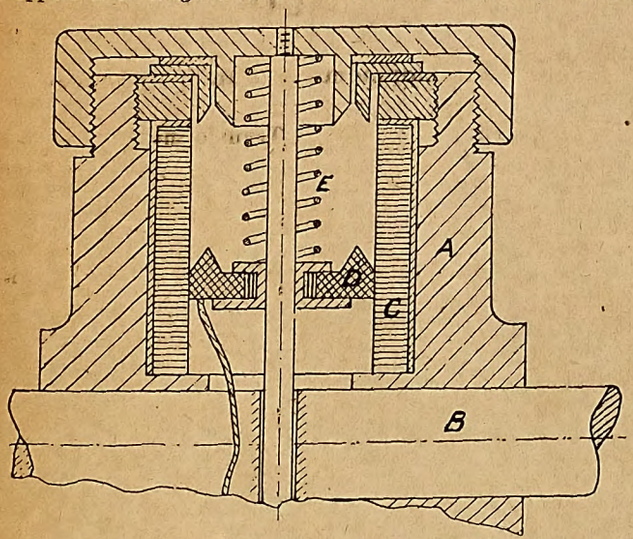

Fig. 1.—Arrangement of Automatic Starting Equipment.

which it revolves, its operation depending upon the centrifugal force produced. The principle is that of the potentiometer type of variable resistance, part of all of the resistance wire, according to the stage in the starting operations, being in series with the motor windings through a sliding contact. Fig. 1 shows simply the arrangement of the apparatus. A cylindrical holder A is rigidly secured to the motor shaft B, and

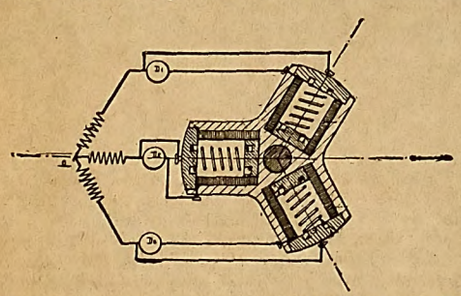

Fig. 2.—Connections for use with 3-phase Motor.

carries at its interior surface, also in cylindrical form, the wound resistance wire C. The sliding contact D moves outward under the influence of the centrifugal force and against the tension of the spring E. Fig. 2 depicts the arrangement for a 3-phase wound-rotor motor. The following claims are made for the apparatus—that it can be easily adapted to most standard motors, in many cases inside the motor frame; that it permits no abrupt variation of current during the period of starting; that there is no sparking at the points of contact on the resistance wire; and that the starting time can be regulated by calculation of the resistance.

A Cable-trunk System.

The "Turret" cable-trunk conduit system recently introduced by POWER CENTRE CO., LTD., 15, Park Lane, Liverpool, consists of heavy-gauge sheet-steel troughing A, fitted with detachable cover plating B on its front side. The upper side of the trough, fig. 3, is so shaped by a projecting continuous lip C as to throw off any drip or moisture which may collect on the top, and the cover plate fits well inside this projection. The cover also has a continuous projecting lip on its lower edge D, which again serves to carry away any drip, the troughing being made of one continuous sheet, forming the base, side and top, and is practically damp-proof. The cover plate is secured to steel strips E at intervals, these being easily removable to

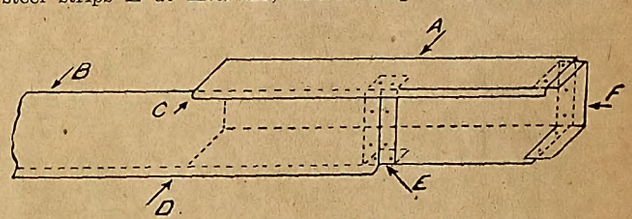

Fig. 3.—"Turret" Cable Trough.

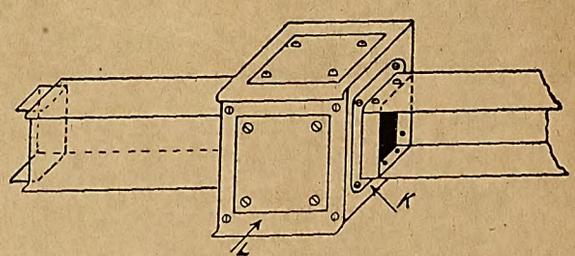

Fig. 4.—"Turret" Tee Box.

enable the cables to be readily pushed into place in the trough and secured, pending the replacing of the cover. Cables are not damaged in any way, it is claimed, in installing, and no draw-in boxes are required, such as are necessary at intervals with heavy cables, or groups of cables in heavy conduit. The trunking is supplied in 8-ft. lengths in various sizes, and may be fitted with welded block ends, or detachable block ends suitable for drilling. The lengths are each fitted with one butt strap—joint piece F, which is rivetted in position and is drilled to enable it to be bolted to the next section, the small bolts and nuts necessary being supplied with the trunking. Where trunking is required for vertical runs a simple overlapping cover is supplied; this is also useful for laying in floors, where it may be necessary to put the cables in from the upper side. Special bends, angles or tees of any shape can be supplied, and are made to templet. A universal angle or tee box, fig. 4, which can also function as an inspection or connecting box, is also supplied as standard. This box is so constructed that the detachable socket K is interchangeable with any of the cover pieces L, which are fitted on the blank sides

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so that outlets can readily be arranged in any desired direction, and unnecessary outlets covered, all sockets and plates being readily interchangeable one with another. The trunks can be secured to walls or ceilings by any suitable method, or special hangers or brackets can be supplied to suit contractors' requirements.

A Gallery for Shop-window Reflectors.

Much of the success of shop-window reflectors depends upon the correct focus of the lamp, and as lamps of different wattages have varying light centre, some means of adjustment to obtain correct focus is necessary. This problem has been met by an ingenious gallery invented and patented by PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2. The most notable feature of the gallery is its simplicity. It is made in two parts, fig. 1, the shade-carrying part fitting inside the other and being held in the desired position by means of three pins which engage in appropriate slots, according to the wattage of the lamp in use. A coil spring in the inside of the outer portion maintains rigidity. It will thus be readily seen that it is a simple matter to ensure the correct focal position of the filament. When erecting or removing the reflector for cleaning purposes, it is unnecessary to interfere with any screws, as the bottom half of the gallery holding the reflector is disengaged by a simple turning movement. The light centres of electric lamps having been standardised by the leading lamp manufacturers, the galleries are suitable for use with any make of lamp. The makers supply full particulars with each gallery, showing the appropriate slots to be used for various types of reflectors and sizes of lamps.

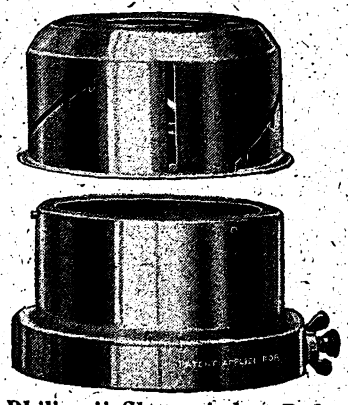


Fig. 5.—"Philips" Shop-window Reflector Gallery.

A New Radio Direction Finder.

Marconi Apparatus for Naval Vessels.

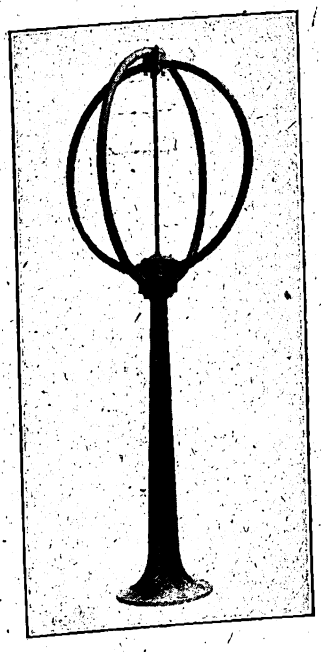
A NEW wireless direction finder known as the Type DFM.4 has been developed by the Research Department of Marconi's Wireless Telegraph Co., Ltd., for use primarily on all classes of naval ships as a navigational instrument.

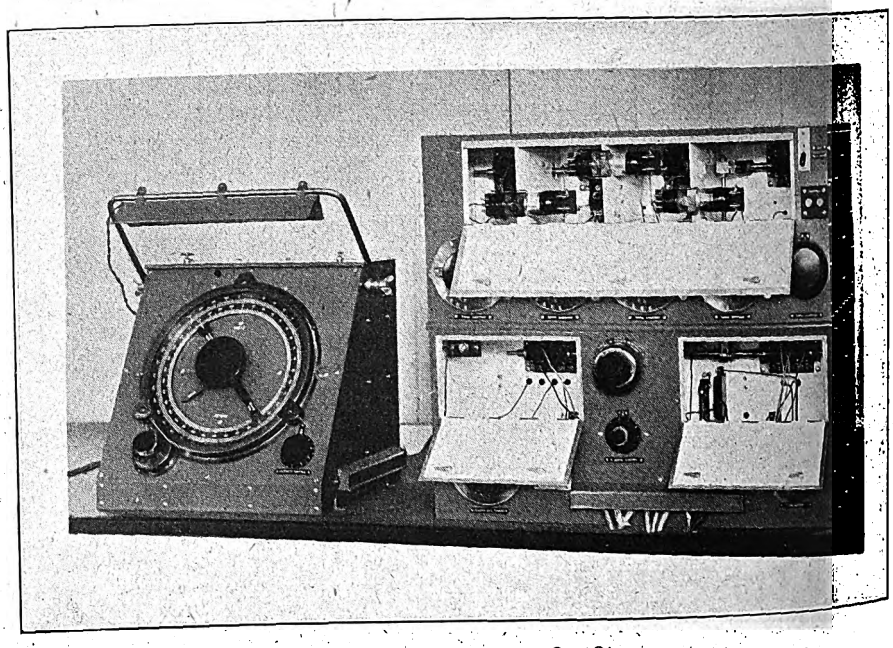
Experience has shown that to meet naval requirements a wireless direction finder must be capable of taking accurate bearings from continuous-wave, interrupted-continuous-wave, spark, or telephone, transmitters over a wide range of wave-lengths. The new equipment comprises three parts—the frame aerial, the radio-goniometer, and the tuner and amplifier, as illustrated below. The frame aerial, working on the well-known Marconi-Bellini-Tosi principle, consists of two fixed loops totally enclosed in strong metal tubes that are mounted on a pedestal. The latter is rigidly fixed to the deck of the ship and the leads to the receiver are well protected by being carried down through the centre of the pedestal. In the receiver, the tuner and amplifier are combined as one compact unit, and cover a range of from 300 to 4,000 metres. To obtain this wave-range three sets of coils are eemployed, and by means of a single switch mounted on the front of the receiver any one set of the coils can be switched into circuit; an indicator shows which coils are in use and their wave-range. Three Marconi shielded valves are used to provide high-frequency amplification, and four condensers, which are calibrated in metres, are used to tune the grid circuits of the high-frequency and detector valves; each of the condensers can be adjusted independently, but a common control enables them to be varied over a range of approximately 10 per cent. on either side of the wavelength to which they are set.

For the reception of continuous-waves a separate heterodyne device, mounted in the amplifier, is employed. In all, seven valves are used, of which three are high-frequency amplifiers, one is a detector, one a note magnifier, and one a local oscillator generator, which can be used as an additional note magnifier if required, and one a coupling valve.

In order that the "sense" of bearings over the whole wave-band of the receiver may be obtained with the aid of only a short vertical aerial, a stage of valve amplification using the coupling valve is employed for the vertical component.

The radio-goniometer is constructed as a separate part which can be fixed in any convenient position. Two calibrated scales from which the bearings are read are mounted on the face of the instrument. The inner scale is fixed and bearings taken from this scale are relative to the centre line of the ship. The outer scale can be rotated until the figure indicating the ship's true course is at the top of the dial opposite the zero mark of the inner scale, and then, if the ship is steady on her course, the bearings reading from the outer scale will be true bearings.





Figs. 1 and 2.—Marine Radio Direction-Finding Outfit.

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Power Plant in America.

Small isolated electric power generating undertakings have decreased appreciably in number during the last few years.

According to the National Electric Light Association, one of the consequences of the consolidation of smaller enterprises into larger operating undertakings, as a practical result of widespread interconnection, has been that the number of electric light and power enterprises, both corporate and municipal, has strikingly decreased since 1922. The United States Bureau of the Census summary of electrical industries for the year 1927 indicates that at the end of 1922 the systems serving the United States comprised 3,774 commercial enterprises and 2,581 separate municipal plants, making a total of 6,355. Five years later the number of commercial enterprises had decreased to 2,135, a reduction of 1,639, or of 44 per cent., while the number of municipal plants had decreased to 2,192, a diminution of 389, or of 15 per cent. A grand total of 2,028 enterprises have thus been consolidated and unified during the five-year period covered, a process explained by the Census as being "due to the centralisation of ownership, or control, and the absorption of independent generating stations accompanying the extension of transmission lines" in the case of commercial systems, and "to the abandonment of municipal generating stations and the acquisition of municipal distribution lines by commercial systems" in the case of municipal undertakings.

A similar striking decrease is evident in the number of power houses during the five-year period under review, although the total installed capacity of the generating equipment has shown a very large growth. At the end of 1922 there were 5,444 power plants devoted to the service of electricity supply and their total capacity was 14,313,438 kilowatts, whereas at the end of 1927 the number had decreased to 4,387, a diminution of 1,057, or of 19 per cent.; at the same time, their total capacity stood at 25,802,530 kilowatts, an increase of 80 per cent. The replacement of the smaller and isolated power houses by co-ordinated systems of greater size and more efficient operation is graphically illustrated by the average size of the power houses in those two years: in 1922 the average generating plant in the United States had an installed capacity of 2,628 kilowatts; in 1927, the figure had grown to 5,880 kilowatts. In other words, although the number of power houses declined by one-fifth, their average size more than doubled during the five years.

TABLE I.—Summary 1927 and 1922.

	1927.	1922.	Per cent. Increase or Decrease.
Number of establishments, total ...	4,327	6,355	−31.9
Commercial ...	2,135	3,774	−43.4
Municipal ...	2,192	2,581	−15.1
Number of generating stations	4,387	5,444	−19.4
Prime movers.			
Total number	12,007	13,242	− 9.3
Total horse-power ...	35,622,593	19,850,860	+79.5
Steam engines—			
Number ...	2,264	4,175	−45.8
Horse-power ...	1,054,922	1,371,296	−23.1
Steam turbines—			
Number ...	2,852	2,350	+22.4
Horse-power ...	24,187,470	12,354,551	+95.8
Internal-combustion engines—			
Number ...	3,172	3,256	− 2.6
Horse-power ...	545,238	302,995	+79.9
Hydro-turbines—			
Number ...	3,719	3,481	+ 6.8
Horse-power ...	9,834,963	5,822,018	+68.9
Generators.			
Number ...	11,948	12,701	− 5.9
Kilowatt capacity	25,802,530	14,313,438	+80.3
Output of stations, kilowatt-hours ...	74,654,531,374	40,291,536,435	+85.3
Number of customers	21,782,080	12,709,868	+71.4

The total number of customers of "electric service" is reported by the Census as being 21,782,080 at the close of 1927, as against 12,709,868 at the close of 1922, which represents an increase of 9,072,212 during the five years, or a growth of 71 per cent.

The output of electricity is recorded by the Census as 74,654,531,374 kilowatt-hours during 1927, as compared with 40,291,536,435 kWh during 1922, an increase of 85 per cent. Some qualification must, however, be made in all these comparisons; for instance, the "coverage" of the 1927 Census is more complete than it was in 1922, for the reason that the earlier enumerations eliminated many enterprises which were partly engaged in electric tramway operations and classified those companies, not as electric light and power, but as "street railways," which discrepancy was rectified in the Census for 1927. In addition, attention must be drawn to the detailed figures for the state of North Carolina, which shows totals in 1927 of five times the figures for 1922; this situation arises largely from the expansion of the operations of subsidiaries of the Aluminium Company of America, whose capacity and electricity output are predominantly employed in the manufacture of the metal.

The detailed summary for the United States by the Census is as shown in Table I.

Legal.

Cooper Roller Bearings Co., Ltd., v. Power Plant Co., Ltd.

Legal argument was heard before Mr. Justice Talbot in the King's Bench Division on May 16th in this action, which was reported in our issue of April 19th (p. 722).

On April 12th his Lordship found that the plaintiffs had established a *primâ facie* case for the recovery of a bill of over £800 for work done in maintaining certain friction clutches supplied to rolling and other mills at the order of the defendants. The defendants contended that the clutches supplied were unsuitable for the purpose for which they were required, and that plaintiffs had committed breaches of contract and warranty.

Mr. G. O. Slade, for the plaintiffs, now asked that judgment be entered for the Cooper Roller Bearings Co. for an amount to be determined by the Official Referee and for costs of the hearing to be taxed, with judgment for the plaintiffs on a counter-claim with costs. Counsel also asked for liberty to apply to the Court again when the amount had been determined.

Mr. Pritt, K.C., said that if the defendants desired to appeal, he hoped their right to do so would not be prejudiced.

His Lordship, in granting Mr. Slade's application, observed that the defendants' right to appeal would not be prejudiced.

Compensation Award Against the English Electric Co., Ltd.

The English Electric Co. was sued at Preston County Court on May 14th by the dependants of John D. Darlington (27) for £300 compensation for his death on October 15th, 1928, in a motor-cycle accident. Deceased had worked as a turbine fitter, and it was stated that his father and family were wholly dependent on his earnings.

For the company it was submitted that it was only partial dependency, as the money sent home was not the sole source of income.

Judge Bradley awarded the amount claimed, to be divided as applicants agreed.

Swinden & Co., Ltd.

In the Companies' Winding-Up Court on May 14th, Mr. Justice Maugham made an order for the compulsory winding-up of Swinden & Co., Ltd., agents for mining and electrical plant, on the petition of the Albion Iron Co. (London), Ltd.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Compulsory Earthing of Prepayment Meters.

As a matter of fact, I am married, and it appears, from Mr. L. F. S. Sington's letter, that I am very fortunate.

Perhaps the explanation lies in the fact that my wife is a Scotch lady.

It is a well-known fact that the Scotch people are very much more generous than the Southern race, who love to tell the usual tales about the man from Aberdeen.

What all this has to do with the compulsory earthing of prepayment meters I don't know, but it certainly introduces a pleasing topic, namely, the perfect Scotch wife!

A. J. Abraham.

Bexleyheath, *May 24th*, 1929.

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I have been a subscriber to your valued Review for many years, and after reading Mr. A. J. Abraham's letter on "The Compulsory Earthing of Prepayment Meters," I have at last found a real live earthing specialist. I simply love those slight tingles. No doubt this super-electrician would replace a fuse with a piece of wet string, or repair a fuse board with a 5-ampere nail. No doubt when the lady and her "hubby" get slight shocks they both burst their sides a-laughing.

I have been on electrical work for nearly 50 years, and am now looking forward to my slight tingle. I do wish, when I get it, that Mr. A. J. Abraham could be holding my hand. Of course, I agree that manufacturers should get rid of metal casings altogether and use instead "passover."

I agree that lead covering should be earthed in case of *fire*, but why deliberately try to break down the insulation of kettles, irons, radiators, &c., by earthing them? Why not plant them in the garden?

Mr. A. J. Abraham must tell us some more.

W. Overs,
Foreman, Crompton Parkinson, Ltd.

Brentwood, *May 18th*, 1929.

[This letter has been shortened.—Eds. Elec. Rev.]

132,000-volt Cables.

In recent correspondence on the Battersea station it seems that the risks of employing these cables are quite unduly magnified. To anybody who has got the least foresight, cables of 132,000 volts *must* come, as surely as steam pressure and hydraulic pressure—and now even town gas pressure—must go up; and the sooner we get experience with them the better.

What are the risks? The Pirelli cable in Italy has been working continuously for the last eight years; two 90,000-kVA transmission lines, one in New York and one in Chicago, have now been working practically for two years; and I have private information which shows that American cable manufacturers are tendering for, and guaranteeing the performance of, other large installations in the U.S.A. of these cables. Indeed, so confident are they, that one of the very foremost of them is, to my own knowledge, ready to put down such cables in London under a two-year guarantee.

However, let us consider the risks. According to *Engineering's* estimate for Battersea it will cost £2,700,000 to run perhaps 15 miles down the river, or, say, £180,000 per mile of route. Now the (66,000-volt) cables cannot cost more than £3,000 per single-core cable per mile, so that there must be at least 60 cables (20 circuits; each a complete unit).

I suppose I shall hardly be believed when I say that 300,000 kW could be transmitted by twelve 132,000-volt pressure-oil-filled cables, costing, on reliable information in my possession direct from the manufacturers, not much over £1,000,000, even for 15 miles (I submit that 10 miles, however, is amply sufficient); it would carry us down past many possible sites. Whether this figure be accepted or not, I am prepared to demonstrate (in the right quarter) that 12 cables would do the job with the amplest possible margin for spares.

Now if a (66,000-volt) cable breaks down, and they will only go down one at a time, we have 57 cables still in parallel to carry the load. Only 10 years ago a certain prominent engineer was criticised for being ultra-conservative because he preferred 10 small generating sets in his station to, say, three large ones and one spare—but 20 sets; how ridiculous!

Now take the 132,000-volt side. In the above-mentioned 12 cables there is provision equivalent to two large generating sets and *four* full-sized spare, or *stand-by* sets (this may not be clear in certain quarters, but let it stand; I can justify it). What generating-station engineer would not be delighted if he could have such a stand-by equipment and at such a relatively low cost!

The fact that the New York and Chicago installations have now been running without any hitch for nearly two years, under strenuous conditions as regards load, is conclusive proof that they are going to stand; that nothing short of the perforation of the lead sheathing or the gradual failure of the dielectric can put them permanently out of working. In the early days of 33,000-volt cables the mistake was made of not testing the cables under heavy over-loads. *We have learnt our lesson*, and it will not occur again. On the question of any radical changes developing with time in the dielectric (*apart* from loading), *that* is settled for us by the eight years of experience on the aforesaid Italian line.

If we save £1,700,000 by using pressure-oil-filled cables, and if—to assume the worst case conceivable—these began to go wrong after eight years, and if we had to replace the whole lot, bit by bit, within 12 years (total), we still have that £1,700,000 (plus the saved interest and depreciation over eight years) with which to buy two complete sets of new cables, extending the equivalent life *to 36 years*, at least. Who is to say that 66,000-volt plain-impregnated cables will last longer than 36 years?

Again, quite apart from Battersea, we *must* face the need for cross-linking in London. They are already doing it in New York. Only a fortnight ago a report came across that, owing to a heavy thunderstorm, the load at one part of New York went up suddenly by 300,000 kW. This cannot be met with 66,000-volt cables, without great expense, owing to the congestion of our streets and the annual losses in the cables. What a gain in relieved street congestion would be effected by reducing the 60 cables to 12 (spread over four different routes)!

It seems to be pretty obvious that British cable manufacturers are now discountenancing the employment of 132,000-volt cables. This, however, is a dangerous proceeding. One of these days we shall have one of the more enterprising American cable companies, *in fact, they are ready now*, actually offering to lay and guarantee in London pressure-oil-filled cables at a cost not much more than one-third of that of 66,000-volt cables. Are we going to hamper British industry and lose annually hundreds of thousands of pounds (it will come to this, shortly) waiting for these cables to have had two or three years' more "experience," at somebody's else's expense, while meanwhile American and Italian manufacturers will reap the reward of that enterprise which used to be considered an exclusively British possession?

In conclusion, I commend the extract from Sir John Snell's statement before the Parliamentary Committee in 1927 to your readers, as showing what we have got to face in the way of increased power loads in the West End of London. What if the E.D.A. *should succeed* in its efforts to increase loads? Even Sir John Snell's estimates might then be upset; and my case would be all the stronger.

This letter is neither a plea for, or against, shifting the Battersea station; it is solely a plea for giving pressure-oil-filled cables a thorough trial at as early a date as possible. Reference has been made to Battersea merely as a convenient exemplification of the issues involved. As I can claim to be the only engineer who has had made, and successfully tested (up to 720,000 volts), at his own expense, a super-voltage cable intended for 150,000-volt working, I hope I may be considered as entitled to say something on this subject.

A. M. Taylor,
Major, S.O.2.

Birmingham, *May 17th*, 1929.

An Old Problem—from a New Point of View.

It seems to me that Mr. F. T. Fawcett, in writing from a particular viewpoint—naturally—has taken a single remark of mine away from its context and, unfortunately, misconstrued it. I have said: "It is the easiest thing . . . to obtain a diploma . . . from a correspondence school," and he assumes I mean that such schools give their students work that is easy to do; he understands me to say, in effect, "there's nothing in it." Taking that as it stands, I do not wonder that at least one of his students felt discouraged, but the sentence does not stand on its own, it leads to, and supports, the central idea of the paragraph, and should be considered in its relation to that main point, *i.e.*, an employer "may wish to believe you earned that certificate honestly, but that is not enough; he must know. . . . My statement holds: but it is not that a diploma can be obtained with little effort by a man who is conscientious, but that it can be got easily and unfairly by one who is not. Mr. Fawcett says that his schools, at any rate, can arrange for supervision of a students' final examination. Even if that were compulsory—and apparently in this country it is not—would it carry the assurance that lies behind the certificate of some well-known examining body? It is pointed out both by Mr. Fawcett and Mr. Hunt, who complained a fortnight ago of my unfairness, that many correspondence students are simply being coached for outside examinations, such as the I.E.E. examination, and it is exactly that part of the schools' work that I do agree is being efficiently applied, and the extension of which I wrote in my last paragraph but two.* If the schools' own diplomas were given under similar conditions, I believe they might supersede some of the existing public examinations, because they are more highly specialised and to the point.

I thank Mr. Fawcett for his courteous invitation, but neither the efficiency of teaching nor the scope of the work taught by the schools is the point at issue. I query neither, but I contend that diplomas actually offered by the schools themselves, even when backed by a supervisor's certificate, do not convince of the honesty of the man who wins them to an extent at all comparable with those of existing bodies—well known to a busy interviewer or employer—or to a certificate from an examining body of the nature I have suggested.

Statistics may show that many owe their jobs, or their promotion, to correspondence tuition, but they would not carry the point. I think it is for employers themselves to state what importance they attach to correspondence schools' diplomas, and the relative weight that, in their minds, is carried by a public examination.

Ric.

May 25th, 1929.

* Elec. Rev., May 10th, 1929, pp. 822-3.

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Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

27,558. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 17th, 1928. (310,829.)

28,474. "Receiving circuits employing local oscillation, applicable for use with multiple thermionic valves." Dr. S. Loewe and W. Kunze. October 28th, 1926. (279,861.)

29,282. "Method of, and means for electrically controlling a sub-station from a remote main station." Siemens & Halske Akt. Ges. November 3rd, 1926. (280,214.)

31,712. "Headlights for automobile vehicles." F. Espine and A. Lalaurie (trading as Etablissements Faradoc). November 24th, 1926. (281,317.)

32,252. "Electromagnetic acoustic devices." British Thomson-Houston Co., Ltd., and A. P. Young. November 30th, 1927. (310,759.)

32,262. "Thermionic valves." W. R. Bullimore. November 30th, 1927. (Addition to 192,464.) (310,760.)

32,932. "Electrical selective remote-control systems." A. Reyrolle and Co., Ltd., B. H. Leeson, and O. C. F. King. December 6th, 1927. (310,984.)

35,399. "Electrolytes for electrolytic rectifiers or the like." Fansteel Products Co., Inc. January 7th, 1927. (283,208.)

35,470. "Gramophone and the like reproducing devices, and circuits therefor." E. W. B. Gill. December 31st, 1927. (Cognate applications, 9,416/28 and 23,757/28.) (310,762.)

1928.

188. "Electric heating units." Hotpoint Electric Appliance Co., Ltd., and W. J. Sims. January 3rd, 1928. (310,902.)

271. "Moving-coil apparatus for controlling illumination and like purposes." J. Neale. January 4th, 1928. (310,986.)

416. "Device for transmitting signals from the railway track to a moving train." Allgemeine Elektricitäts Ges. January 5th, 1927. (283,165.)

2,299. "Thermionic valves." Edison Swan Electric Co., Ltd., and L. H. Soundy. January 24th, 1928. (310,903.)

2,300. "Circuit arrangements employing thermionic valves." Edison Swan Electric Co., Ltd., and L. H. Soundy. January 24th, 1928. (310,764.)

2,567. "Electric alternating-current measuring instruments." Nalder Bros. and Thompson, Ltd., and C. L. Lipman. January 26th, 1928. (310,766.)

2,690. "Portable electric battery lamps." H F. Joel, Sen. January 27th, 1928. (310,824.)

2,840. "Piezo-electric crystals." Dr. E. Giebe and Dr. A. Scheibe. January 28th, 1927. (Patent of addition not granted.) (284,357.)

3,072. "Driving of reciprocating machines by asynchronous electric motors." Siemens-Schuckertwerke Akt. Ges. February 10th, 1927. (285,056.)

3,079. "Automatic cleaning devices for instrument dials and like designation plates." Automatic Telephone Manufacturing Co., Ltd., and W. H. Paulett. January 31st, 1928. (310,787.)

3,472. "Electric oscillation generators." N. W. McLachlan. February 3rd, 1928. (310,915.)

3,485. "Electrical controlling apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. May 7th, 1927. (290,152.)

3,604. "Wireless loud-speakers, microphones, and the like." A. Stanley. February 6th, 1928. (310,997.)

3,700. "Manufacture of electrolytic zinc." I. G. Farbenindustrie Akt. Ges. February 14th, 1927. (285,373.)

4,062. "Terminal for electric leads." E. Elliot. February 9th, 1928. (311,011.)

4,102. "Electrical transmission and/or distribution systems." W. T. Taylor. February 9th, 1928. (311,013.)

4,316. "Photo-electric signalling, regulating, or measuring device." Neufeldt & Kuhnke Betriebe-Ges. February 10th, 1927. (285,062.)

4,611. "Electrical turning gear for starting internal-combustion engines." F. H. Royce. February 14th, 1928. (Patent of addition not granted.) (311,020.)

5,031. "Device for fastening electric bonding conductors to the rail base." R. Bomig. June 3rd, 1927. (291,425.)

6,630. "Alternating-current electrical generators." C. Lorenz Akt. Ges. March 18th, 1927. (287,167.)

6,754. "Mercury-vapour lamps or quartz lamps." Quarzlampen Ges. March 4th, 1927. (286,317.)

7,926. "Diaphragms for gramophones, telephonic loud-speakers, and the like." T. H. Tuite. March 15th, 1928. (311,044.)

8,011. "Electric storage batteries." J. Morris. March 16th, 1928. (311,045.)

9,455. "Piezo-electric substances." P. Freedman and W. J. Rickets. March 29th, 1928. (Cognate applications, 9,459/28 and 9,478/28.) (311,055.)

9,695. "Device for measuring electric resistances with the aid of a cross-coil instrument." Siemens & Halske Akt. Ges. April 9th, 1927. (288,288.)

11,125. "Electromagnetic transmission gearing." L. Mellersh-Jackson (Maschinenfabrik Esslingen). April 14th, 1928. (Convention date not granted.) (288,979.)

11,188. "Sound-reproducing devices." Graham Amplion, Ltd., and P. K. Turner. April 16th, 1928. (311,071.)

11,823. "Picture telegraph, television, and the like systems." A. Carpmael (Telefunken Ges. für Drahtlose Telegraphie). April 21st, 1928. (311,075.)

12,408. "Arrangement for the testing of electric resistances by means of a cross-coil instrument." Siemens & Halske Akt. Ges. August 3rd, 1927. (Addition to 288,288.) (294,976.)

12,802. "Electric transformers." General Electric Co., Ltd., W. Wilson, and T. W. Dann. May 1st, 1928. (311,082.)

12,916. "Picture and the like telegraph systems." Telefunken Ges. für Drahtlose Telegraphie. May 21st, 1927. (290,973.)

12,943. "Diaphragms, more particularly for loud-speakers and the like." Siemens & Halske Akt. Ges. May 6th, 1927. (Addition to 287,065.) (289,888.)

13,149. "Electromagnetic controlling apparatus for transmitting movement electrically." G. Brewer (F. Krupp Akt. Ges.). May 4th, 1928. (311,091.)

13,450. "Electric radiators." General Electric Co., Ltd., and L. Gardiner. May 7th, 1928. (311,096.)

14,661. "Electrical filter and the like frequency selective circuits." Marconi's Wireless Telegraph Co., Ltd. July 7th, 1927. (293,446.)

15,134. "Regenerative braking of electric motors." British Thomson-Houston Co., Ltd. May 25th, 1927. (291,057.)

15,832. "Electric heating cushions." J. Bartik and M. Munzer. May 31st. 1927. (291,381.)

18,057. "Electrical condensers of the variable differential type." H. W. Sullivan, Ltd., and W. H. F. Griffiths. June 22nd, 1928. (311,131.)

19,567. "Metal-arc or metal-vapour lamps." H. Stammereich. July 19th, 1927. (294,172.)

20,739. "Liquid film seals for use in gas-cooled dynamo-electric machines." British Thomson-Houston Co., Ltd. July 22nd, 1927. (294,249.)

21,632. "Means for the generation of compressed air for electro-pneumatic devices, in particular clock installations." Junghans Akt. Ges., Geb. December 22nd, 1927. (302,884.)

23,409. "Diaphragms such as are employed in signalling, indicating, and recording apparatus." H. R. G. Moore and T. P. Rigby. August 14th, 1928. (311,154.)

23,630. "Electric cigar lighters." A. Rupps. October 1st, 1927. (298,073.)

28,888. "Electromagnetically-operated vehicle direction indicators." P. Schober and R. Schober (trading as R. Schober). March 26th, 1928. (308,675.)

29,285. "Frame-shorting protective device for generator plants having several bus-bar systems." Siemens-Schuckertwerke Akt. Ges. November 10th, 1927. (300,263.)

31,890. "Railway signalling devices." W. Gabbitass. February 1st, 1928. (Divided application on 310,112.) (310,866.)

32,519. "Shadowless lighting apparatus." Anciens Etablissements Barbier, Benard & Turenne Soc. Anon. February 10th, 1928. (Divided application on 302,105.) (305,646.)

34,783. "Picture and the like telegraph apparatus." Marconi's Wireless Telegraph Co., Ltd. November 25th, 1927. (301,327.)

35,339. "Piezo-electric control of valve oscillation generators." C. Lorenz Akt. Ges. December 2nd, 1927. (301,510.)

35,490. "Vacuum-tube oscillators controlled with piezo-electric resonators." C. Lorenz Akt. Ges. December 2nd, 1927. (301,518.)

38,308. "Circuit arrangements suitable for use in valve transmitters." Telefunken Ges. für Drahtlose Telegraphie. December 29th, 1927. (303,171.)

1929.

7,233. "Magnetostrictive and piezo-electric vibratory systems." G. W. Pierce. January 3rd, 1928. (Divided application on 283,116.) (311,004.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 22nd :—

Elephant and Dragon (design only). No. 491,038. Class 1. Accumulator acid. No. 491,039. Class 13. Magneto contact points, &c. No. 491,042. Class 50. Tape impregnated with rubber for insulating purposes.—Elephant Chemical Co., Ltd., 171-173, Neate Street, Camberwell, S.E.5.

Rico (lettering and design). No. 498,132. Class 6. Magnetic separators and parts thereof.—H. G. Richardson, trading as Herbert G. Richardson & Co., Magnet Works, Walsall.

A.C.E.C. (lettering and design). No. 499,662. Class 6. Pumps and electric motors.—Société des Ateliers de Constructions Electrique de Charleroi, Belgium. (British representatives: Feeny & Feeny, 73a, Queen Victoria Street, E.C.4.)

Telelector. No. 501,382. Class 8. Apparatus for use in transmitting sounds and for transmitting and displaying views, scenes, images or messages to a distance by telegraphy or telephony.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Stella Ray (lettering and design). No. 499,552. Class 13. Lampholders for flood and spot lighting.—Central Electrical Engineers' Accessories Supply, Ltd., 193, Bethnal Green Road, E.2.

Elm. No. 501,223. Class 13. Gas and electric light fittings, reflectors, shades, and parts thereof.—Elm Works, Ltd., Summerstown Road, Tooting, S.W.17.

New Telemetering Equipment.

The General Electric Co. of America announces a rectified-current type of telemeter, which is claimed to be an improved design of remote metering equipment particularly adapted to transmitting voltage and ampere readings of an alternating-current circuit in conjunction with the company's synchronous selector supervisory equipment. This equipment, however, also provides an economical means of telemetering such readings over a pair of telephone wires. When used with the synchronous selector supervisory system, the equipment does not require the installation of extra line wires. One transmitter and one receiver may be connected to any one of a large number of sub-station circuits. The equipment is economical and simple to operate and maintain, since there are no moving parts except the indicating or recording instruments at the dispatcher's station. The synchronous selector system with which this new equipment is designed to operate, provides for the centralised control and indication of various types of switching equipment located at outlying sub-stations. With it, large or small groups of units can be co-ordinated, and thereby the application is broadened to include power systems of all sizes. The new telemetering transmitter consists of the following equipment: a special transformer for each circuit to be indicated; a full-wave rectifier valve; a transformer to supply filament current to the valve; a line-wire compensating resistance, and protective equipment to prevent the possibility of high voltages in the event of the opening of line wires or damage to equipment. The special transformers are of such design that the rectifier will deliver to the receiver approximately 25 milliamperes at full-load current or maximum voltage, as the case may be. The receiving instrument is a standard type direct-current milliammeter adapted to panel mounting. When used in conjunction with a synchronous selector supervisory installation, it can be mounted on the dispatcher's control board.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALTRINCHAM.—Extension of public offices, Market Street; F. H. Brazier, architect, 7, Market Street.

BARDSLEY (MANCHESTER).—Laboratory, Bardsley Vale Works, for Kerfoot & Co., Ltd.

BLAYDON.—Mining centre; Durham County E.C.

BRIGHTON.—Extensions, borough sanatorium; borough engineer. Hotel, The Dyke; Clayton & Black, architects. Alterations, Old Ship Hotel; R. Bacon & Co., Ltd. Development, London Road estate, Withdean; F. H. Nye. Additions, school for blind boys, Eastern Road; committee of management.

BOURTON-ON-THE-WATER.—Clinic, for Gloucestershire C.C.; R. S. Phillips, county architect, Shire Hall, Gloucester (returnable deposit of £2 2s.).

CARLISLE.—Development of prison site for business premises, for the T.C.; P. Dalton, city surveyor.

CHESTER.—Municipal aerodrome; city engineer. County office extension, Chester Castle; Cheshire county architect.

CHESTERFIELD.—Senior Catholic school; C. A. Edeson, architect, Berryhill Lane, Mansfield.

CRADLEY HEATH.—Works extensions; Ernest Stevens, Ltd.; A. Long, architect, West Bromwich.

CREWE.—School, Newdigate Street, for the borough E.C.; director of education.

DERBY.—Re-erection of Normanton Mills, Charlotte Street, for A. Green, Ltd. (£30,000).

DONCASTER.—School, New Intake, for the borough E.C.; Athron & Dyson, architects, Dolphin Chambers, Market Place. (Returnable deposit of £2 2s.)

DRIGHLINGTON.—Alterations to Council offices; housing scheme (40), Whitehall Road site (deposit £2 2s.); S. H. Senior, surveyor to U.D.C.

DUDLEY.—School, for the borough E.C.; J. Whaley, director of education.

EDINBURGH.—Printing works, for T. & A. Constable, Ltd.; the manager. Additions and alterations to surgical house; medical superintendent, Royal Infirmary. Further works, including dormitories, workshops, &c., at Gogarburn, for District Board of Control (whole scheme £400,000); master of works, Board of Control.

EPSOM.—Extensions, Court House; Surrey C.C.

FIFESHIRE.—Markinch public school, new buildings (electric lighting); G. Sandilands, architect and master of works, Education Offices, Kirkcaldy.

GLASGOW.—Central employment exchange and other Government buildings; H.M. Office of Works.

GRAVESEND.—Machine house and pumping station, Clifton Marine Parade; Imperial Paper Mills, Ltd.

HERNE BAY.—Reconstruction, Tudor Café, Central Promenade; R. Messenger.

HOLMES CHAPEL.—Institution for mental defectives, for the C.C.; clerk, Chester.

HUNWICK.—School enlargement (£8,200); Durham County Education Committee.

KEW.—Building, for the Imperial Bureau of Mycology, for H.M. Office of Works, King Charles Street, S.W. (returnable deposit of £1 1s.).

KIRKCALDY.—Housing scheme (£13,500); District Committee, Fife C.C. Slaughter house, for Corporation (£20,000); burgh surveyor.

LEEK.—School (£10,000), for the Church of England managers; Rev. J. G. Halford, vicar.

LINCOLN.—Extensions, St. Giles' school (300 places), for the City E.C.; R. C. Minton, director of education. Conversion of Nocton Hall into mentally defectives' institution, for the Lincs. Joint Board for the Mentally Defective; clerk.

LONDON (SHOREDITCH, E.).—School centre, adjoining central school; L.C.C. Education Committee.

(HENDON, N.W.).—Wesleyan church, Watling estate; trustees.

(BECKENHAM, S.E.).—School (900 places), for the E.C.; J. R. Hambridge, secretary.

(BERMONDSEY, S.E.).—Conversion of booking hall, South Bermondsey station, to dance hall; F. Gray, 50, Gubyon Avenue, Herne Hill.

LONDON—*continued.*

(NORWOOD, S.E.).—Estate development, Roxburgh Road and Cheviot Road; W. Wilmot, Ltd.

(KENSINGTON, S.W.).—Tenements, Hesketh Place (£16,526); borough engineer.

(EALING, W.).—Transformer and garages at Greystoke estate, for Ardsley Estates, Ltd.; T. P. Bennet & Son, 41, Bedford Row, W.C.1, architects. School at Greenford, for E.C. (£30,600); Andersons, Ltd., contractors, Chesterfield.

MANCHESTER.—Pavilion, Queen's Park; A. Fenton. Houses, Lightbowne estate; W. Chappell & Sons, Ltd., Swinton.

MELTON MOWBRAY.—Extensions, War Memorial Hospital (£14,986); Mr. Moore, architect; H. Herbert and Sons, builders, Leicester.

MERIDEN.—Biscuit factory, Castle Bromwich; surveyor to R.D.C.

MORAYSHIRE.—Public hall for Craigellachie; secretary, Hall Committee.

MOSSLEY.—Housing scheme (30), Hollins Farm estate, Micklehurst; G. G. Forster, housing surveyor, Town Hall.

NEWCASTLE-ON-TYNE.—Re-erection of Kirkley Hall, residence of Sir William Noble.

NORTHOLT.—84 houses, Station Approach, Halsbury and Belvue Roads; Estates Improvement Trust, Ltd.; Arohead, Ltd., architects, 20, Copthall Avenue, E.C.

NOTTINGHAM.—Municipal lodging houses; city architect.

PORTSMOUTH.—Church, Battenburg Avenue; Sir W. W. Parker, secretary, Portsmouth Diocesan Extension Committee. Extensions, Town School, Highbury Street; Education Committee. Extensions, mental hospital; city engineer. Showroom, workshop and garages, Grove Road; English Motor Agencies, Ltd. Business premises, London and Oriel Roads, and extensions to warehouse, Buckingham Street; Timothy White, Ltd. Aerodrome, Hilsea; city engineer.

REIGATE.—Public baths, police and fire stations (£28,650), for the T.C.; borough surveyor.

RICHMOND (SURREY).—Station, North Sheen, for the Southern Railway Co.; engineer.

ROCHESTER.—Extensions, St. Bartholomew's Hospital; Read & MacDonald, architects, 2, Bloomsbury Place, Bloomsbury Square, London, W.C.

ROMSEY (HANTS.).—Hospital (£13,000), for the Cottage Hospital Committee; Mr. Gutteridge, architect, 9, Portland Street, Southampton.

ROTHERHAM.—Two schools, for the borough E.C.; Vincent Turner, borough engineer (returnable deposit of £2 2s.).

ST. ALBANS.—Central school; Herts. Education Committee.

SALFORD.—Extension of Hope Hospital, Pendleton; clerk to Board of Guardians.

SEVERALLS.—Extensions, mental asylum (£12,500); Essex C.C. and Colchester Corporation.

SHAVINGTON.—Police station; Cheshire Standing Joint Committee.

SHIPLEY.—Erection of works; W. R. Anderton, architect. Midland Chambers.

SOUTHAMPTON.—Business premises, 195-203, Shirley Road, for S. H. Foy & Son (£35,000).

STAFFORD.—Police station, for the T.C.; borough surveyor.

STOURBRIDGE.—Church; Webb & Gray, architects; T. W. Edwards & Sons, builders, Audnam.

STRATFORD-ON-AVON.—Works extensions, Birmingham Road, for N. C. Joseph, Ltd.; W. H. Simster, architect.

SUNDERLAND.—Roman Catholic school, for 350, Corporation Road; Rev. W. T. Harris.

SURREY.—Five police houses, various sites; Surrey county architect.

THIRSK.—Electric wiring and fittings, Congregational Church; Frank Taylor, secretary, 2, Melbourne Place.

WATFORD.—Works, for the Electric Hose and Rubber Co., of Wilmington, Delaware, U.S.A.; F. R. Green, English managing director.

WELWYN GARDEN CITY.—Hospital, Garden City Health Association; secretary.

WIGAN.—School (640 places), for the Blue Coat Church of England school managers.

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The

Electrical Review

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The I.M.E.A. Convention.

THIS year's Convention well maintains the standard set in previous years in being productive of some useful and carefully thought out papers. The most striking feature of the President's address was his advocacy of regional control of distribution networks, analogous to the control of generation and high-voltage transmission by the Central Electricity Board. Mr. Nichols Moore cites the interesting attempt that has been made to overcome the faults inherent in both municipal and company control in Berlin and the surrounding country. The system of supplying electricity by means of State- and municipally-financed companies with a view to combining low capital charges with flexibility of operation has been in vogue elsewhere in Germany for a number of years. It was the subject before the late war of a comprehensive British Consular Report, of which too little notice was taken at the time. But however desirable it may be to free the electricity supply industry from the domination of local politics on the one hand, and of short-sighted financial considerations on the other, and at the same time to standardise distribution voltages and to give supplies in the commercially unattractive areas, we see far greater difficulties in framing the legislation Mr. Nichols Moore calls for than in that required for the interconnection of power stations.

Mr. Nichols Moore, it seems to us, is either too early or too late. Too early, because the industry requires a long breathing space before further legislation is attempted; too late, because almost the whole of rural England has now been parcelled out among statutory companies, each of which distributes, or will distribute, in an area quite as large, presumably, as the area Mr. Nichols Moore has in mind.

Of the papers read and discussed at the Convention, only one deals with a purely technical subject. The others relate rather to managerial and administrative functions, as might be expected from the composition of the Association. They deal with "Whitleyism," legal cases and problems, and tariffs, all matters of immediate moment. They are all by laymen. The first two are by recognised authorities on the subjects they chose to speak on. The paper on tariffs shows the clear grasp of the fundamental requisites of tariff-making,

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which one would rather expect to find in an engineer of specialised experience. These fundamentals are (1) the recognition of the importance of commercial expediency, and (2) the correct allocation of costs to fixed and running charges. We recollect publishing an article on the first aspect as long ago as 1909 ("Equity *versus* Expediency," by Mr. E. E. Sharp, April 23rd, 1909, p. 698). Load factor has an important bearing on the relationship between fixed and running charges. This was clearly shown in another article which appeared more recently in these columns ("Generating Station Costs," January 28th, 1927, p. 124, by Mr. R. O. Kapp).

U-V Rays in Rubber Manufacture.

Considerable developments have been made recently in the application of ultra-violet radiation to the rubber industry, and the method has now become a recognised part of manufacturing technique. The radiation is mainly obtained by the use of the quartz mercury-vapour lamp as supplied by several British manufacturers.

The two main applications of this instrument in the rubber industry are, primarily, for the identification of materials by means of the characteristically-coloured fluorescence which is exhibited when various substances are examined under ultra-violet radiation, and, secondly, the application of the rapid photo-chemical reactions induced by exposure to this source of light.

A considerable amount of work has been done recently in the first application of this method, and some very successful results have been made possible. Special advantage is taken of the fact that many mineral substances continue to exhibit characteristic colours when mixed with rubber, both in the vulcanised and unvulcanised states. Materials, such as zinc oxide, can often be classified according to the source of supply by examination under a mercury-vapour lamp, and the presence, or absence, of a large number of powders and drugs in rubber mixers can be detected by this means. There is wide scope for more intensive investigation into the possibilities of this method, and from the results obtained already it would appear to be one which may well become of much practical importance in the future development of the rubber industry.

The photo-chemical reactions induced by exposure to ultra-violet light include the fading of organic dyestuffs, the darkening of certain white pigments, and the rapid oxidation of rubber, which is often revealed by the appearance of large numbers of minute cracks on the surface of the sample. Technically, much advantage is gained from the rapidity with which these reactions take place, and the use of ultra-violet radiation enables some processes to be accelerated.

The "fastness," or colour stability in sunlight, of dyestuffs used in the proofing trade is, of course, a matter of great importance. Apparatus known as the "Fadeometer," which consists essentially of a mercury-vapour lamp in a suitable housing, is in common use. Rapidity of action is, again, the great advantage, and the effects of strong sunlight, approximating to many days, can be observed in a short time under the greater intensity of the rays generated by mercury-vapour lamps. In the same way, exposure tests are carried out to determine the resistance to sun-darkening of white rubbers loaded with such pigments as lithopone.

In the tire industry resistance to sun-cracking is of considerable importance, and accelerated ageing tests involving the use of ultra-violet radiation are carried out in the laboratory to determine the relative values of various rubber compounds so far as this particular property is concerned. The establishment of many new tire factories in this country comparatively recently has brought this method into prominence, for competitive reasons have demanded the careful investigation of every possible scientific method to improve, either the product, or the process, of manufacture.

Both in applying the photo-chemical effects and in the identification of materials there is scope for much further development, and it is probable that the use of ultra-violet radiation will ultimately become an important factor in many technical processes of the industry.

Birthday Honours.

Foremost, and deservedly so, in the King's Birthday Honours list, appears the name of Sir Arthur Balfour, K.B.E., J.P., who has been made a baronet, in recognition of the splendid devotion that he gave as chairman of the Committee on Industry and Trade for a period of 4½ years. Mr. Benjamin Dawson, who also receives a baronetcy, is chairman of the Bradford Conservative Association and the proprietor of the Bentham Power Supply Company. Knighthoods are conferred upon: Prof. H. C. H. Carpenter, M.A., F.R.S., Professor of Metallurgy in the Royal School of Mines; Mr. J. Plowright Houfton, who is on the boards of the Mansfield District Tramways and the Mansfield District Light Railway Co.; Mr. R. T. Nugent, Director of the Federation of British Industries; and Mr. W. S. Jarratt, Comptroller-General of the Patent Office. A C.B.E. in the Military Division is given to Capt. R. A. H. Lewin (late Royal Engineers, Instructor School of Electric Lighting, Gosport). Sir A. M. Duckham, K.C.B., M.Inst.C.E., M.I.M.E., chairman of the Economic Mission to Australia, receives the award of G.B.E. in the Civil Division; Mr. A. D. Erskine, Officer for Light Railway Work, Ministry of Transport, becomes an O.B.E. (Civil Division), and Mr. W. L. Buxton, lately Assistant Secretary to the Committee on Industry and Trade, receives the M.B.E.

Advertising the Register.

One of the principal criticisms to which the National Register of Electrical Installation Contractors has been subjected in the past is that its light has been hidden under a bushel. This can no longer be charged against it, for during the past year a great deal has been done in the way of bringing the Register's aims before those principally interested in sound wiring installations. Advertisements have appeared regularly in a number of electrical, municipal, architectural and building journals; a pamphlet entitled "Hidden Risks," condemning shoddy wiring, has been widely circulated; local lists of registered contractors have been prepared and distributed; and in a number of other ways the Register has received the publicity to which it is justly entitled.

To ensure the continuance of this publicity the revenue (which is very small per contractor) must be maintained, and it is incumbent upon the registered to induce eligible contractors in their districts to become enrolled, and upon municipal authorities, architects, builders and others having the placing of electrical work to see that only qualified contractors are employed.

The Position of French Engineering.

Yesterday, June 6th, the E.H.P. Conference opened its proceedings in Paris, and from June 11th to 22nd the summer meeting of the Institution of Electrical Engineers will be educating many members with particulars of the more interesting French works and plant. During the past few months we have given in these leaderette pages a number of authoritative comments regarding the industrial and engineering position in France and to-day we may touch upon such matters again.

If it were based on anything like sound foundations, a striking example of the topsy turvydom which exists generally in relation to Great Britain and France would be furnished by the argument so often advanced in France that the cause of French industries being backward, as compared with the activity of agriculture, is the insufficiency of professional engineers. It is perfectly true that there is an insufficiency of competent industrial labour, but that is quite another matter. What it is probably intended to convey is

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that there is an insufficiency of *creative engineers*, and that what is lacking in France is not quantity, but quality. In perfect justice it must be admitted that in this respect France is not alone; nevertheless, no matter what affection one may have for France, and in spite of all due appreciation of what she has accomplished in science, anyone who knows the two countries must recognise the utter fallacy of the statement so frequently made, even in England, that the standard of French education is superior to ours.

Why did the water power of the Pyrenées and the Alps, now being developed, have to wait for the 1914-18 European war before any important attempt was made to utilise it? Engineers in France, duly in possession of diplomas, may be had to-day in hundreds, and perhaps thousands, but in the present state of French industry there is very little demand for mediocrity.

France being primarily an agricultural country, with abundant resources in water power which are being gradually absorbed for the generation of electricity, it is not surprising that an important increase should be noticeable in the employment of electricity for agricultural purposes and in rural districts generally. One of the uses which promises to develop to a very important extent so soon as the conservatism of the peasant can be overcome, and will cause a large amount of electric power to be consumed, is the operation of ploughs by electric power; recently, particularly in the departments of Oise, Seine et Oise, and Eure et Loire, applications have been made under practical conditions. Apart from the convenience which is afforded by electricity in being always ready, the great advantage to the agriculturer in France is the economy which it effects in labour, for in certain parts of the country agricultural labour is both scarce and expensive, while the possibility of reducing the number of oxen maintained solely for traction is also an important consideration. On the other side of the account is the heavy initial expense of the installation, which makes landowners hesitate to adopt a system which is quite new to them. However, it is much more easy to converse with farmers on the subject now; they are ready to listen and to learn, and there is no doubt that with the next generation with its inevitable development in the use of electricity generally, progress is assured in the employment of electric power for agricultural purposes in France.

Magnetic and Non-Magnetic Alloys.

METALLURGICAL science has been influenced to a greater extent than is commonly appreciated by the requirements of electrical engineers. We have recently had our attention drawn to several new magnetic alloys, but equally as important in practice are non-magnetic metals. The fundamental objection to cast iron for many purposes was, until recently, that it was magnetic to a greater extent than any other metal, but this feature has now been overcome and non-magnetic cast iron has become a competitor of brass, aluminium, and other non-magnetic materials.

The condition of the carbon compounds in cast iron is largely responsible for the change of properties that may be brought about in the metal, either electrically or magnetically. The various allotropic forms of iron also have differing magnetic and electrical properties. It is claimed that non-magnetic cast iron, with its unity permeability and high resistance, has a combination of properties which is not possessed by any other material, or metal, and is thus useful in the manufacture of many electrical components, such as insulator carriers and holders, switch covers, &c. The electrical engineer knows of many purposes for which non-magnetic cast iron is of great value, and he recognises the value of the work of the British Cast Iron Research Association and of private research workers. If the metallurgist has come to the aid of the electrical engineer, on the one hand, the electrical engineer has, on the other, very greatly assisted the metallurgist by the development of the electric furnace as a melting unit.

It is important, indeed essential, that the electrical engineer should know almost exactly what are the magnetic and electrical properties of metal. Alloys that have specified magnetic, or electrical, properties are usually of a proprietary kind. The electrical engineer has not always a foundry, however, and may have to depend on a jobbing foundry to supply him, when castings are required, with metal of a specified composition. A foundry is more likely to do so if it is assured of a regular demand. In fairness to jobbing foundries, it should be remembered that it is not practicable to melt different mixtures for all their customers. Apart from castings, an alloy can now be obtained that is particularly suitable for the cores of audio-frequency transformers. Then, with the development of electric resistance furnaces, came a demand for alloys with pronounced heat-resisting properties; alloys of nickel and chromium are largely employed, the chromium content being about 20 per cent., and such alloys ought to be commercially free from iron, carbon, manganese, silicon, and aluminium. Such alloys have a very high resistance to heat. Another magnetic alloy has an initial premeability of the order of 7,000 to 10,000 with very low hysteresis losses, the latter being about one tenth of those of the best Swedish charcoal iron. Some of these special magnetic alloys require heat treatment in order to develop their properties fully. Progress with regard to special magnetic alloys is due to the combined efforts of engineer and metallurgist.

Flat-rate Tariff in Norway.

As Norway is endowed with plenty of water power and has but little coal, it is only natural that advantage has been taken of the former for the purpose of producing electricity instead of having to import coal. On the basis of six large works in that country Mr. Norberg Schulz, of Oslo, has investigated the subject of how far the sale price of energy generated with the aid of water power and used to supply towns can compete with that of energy furnished by modern steam power stations. In Norway, he states ("E.T.Z."), electricity is almost exclusively produced from water power. At the end of 1927 the plant installed represented 1,579,086 kW of generator capacity, steam power having only a small share of the total.

As there is much water power in Norway and but little coal is available, it is quite out of the question to consider the subject of competition in the same way as in countries having abundant supplies of coal and oil. The author says that if the annual load factor of the Norwegian works has reached a level that is considerably above the figure elsewhere recorded, it is due substantially to the very extensive use of flat rates (bulk tariff) for charging for energy. Almost everywhere domestic requirements are delivered at a flat rate, and that method is gradually becoming the greatest market for Norwegian works. At present it may be reckoned that about 70 per cent. of the supply of energy is used for domestic purposes, if the large industrial works are left out of consideration. Under the flat rate tariff the consumers pay a fixed annual price per kilowatt, which is determined by current limiters, and energy for lighting, cooking, heating, &c., is used as consumers please. In this way a high annual load factor and a correspondingly low price per kilowatt-hour supplied are obtained. It is considered that the rapid extension of the use of electricity in dwellings must in the first place be ascribed to the flat rate, as both the consumers and the suppliers know exactly what they will have to pay and receive, respectively. The supply of electricity takes place everywhere with the object of obtaining the greatest possible extension of the use of electrical energy and the flat-rate-tariff policy seeks to keep the price as low as possible consistent with commercial remunerativeness. The results quoted by the author show that the flat-rate-tariff fulfils the purpose in this respect, because it would probably only in this way be possible to offer cheap prices simultaneously with the necessity of maintaining a high annual load factor.

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Electric Power in Tweed Mills.

Two interesting Scottish border installations, one of which is steam-electric and the other hydro-electric, aided by a pump-filled water-storage reservoir.

MESSRS. Henry Ballantyne & Sons, Ltd., of Walkerburn and Innerleithen, Peeblesshire, enjoy a long-established reputation as manufacturers of Scotch tweeds. The firm's success in the home and overseas markets alike is largely due to the persistent employment of the best raw materials, worked on modern machinery by skilled workers, and is further contributed to in no small measure by the adoption of the electric drive, first in the Tweedvale and Tweedholme mills at Walkerburn, and later in the Leithen mill at Innerleithen, the latter installation having been decided upon as a direct result of the economies and improvement in the quality of the products effected at the Walkerburn mills. From the following brief description of the power plant installed at the mills it will be appreciated that the installations offer evidence of the economies made possible by substituting the efficient, reliable, and convenient electric drive for the old methods.

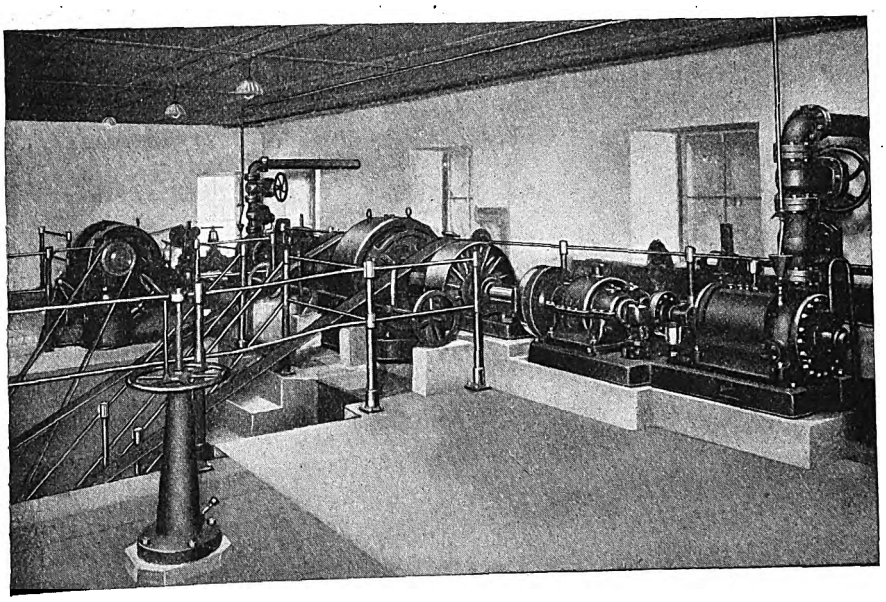

Fig. 1.—Interior of Walkerburn Mills Power House.

The two mills at Walkerburn obtain their power from a hydro-electric plant installed in a central power house. This plant has several noteworthy features, which make the scheme one of special interest to power engineers and to those who may be contemplating the utilisation of any available water-power.

Formerly the Walkerburn mills were each driven by a pair of breast wheels operated by the mill lade from the River Tweed, one pair on a fall of 5 ft. 4 in. and the other on a fall of 4 ft. 10½ in. The water-wheels between them developed approximately 110 horse-power, and as the mills were extended the additional power required was met by the installation of steam and gas engines. After considering the inefficient nature of the existing power plant and comparing it with the advantages accruing from the electric drive, it was decided to demolish the old plant and install in its place hydro-electric plant of such capacity as would meet future extensions to the mills.

The total power required is 300 kW, and as 145 kW is the maximum which can be obtained from the mill lade, and that only by uniting the two falls and deepening the channel between them, a scheme was evolved whereby the additional 155 kW has been obtained from a reservoir constructed on the top of a near-by hill, which is filled with water during the hours when the mills are standing. The contract for the complete installation was carried out by Boving and Co., Ltd., London, the two dynamos being supplied by Bruce Peebles and Co., Ltd., Edinburgh. The power house contains a Boving high-pressure water turbine directly coupled to a Peebles 155-kW, 250-volt, 1,000-r.p.m. open-type dynamo, two Boving low-pressure water turbines driving a Peebles 145-kW, 250-volt, 600-r.p.m. open-type dynamo, and two Boving 400-g.p.m. centrifugal pumps. This dynamo is situated between the two pumps and is driven by belts from the two low-pressure turbines. The pump pulleys are in alignment with, and alongside, the dynamo pulleys, and when the mills close down each night the belts are shifted to the pump pulleys. The capacity of the pumps is such that they lift sufficient water to the reservoir during the idle hours of the mills to supply the high-pressure turbine driving the 155-kW dynamo during working hours.

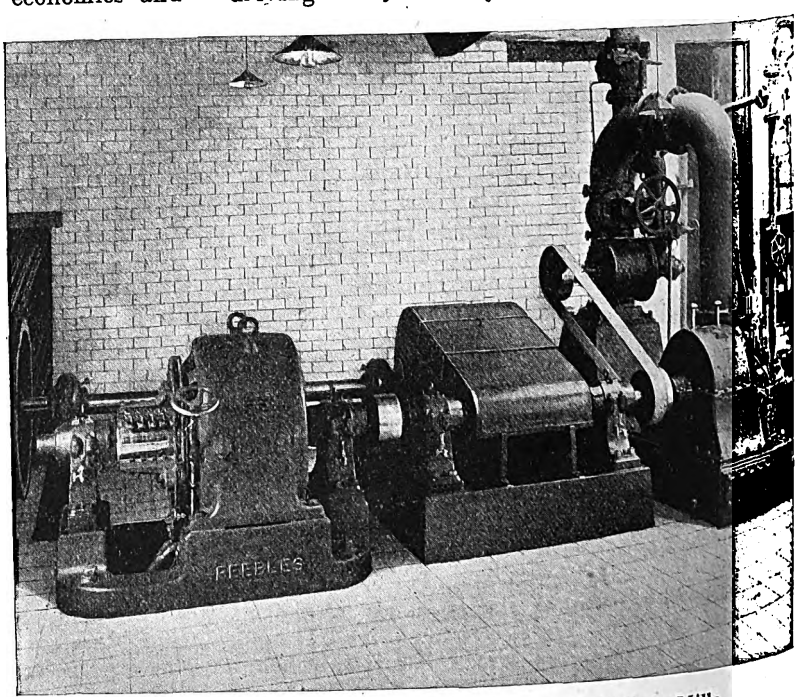

Fig. 2.—Turbo-generating Set at Innerleithen Mills.

Fig. 1 shows the interior of the power house with the belt drives from the low-pressure turbines to the dynamo and pumps in the middle foreground, and the high-pressure directly-coupled set in the background.

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From the foregoing description it will be seen that when the mills are at rest, power equivalent to 220 horse-power, instead of running to waste, is utilised to pump water into the reservoir already mentioned. The reservoir, which is constructed of ferro-concrete, is 1,000 ft. above the power house and has a capacity of 3½ million gallons of water.

The electricity supply to the various motors installed throughout the mills is controlled by a switch panel located in the power house.

Innerleithen is situated about four miles west of Walkerburn and is on the River Leithen, just above its entrance into the River Tweed. The Leithen mill, unlike those at Walkerburn, was originally driven by a Petrie 120 horse-power, 75-r.p.m., steam engine. When the firm decided to reorganise the power plant several schemes were considered and, as efficient boiler plant existed and steam was required for process work, it was decided that a steam turbo-generating set would give the most economical results. Mitchell Graham & Son, Ltd., agents for Messrs. Bruce Peebles & Co., Ltd., laid out a scheme which had for its object the temporary retention of the existing main rope drive to the mill, and at the same time the provision of a dynamo large enough to meet present and future requirements. By this means the electrification could be carried out step by step while the work of the mill proceeded in the usual manner. The scheme was adopted and the whole of the installation work, including the demolition of the existing steam engine, was carried out under the direction of Mitchell Graham & Son, Ltd. It is interesting to note that the new plant was installed without any interruption in the working time of the mill, and to enable that to be done the turbo-generating set was installed while the old engine was still in use. Owing to restricted space, the connecting shaft between the turbine and existing mill drive could not be laid until after the removal of the engine. A week-end was sufficient in which to dismantle the engine and install the new drive, notwithstanding the large and heavy parts which had to be handled.

The new plant, which is shown in fig. 2, consists of a "Carmac" 220-h.p., 12,000-r.p.m., steam turbine driving through gears a Peebles 120-kW, 250-volt, 1,200-r.p.m. open-type dynamo, and also the main mill shaft which runs at 216 r.p.m. and is driven by four Hans Renold chains from the 1,200-r.p.m. shaft. When the mill has been completely electrified this shaft and the rope drive will be discarded, and all the power required will then be supplied by the dynamo.

It is noteworthy that with the 220-h.p. steam turbine the coal consumption is less than was used by the 120-h.p. engine, the efficiency of the turbine being about 12 lb. of steam per b.h.p., as against 25 lb. in the case of the engine.

The lighting of the mill has been very efficiently carried out and it has been said that it is superior to any mill-lighting system used on the Scottish border.

The advantages resulting from electrification are now generally realised, and they may be assumed to include economy and reliability, simplicity of control, cleanliness, adaptability, elimination or reduction to a minimum of shafting and belts, improvement in the quality of the product, due to the steady drive, and the facility of checking the power consumption of any particular machine, or line of machines. These benefits, coupled with safety, an important factor where female labour is employed, result in increased production.

We are indebted to Mr. Ewan, chief engineer to Messrs. Henry Ballantyne & Sons, Ltd., for assistance in the preparation of this article, and also for the accompanying illustrations.

Potentiometer Regulators.

Notes relative to a method of varying and reversing the field current of the special generators employed for the control of motors on the Ward-Leonard system.

By CLAUDE W. HILL, M.Inst.C.E., M.I.E.E, M.I.Min.E.

THE use of the Ward-Leonard system of controlling the electrical operation of opening span bridges necessitated the evolution of new designs of potentiometer regulators for the purpose referred to.

Each of the designs outlined below is capable of reducing the field current of the special generators utilised to zero and reversing it without breaking the circuit. Figs 3*a*, *b*, and *c* show a very simple form of potentiometer regulator, the arrows on the three diagrams showing the directions of the current in each case. It will be noted that in this design, when the switch lever is full on, one half of the resistance remains in series with the field coil. Consequently the total wattage, field coil plus potentiometer, is greater than it would be if the resistance were all in parallel with the field coil when the switch is in this position. This point is dealt with again later.

Figs. 5*a*, *b*, and *c* illustrate a development of the previous design, in which two levers are used, geared to move in opposite directions. In this case, when the switch is full on, the whole of the resistance is in parallel with the field coil, so that the latter receives the full voltage of the circuit. Obviously, if the motor is to run for long periods at full speed it might be worth while to provide a subsidiary switch which would cut out the resistance when the potentiometer switch was on the last step, bringing it in again when

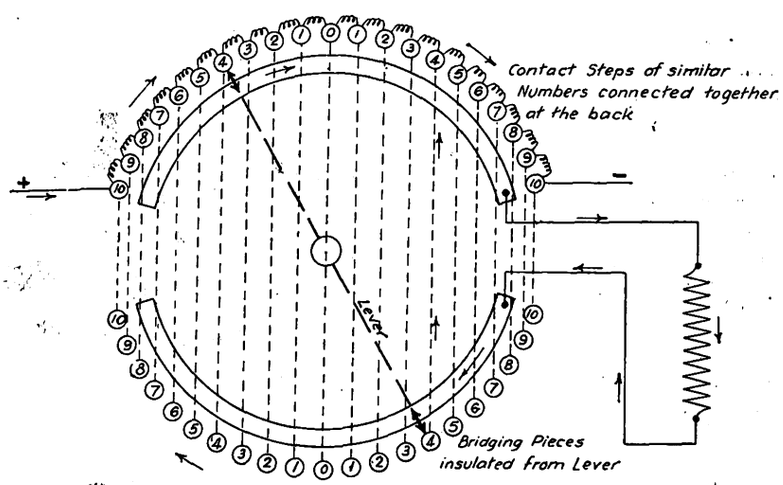

Fig. 1.—Single-lever Apparatus; Two-lever Principle.

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it was moved back to the last step but one. This, however, is a comparatively small detail. It is not actually necessary to use two levers as shown diagrammatically in fig. 5, as the same effect may be obtained with a single lever arranged as shown in fig. 1, while if a greater number of running steps are required the design shown in fig. 2 may be employed.

Referring to fig. 4, the symbols are as follows:—V = circuit voltage; V_1 = voltage on field coil; C_1 = current in parallel with the field coil; C_2 = total current, potentiometer plus field coil; C_3 = current in field coil; R = resistance of potentiometer; R_1 = resistance in parallel with field coil; R_2 = resistance of field coil; and W = total wattage, potentiometer plus field coil. The equations of the potentiometer with the lever on any given step are then as follows:—

$$C_3 = \frac{V}{R\left(1 + \frac{R_2}{R_1}\right) - R_1} \quad \ldots \quad (1)$$

$$C_1 = \frac{C_3 R_2}{R_1} = \frac{V_1}{R_1} \quad \ldots \quad \ldots \quad (2)$$

$$C_2 = C_1 + C_3 \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$R_1^2 + \left(\frac{V}{C_3} - R\right) R_1 - R R_2 = 0 \quad (4)$$

$$W = C_3^2 R_2 + C_1^2 R_1 + C_2^2 (R - R_1) \quad (5)$$

The value to be taken for R is rather a matter of choice, the author's preference being for a value which makes the current in the resistance about one-fifth of the field current when the switch is full on. The value which R_1 requires to have on each of the running steps may be calculated from equation (4), but it is a long process. A more convenient method is to calculate a series of curves from equations (1), (2) and (3), in which the values of R are abscissæ and the currents are ordinates; an example is given in fig. 6. It will be noted that the curve C_3 has a reversed curvature, the point of inflection being at A. It is not necessary to calculate a point for each running step, for it is sufficient to calculate, say, four points at the commencement of the curve, the inflection point, and about five points equally spaced between the latter and the end of the curve. The determination of the exact position of the inflection point requires double differentiation of equation (1), thus—

$$dc_1 = \frac{V\left(\frac{R R_2}{R_1^2} + 1\right)}{\left\{R\left(1 + \frac{R_2}{R_1}\right) - R_1\right\}^2} \quad \ldots \quad \ldots \quad (6)$$

$$dc_2 = \frac{2V\left(\frac{R R_2}{R_1^2} + 1\right)^2}{\left\{R\left(1 + \frac{R_2}{R_1}\right) - R_1\right\}^3} - \frac{2 V R R_2}{R_1^3\left\{R\left(1 + \frac{R_2}{R_1}\right) - R_1\right\}^2} \quad (7)$$

The exact position may be determined from equation (7) by finding the value of R_1 when $dc_2 = 0$. This is, however, a long process, and the position may be found with sufficient accuracy for practical purposes by calculating a few values of dc_1 and plotting them. The lowest point on the curve so found corresponds with the position of the point of inflection. Thus the curve dc_1 in fig. 6 gives values of dc_1, and its lowest point (at which $dc_2 = 0$) shows that the inflection point occurs when $R_1 =$ 29.5 ohms. As an illustration, curve dc_2 has been plotted, and it will be seen that the zero point of this curve also agrees with the same value of R_1.

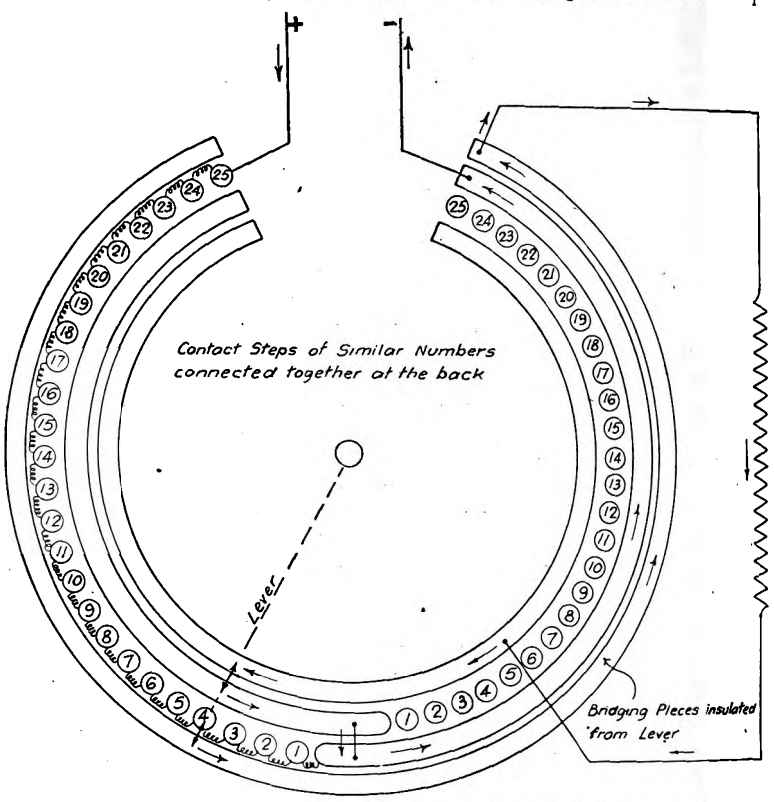

Fig. 2.—Potentiometer for Large Opening-Span Bridges.

The steps to be taken in designing a potentiometer are, briefly, as follows:—

1. Decide on the motor speed required on each running step.
2. Determine the voltages required to give those speeds.
3. From the induction curve of the special generator find the values of C_3 corresponding to those voltages.

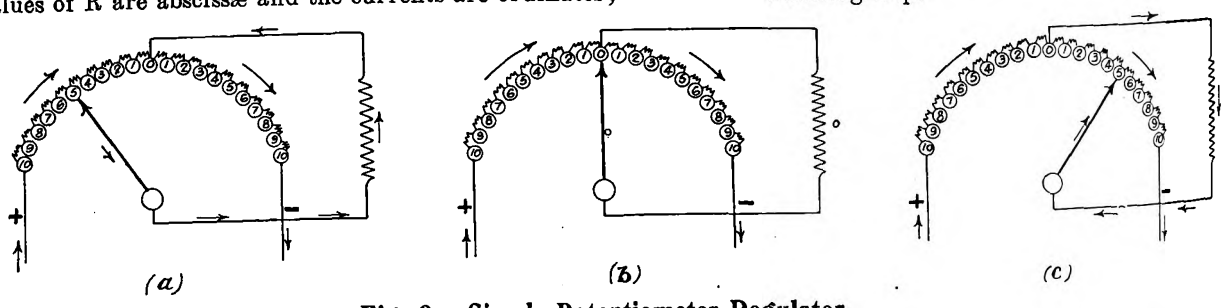

Fig. 3.—Simple Potentiometer Regulator.

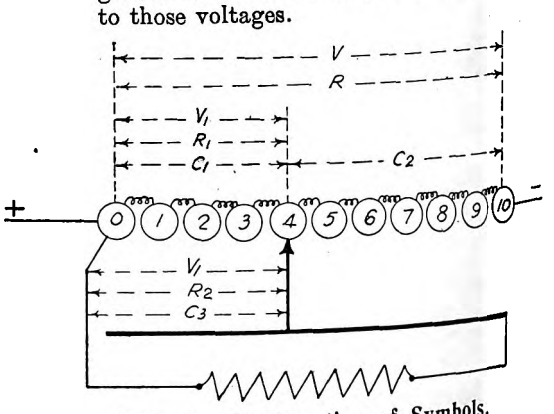

Fig. 4.—Explanation of Symbols.

4. Calculate curves C_1, C_2 and C_3, as in fig. 6.
5. From curve C_3 read off the values of R_1 corresponding to the required values of C_3.

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6. From curve C_2 read off the amounts of current in the potentiometer resistance for each running step and settle the sizes of wire accordingly.

Reverting to the design shown in fig. 3, it has already been mentioned that in that case one half of the potentiometer resistance remains in series with the field coil when the switch is full on. Consequently the total wattage, potentiometer plus field, is greater than in the other designs shown, so rendering that design only suitable for small sets, or sets that work infrequently. A further point is that the value of R is not a mere matter of choice, there being in each case a definite value which gives minimum wattage. The correct value of R may be found by differentiating the wattage equation (5), and equating to zero in the usual manner for the determination of minima. For this purpose equation (5) may be put into a slightly different form: with the switch full on $R_1 = 0.5\ R$ and $R = (2V - 4\ V_1)/C_3$ (8).

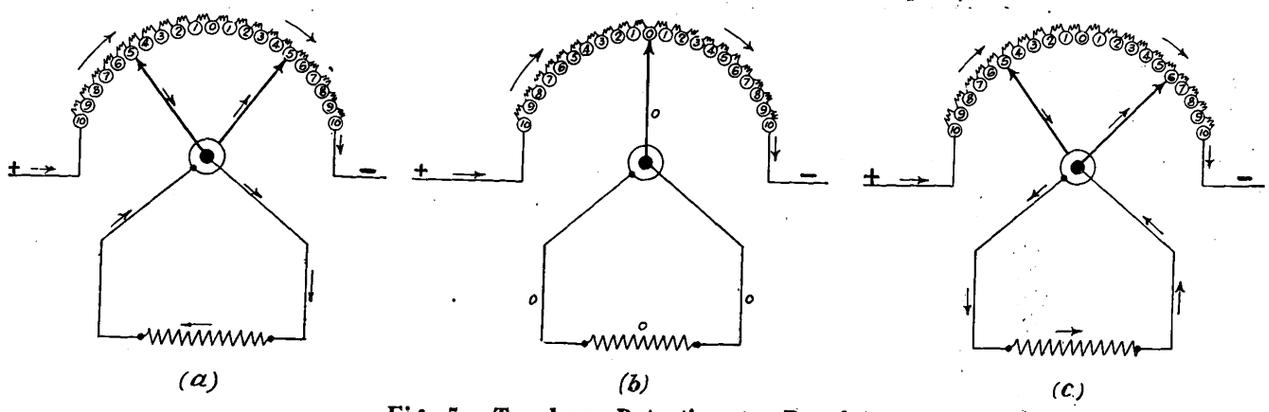

Fig. 5.—Two-lever Potentiometer Regulator.

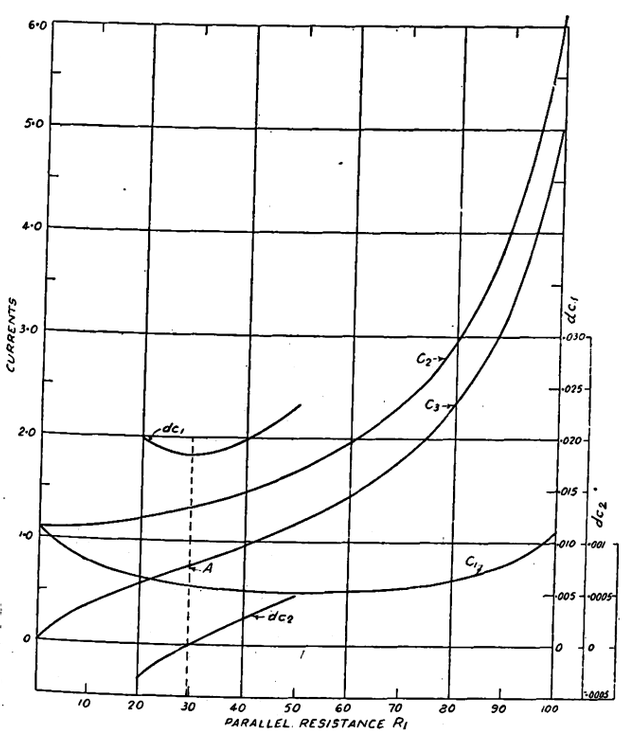

Fig. 6.—Resistance-current Characteristics.

Taking these into consideration the equation becomes

$$W = \frac{V_1^2}{R_2} + \frac{C_3\{V_1^2 + (V - V_1)^2\}}{V - 2\ V_1} \quad \ldots \quad (9)$$

Differentiation of this gives

$$dc = C_3\left(1 - \frac{2\ V_1^2}{(V - 2\ V_1)^2}\right) \quad \ldots \quad (10)$$

Equating this to zero, $V^2 - 4\ VV_1 + 2\ V_1^2 = 0$ (11) and the solution is $V = (2 + \sqrt{2})V_1 = 3.414\ V_1$ (12). As $V_1 = C_2R_2$, and as, for minimum wattage, $V = (2 + \sqrt{2})\ V_1$, the correct value of R may be found by substituting these in equation (8) thus—

$$R = \frac{2 \times (2 + \sqrt{2})\ C_3\ R_2 - 4\ C_3\ R_2}{C_3} = (2 \times \sqrt{2})\ R_2 = 2{\cdot}828\ R_2 \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

The process of determining R is then as follows:—

1. From equation (12) calculate the value of V_1 to give minimum wattage on the circuit voltage V; that is, $V_1 = V/3.414$.
2. Determine the ampere-turns required in the generator field and calculate the diameter of wire which will give them with voltage V_1; then calculate the values of C_3 and R_2 which will give the correct rise of temperature in the field coil.
3. From the value of R_2 so found calculate the value of R from equation (13).

Fig. 7 is an example of the wattage and resistance curves at different circuit voltages of a potentiometer for which the field circuit data are: voltage on field

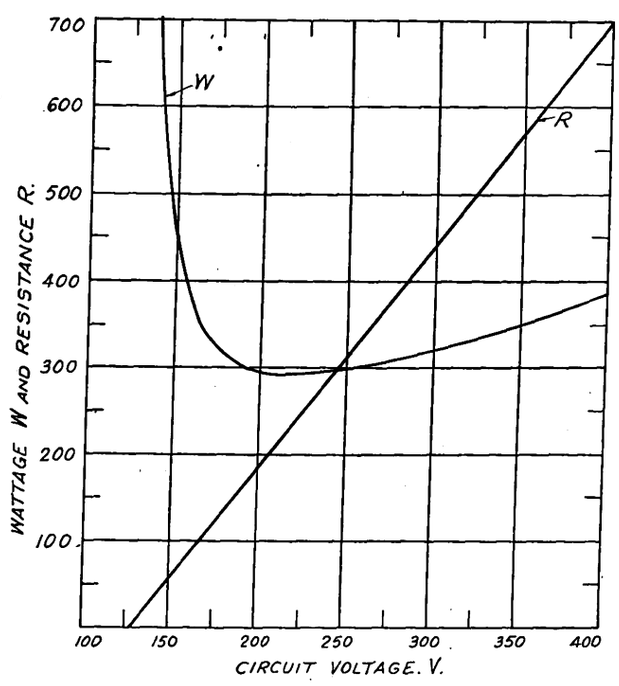

Fig. 7.—Wattage- and Resistance-voltage Characteristics.

64.4 volts; resistance of field 83.0 ohms, and field current 0.776 ampere. It will be noted that for minimum wattage the circuit voltage is 220 ($= 3.414\ V_1$) and the potentiometer resistance 235 ohms ($= 2.828\ R_2$).

For Ward-Leonard sets of 100 h.p. and over for the operation of large opening span bridges, &c., the design shown in fig. 2 is being used. For smaller sets the design shown in fig. 1 is suitable, while for cases in which a wide range of speed is required with very small power, as in the feed motions of some classes of machine tools, the design shown in fig. 3 may be used.

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disintegrating the coal by passing it through rows of intermeshing pegs from its entrance at the centre of the pulverising chamber, its ultimate pulverisation to be effected by passing the disintegrated particles of coal through a second stage from the periphery to the centre

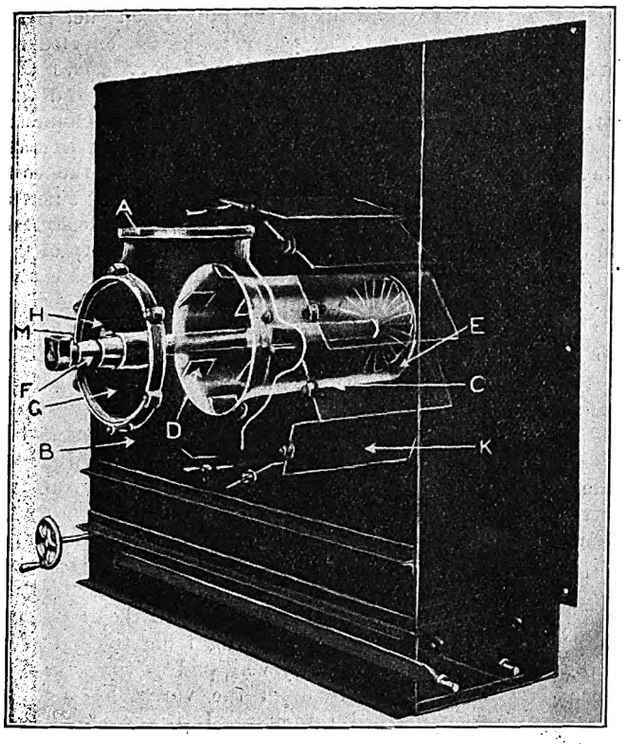

Fig. 3.—Ghost View of " Riley " Burner.

against centrifugal force. The scheme permitted the coal particles to be held indefinitely in a pulverising zone, the centrifugal eddies produced by the moving impellers being counteracted upon by the centripetal effect of the air stream through the mill, which endeavoured to carry the fine particles inward. It was found that the moving pegs created eddies upon which the coal particles were carried; the larger particles selecting the high-velocity eddies, and the finer particles those of low velocity.

When the fixed pegs in the second stage were omitted the ground product was superfine in quality, the power was high and the output low. The explanation is that in this zone were many air-coal streams travelling at widely varying velocities, and the attrition or rubbing effect caused the coal particles to become smaller and smaller in size as they approached the centre. A tendency for the dust cloud to gyrate was overcome by the judicious introduction of fixed pegs to break up the gyratory effect and co-ordinate the problems of output, fineness of grinding and power required. As the selective effect in the pulverising zone was based on a mass-surface principle, many particles, light in weight, but over-sized, were carried to the burner. That difficulty was overcome by a mechanical device, the rejector, which rotated at the same speed as the shaft and rejected the over-sized pieces back to the pulverising zone for further treatment. Experience gained in pulverisation in connection with the cement-manufacturing industry showed that it was practicable to dry and pulverise the coal simultaneously by passing hot air through the mill.

In the modern " Atritor " the peg-type disintegrator has been replaced by a hammer disintegrator which is unaffected by the presence of foreign materials, and a metal separator has been incorporated in the design, so as to trap any such material before it enters the mill. The rotating pulverising elements can no longer be described as pegs, but rather as air beaters or impellers. These are segmental in shape, easily fixed to the steel rotor, and wear very slowly. The new construction is claimed to entirely remove the wear from the rotor plate. Fig. 1 shows the details of the interior of the " Atritor "; the hinged construction is essentially simple and avoids the handling of heavy parts.

The operation of the complete " Atritor " is as follows. The coal is fed into the hopper on the machine and descends on to a horizontal rotating disk. The speading of the coal over the disk is controlled by a sleeve, adjustable for height, and the feed of coal to the machine is regulated by a knife which scrapes the coal off the disk. The position of the knife is controlled by a handwheel. The feeder is specially designed to obtain fine regulation of the coal, and is capable, it is claimed, of dealing with any normal coal containing up to 15 per cent. moisture content. Large detachable covers are fitted for inspection or cleaning purposes when necessary. From the feeder, the coal descends to the separator where all metals and foreign substances, heavier than coal, are rejected from the machine. This separation is performed by a current of air which passes through the separating device in such a direction and with such velocity that it carries the coal into the machine, but fails to sustain or convey heavier materials than coal. Fig. 2 depicts the separator arrangements.

The coal enters the machine about the centre, and is pulverised in two stages. In the first stage there is a number of hammers pivoted freely on the hub that carries the disk. When the machine is running, these hammers are held out by centrifugal force. They catch the incoming coal and beat it against the screen ring which partially surrounds them. This stage is known as the first effect. After passing the edge of the disk, the coal turns inward to the centre, and during its progress the final stage of pulverisation is effected, this being termed the second effect.

Hot air passes into the machine with the coal, and owing to the large surface or contact area of the coal it is instrumental in drying moist coals, without causing

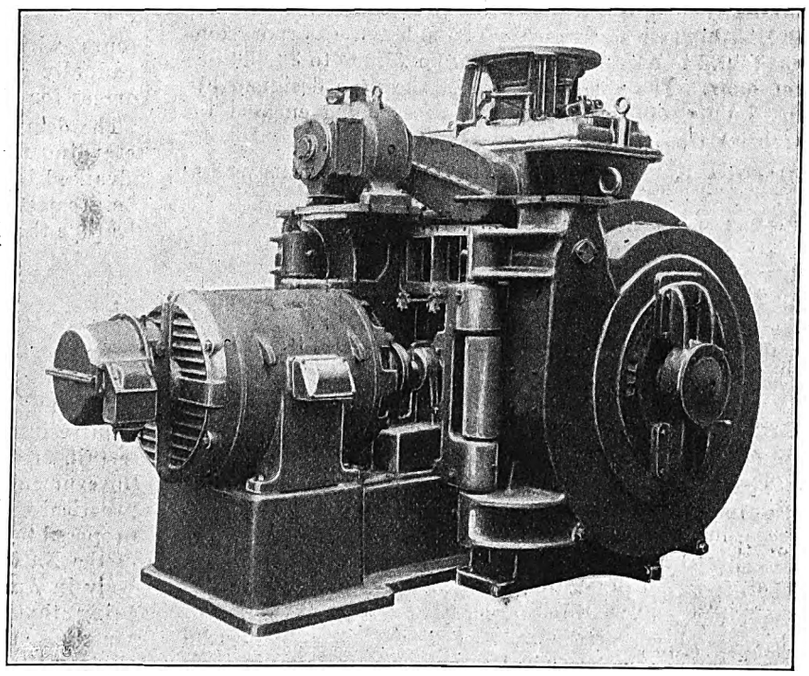

Fig. 4.—No. 24 " Atritor," as Supplied to Hams Hall Power Station, Birmingham.

either pulverising or combustion difficulties. The hot air may be obtained from the boiler through cavities in the walls of the combustion chamber, or from air heaters placed in the flues of the furnace. Before leaving the second effect of the machine, the coal passes through

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the rejector, which revolves at the same speed as the shaft. The coal particles of satisfactory fineness are drawn, together with the air, to the fan which projects the dust cloud to the furnace.

The casing of the machine is fitted with renewable liners, and all parts which are subject to wear have been designed to be replaced easily and quickly at a minimum cost. All rotating parts are mounted in ball or roller bearings of suitable size, and the attention required during continuous running is almost negligible.

The maintenance costs for a No. 16 "Atritor" are given in the following schedule of renewals:—

Tons of Coal Pulverised.	Parts to be Renewed.	Cost. £	s.	d.	Cost per ton in Pence.
3,000 to 4,000	Hammers Agitator segments Moving peg segments Fixed pegs Rejector arms	11	17	8	0.950
6,000 to 8,000	Fan blades	2	18	6	0.117
9,000	Fan casing liners	16	5	0	0.435
18,000	Body liner	21	0	0	0.28

Total cost per ton of coal pulverised, 1.782d.

Fig. 4 shows a No. 24 "Atritor" as supplied to the new Hams Hall power station of the City of Birmingham Electric Supply Department. Twenty-five "Atritors," each having a pulverising capacity of 4 tons per hour, complete the initial installation at Hams Hall, and five of these serve each 190,000-lb./hr. boiler. Four of the "Atritors" are driven by a.c. squirrel-cage motors, and one by a d.c. constant-speed motor. The supply of coal to the machines, and consequently the burners, is remotely controlled from an operating platform by suitable switchgear operating variable-speed d.c. feeder motors.

It is interesting to note that in the power station at the Alfred Herbert works are, in addition to a small testing boiler of 870 sq. ft. heating surface, two Babcock and Wilcox water-tube boilers of the ordinary land type, all equipped for pulverised-fuel firing with "Atritors" and Riley burners.

The following data concern the two B. & W. boilers, which, when equipped for stoker firing, had each an output of approximately 15,000 lb. per hour. When, however, the boilers were fired with pulverised fuel, after having been equipped with suitable combustion chambers and with water walls on the two sides, the evaporation was found to have increased to from 25,000 to 30,000 lb. per hour. The side walls are of the type designed by Dr. Lulofs, of Amsterdam, the tubes being encased in firebrick tiles.

Data for B. & W. Boilers Equipped for Pulverised-fuel Firing.

Heating surface of boiler	4,483 sq. ft.
,, ,, ,, superheater	816 sq. ft.
,, ,, ,, side walls of combustion chamber ...	230 sq. ft.
Steam pressure	160 lb. per sq. in.
Steam temperature	550° F.
Combustion chamber volume	2,200 cu. ft.
,, ,, width	10 ft. 1 in.
,, ,, depth from tubes to floor level	17 ft. 6 in. (mean).
Combustion chamber distance from front to back	13 ft. 6 in.

The Riley flare-type burner is strongly advocated for use in conjunction with the "Atritor." The construction and operation of this burner may best be described by reference to the ghost view given in fig. 3. The discharge pipe from the pulveriser is connected to the flange A at the inlet of chamber B. At the outlet of this chamber and the inlet of pipe C is a number of vanes D arranged parallel to the axis and at an angle to the pipe radius. At the end of the pipe is a coal spreader E carried on a pipe which projects through the outside cover plate of chamber B. This coal spreader is adjustable and held in position by screw H. The pipe C is contained within a plenum chamber, one side of which sets against the furnace wall. The opening in the plenum chamber coincides with a similar opening in the furnace wall. Secondary air is admitted to the plenum chamber through damper M, and within this chamber and surrounding pipe C is a set of vanes K, the axes of which are parallel with the axis of the pipe. Damper M can be located on either side or the top or bottom of the plenum chamber. Chamber B can be installed with the inlet in any position desired, and it can also be reversed, so that the rotation of the pulverised fuel is in the opposite direction. The pulverised coal, carried in suspension by primary or conveying air, enters the chamber B through the flanged connection A and the stream is given a circular motion within the chamber and enters the pipe C while revolving about the axis of the pipe. Since this motion tends to cause the coal stream to travel in a zone adjacent to the inner surface of the pipe, the vanes D are arranged to divert the stream toward the centre. The coal then passes to the tip of the pipe, completely filling the space between the pipes F and C. The vanes E break the coal streams into a number of stratified streams and divert these strata into a conical form or flare.

Secondary air, supplied under pressure from a fan, passes the dampers M which control the quantity of air flowing, and is given a whirling motion in passing between the vanes K. The amount of whirl is determined by the angular position of these vanes. In general the direction of rotation of the secondary air is opposite to that of the primary air and coal in the chamber B and pipe C, but they are so designed that they may be set to give the same direction. Mixing of secondary air with primary air and coal occurs beyond the tip of the burner E. The coal stream issuing from the tip E in the form of a flare is violently whipped by the stream of secondary air issuing through the vanes K, the two streams being in rapid rotation. Impingement of the coal stream on the vanes E results in strata consisting of alternate rich and lean mixtures of coal and air. The rich portions of the stream ignite readily and act as kindling to the remainder of the mixture.

Initial ignition may be secured by means of a kerosene torch. A five-gallon tank of kerosene is mounted on the boiler front wall and a connection made between the tank and point M on pipe F. Kerosene is then permitted to flow through this pipe into the furnace and is ignited by means of a waste torch. Primary air and coal are then introduced without any secondary air. Ignition of this rich mixture is practically instantaneous and occurs without any puff. The dampers M are then gradually opened until the amount of secondary air is correct for the amount of coal being burned.

The degree of the flame is adjusted by advancing or retarding the pipe F and rosette E. With the rosette advanced beyond the end of the pipe C the flare will be the greatest, and with the rosette drawn entirely within the pipe the flare will be the least.

Government Research Staffs.

A committee has been appointed by the Treasury to inquire into matters affecting the functions and staff of certain research and experimental establishments of Government Departments. The scope of this inquiry is practically the same as that of the committee which was proposed by the staff side and rejected by the official side of the National Whitley Council at the meeting of that body in April last, says *The Times*, the main difference being that the Treasury inquiry does not cover the museums, the observatories, or the research services of the Ministry of Agriculture and Fisheries. The staff side of the National Whitley Council is understood to have pointed out to the official side that the appointment for this purpose of an inter-departmental, instead of a Whitley, committee contravenes the spirit and intention of Whitleyism, and deprives the staff of the opportunity that was definitely intended by the Whitley Council constitution, of being represented on such a body and given an equal share in the determination of its findings.

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A Locomotive Snow Plough.

Details of a Swiss passenger and goods train electric locomotive which is also intended to act as a snow plough.

THE Société des Ateliers de Secheron, of Geneva, in conjunction with the Fabrique Suisse des Machines et de Locomotives of Winterthur, has recently completed an interesting electric locomotive that is intended to serve for passenger and goods train haulage and also to act as a snow plough on the Swiss Bernina metre-gauge railway. The line connects the Engadine valley with Italy and is the highest adherence railway in Europe. It is approximately 38 miles in length, and differences in level of no less than 7,963 feet have to be overcome, only about 12 per cent. of the line being on the level. Moreover, 42 per cent. of the track consists of curves, and the temperature in winter falls to from 25 to 30 deg. C. below zero, while in summer snow to a depth of 17 ft. has been encountered. After a careful study of the problem the Secheron Co. submitted plans for an eight-wheel double-bogie locomotive designed to attain speeds of 12½, 6¼, and 3⅛ m.p.h. when hauling a 47-ton train, that weight not including that of the locomotive, each of the four axles being equipped with twin electric motors. The four twin motors, which are enclosed in a common casting, are coupled in parallel when the machine is running at low speed, the small-diameter wheels being driven through gearing and spring couplings, which is considered a better method of overcoming wheel slip on a snow-covered track than that of using motors in series and linking the two axles of each bogie by connecting rods.

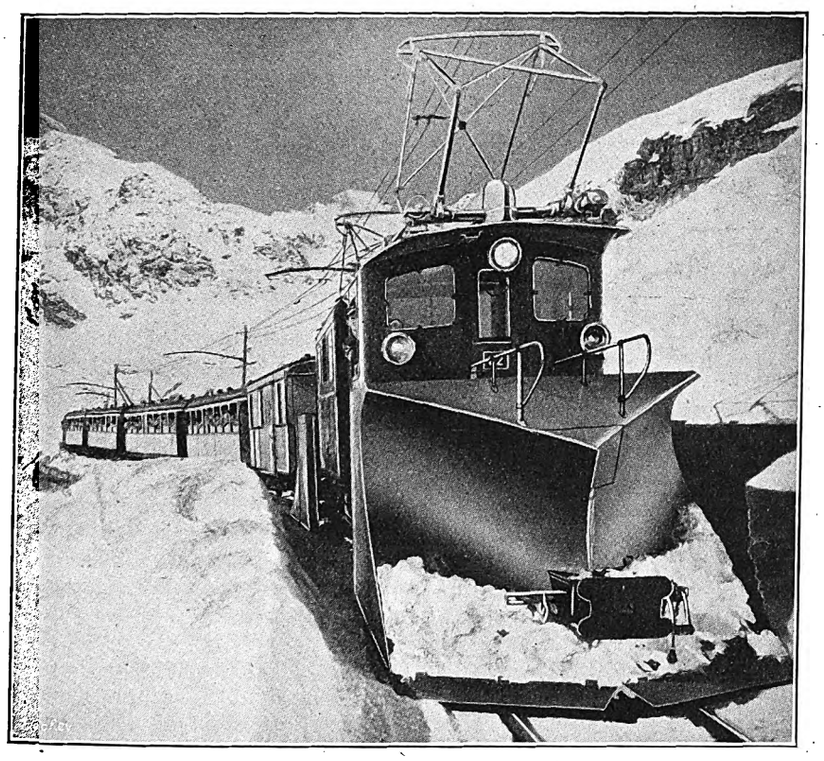

Fig. 1.—An Electric Train on the Bernina Railway.

The inter-coupling of the electric motors and the calculation of the starting resistance necessitated careful study in order to obtain as regular a degree of train acceleration as possible. Both for series working at starting and parallel running, a wide range of current graduation has been secured by a judicious choice of resistances and the use of contactors individually operated by compressed air. Furthermore, in order to obviate any train shock when changing the motor couplings, especially on steep gradients, the motor circuits have been arranged to avoid any reduction in power output during the change from series to parallel coupling.

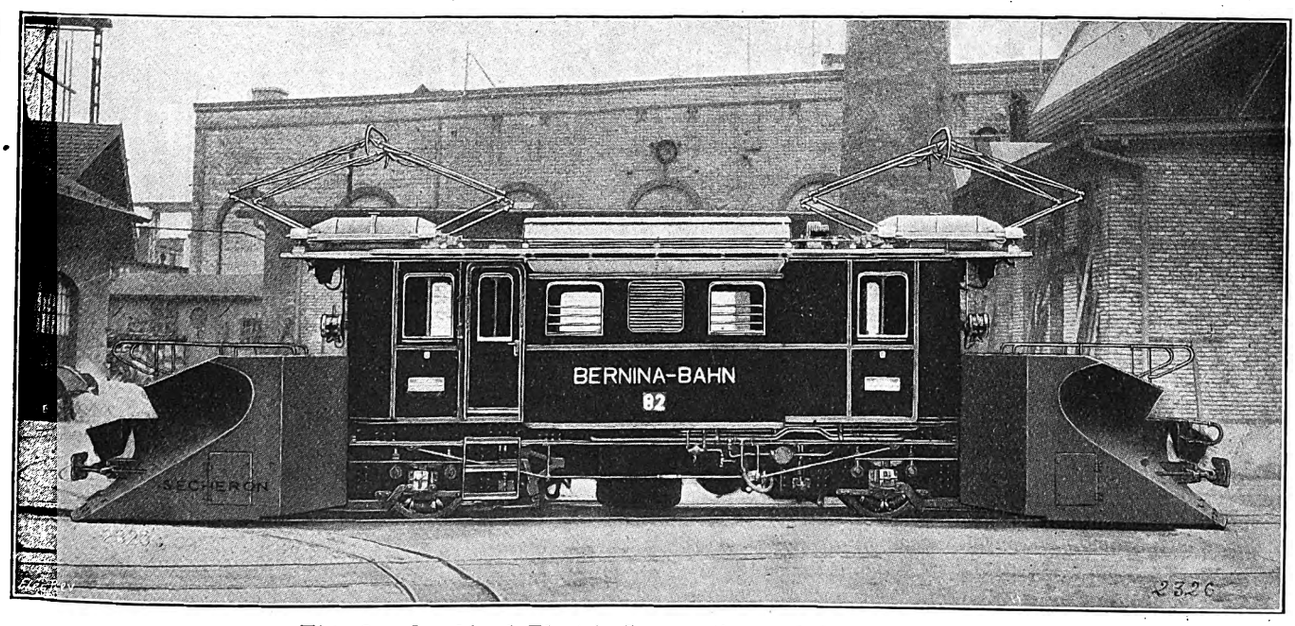

Fig. 2.—Combined Electric Locomotive and Snow Plough.

For normal running the two armatures of each motor are coupled in series and the four motors are connected in parallel with the main circuit. In other cases, the

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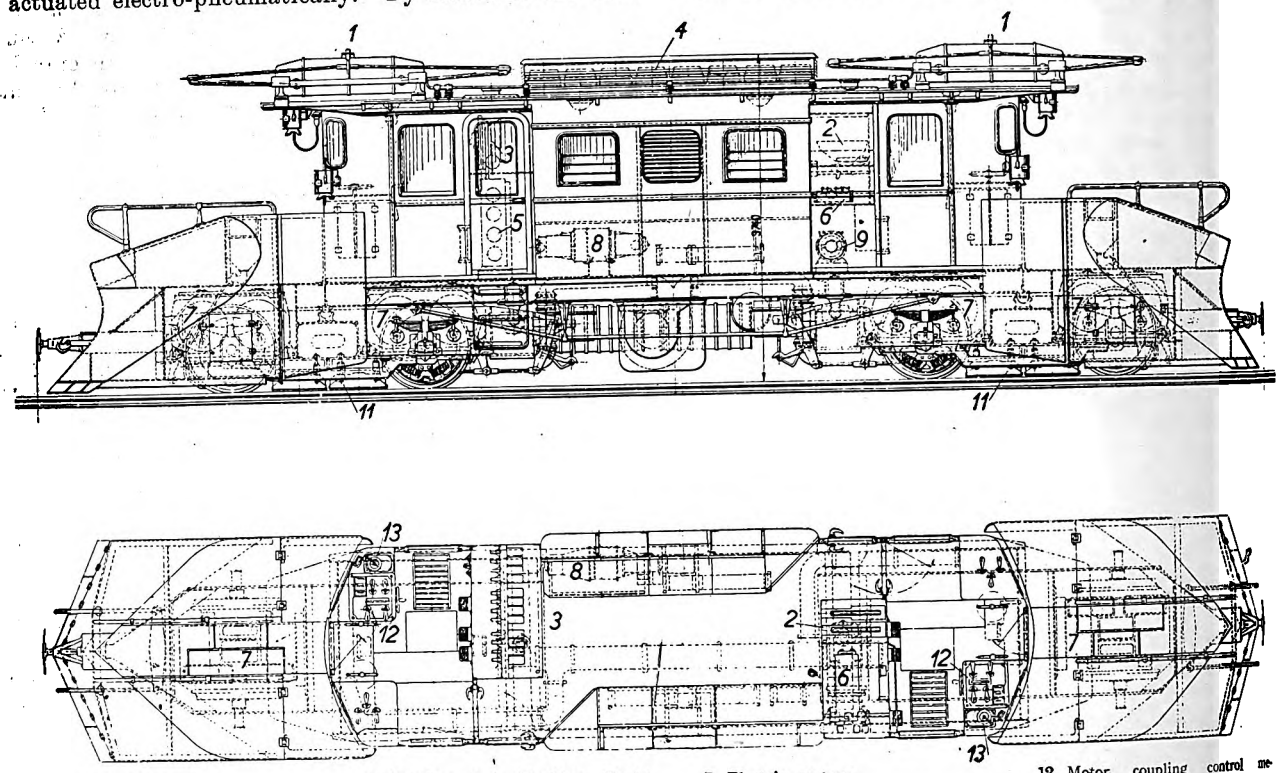
armatures are connected in parallel. Altogether the engine can be run at eight different speeds: a normal rate and three others (by weakening the field) for each method of armature coupling. Drum-type commutators operated electro-pneumatically are used to effect the field weakening. The motors are reversible, the reversing gear which alters the connections being actuated electro-pneumatically. By means of the same gear, any one of the motors, should a fault develop, can be cut out of circuit. The resistances used in connection with the engine are located in the roof of the machine, where they receive ample ventilation.

The engine, which can attain a maximum speed of 31¼ m.p.h., has an axle pressure of 11 tons and is designed to work with direct current at minimum, average, and maximum voltages of 550, 800 and 1,100 V. At a speed of 12½ m.p.h. it is able to develop 500 h.p. continuously at the wheel tyres with d.c. at 800 V.

The braking system comprises a Hardy vacuum brake, a hand brake acting independently on each bogie, an electrical brake working through resistances, and an emergency electro-magnetic brake acting on the rails.

The principal dimensions and weights of the engine are: overall length between buffers, 47¼ ft.; total wheel base, 32 ft. 9 in.; bogie wheel base, 7 ft. 2½ in.; overall width, 8 ft. 2½ in.; diameter of wheels, 38⅜ in.; transmission gear ratio 1 to 7; weight of mechanical part of the locomotive, including vacuum brake, compressor, and snow plough, 25 tons 15 cwt.; weight of electrical equipment and transmission gear, 17 tons; miscellaneous equipment, 12 cwt. The total weight of the engine is therefore 43 tons 7 cwt.

A snow plough is provided at each end of the machine, the bottom edge of which can be lowered to within 1 3/5 in. of the rails. As the sides of the plough encompass part of the engine, mounting steps for the drivers are fitted in the front centre and so pivoted that they can be turned up when the engine is snow ploughing. The ploughs are designed to cut a passage 10 ft. 6 in. in width.



1. Current collectors.
2. Main control switch.
3. Running and braking contacts.
4. Starting and Braking Resistances.
5. Reversing gear.
6. Field shunting control.
7 Electric motors.
9. Motor-driven air compressor.
9. Motor-driven vacuum pump.
11. Electro-magnetic brake shoe.
12. Motor coupling control mechanism.
13. Vacuum brake control.

Figs. 3 and 4.—A Swiss Electric Locomotive and Snow Plough.

The Financing of Export Trade.

An Explanation of the Facilities available to the Electrical Exporter.

By A. W. WILLSMORE.

In 1927 Great Britain headed the list of competitive countries in the value of exports of electrical goods. The figures for 1928 show that we have now fallen to third place, both Germany and the United States having passed us. This fact is, of course, partly explained by the reparations situation in the case of the one country, and the development of electrical finance in that of the other. At the same time, however, no small part is played by the apathy towards export trade evinced by certain sections of the electrical industry in this country. There are many electrical manufacturers who could find good markets for their merchandise overseas. The reason why they do not take advantage of this fact is in many cases the result of imagined financial difficulties. If foreign customers were prepared to do business on a cash-with-order basis there would be little objection to export trade. In actual practice, however, the foreign buyer wants to have the goods actually delivered before he will pay. And very frequently it is stipulated that payment shall be delayed until two or three months after delivery, often as not in order to enable the buyer himself to sell the goods before he pays for them.

The manufacturer is prepared to grant such facilities

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to home customers as a matter of routine, provided of course that their credit standing bears investigation. If the customer resides in a foreign country, however, the manufacturer very often does not feel safe in engaging in business on such terms unless he can afford to pay a personal agent to look after his interests in the country. For the smaller manufacturer this is out of the question. But it is not generally appreciated that the big London bankers are prepared to act as foreign financial agents for their customers in this connection. Or at least, if the fact is known, the maximum advantage is not taken of it.

Banks as Collecting Agents.

One of the features of post-war banking in this country has been the increased attention paid to export finance by the larger banks, and in many instances special departments have been established to deal with this side of the business. Let us take as an illustration the case where a manufacturer has secured an inquiry from a foreign buyer who agrees to pay for the goods on delivery. The first preliminary is, of course, to have an investigation made into the credit standing of the prospective customer. The bank is prepared to make this investigation without any responsibility attaching to its customer, and if the result of this investigation is satisfactory it will be prepared to act through its overseas connections as his collecting agent in the foreign country.

It is common knowledge that when goods are shipped, the master of the ship signs a bill of lading making himself responsible for the goods specified therein. This bill of lading is a document of title. The man holding the bill has legal possession of the goods it covers, and while he keeps it he retains control over his goods. The manufacturer takes this bill of lading to his bank attached to a sight bill of exchange drawn on his foreign customer. The bill of exchange, together with the shipping documents, is sent by the bank to its local agents in the foreign country, and these agents will ensure that the importer pays the full face value of the bill before they relinquish the bill of lading, without which he cannot secure the goods. As soon as they are advised by their agents that the bill has been paid, the home bankers will credit the manufacturer's account with the amount (less the small charges involved), and the manufacturer can immediately draw on this account.

By utilising the services of his bank in this way, the exporter can ensure that the foreign buyer will not secure the goods until he has paid for them, and that he, the exporter, will get his money as soon as his customer has accepted the goods

Granting Credit.

Circumstances may arise where the credit standing of the importer is good and the manufacturer agrees to give him two or three months' credit. In this case the manufacturer would draw a bill payable at two or three months, and present it to his bank with the bill of lading. The bank, through its agents, would get this bill accepted before parting with the shipping documents, and if the manufacturer were giving three months' credit, the bill would fall due for payment three months after it was accepted. In the meantime the manufacturer could wait until the bill matured, when it would be presented for payment by the agent and the money credited to the manufacturer's account by his bank, or, alternatively, the manufacturer could arrange to have the bill returned to him to be discounted.

The problem arises, however, that, although the credit standing of the customer in his own country may be excellent and his financial standing good, he may be entirely unknown in the manufacturer's country, so that the manufacturer would have to pay relatively high rates for discounting. Under such circumstances a more satisfactory means of settlement is by confirmed bankers' credit if the buyer can be persuaded to adopt this method of payment.

Documentary Credit.

This confirmed bankers' credit substitutes for the credit of the buyer the credit of a bank. The buyer gives his own bank full particulars of the proposed transaction, and asks it to arrange with the bankers of the seller for the credit to be opened. It can be arranged for this credit to be a confirmed credit or an unconfirmed credit. If it be unconfirmed, the credit can be cancelled by the buyer with or without notice. A confirmed credit, however, is irrevocable and can only be cancelled with the sanction of the party who benefits under the arrangement (in this case the seller). Obviously, therefore, the seller would only agree to the credit being unconfirmed where he had absolute confidence in his customer, and in the majority of cases it is better to demand confirmed credit.

If the credit standing of the intending buyer is satisfactory, his bankers will request the London bank to open the required credit in favour of the seller of the goods. The London bank will write to the seller to inform him that the credit has been opened, and the seller can immediately draw on this amount by submitting a documentary bill (*i.e.*, a draft accompanied by the shipping documents covering the goods which are the subject of the transaction). Unless he has agreed to allow his customer time to pay, the seller can in this way obtain his money immediately after shipment. If he has allowed his customer credit, he will present with the shipping documents a bill payable at the end of the credit period. This draft, which is presented with the documents, will be accepted by the London bank, and the seller can then, if he desires, discount the accepted bill in the open market. Being an approved bankers' acceptance, very low rates will be charged for discounting.

The Government Scheme.

We have so far dealt with the finance facilities available to the electrical manufacturer through his bank. It is, however, well known that the Government is also prepared to help in this connection through the Export Credits Guarantee Scheme. The principle of this scheme is that the Government is prepared "to guarantee the payment at maturity of accepted bills of exchange drawn in connection with the export of British goods." It will be appreciated from this that the main feature of the Government scheme is that it offers insurance facilities. The scheme has, however, now been extended so that finance facilities can be granted as well as insurance.

The Export Credits Guarantee Department provides two forms of contract: Contract "A" provides insurance facilities only; Contract "B" provides finance and insurance facilities. If a manufacturer secures a Government guarantee under Contract "A" he can draw a bill on his foreign customer and get it accepted, safe in the knowledge that if his customer should fail to pay the bill on maturity, then the Government will immediately pay the amount of its guarantee (which may be up to 75 per cent. of the face value of the bill). In addition, the Government will take any legal action necessary against the defaulting buyer, and will share with the exporter *pro rata* in any amount that it may recover from the debtor. For instance, if the manufacturer insures a transaction for 75 per cent. involving £10,000 and the bill drawn in that connection is not honoured at maturity, the Government will, upon being notified of the fact, immediately pay the manufacturer £7,500, thus leaving 25 per cent. of the original sum as the initial loss to the manufacturer. Whatever sum the Government recovers from the debtor the manufacturer will be credited with 25 per cent. of that sum, so that if the debtor can be induced to pay in full, the exporter receives his debt in full.

Of course, the Government will only insure transactions with foreign customers whose credit is considered sound, and the premium charged for insurance will depend upon the amount of risk involved and the credit standing of the importer. The premiums are, however, quite reasonable, as is shown by the fact that during

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the first quarter of this year exports to the value of £1,716,800 were insured under the Government scheme. This figure is more than double that for the corresponding quarter of last year, and since the existing scheme was initiated in July, 1926, the transactions handled by the Department exceed £7,000,000, nearly 25 per cent. of which represents business in the first three months of this year.

The manufacturer can treat each inquiry as an individual transaction or he can arrange for the Government to guarantee short-term bills drawn on a list of customers in a particular market up to a specified amount. The advantages of the scheme are obvious. Not only is the risk run by the manufacturer considerably lessened, but there is the added advantage that he is completely relieved of the necessity of taking legal proceedings in a foreign court.

Even greater benefits, however, are to be found under Contract "B," where, in addition to the insurance facilities considered above, the manufacturer is given facilities for "obtaining advances from his bankers at fine rates without recourse to himself." That is, in effect, he gets a Government endorsement to his bill. The procedure is similar to that described above, but in addition the Government gives an unconditional guarantee to the manufacturer's bank on the bill of exchange, and on the strength of this endorsement the bankers are prepared to discount the bill at very low rates.

Long-term Credits.

In the preceding paragraphs we have referred to the fact that where a manufacturer grants credit to his customer he can himself discount the accepted bill of exchange and so obtain the use of his money before the bill matures. It should be appreciated, however, that this only applies to short-term bills of less than six months' duration. The average bank is not prepared to finance long-term bills of exchange, because it cannot afford to lock up its resources for a long period. Nevertheless, the exporting manufacturer is often expected to give anything up to five years' credit on certain transactions. Especially is this the case in connection with electrical export trade where British manufacturers often have to compete with foreign firms who are prepared to wait two, three, or even more years for payment. In order to fill this gap in British financial machinery, the Export Credits Scheme has been extended to cover long-term credits. The scheme is in principle the same as that described under Contract "B," but arrangements are made for the ordinary six months' bills to be drawn under an agreement to renew them throughout the period of credit. These bills, as before, are endorsed by the Government, and as such are a first-class banking security and can be discounted at very low rates. Arrangements can also be made under the long-credits scheme for payments by instalments, and the Government is always prepared to consider special arrangements for exceptional contracts.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Correction.

In the "Index to Advertisers" in our last issue we gave an entry Fuel Control, Ltd., sup. page 32, but owing to late arrival of matter the advertisement of Combustion Steam Generator, Ltd., of 1, Southampton Row, W.C.1, was published on that page; the former company had no advertisement in that issue.

The British Industries Fair.

Arrangements for the Heavy Section of the 1930 British Industries Fair in Birmingham are even more advanced than at this time last year, when the whole of the stand accommodation was booked seven months before the opening; more than 60 per cent. of the space has already been let. Approximately one-fifth of the firms have already taken advantage of the opportunity offered them to secure their stands for five consecutive years. This early reservation of the major portion of the space greatly facilitates a policy of grouping kindred interests which was put partly into operation last February and is to be considerably extended in 1930. The system of alignment recently introduced—by which all stands have frontage to straight avenues one-third of a mile long—was the first important step towards a new development of progressive grouping which will add to the convenience of trade buyers not only in bringing the leading industries more closely together, but also in permitting allied trades to congregate in proximity to them. The new scheme, moreover, is so devised, taking into account the proposed building extensions for 1930 and future Fairs, that any industrial section can automatically expand to any dimensions, still retaining its unity of interest without disturbing the similar grouping of any other section. The principal officers of the 1930 Birmingham Section are as follow: President, Mr. Walter Barrow (Cadbury Bros., Ltd.); vice-president, Mr. John Belliss, M.I.Mech.E. (Belliss and Morcom, Ltd.); chairman of the Fair Management Committee, Mr. E. W. Bache (Geo. Salter, Ltd.); vice-chairman, Mr. C. Holland Harper (John Harper & Co., Ltd.); deputy-chairman, Mr. G. N. Guest, M.I.Mech.E. (Hollings & Guest, Ltd.); hon. treasurer, Mr. C. E. Greener (W. W. Greener, Ltd.).

Northern Contractors' Annual Meeting.

The annual meeting of the Northern Section of the Electrical Contractors' Association was held on May 29th in the Small Conference Hall at the North-East Coast Exhibition. Representatives of all the branches in the six northern counties were welcomed by the Lord Mayor of Newcastle; Mr. H. C. Hazel, chairman of the Section and vice-president-elect of the E.C.A., presided. The Lord Mayor said that he had willingly accepted the invitation of Mr. R. Robson, the hon. secretary, to attend the meeting. He referred to the Exhibition, making special note of the scheme of illuminations, and said that in two weeks there had been half-a-million visitors, and the organisers were doing their best to sustain public interest. The Sheriff of Newcastle said that the contractors' visit coincided with a distinct improvement in business, and he hoped that brighter and better days were at hand.

In proposing a vote of thanks to the Lord Mayor and Sheriff, Mr. W. H. Walton (president of the E.C.A.) said that the Exhibition must eventually have a great effect upon the industries of the area, improving trade and providing employment. The vote was seconded by Mr. H. Willoughby Ellis (president-elect of the E.C.A.). At the meeting Mr. T. H. Beardsall was elected chairman for the ensuing year and retiring delegates to the National Council were re-elected. In addition to those already named there were present at the meeting Mr. L. C. Penwill (general secretary of the E.C.A.) and Mr. R. W. Kennedy (editor, *Electrical Contractor*). After the meeting the members partook of luncheon, at which Mr. A. B. Maclean (one of the consulting engineers to the Exhibition), Mr. P. W. Wood (resident engineer), and Mr. J. C. Graham (secretary of the Newcastle branch, E.C.A.) were present.

The Electrical Imports of Uruguay.

During 1928 electrical materials valued at $937,940 (£187,590) were imported into Uruguay, as compared with $993,558 (£196,710) in 1927. In Uruguay's foreign trade generally Great Britain was the principal customer, but was second to the United States in the list of suppliers.

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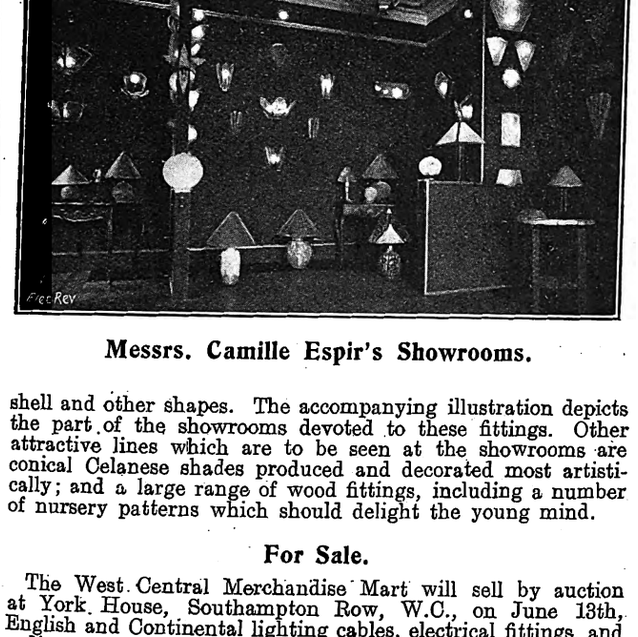
Moulded Glass Lighting Fittings.

In a recent re-arrangement of their showrooms, Messrs. CAMILLE ESPIR, LTD., 19, Hanover Square, W.1, have made a special display of moulded glass lighting fittings. For some time this class of fitting has enjoyed a considerable vogue as it can be produced in a wide variety of styles and designs. The models displayed by the company include ball pendants, panelled pendant fittings, wall panels, and cornice fittings. The wall panels offer an especially wide choice, as they are made in many forms—rectangular, triangular, hemispherical,



Messrs. Camille Espir's Showrooms.

shell and other shapes. The accompanying illustration depicts the part of the showrooms devoted to these fittings. Other attractive lines which are to be seen at the showrooms are conical Celanese shades produced and decorated most artistically; and a large range of wood fittings, including a number of nursery patterns which should delight the young mind.

For Sale.

The West Central Merchandise Mart will sell by auction at York House, Southampton Row, W.C., on June 13th, English and Continental lighting cables, electrical fittings, and radio goods. Fuller, Horsey, Sons & Cassell will sell by auction on June 19th, at the depôt adjoining the main entrance of the Wembley Exhibition Grounds, electrical plant and stores removed from Wembley Exhibition. (See our advertisement pages to-day.)

German Price Increases.

Owing to the increasing cost of copper and its alloys the Central Union of the German Electro-Technical Industry has recently announced an advance in prices. Arc lamps, starters, and electrical machinery accessories are up to the extent of 5 per cent.; electrical machinery, tools, rectifiers, switchgear and installation material 7½ per cent.; transformers 10 per cent.; and low-pressure apparatus 15 per cent. Higher advances are in operation in the case of electrical material which comprises more than 50 per cent. copper.

The Marking of Imported Glassware.

The Merchandise Marks Act inquiry concerning the application of British glass makers for an Order requiring imported illuminating and other glassware to bear an indication of the country of origin was resumed on May 29th.

Mr. N. L. Macaskie, on behalf of the opponents, said that although the applicants asked for an Importation Order, no evidence justifying the application had been given, and no attempt had been made to deal with the difficulties which would be encountered by the Customs authorities. Manufacturers of lighting fittings would be seriously handicapped if the glass which they used had to be marked; this glass formed but a small proportion of the total cost of the completed article. If the Committee saw fit to recommend an Order, then they asked that the marking should be by means of labels, as that was the most practicable method, although it would involve inconvenience and expense. He also asked that if an Order were recommended a considerable interval of time, say, six to nine months, should be allowed to elapse before it came into operation to enable existing stocks to be cleared.

Mr. Wethered, replying for the applicants, said that manufacturers objected to marking only because they did not desire to let their customers know that they were using foreign glass. Referring to the evidence given on behalf of the Chloride Electrical Storage Co., he said that the ground of objection was not, as in the case of illuminating glassware, that the mark would disfigure the accumulator and battery containers, but that the company desired to have an alternative supply to that obtained in this country, but at the same time the desire was expressed that this foreign glass should not be marked owing to the fear that it would prejudice the sales of the company's products. He suggested that this was not an adequate reason for asking the Committee not to recommend an Order. The Chloride Co. was obtaining the bulk of its supplies from English makers, but the applicants did not feel that the company was justified in making the suggestion.

At the conclusion of the hearing on May 29th, Mr. Wethered maintained that the evidence had proved that the cost of marking was negligible. He urged that, if the Order were made, the Committee should not sanction marking by means of adhesive labels, which was considered unsatisfactory. The applicants asked that blown and pressed glassware should be marked indelibly, and that the marks on coloured glassware should be applied in colours contrasting with the colours of the glassware itself. Further, it was necessary that the glassware should bear the marks at the time of importation, because it was difficult even for the experts to distinguish between the British and foreign glassware if it were unmarked.

The Committee will submit its report to the Board of Trade in due course.

On Monday last an inquiry into an application for an Order requiring the marking of imported scientific glassware was commenced.

Cheap Electricity.

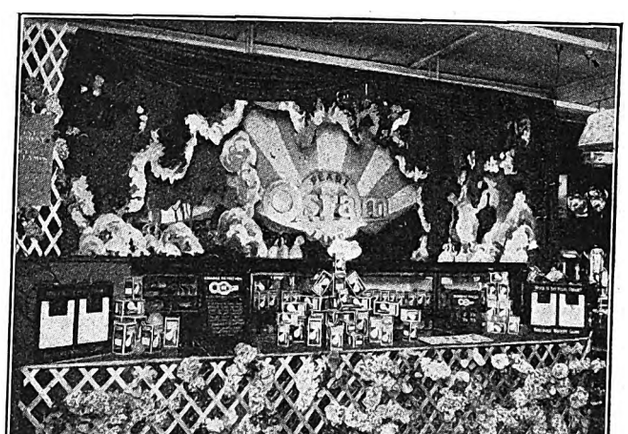
When there are such places as all-electric towns in this country Wimbledon should be one of the first. For a long time it has had a reputation for the cheapness of its electricity, and now a further step in the downward direction is announced. We are informed by the chief engineer and manager (Mr. A. E. McKenzie) that during the September, 1929, quarter all electricity consumed for cooking, heating, and water-heating will be charged for at a flat rate of one halfpenny per unit, without any restrictions, minimum charge, or other qualification. This represents a reduction of 33⅓ per cent. on the present summer tariff and 50 per cent. on the winter tariff. It is anticipated that the reduction will result in a largely increased output during the summer months, and thus make it possible for the low tariff to be operated throughout the six summer months in future years. The pamphlet containing this information is justly entitled "An Announcement Worth Reading." We may mention that the flat rate for domestic lighting in Wimbledon is only 3½d. per kWh.

The Quest for Markets.

At the Advertising Convention to be held at Newcastle-on-Tyne from June 15th to 19th, proprietors of industrial papers will take part in the proceedings for the first time. The theme of the convention is the "Quest for Markets," and there are few more important questions affecting industry at the present moment. Sir E. Iliffe, M.P., will preside on Monday, June 17th, over the "Industrial Press" session, when the speakers will be Sir Gerald Chadwyck-Healey, Bart., C.B.E. (chairman, Morgan Bros. (Publishers), Ltd.); Mr. V. Watlington (managing director, English Electric Co., Ltd., chairman, B.E.A.M.A.); Mr. E. M. I Buxton (Paul E. Derrick Advertising Agency); and Mr. Percival Marshall (chairman, P.T.P. and W.N.P.A.). It is anticipated that the speeches at this session will provide points of interest to manufacturers who are concerned with the industrial Press.

An "Osram" Display at Liverpool.

Now and again Messrs. Lewis, the prominent Northern proprietors of departmental stores, stage very effective electrical displays at their premises. The accompanying illustration shows an "Osram" display recently arranged at the



A "Pearl-Osram" Lamp Display.

company's Liverpool stores. This was devoted to pointing out the advantages of "Pearl Osram" lamps. Upon the counter there was an arrangement of lamps and cartons and cards announcing the recent price reductions. The background was reminiscent of Watteau or Fragonard, and had a "summery" atmosphere. In the front there was a garlanded trellis, behind which a number of electrical appliances were arranged.

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Price Reductions.

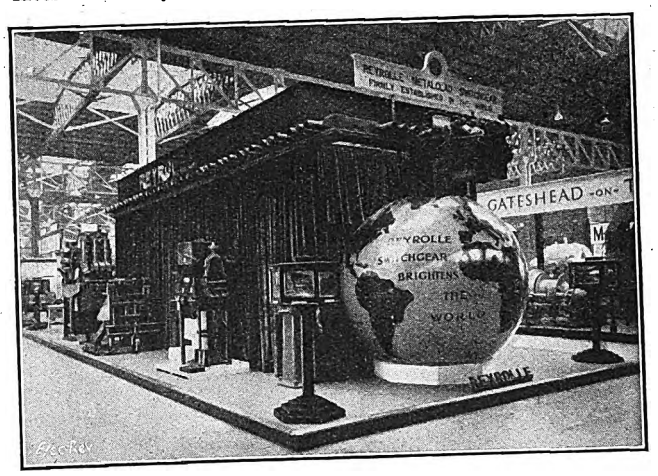
The General Electric Co., Ltd., announces reductions in the prices of its automobile lamps rendered possible by standardisation. Of the 13 lamps affected the majority are "BAS" lamps, that is, lamps standardised in accordance with Specification No. 104 of the Society of Motor Manufacturers and Traders, and accepted as standard by all manufacturers of motor-car accessories, motor-cars, and automobile lamps.

An Industrial Mission to Canada.

Under the auspices of the Incorporated Sales Managers' Association of Great Britain, a party of British manufacturers and sales managers is to make a tour of Canada, commencing in August. Visits will be paid to the principal cities, and arrangements have been made for the members to meet representatives of their particular industries, as well as the principal trade organisations of the Dominion.

Reyrolle's Stand at the Newcastle Exhibition.

We reproduce herewith a view of the stand arranged by Messrs. A. Reyrolle & Co., Ltd., at the North-East Coast



The Reyrolle Display at Newcastle.

Exhibition. Upon this side of the display there appear examples of the company's heavy switchgear. Other sides of the stand demonstrate some of the smaller equipment made at Hebburn—such as switch-plugs, fusegear, &c.

Book Notices.

"*Transactions* of the Fuel Conference, London, 1928," in three vols. Pp. clii+3,856 and Index vol. London: Percy Lund, Humphries & Co., Ltd. Price £12.

Science Abstracts A and B. Vol. XXXII. Part 5. May 25th, 1929. London: E. & F. N. Spon, Ltd. Price 3s. each.

"New Developments in Auxiliary Testing Equipment." A serial report of the Meter Committee, 1928-1929, of the Engineering National Section of the National Electric Light Association (U.S.A.). Price 55 cents.

Trade Announcements.

The business of Messrs. Kirk, Wilson, Ltd., electrical engineers and contractors, Lincoln, has been acquired and reorganised by Messrs. Wm. Wright & Sons (Lincoln), Ltd., Park Street, Lincoln. The business will now be known as Kirk, Wright & Co., and Mr. J. P. Kirk will act as general manager.

Messrs. Mawdsley's, Ltd., Dursley, Glos., inform us that their Midland representative, Mr. J. E. Horsburgh, Sutton Coldfield, is resigning on June 10th, and that Mr. F. G. Ketelbey, of Worcester Chambers, New Street, Birmingham, will represent them after that date.

The Cardiff branch of Philips Lamps, Ltd., is being removed as from June 10th from 27 to 11, Womanby Street; the telephone number and telegraphic address will not be altered.

Mr. Cecil Veitch, electrician, of Prestwick, Ayr, has removed his business to Royal Bank Buildings, Gardiner Street.

Mr. Louis Holzman has removed to 37, Newman Street, W.1.

Italian Lamp Production.

According to figures just published by *L'Energia Elettrica* the output of electric lamps in Italy during last year amounted to 16,127,533, as compared with 12,425,002 in 1927, an increase of just over 13 per cent.

Direct Labour at Mansfield.

A long discussion accurred at a recent meeting of the Mansfield Town Council on the subject of direct labour for wiring installations. The Electricity Committee's minutes contained a recommendation that all future installation work should be carried out by the Department. A member of the Council, opposing this, stated that the Department's tender for the work was 35 per cent. above the lowest offer received from local electrical contractors and 20 per cent. higher than the one next to it. Moreover it exceeded by 22 per cent. the price which the Council had paid for the work hitherto. On behalf of the Committee, the Mayor said that on previous occasions the contractors had formed a "ring" to fix prices and the Council was fortunate in finding a man outside the "ring" to quote a low price. He maintained, however, that the Department could have carried out the work considerably cheaper. The matter was eventually referred back to the Committee.

Bankruptcy Proceedings.

C. B. Marsden, rear of 60, Pisgah Street, Kenfig Hill, Glam., electrical engineer.—The first meeting of creditors was held on May 30th at Cardiff. According to the statement of affairs there were liabilities amounting to £213, and a deficiency of £141. Debtor attributed his failure to losses on small contracts through breakages and under-estimating on contracts. The matter was left in the hands of the Official Receiver.

R. Blood, wireless dealer and electrician, 44 & 46, Station Road, Padiham.—Receiving order made May 27th, on debtor's own petition. First meeting June 10th, at the Official Receiver's office, District Bank Chambers, Blackburn. Public examination June 18th, at the County Court House, Burnley.

S. E. Hunt, electrical engineer and contractor, 8a, Torwood Street, Torquay.—First meeting June 7th, at the Official Receiver's offices, Exeter Bank Chambers, Broadgate, Exeter. Public examination June 27th, at the Castle, Exeter.

C. R. W. Rowed and A. E. Smith (Rowed & Smith), electrical engineers and house decorators, 1a, Alexandra Road, Ellacombe, Torquay.—Trustee, Mr. W. R. Cocks, Official Receiver, 67, High Street, Exeter, released May 13th.

C. L. Weeks (C. L. Weeks & Co.), electrical engineer, 27a, Charles Street, Newport, Mon.—Trustee, Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff, released May 10th.

T. W. Bowler, trading with J. Cave as Taylor & Wynne, electrical engineer, back of 180, Green Lanes, Small Heath, Birmingham.—Last day for proofs for dividend, June 17th. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

R. Yeend (Central Electrical Works), electrician, 57, West Street, Wisbech, and 37, Red Lion Street, Spalding.—First and final dividend of 7d. in the £, payable June 11th at the Official Receiver's office, 41, Sidney Street, Cambridge.

S. H. Skipper (S. H. Skipper & Co.), 35, Broad Bridge Street, Peterborough.—Receiving order made May 25th, on debtor's own petition.

G. A. Ranger, cycle and wireless dealer, &c. (Terminus Garage & G. Ranger), 1889, Pershore Road, Kings Norton, Birmingham.—First meeting held June 5th, at the Official Receiver's office, 191, Corporation Street, Birmingham. Public examination, June 26th, at the Court House, Birmingham.

W. M. Horsfall, electrical engineer, 7, Redcross Street, Liverpool.—Fifth dividend of 4¾d. in the £, payable at the offices of the Official Receiver, Government Buildings, Victoria Street, Liverpool.

E. Temple, separate estate (Westoe Electrical Co.), wireless dealer and electrical contractor.—First and final dividend of 20s. in the £, payable at the Trustees' office, 48, Pilgrim Street, Newcastle-upon-Tyne.

Company Liquidations.

De Luxe Cars, Ltd., 189, Regent Street, W.—The first meetings of the creditors and shareholders of this company were held on May 30th at Carey Street, W.C. A statement of affairs was presented showing total liabilities of £7,763 (unsecured £4,997), assets valued at £2,125, and a deficiency of £4,851 with regard to contributories, the issued capital being £358 in £1 ordinary shares. Mr. H. P. Naunton, Assistant Official Receiver, reported that the company was incorporated in December, 1927, as Portable Wireless, Ltd. The name was changed to its present style in September, 1928. The promoter, T. F. Cowan, was one of the first directors, and acted as managing director at a salary of £20 a week, but ceased to hold office on being adjudged bankrupt on January 18th, 1929. The company acquired from Cowan, a business of wireless manufacturers, the consideration being £501, payable as to £250 in cash and £251 in shares. Cowan had stated that the circumstances which led to the promotion of the company were that for two months he had bought and sold portable wireless sets from his private house, and had made a profit of £10 on each set. He had no plant or machinery. The assets acquired by the company consisted of two wireless sets which had cost £40 each. The company appeared to have started business with a cash capital of £156, of which £50 was provided by A. J. Parsons, who received a debenture for £100, which was subsequently redeemed. The business of dealing in wireless sets was continued until May, 1928, when the company had added a garage and car-hire business. To secure managers for the garages and to raise capital, the company advertised inviting applications for the posts, the applicants to invest £500 in the business. Four appointments were made, the applicants providing in all £1,850, in consideration for which they were to receive salaries of £5 a week and 5 per cent. commission on the profits. Those loans had not been repaid, and debentures for £1,400 held by three managers were stated to be invalid, having been issued for a past consideration and within three months of the winding-up petition. The chairman added that the company had traded at a loss of £7,476, and although the gross assets were returned at £3,269, they chiefly consisted of leases which would not

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produce anything, while the other items would only realise about £35. The failure of the company was attributed to heavy overhead charges, cost of working up the business, want of working capital, and want of supervision at the branches. The liquidation was left in the hands of the Official Receiver, who observed that there were several matters calling for a searching investigation.

UNEEDA MAGNETO CO. (LEEDS), LTD.—A meeting of members is called for June 27th at 26-27, Bond Street, Leeds, to hear an account of the winding up from the liquidators, Messrs. V. Walton and J. H. Alexander.

RADIO ELECTRIC CO. (BOURNEMOUTH), LTD.—Winding up voluntarily.

A petition for the winding-up of the company has been presented to the County Court of Dorsetshire and Hampshire by the East London Rubber Co., of 29, 31 & 33, Great Eastern Street, E.C., and will be heard at the Law Courts, Bournemouth, on June 18th.

PRESTEIGN ELECTRIC CO., LTD.—A meeting of creditors is called for June 10th, at the Post Office, Presteign.

WORMIT ELECTRIC LIGHT CO., LTD.—At a recent meeting of creditors, the voluntary liquidation of the company was approved and the appointment of joint liquidators confirmed.

Private Arrangements.

C. L. F. JONES, electrical and wireless engineer, Colwyn Avenue, Rhos-on-Sea.—A meeting of creditors was held on May 24th at Colwyn Bay, when a statement of affairs was submitted which showed liabilities of £600. The assets were valued at £177. It was reported that the debtor entered the electrical trade as an apprentice to a well-known firm. After he had completed his apprenticeship he continued with the firm until he joined the Army in 1915. He was discharged in 1918, but his health was affected, and he had to relinquish his employment. In April of last year he commenced trading on his own account, and, according to the books, the purchases during the period of the trading had been £90, with sales of £1,116, and there was a gross profit of £316. The expenses, however, exceeded £300. A resolution was passed confirming a deed of assignment already executed, conditional upon certain cash creditors withdrawing their claims. A committee was also appointed consisting of the representatives of Metro-Vick Supplies, Ltd., and B.N.B. Wireless, Ltd. The following are creditors:—

	£		£
Hollindrake, H., & Sons, Ltd.	20	Beardsall, E., & Co., Ltd.	80
B.N.B. Wireless, Ltd. ...	25	Marconiphone Co., Ltd. ...	30
Metro-Vick Supplies, Ltd.	11	Revo Electric Co., Ltd. ...	26
		General Electric Co., Ltd.	25

P. JONES and J. H. MERCER, lately trading as the Northern Wholesale Electrical Supply, 266 & 268, Holloway Road, N.7.—A circular has been issued to the creditors herein by Mr. O. G. Sunderland, 15, Eastcheap, E.C., stating that in January last a deed of assignment was executed in his favour. At that time the liabilities were estimated at £1,051, against assets expected to produce £1,249. The estate has been realised, and has produced £1,197, and a dividend of 20s. in the £ has been paid. The creditors were entitled to interest at the rate of 4 per cent., but they were asked to forego this interest and accept a dividend of 20s. in the £ in full and final settlement. A committee of the principal creditors recommended that the dividend should be accepted.

Dissolution of Partnership.

BREWER & BRUNT, electrical engineers and electricians, 17, Albert Road, Hoylake.—Mr. A. G. Brewer and Mr. W. H. Brunt have dissolved partnership. Mr. Brunt will attend to debts and continue the business.

Receiver Appointed.

JOHN BUTLER & CO., LTD., Stanningley Ironworks, Leeds.—Sir W. H. Peat (Messrs. Peat, Marwick, Mitchell & Co.) has been appointed receiver for the debenture holders. It is his intention to complete most of the contracts in hand.

Electricity in Any Event.

From the current "Galliers' Electrical Bulletin":—Weather forecast for June: We are not able to supply one, but at Galliers' you will be able to get either an electric fan or an electric heater, whichever may be requisite.

The Dudley E.D.A. Circle.

There was a large gathering of electrical people at a recent meeting which was held at Dudley, under the auspices of the Midland Circle of the British Electrical Development Association. The circle has recently been formed, and the object of the meeting was to impress on all interested in the industry the advantages to be gained by joining E.D.A. Mr. G. R. J. Parkinson, M.I.E.E. (manager and engineer of the Midland Electric Corporation for Power Distribution, Ltd.), the chairman of the circle, presided, and the speaker was Lt.-Col. W. A. Vignoles, D.S.O. (director and secretary of E.D.A.). Mr. Parkinson pointed out that of the electricity sold in the Dudley area, 95 per cent. was used for industrial purposes, and only 5 per cent. for domestic uses. In view of this the information which E.D.A. was collating and would shortly publish comparing oil engines and electric motors for driving purposes would be of the utmost value to them.

Dutch Enterprise in France.

It is reported that the N. V. Splendor Gloielampenfabrieken of Nijmegen has established a subsidiary company in Paris under the title of "La Lampe Splendor" for the sale of its manufactures in France.

The German Conductor Wire Syndicate.

In April last the German Conductor Wire Syndicate was re-established in the form of a price convention, and the rebates were reduced in such a manner that the sale prices were increased by an average of 8 per cent. As almost all the large works belong to the convention it is assumed that a tighter control over the market will be gained. The convention will in the first place regulate prices in the home market. The recent slackening in the demand for insulated wires is assumed to have resulted from the increase in prices. On the other hand exports of insulated wires have increased in recent months, the monthly average in the first quarter of this year having been 1,200 tons, as against about 900 tons in 1928. The chief buyers in recent months are said to have been England, Holland, China, the Dutch Indies, and Argentina.

A German Working Agreement.

The Frankfort correspondent of the *Financial Times* reports that the Elektricitäts A.G. of Nürnberg, formerly Schuckert and Co., and the Licht and Kraft A.G., of Berlin, members of the Siemens combine, have decided to co-operate more intensively. This plan, which is a reflection of the tendency to combine in the international electric market, is the direct outcome of the scheme by which the Siemens concern is bringing about a closer co-operation with the firms of which it is composed. The Siemens concern is known to be about to conclude an important agreement with its former daughter company, Siemens Bros., of London, with which firm it will probably co-operate in the future on the world's market.

New Catalogues and Lists.

MESSRS. ELLIS & COE, 308, King Street, Hammersmith, W.—A leaflet drawing attention to the "Kausis" electric brander for branding wood, cork, ebonite, leather, rubber, &c.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Publication No. 6477, describing the Igranic-Elkon rectifiers and high-capacity condensers. Priced.

MESSRS. SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., New Bridge House, 30-34, New Bridge Street, E.C.4.—An illustrated brochure describing telephone and signalling installations for business houses and offices.

MESSRS. WILLIAM GEIPEL, LTD., Vulcan Works, 156-170, Bermondsey Street, S.E.1.—Bulletin No. 75, issued by the Ward Leonard Electric Co., of New York, giving installation and maintenance instructions for "Vitrohm" resistance and reactance dimmers, for which Messrs. Geipel are sole agents for the United Kingdom and Europe.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive leaflet No. 460/2-1, dealing with the company's central flow surface condensers, and giving illustrations of actual installations. Also a well-produced and fully-illustrated brochure (pp. 48) giving a short survey of work carried out by the company in connection with the electrification of British railways. A map (scale, one inch to a mile) showing the electrified railways of London and the surrounding districts is included.

VERITYS, LTD., 31, King Street, Covent Garden, W.C.2.—Publication No. 1069, dealing with "Verity-Heemaf" high torque motors, "Aston" control gear, and main switchboards (illustrated), together with a stock list of motors.

Messrs. COURTNEY RUSSELL & CO., LTD., 31, Fitzroy Square, W.1.).—A loose-leaf pocket catalogue showing some of the company's lighting fittings, including French pressed glass and crystal fittings. Priced.

MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham.—An illustrated and priced folder outlining the advantages of M.E.M. small ironclad fuseboards for industrial use.

A. E. G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—Four illustrated publications dealing with industrial lighting equipment for both interior and outdoor use.

ALLIANCE WHOLESALE, LTD., 62, Great Russell Street, W.C.1.—A leaflet giving particulars of the "Russell-Laxnot" fire alarm unit.

RIPAULTS, LTD., King's Road, St. Pancras, N.W.1.—An illustrated booklet describing the company's automatic system of lubrication for motor chassis and all kinds of machinery.

Messrs. FALK, STADELMANN & CO., LTD., Veritas House, 83 to 93, Farringdon Road, E.C.1.—Catalogue No. 615, illustrated and priced, drawing attention to "Antarctic" electric fans.

Messrs. GENT & CO., LTD., Faraday Works, Leicester.—Leaflet No. 186, illustrating interchangeable and combined wave coils for the Mullard S.G.P. wireless receiver.

ELECTROSERVICE, LTD., 3, Waterloo Road.—An illustrated and priced pamphlet of "Frigid" fans.

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Messrs. Wadkin & Co., Green Lane Works, North Evington, Leicester.—Booklet No. 205, containing illustrated descriptions of cross cutting and trenching machines.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—June price list of electrical equipment, including "Ashdown" moulded accessories, "Credalux" reflectors and lanterns, motors, generators, electrical accessories, &c.

Prices of Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, June 4th:—No change in copper and lead prices.

Messrs. Edward Till & Co. report, June 4th:—India-rubber, Para fine, 10⅞d., ⅜d. dec

Reporting on June 1st, Messrs. James Forster & Co. stated that very quiet conditions prevailed in the lead market last week pending the result of the General Election and the settlement of the reparations question. The revival in demand from consumers in this country and on the Continent, so long expected, has failed so far to materialise, and it is certainly a good point for the market that prices have kept so steady. Should any fresh demand arise, prices would undoubtedly respond, but until that event happens we are likely to witness a continuance of the present sagging markets.

Lighting and Power Notes.

Barking.—Mains Extensions.—The Urban District Council Electricity Committee is to lay additional mains from Axe Street sub-station to the sewage works at a cost of £3,200.

Birmingham.—Electricity Supply Progress.—According to the *Birmingham Post*, the results of last year's trading of the Electric Supply Department were considered at a meeting of the Electric Supply Committee on May 29th. The accounts show a satisfactory surplus in spite of the very large increase of £97,000 in the rates and taxes charged on the undertaking during the year. Further expansion of the business was reported during the month of April, when 900 additional consumers were connected to the mains, representing upwards of 7,800 extra lamps and 3,400 h.p. in power supplies.

Bishop Monkton.—Underground Cables.—It was reported recently to the Ripon Rural District Council that the residents of Bishop Monkton had raised objections to the erection of overhead cables for the provision of electric lighting to the village, and that the ratepayers were willing to pay the additional cost of laying them underground. The Council accordingly has given consent for the work to be done in accordance with the wishes of the villagers.

Bognor.—Extension of Supply Area.—Work has now been commenced on the Bognor Gas and Electricity Co.'s new extension to Felpham, Middleton, Yapton and Arundel, and it is hoped that the scheme will be completed by the autumn. The e.h.p. supply is being obtained from Chichester Corporation, which in turn receives its supply from Portsmouth.

Bolton.—Electricity Supply Extensions.—At a meeting of the Corporation Electricity Committee, held recently, the borough electrical engineer reported that the Electricity Department would shortly be in a position to furnish a supply of electricity from proposed overhead lines to premises in the Over Hulton district of the borough, which are now being supplied by the Lancashire Electric Power Co. It was decided that three months' notice should be given to the power company to terminate its agreements.

Bradford.—Extensions.—The Electricity Committee has recommended the erection of a transformer chamber at Frizinghall at an estimated cost of £5,151, including mains, and also the extension of services at an estimated cost of £1,578.

Chester.—Loan.—The Electricity Committee has made application for sanction to the borrowing of £8,000 to meet the cost of carrying out extensions to underground lines in its various supply areas.

Continental.—Finland.—A large hydro-electric power plant has been officially opened at the Imatra Rapids, Eastern Finland. The plant now has a capacity of 81,000 h.p., but when it is completed it will have a capacity of 220,000 h.p. Electricity generated will be distributed to all parts of Southern Finland.—*Reuter* (Helsingfors).

Luxemburg.—The Compagnie Luxembourgeoise d'Electricité, in its report for 1928, issued recently, states that the h.p. lines have been extended by 227 miles, of which 105 miles are in the province of Namur and 122 miles in Luxemburg. Out of the 185 communes included in the concession, 90, with a population of 61,761, are now being supplied with electricity. Work is in hand to extend the system to 40 more communes during the present year, and it is expected to complete the work by the end of 1930.

Germany.—A power station has recently been completed by the A.E.G. at Unterelbe, Schlau, Altona. The plant has a capacity of 45,000 kW, and is estimated to have cost £585,000.

France.—La Compagnie d'Electricité de Brest has recently secured official approval to a scheme to establish a number of 15,000-V transmission lines in the Department of Finistère for the distribution of the electricity generated at the power station which is at present being established at Aber-Wrac'h to utilise the power of the tides.

Austria.—Plans have been prepared for the establishment of a new 130,000-h.p. hydro-electric power station at Kornenburg, near Vienna. The construction of the station will occupy from three to four years.

Coventry.—Assisted Wiring Scheme.—The Corporation Electricity Committee has recommended the adoption of an assisted wiring scheme.

Croydon.—Extensions.—The Corporation Electricity Committee has been in negotiation with the Central Electricity Board with regard to extensions for supplying the further needs of the Corporation, and for giving additional supplies to neighbouring undertakings on behalf of the Board. Preliminary plans and estimates have been prepared for the extension of the electricity works, including one 20/25,000-kW turbo-alternator, together with condensing plant, &c., extensions to boiler house for two 100,000-lb. boilers, with all auxiliary plant, pumping machinery, cooling and coal-handling plant, and a new main switchroom, and the Committee has recommended that it be authorised to obtain tenders for the necessary plant and works. The total estimated cost is £300,500.

Dover.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to a loan of £3,000 for services.

Dulverton.—Overhead Lines.—The Exe Valley Electricity Co., Ltd., recently informed the Rural District Council of its application to the Ministry of Transport for consent to use overhead lines for carrying out the Brampton and Dulverton Special Orders, and asked whether the Council desired to be heard in connection with the application. The line is to be operated at a pressure of 6,600 V, but, with a view to linking up ultimately with larger centres of electricity supply and extending further west, the central section has been designed for a working pressure of 33,000 V. The Council has agreed not to be heard in connection with the application.

Eastbourne.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to loans totalling £16,880 for mains, sub-station plant, and buildings.

Guildford.—Mains Extensions.—The Corporation Electricity Committee has decided to extend mains, at a cost of £2,920, to supply the village of Clandon.

Glasgow.—Electricity Supply.—At a meeting of the Corporation Electricity Committee held recently, a report was submitted on the position of electricity supply in the city. The Committee recommended that it should be empowered to give notice, if it so resolves, of the intention of the Corporation to terminate, on December 31st, 1929, the agreement involving the Lanarkshire County Council and the Clyde Valley Electrical Power Co., for the distribution of electricity within the area of supply authorised by the Shettleston and Tollcross Electric Lighting Order, 1926, so far as the area of supply is included in the city boundary.

Switchgear and Cable Extensions.—The Corporation Electricity Committee at its last meeting approved of the installation in the Byres Road and the Cadogan Street sub-stations, of additional switchgear at a cost of £2,094. Expenditure was recommended on e.h.p. transmission system extensions in Port Dundas to Byres Road, £8,616; Great Western Road, &c., for distribution and change-over purposes, £5,269; other extensions, £2,164. Under the Corporation Electricity Department's scheme 805 houses were wired in April, making the total to date 13,633. Thirty applications for the hire of appliances were dealt with during the month, making the total to date 18,546.

Haltwhistle.—Objection to Electricity Order.—At a recent meeting of the Rural District Council a letter was read from Messrs. Saul & Lightfoot, solicitors, of Carlisle, stating that they had lodged objections on behalf of the Council against the South-West Northumberland Electricity Order. The main objection was that the Council desired to co-operate with the Brampton District Council rather than with the Newcastle-upon-Tyne Electric Supply Co., Ltd. It was stated that a loop-line scheme for the supply of electricity was being prepared by the engineer of the Carlisle Corporation and could be made to include Haltwhistle. Under this scheme it was considered that a cheaper supply of electricity would be obtained. It was decided that full particulars should be obtained for submission at any inquiry that might be called.

Japan.—Electrical Development.—The Tokio Electric Light Co. is considering the erection of a steam power station having a generating capacity of 150,000 kW. The station will be equipped with two generators, one of 50,000 kW and the other of 100,000 kW. A high-pressure steam plant will be installed.

It is stated that the Sanyo Chuo Suiden K.K. will in all probability purchase one of the two 35,000-kW turbo-generators required for the Shikama power station in England, and the other in Japan.

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Kingston-on-Thames.—ADDITION TO PLANT.—The Town Council proposes to install additional plant at the electricity works, including a 3,000-kW generating set, at a cost of approximately £43,000, in order to meet the increased demand for electricity in the borough and for the estimated supply to Walton-on-Thames and Weybridge.

Leek.—INAUGURATION OF EXTENSIONS.—The extensions to the Urban District Council's electricity works were formally inaugurated by the chairman of the Electricity Committee and the chairman of the Stoke-on-Trent Electricity Committee on May 28th. Hitherto all the energy required for the district has been generated by the Council, but with the new plant installed additional supplies will be taken in bulk from Stoke-on-Trent. The additions include one 400-kW and one 200-kW rotary convertors. Electricity is supplied from Stoke by means of overhead lines at a pressure of 22,000 V a.c. to two transformers where it is reduced to 350 V. From the transformers it is conveyed to the rotary convertors and converted to d.c. 240 and 480 V for local distribution. The contractors for the extensions were Messrs. Crompton Parkinson, Ltd.

Lytham St. Annes.—EXTENSION OF SUPPLY AREA.—The supply of electricity from Lytham St. Annes to Warton and Freckleton will be available by June 14th. The Mayor will perform the ceremony of inauguration on June 18th.

Maidstone.—ELECTRICITY SUPPLY PROGRESS.—The Town Council has received sanction to a loan of £3,000 for domestic apparatus to be let out on hire. A supply of electricity is to be given to Teston and Wateringbury, at an estimated cost of £6,500, and during the summer, mains in the town are to be relaid and other work carried out at an estimated cost of £8,173. The capacity of the main to the sewerage works is to be increased at an estimated cost of £2,125, allowing electricity to be supplied to a large number of houses now being erected on the Allington estate.

Malpas.—ELECTRICITY SUPPLY.—In a recent report to the Rural District Council it was stated that the North Wales Power Co., Ltd., would have a supply of electricity available for the district towards the end of this year.

Preston.—MAINS EXTENSIONS.—The Electricity Committee has recommended the expenditure of £2,061 on extensions of mains.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

CARSHALTON.—*South Metropolitan Electric Light and Power Co.*—Lighting: From 6d. to 5½d. per kWh, the reduction to operate from the June meter readings.

WIMBLEDON.—Power: From ¾d. to ½d. per kWh. Industrial power consumers under special agreement: From ½d. to 0.4d. per kWh. The recommended reduction is to operate for the September quarter, 1929, only.

HUDDERSFIELD.—Photographers' printing arcs, &c.: At single-phase power rates. Single-phase domestic consumers: Standing charge on ratable value not to exceed £12 per annum. Doctors' and dentists' premises: Consumers to be considered as single-phase domestic consumers, and therefore to be given the option of being supplied with electricity at new scale of charge fixed on March 15th last. Three-phase power consumers: Scale of charge to be extended as follows: Over 1,000,000 kWh, 0.55d. per kWh, plus coal clause; over 2,000,000 kWh, ½d., plus coal clause. Supply to Tramways Department: Reduction of 0.1d. per kWh.

TYNEMOUTH.—Flat rate: From 5d. to 4¾d. per kWh.

Reigate.—SUPPLY OFFER ACCEPTED.—The Rural District Council has accepted the offer of the County of London Electric Supply Co., Ltd., for electricity for power at the Merstham Outfall, at 1¼d. per kWh, provided the consumption exceeds 1,250 kWh per h.p. installed per annum.

INQUIRY RESULT.—Following a recent inquiry the Ministry of Transport has informed the Rural District Council that the Minister has consented to the retention of certain overhead lines erected by the Sussex Electricity Supply Co., Ltd., in the Council's area and adjacent districts.

Sidmouth.—ELECTRICITY SUPPLY.—It was reported, at a meeting of the District Council on May 29th, that some of the transmission lines were so heavily loaded that in certain districts consumers were not receiving an adequate service. Various remedies had been under consideration, but to deal with immediate difficulties and provide for the future would involve large expenditure, and as the Electricity Commissioners refused to sanction it in view of the present transitory position of the undertaking it was decided not to connect any more consumers.

Special Order.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Derbyshire and Nottinghamshire Electric Power Co. to supply electricity in the urban district of Bonsall and parts of the rural districts of Ashbourne, Belper Repton and Sudbury and Basford.

Stirlingshire.—STREET LIGHTING.—Final details of the scheme for the installation of electric lighting in the streets of the mining villages of Cowie, Plean and Fallin were reported at a meeting of the Central District Committee of the County Council held in Stirling recently. The electricity supply is to be provided by the Scottish Midland Electricity Supply, Ltd.

Stoke-on-Trent.—LOANS.—The Corporation Electricity Committee has obtained sanction to loans of £10,000 for general sub-station extensions, £1,535 for mains, Cannon Street area, Hanley, and £20,000 for general mains extensions. The Committee has applied for sanction to a loan of £2,500 for the erection and equipment of a sub-station in Campbell Road.

BULK SUPPLY.—The Corporation Electricity Committee has instructed the engineer to proceed with the erection of the secondary transmission lines necessary in order that a bulk supply may be given to Whitmore pumping station and the Market Drayton Electric Light & Power Co., Ltd., at a cost of £50,000.

Worksop.—NEW ELECTRICITY CHARGE.—The Electricity Committee has decided to introduce a new charge for combined domestic and business supply of £1 per kW, plus 1d. per kWh, with a minimum of 2 kW.

York.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £3,422 for sub-station buildings; £16,390 for mains; £9,935 for plant; £5,000 for transformers; and £30,000 for mains and services.

Tramway and Railway Notes.

Blackburn.—YEAR'S WORKING.—We have received from Mr. J. H. Cowell, general manager of the Corporation tramway undertaking, a copy of his annual report, together with the statement of accounts for the year ended March 31st, 1929. The total revenue is shown to be £109,469, as compared with £104,700 in the previous year. Working expenses amounted to £84,959, as against £90,148, leaving a gross surplus of £24,510 (£14,552). After payment of capital charges, contribution to permanent-way renewals fund, &c., there remained a net surplus of £13,945, as compared with a deficit of £109 in 1927-28. From the surplus a sum of £5,000 has been transferred to the borough fund. The report shows a decrease for the year in the number of passengers carried from 17,993,490 to 17,149,703, and in the car miles run from 1,174,269 to 1,147,297. The average total revenue per car mile, however, was 22.9d., as against 21.4d. for 1927-28.

Continental.—ITALY.—The steam tramway systems between Chivasso and Brusasco, and between Trofarello and Poirino, near Turin, are to be electrified. The two lines have a total length of approximately 15 miles.

RUSSIA.—The construction has commenced of a new tramway between Motovilikha and Perm. The line will probably be completed by October.—*Reuter's Trade Service* (Moscow).

Dearne Valley.—EXTENSION OF TIME.—The Dearne District Light Railways Joint Commitee has announced its intention to apply to the Ministry of Transport for a prolongation to June 24th, 1930, of the time limited for the completion of the works authorised by the Dearne District Light Railways Orders, 1915-1924.

India.—RAILWAY ELECTRIFICATION.—It is reported that the Railway Board has sanctioned the electrification of the section of the Nilgiri Mountain Railway between Coonoor and Ootacamund, a distance of 13 miles. The Board is of the opinion that the electrification of the line need not be delayed till the Pykara hydro-electric scheme has been sanctioned and that power can be obtained from the Glen Morgan scheme now in progress.—*Reuter's Trade Service* (Bombay).

Japan.—NEW ELECTRIC RAILWAY.—The Japan Electric Railway Co., Ltd., has applied for a concession to construct an electric railway between Tokio and Osaka. The distance of 298 miles between the two cities will be covered in six hours.

Wolverhampton.—RAILLESS CARS.—The last of the Corporation's routes to be converted from the tramway to the railless-car system was opened on May 27th, when members of the Corporation and representatives of neighbouring authorities were taken over the final section of the route to Darleston. The Bilston section was completed some time ago, and the final section from Bilston to Darleston represents 2½ miles of the 4½-miles route. With the completion of this system the town becomes the largest owner of railless cars in the world, with 25 miles of route. Referring to the growth of the undertaking, Councillor Alan Davies, chairman of the Transport Committee, stated that in 1918-19 the number of passengers carried was 21 millions, while in 1928-9 the total was no less than 36½ millions.

York.—FARE EXPERIMENT FAILURE.—The Tramways Committee has reported that the experiment of penny fare stages, introduced in January last, has proved a failure. The total receipts for all services—trams, railless cars, and 'buses—for the four months have fallen from £23,509 to £22,229, the number of passengers carried having dropped from 3,059,368 to

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3,048,218, in spite of increased mileage. The tramway has lost about 100,000 passengers. The Committee has recommended that the penny stages be abolished and the 2d. universal fare be again brought into operation with transfer from tram to tram only, a charge of 3d. to be made for all other transfer fares.

Telegraph and Telephone Notes.

Costa Rica.—NEW RADIO STATIONS.—Congress has authorised the construction of three additional receiving stations: one at Liberia (or Guanacaste), another in the Canton of San Carlos, and a third in the province of Puntarenas. With the completion of five other wireless stations, the Republic will have twelve stations, including a small one on the Nicaraguan frontier not at present in use.—*Reuter's Trade Service* (San José).

Greece.—WIRELESS-TELEPHONY.—The Greek Minister for National Economy has tabled in the Chamber a Wireless Telephony Convention concluded with Marconi's Wireless Telegraph Co., Ltd.

Hull.—MUNICIPAL TELEPHONE SERVICE.—The finances of the Hull Corporation telephone undertaking were reported last week to be in a very satisfactory position. The manager (Mr. T. Holme) said the gross profit for the financial year amounted to £40,817, and the net profit was £14,955. The structural alterations and additions to the Central Exchange, to provide accommodation for a 4,000-line automatic exchange, were nearing completion, and the initial equipment for 1,000 lines was ready for installation. This would complete the network of main automatic exchanges required to serve the city. According to the *Yorkshire Post*, it was agreed to reduce the tariff for measured service from £6 10s. to £5 10s., and for five-party service from £4 10s. to £3 10s. per annum, flat-rate users to have the option to transfer to the new tariffs.

International Telephony.—FRANCE-GERMANY.—The results of the working of the Paris-Berlin trunk telephone in 1928 show that, in the first three months after the laying of larger through lines, the number of calls increased by more than 300 per cent.

ENGLAND-FRANCE CABLE.—Although twenty-two telephone circuits are already in operation between Paris and London, the "*Revue des Telephones, Telegraphes, et T.S.F.*" reports that the French telephone authorities, in conjunction with the British authorities, proposes to lay a new submarine cable across the Channel with the view of further increasing the telephone facilities between the two countries.

FRANCE-FINLAND.—Telephone communication has recently been established between France and Finland. The line, which is 1,870 miles in length, of which nearly 200 miles is laid in the Baltic Sea, passes *via* Berlin, Copenhagen, and Stockholm.

RUMANIA.—As part of a far-reaching programme for the improvement of communication between Rumania and other European countries, telephone calls have recently been made successfully from Bucharest to Paris and from Bucharest to Berne, Lausanne, Zurich, and Bale. Reception was good on all occasions, and the success of the experiments has aroused keen interest.—*Reuter* (Bucharest).

Marine Radio.—LONDON CONVENTION.—A convention was signed in London on May 31st by delegates of 18 nations as the result of agreement reached following discussions in committee of the International Conference on Safety of Life at Sea, which was called on the initiative of Great Britain (see ELEC. REV., April 26th, 1929, p. 768). The Conference reaffirmed that in the case of a ship carrying a large number of lifeboats one, or more, of the latter must be a motor boat fitted with a wireless installation and a searchlight.

Peru.—RADIO STATIONS.—The International Telephone and Telegraph Corporation, through its associate, All-America Cables Incorporated, has secured permission to establish wireless telephone and telegraph stations in Peru for point to point and international communication. The concession renews the company's previous rights to establish submarine cables for international telephone transmission, in addition to its present telegraph services. A condition of the concession is that all present and future lines must be capable of carrying both telephone and telegraph communication independently or simultaneously. It further binds All-America Cables to erect within two years the necessary stations for wireless telegraph communication with the United States, Spain, Argentina, Chile, and Central America, and for wireless telephone communication with Spain, with connections to other parts of Europe, and to Argentina, Chile, and the United States. The new concession considerably enlarges the International Telephone and Telegraph Corporation's activities in South America, and is a continuation of its policy of promoting world communication by telephone, telegraph, and radio.

Radio Telegraphy.—ENGLAND-BULGARIA.—A direct wireless telegraph service between Great Britain and Bulgaria was opened on May 29th.

Siam. — RADIO-TELEGRAPHY.—Prince Purachatra, Siamese Minister of Commerce and Communications, who is visiting this country on a commercial mission, was present recently at the Ongar station of the Marconi Company during experimental wireless communication to and from the Bangkok station of the Siamese Government. Transmission to Bangkok was on a wave-length of 15 metres, and return messages on one of 17 metres. According to *The Times*, Prince Purachatra said that if the King of Siam should ratify the agreement with the Marconi Company, the service would become permanent. Before coming to Britain, he visited France and Germany for the purpose of putting through practical wireless communication between Bangkok and the stations of Radio France and the Trans-Radio Company of Germany. The agreement with Germany had been signed for some time, but that with France was not yet signed. Though it was not yet possible for the Marconi Co. to arrange for direct wireless-telephone communications between this country and Bangkok, he had sent a good many wireless telephone messages to Bangkok through the French and German stations. He could, in fact, speak from the Siamese Legation in London, *via* Paris or Berlin, to Bangkok.

The radio-telegraph service between England and Siam was inaugurated on June 1st, the ordinary rate being 1s. 11d. per word.

The Telephone Service.—MANX CABLE.—The cable ship *Faraday*, owned by Messrs. Siemens Bros., arrived at the Isle of Man on May 31st with over 2,000 tons of submarine telephone cable to be laid from Norbreck, near Blackpool, to Port Grenaugh, Isle of Man, and from Port Erin, Isle of Man, to Ballyhoman, Ireland. The vessel left the island the same day to mark out the course with gas buoys.

United States.—CABLE-WIRELESS FUSION.—General J. G. Harbord, president of the Radio Corporation of America, has stated in a newspaper that the recent successful effort of British companies to consolidate their cable and wireless interests is a serious challenge to the wireless supremacy of the United States, which is more important to the United States than oil, or the merchant marine. He points out the importance of communication, particularly wireless, to world-wide commerce, and also national defence, especially in the case of countries having distant possessions. American trade in every quarter of the globe, he writes, cannot but be profoundly affected. Owing to American distrust of a monopoly, while Great Britain, France, Italy, and Germany are each uniting their cable and wireless services, America is endeavouring to keep them apart, and he quotes as an example the White Act of 1927, which forbids the purchase of a wireless company by a cable company, and *vice-versa*. General Harbord explains that his statements are intended to indicate the attitude of the American Government, which should be altered. The alternative is to surrender and acquiesce in the leadership of communications by Great Britain.

The Senatorial inquiry into the radio, telephone, and telegraph monopolies will begin this week.

Radio Notes.

Argentina.—GOVERNMENT DECREE. — According to the monthly journal of the British Chamber of Commerce in the Argentine Republic, a decree was recently issued governing the future operation of broadcasting services and the use of transmitting apparatus for experimental, research, and other purposes. One of the provisions is that the broadcasting stations must within a period of nine months be removed beyond the limits of the city and its immediate environs. General provisions aim at the improvement of the services, the limitation of the use of them for advertising purposes, and the attainment of higher standards of artistic merit in the entertainment provided. During the next twelve months extensive renovation of broadcasting installations, apparatus, and materials will probably be undertaken, and it is hoped that in the event of any resultant improvement in the quality of the services the public demand for radio apparatus and equipment will be enlivened. The imports of such equipment more than doubled between 1926 and 1927, but the tendency suffered a check in 1928, and there is reason to believe that before any further rapid expansion of business can be expected the improvement in the artistic merit of the broadcasting services at which the Presidential Decree unquestionably aims will have to be proved. At present a large proportion of the users of radio pertain to the class of "fans," and it is for this reason that the sale of parts has represented a far greater turnover than the sale of complete sets. The market for high-class complete sets will come into its own when the service has been raised to a reasonably high standard, and the effects of the Decree should be watched by British manufacturers of high-class complete sets whose apparatus would be suitable for the trade, which has thus far been held in check by the defects of the services.

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Australia.—TENDERS FOR BROADCASTING.—At the end of April the Commonwealth Government called for tenders for the supply of broadcasting programmes under the control of the Postal Department, covering the whole of Australia. Instead of specifying the type required and inviting competitive prices, a fixed amount will be set aside from each listener's licence fee to be paid to the suppliers, and tenderers were asked to state in detail what standard of programme they would be prepared to supply for the percentage of the licence fee, says *World-Radio*. The Government may reduce the amount paid to the successful tenderer per licence in the event of any falling off in quality. The Federal Government considers that £150,000 a year is the maximum which it will be able to spend on programmes, which is about the amount now spent in Sydney and Melbourne alone. Already (6WF) Perth, the only A-class station in West Australia, has been taken over by the Government, although it will not be ready to take over any of the others until January next.

France.—GOVERNMENT BILL.—A Bill regulating and reorganising the broadcasting services in France was signed by the President of the Republic on May 28th.

Germany.—SHORT-WAVE STATIONS.—There are four short-wave stations in Germany, but transmission takes place on 13 wave-lengths as follows: Döberitz (AFK), 175.6, 105, 67.6, 45.3, 43.1, 37.8 metres. Bergedorf (AFL), 75, 70, 52 metres. Nauen (AGE), 56, 17.2, 14.85 metres. Königswusterhausen (no call sign is used at present), 75.3 metres. Similarly to Nauen, the last-named Weltrundfunksender is rated at 20 kW, about 7 kW aerial energy; it is still experimental, and the only short-wave plant that transmits telephony exclusively, and it is shortly to begin the use of a wave-length between 15 and 50 metres. It is assumed that now Nauen is being used for transcontinental telephony it will not be available to amateurs much longer.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 15th. State Electricity Commission of Victoria. Two 750-kVA transformers and spares. (B.X. 5325.)*

July 23rd. Posts and Telegraphs Department. Telegraph instruments. (B.X. 5323.)*

Belfast.—June 17th. Electricity Department. Manufacture, supply and delivery of h.p. combined cubicle and truck type switchgear and transformer kiosks, and the manufacture, supply, delivery and erection of one 1,000-kW rotary convertor, one 500-kW rotary convertor, d.c. switchgear, h.p. armourclad switchgear, and h.p. truck-type switchgear for sub-stations. (May 31st.)

Canada.—TORONTO.—Hydro-Electric Commission. Unwiped galvanised 7-strand steel cables. (A.X. 8005.)*

Cheadle and Gatley.—June 11th. Electricity Department. Overhead distribution scheme (Contract No. 47), two e.h.p. truck cubicles (Contract No. 50). Specifications (deposit £1 1s. each) and drawings from Mr. R. W. Willis, 37, High Street, Cheadle.

Colwyn Bay.—June 14th. Electricity Department. Supply, laying and jointing of e.h.p. and l.p. cables. (May 31st.)

Dartford.—June 11th. Urban District Council. Supply of 1,815 yd. of 3-core, paper-insulated, l.c. and armoured cable, suitable for a working pressure of 660 V. (See this issue.)

Dumbarton.—The Education Authority is inviting tenders for electrical work for the new Primary and Secondary School at Kirkintilloch. Mr. R. W. Roxburgh, clerk and treasurer of Authority, 18, Park Circus, Glasgow.

East Grinstead.—June 17th. Electricity Department. Supply, laying and jointing of a system of l.p. cables, complete and ready for use. (May 31st.)

East Ham.—June 12th. Education Committee. Installation of electric lighting at Salisbury School. Specification 10s., from Mr. F. H. Thompson, secretary, Town Hall, East Ham.

Edinburgh.—June 17th. Education Committee. Electrical installations at Colinton, Davidson's Mains, Gilmerton, Granton, Juniper Green, Willowbrae, and Milton House Schools. Specifications, &c., from Executive Officer, Education Offices, Castle Terrace, Edinburgh.

Egypt.—CAIRO.—August 13th. Ministry of the Interior. Supply of an electric power station with underground and overhead network for the town of Maghagha. (B.X. 5318.)*

Farnworth.—June 15th. Electricity Department. Supply of l.p. cables. (May 31st.)

Hull.—June 20th. Electricity Department. Supply of stores for 12 months from July 1st, 1929. (See this issue.)

Leeds.—June 17th. Education Committee. Electrical wiring of schools during midsummer vacation. Particulars from Education Offices (architect's section), Calverley Street, Leeds.

London.—CENTRAL ELECTRICITY BOARD.—June 17th. Supply, delivery and erection of 33-kV and lower voltage switchgear for the North-West England and North Wales Electricity Scheme, 1928. (May 17th.)

July 22nd. Supply, delivery and erection of central indicators and telephones for the Central Scotland Electricity Scheme, 1927. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—June 12th. Installation of two electric passenger lifts at Colindale Hospital, fire-alarm system at High Wood Hospital, and electric bell system at Wandsworth casual ward. (May 24th.)

CENTRAL LONDON SCHOOL DISTRICT, HANWELL.—June 8th. Four motors, switchgear equipment, steel shafting, leather belting, &c. (May 24th.)

LONDON COUNTY COUNCIL.—July 8th. 150 complete bodies for tramcars, 150 sets of swing bolster bogie trucks, 150 electrical equipments for tramcars, &c., and 150 magnetic track and wheel brake equipments. (See this issue.)

Newport (Mon.).—June 22nd. Electricity Department. One 1,250-kW motor convertor and switchgear. (See this issue.)

New Zealand.—WELLINGTON.—August 7th. Posts and Telegraph Department. Enamelled and silk-covered resistance wire. (B.X. 5322.)

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

September 4th. Government Railways. Motor generator. (B.X. 5308.)*

AUCKLAND.—August 19th. Auckland Electric Power Board. Single-phase transformers. (B.X. 5324.)*

Nottingham.—June 28th. Electricity Department. Supply of general stores for the electricity undertaking for 12 months from July 1st, 1929. (See this issue.)

South Africa.—PRETORIA.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. (B.X. 5273.)*

PIETERSBURG, TRANSVAAL.—August 13th. Municipal Council. Steam-raising plant, engine alternators, and switchgear. (A.X. 7983.)*

August 13th. H. and l.p. cable, lamps and sundries. (B.X. 5312.)*

JOHANNESBURG.—June 27th. South African Railways and Harbours. 2,200- and 600-V cables and accessories. (B.X. 5343.)*

June 20th. City Council. Supply and delivery of h.p. and l.p. cables. (B.X. 5342.)

Spain.—BILBAO.—Juntas de Obras (Boards of Works). Ten electric cranes.—*Reuter's Trade Service* (Madrid).

Stafford.—July 2nd. Staffordshire Education Committee. Installation of electric light at Kingswinford Brockmoor Council school. (See this issue.)

Stockton-on-Tees.—June 11th. Electricity Department. Supply and delivery of two 1,250-kVA 3-phase transformers and l.p. 3-phase switchgear. (May 24th.)

Sunderland.—July 8th. Electricity Department. Paper-insulated, lead-sheathed cable, rubber-insulated wire, meters, gasfilled and vacuum lamps. (See this issue.)

Uruguay.—PORT AUTHORITIES.—July 22nd. 300-kilo electro pneumatic drop-hammer. (A.X. 7974.)*

Walthamstow.—June 12th. Electricity Department. Supply, delivery and erection of two cooling towers and one ferro-concrete tank. (May 24th.)

West Ham.—June 17th. Education Committee. Installation of electric lighting at Fyfield open-air school extension, and installation of water-heating apparatus at Balaam Street School, Plaistow. (May 24th.)

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Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Three 225,000-lb. boilers with economisers, air heaters, fans, &c. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—SYDNEY.—City Commission. Accepted:—
Power transformers (£45,772).—Electrical Plant Manufacturers, Ltd.
MELBOURNE.—State Electricity Commission. Accepted:—
360 miles of aluminium cable for Yallourn-Richmond main transmission line (£67,432).—British Insulated Cables, Ltd.

Barking Town.—Electricity Committee. Recommended:—
Two 400-kVA transformers.

HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD. (Recommended.)	£179	each.
Johnson & Phillips, Ltd.	204	,,
Crompton Parkinson, Ltd.	205	,,
Brush Electrical Engineering Co., Ltd. ...	208	,,
Ferranti, Ltd.	217	,,
British Electric Transformer Co., Ltd. ...	220	,,
English Electric Co., Ltd.	220	,,

Birmingham.—Water Committee. Accepted:—
Installation of apparatus for electric lighting at Edgbaston pumping station.—Baxter & Impey.
The Corporation has accepted the following tenders during the last three months:—
Electric lighting installations at Bierton Road junior school and Arden Road school.—Reynolds & Bradwell; at George Dixon school.—T. Glover; at City Fever Hospital.—L. Scrutton.
Two electric vehicle batteries.—Tudor Accumulator Co., Ltd.
Electricity Committee. Accepted:—
Rotary convertors for Summer Lane generating station and three sub-stations.—Electric Construction Co., Ltd.
Rotary-convertor equipment at two sub-stations.—General Electric Co., Ltd.

Chesterfield.—Town Council. Accepted:—
Transformer and switchgear in connection with work at Whispering Well (£275).—English Electric Co., Ltd.

Croydon.—Town Council. Accepted:—
Concrete cooling tower in connection with the extensions (£18,680).—Purdie, Lumsden & Co., Ltd.
Pipe work for the tower (£5,352).—Aiton & Co., Ltd.

Glasgow.—Halls Sub-Committee. Recommended:—
Main switchboard at M'Lellan Galleries (£130).—Anderson & Munro, Ltd.
Electricity Committee. Recommended:—
Materials for 12 months:—
Single cables.—Enfield Cable Works, Ltd.
Telephone cables.—Callender's Cable and Construction Co., Ltd.
L.p. cables.—W. T. Glover & Co., Ltd.; Enfield Cable Works, Ltd.; Callender's Cable and Construction Co., Ltd.
E.h.p. cables.—Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.
R.i. cables.—Craigpark Electric Cable Co., Ltd.; Edison Swan Electric Co., Ltd.
Flexibles.—Craigpark Electric Cable Co., Ltd.
D.c. meters.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.
A.c. meters.—Metropolitan-Vickers Electrical Co., Ltd.; Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; Electrical Apparatus Co., Ltd.; Chamberlain & Hookham, Ltd.
Arc lamp carbons.—General Electric Co., Ltd.
Electric cookers.—Siemens Electric Lamps and Supplies, Ltd.; Falkirk Iron Co., Ltd.
Electric kettles.—Bulpitt & Sons, Ltd.
Cast-iron boxes, section pilars, &c.—James Allan, Senr., and Son, Ltd.; Carron Company; Falkirk Iron Co., Ltd.; David King & Sons, Ltd.; Lane & Girvan; John Needham & Sons; M'Dowall, Steven & Co.; Robert Taylor & Co.
Two 20,000-V feeder panels at Cadogan Street sub-station (£1,328).—A. Reyrolle & Co., Ltd.
75 electric cookers.—Siemens Electric Lamps and Supplies, Ltd. (Accepted.)
Cleansing Committee. Recommended:—
Utility electric truck for Govan refuse works (£233).—Electric Vehicles, Ltd.
Six electric vehicles (£1,098 each).—Richard Garrett and Sons, Ltd.
Lighting Committee. Accepted:—
Electrical fittings and accessories for 12 months.—W. McGeoch & Co., Ltd.; Cartwright & Sons; Brown and Co.; Z Electric Lamp and Supplies Co., Ltd.; Sloan Electrical Co., Ltd.; Malcolm & Allan, Ltd.; T. Land & Sons; Bayliss, March & Newey, Ltd.; Credenda Conduits Co., Ltd.

Hornsey.—Electricity Committee. Recommended:—
300-kW rectifier set (£2,460).—Hewittic Electric Co., Ltd.
L.p. switchgear (£1,073).—Bertram Thomas & Co.
H.p. switch panel (£317); h.p. switchgear (£1,405).—A. Reyrolle & Co., Ltd.
H.p. and control cables (£2,712).—Standard Telephones and Cables, Ltd.
300-kW motor convertor (£1,887).—Bruce Peebles and Co., Ltd.
Education Committee. Recommended:—
Additional installation of electricity at Highgate school (£356).—A. E. Sandilands.

Ilford.—Electricity Committee. Recommended:—
Cables.—Metropolitan Electric Cable Construction Co., Ltd., and Union Cable Co., Ltd.

Leicester.—Electricity Committee. Accepted:—
Steam pipe connections for central power station (£1,708).—Aiton & Co., Ltd.

Leyton.—Town Council. Accepted:—
Consumers' motors in connection with the change-over.—Crompton Parkinson, Ltd.

Liverpool.—Electricity Committee.
50,000-kW turbo-alternator for Clarence Dock power station (£193,370).—Metropolitan-Vickers Electrical Co., Ltd.

London.—STEPNEY.—Electricity Supply Committee.
Air compressor (£97).—Reavell & Co., Ltd.
Two tons plumbers' solder (£148).—H. B. Barnard & Sons.
Four 1,500-kW motor convertors and switchgear for sub-stations:—

Ateliers de Constructions Electriques de Charleroi	£19,600
BRITISH THOMSON-HOUSTON CO., LTD. (Recommended.)	19,934
Metropolitan-Vickers Electrical Co., Ltd. ...	19,983
Bruce Peebles & Co., Ltd.	20,204
General Electric Co., Ltd.	20,236
English Electric Co., Ltd.	20,305

LONDON COUNTY COUNCIL.—Accepted:—
V.i.r. cables.—British Driver-Harris Co., Ltd.
POPLAR.—Electricity Committee. Recommended:—
Cables (£738).—Siemens Bros. & Co., Ltd.
Circulating water pumping machinery (£2,230).—Mirrlees-Watson Co., Ltd.

Richmond (Surrey).—Board of Guardians. Rewiring work at the Grove Road Institution:—
RICHMOND ELECTRIC INSTALLATIONS (accepted), £850 and £795.
Telephone and Electric Maintenance Co., £1,590 and £1,700.
Troy & Co., £791 and £759.
Stone & Co., £784 and £744.
Tredegars, Ltd., £1,014 and £910.
J. Passmoor, £881 and £838.
Howson, Jones & Co., £750 and £680.
Richmond Electric Light Co., £1,090 and £1,150.
Messrs. Clark, £1,341 and £1,248.
General Electric and Maintenance Co., £1,985 and £1,817.
Messrs. Higginbothams, £1,150 and £1,150.
Langston-Jones & Co., £929 and £849.
Skase & Co., £3,250 and £2,850.
Burdett & Co., £925 and £850.
Messrs. Vigor, £998 and £1,030.
Carr Bros., £553 and £454.
An amendment to accept the tender of Carr Bros. as the lowest was rejected by nine votes to six.

Salford.—Electricity Committee. Recommended:—
1,170 yards of single-core cables (£627).—W. T. Glover and Co., Ltd.
E.h.p. switchgear for Cromwell Road sub-station (£536).—Metropolitan-Vickers Electrical Co., Ltd.
Three-phase oil-immersed power transformers for 12 months.—Hackbridge Electric Construction Co., Ltd.
Electric thermal storage system at Frederick Road power station (£995).—Saunders & Taylor, Ltd.

Smethwick.—Estates Committee. Accepted:—
Electric light installation at Mallin Street Baths.—Walker and Co.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
Transformers.—Three 1,000-kVA (£1,776), Bruce Peebles and Co., Ltd.; ten 300-kVA (£2,060), seven 150-kVA (£952), eight 100-kVA (£776), Reunert & Lenz, Ltd.; five single-phase (£1,450), Metropolitan-Vickers Electrical Export Co., Ltd.; two 300-kVA (£410), and two 150-kVA (£240), Dowson & Dobson, Ltd.; two 300-kVA (£438), and two 150-kVA (£290), South African General Electric Co., Ltd.

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Fuses.—250 of 350 amps. capacity, and 50 pairs of spare contacts (£369).—Albert Vaux, Ltd.
100 fuse handles (£125).—Saaler & Franks, Ltd.
Spares for boilers (£494).—Reunert & Lenz, Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted:—
1,000-kVA transformers (£570 each).—Metropolitan-Vickers Electrical Co., Ltd.
Overhead wiring and services for new houses on various estates:—Sutton estate (£189) and Eaton Street (£44).—Barnett & Soans. Cornhill estate (£302).—H. Parker; and (£360).—E. Holloway. Hanford estate (£176).—H. Parker; and (£230).—Tomlins, Ltd.

Wrexham.—Town Council. Accepted:—
Wiring 36 houses at Hightown for electric light (£297).—Jones & Williams.

York.—Electricity Committee. Recommended:—
Switchgear for Foss Island works (£1,361) and for Lendal sub-station (£1,220).—A. Reyrolle & Co., Ltd.
Switchgear for Kent Street sub-station (£768); Scarborough Bridge (£634); the Groves (£422); Burton Lane (£320); and South Bank (£324).—George Ellison, Ltd.

Forthcoming Events.

E.H.P. Conference.—Paris. June 6th to 15th. Institution of Electrical Engineers. Summer meeting in France, June 11th to 22nd.

Electrical Association for Women.—June 10th-12th. Newcastle-upon-Tyne. Conference and annual meeting.

Electric Lamp Manufacturers of Great Britain.—June 10th to 14th. Nineteenth Illumination Design Course. E.L.M.A. Lighting Service Bureau. 9.45 a.m. daily.

Institution of Electrical Engineers.—Summer meeting in France. June 11th to 22nd.

Diesel Engine Users' Association.—Friday, June 14th. Caxton Hall, S.W. 6 p.m. "Repairs to Diesel Engine Parts by Electro-deposition." Mr. C. H. Faris.

Electrical Contractors' Association.—June 26th to 28th. Bournemouth. Annual conference.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

CHAPPUIS reflectors.

Notes.

A Small Automatic Hydro-electric Plant.

Some interesting particulars are given in the "Brown-Boveri Review" of the new reserve power station which was built last year by the Buchs Municipal Water and Electricity Supply (Switzerland), to utilise the available head of water below the existing power station. The new plant contains one 900-h.p. hydro-electric generator, and is equipped for automatic control. In addition, the operation of the old power station has been simplified, so that after the new unit, which works alone during the day, has been started up, the attendant has merely to be present when required.

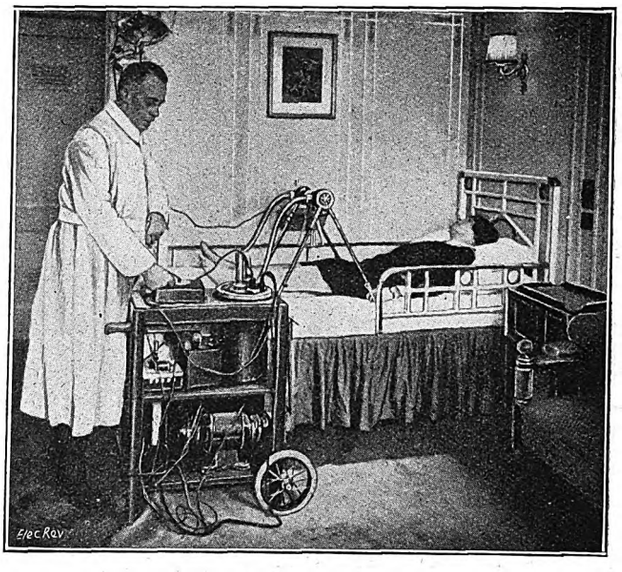
The three-phase alternator, which develops 920 kVA, is of the protected type and self-cooled, air being drawn in from the machine room by means of vanes bolted to the rotor. A directly-coupled exciter is mounted on a bracket secured to the bearing at the non-driving end. Regulation poles are provided, enabling the alternator pressure to be varied within wide limits by means of the rheostat in the exciter shunt-field circuit. The turbine governor has an auxiliary hydraulic servo-motor for preventing the turbine from running away if the oil-pressure governing it should fail. The speed can be varied within wide limits from the main power station by means of an electrical speed-adjusting gear. The water supply to the turbine is regulated by a hydraulically-operated sluice valve controlled by means of an electromagnet.

In addition to the usual equipment for controlling the turbo-alternator set, there are also provided thermostats built into the various bearings, and a contact manometer on the servo-motor. If the oil pressure falls in the regulating system, the manometer trips the oil circuit breaker and notifies the attendant. To ensure reliability in tripping the set under all circumstances, the free end of the turbine shaft is coupled to a small auxiliary dynamo which generates current all the time the turbine is running, for the purpose of tripping the set if necessary. A second winding on the electro-magnet for operating the sluice valve is fed from this auxiliary dynamo.

The switchboard for the new alternator is situated in the old station near the other switchboard; it is completely enclosed by sheet iron, the connections to the existing bus-bars being brought out through three bushing insulators. The 920-kVA set is paralleled on to the mains by means of an existing synchronising apparatus in the old power station. Disturbances are signalled by special apparatus. The set is started up by means of a push-button switch with a holding coil; the current which passes through this coil also passing through the coil of an indicator disk. Thus, when starting up, this disk closes a contact and prepares the signalling circuit for closing. If a disturbance causes a relay to interrupt the retaining current, the push-button switch opens and then closes another contact in series with the one on the indicator disk and causes the alarm bell to ring. The attendant, being notified, can now raise the indicator disk again, thus stopping the bell. If an excess of current causes the set to be tripped, the alarm is given by a special indicator disk.

X-rays at Sea.

One of the most important aids for the doctor aboard ship has not been available hitherto, for purely technical reasons. We refer to X-ray apparatus, without which the surgeon is severely handicapped. Breakages of limbs occur all too frequently on the big passenger liners, and in these cases the ship's doctor has been compelled to work under a great disadvantage for want of X-ray pictures. Until recently, owing to its cumbersome nature, X-ray plant was entirely unsuitable for use at sea, as, in addition to the problem of space, the deleterious action of sea air on the more delicate portions of the apparatus had to be considered, whilst the operation of such an installation would have necessitated the employment of a qualified operator. All these difficulties are claimed to have been overcome however by the introduction of a portable outfit of entirely new design, known as Philips "Metalix-Portable." With this apparatus, the ship's surgeon is enabled to make his own X-ray diagnosis, and the accompanying illustration shows the apparatus in use in a passenger's cabin aboard the liner *Belgenland*, owned by the Red Star Line, which is one of the first companies to take advantage of the innovation. A trolley table carries the entire outfit, and accommodates a small rotary convertor which supplies the necessary alternating current to the apparatus from the ship's electricity supply mains. The outfit is provided with a metal-clad X-ray tube mounted on adjustable legs, by which means it can be accurately centred over the patient, the high-voltage current being fed through two specially insulated shockproof cables. Whilst in operation the outfit can be handled with safety. The patient experiences no sensation, and nothing to indicate that a pressure of some 65,000 volts is being generated within such a small compass. The apparatus is totally enclosed, and requires no special knowledge to operate.



Ship's "Metalix" X-ray Outfit.

The March Railway Yard.

According to the *Morning Post*, March, "the Metropolis of the Fens," has been provided with one of the finest railway marshalling yards in the world. The work, which has been carried out on an elaborate scale, has just been completed at a cost of over £300,000. The new yard is capable of dealing with an additional 1,000 wagons per day, and some 40 additional men have been engaged to man the sidings and work the train service. Electricity plays an important part; not only is the "yard" illuminated by flood lights, but the marshalling sidings are electrically operated, and the points are controlled by one man in an electric control cabin.

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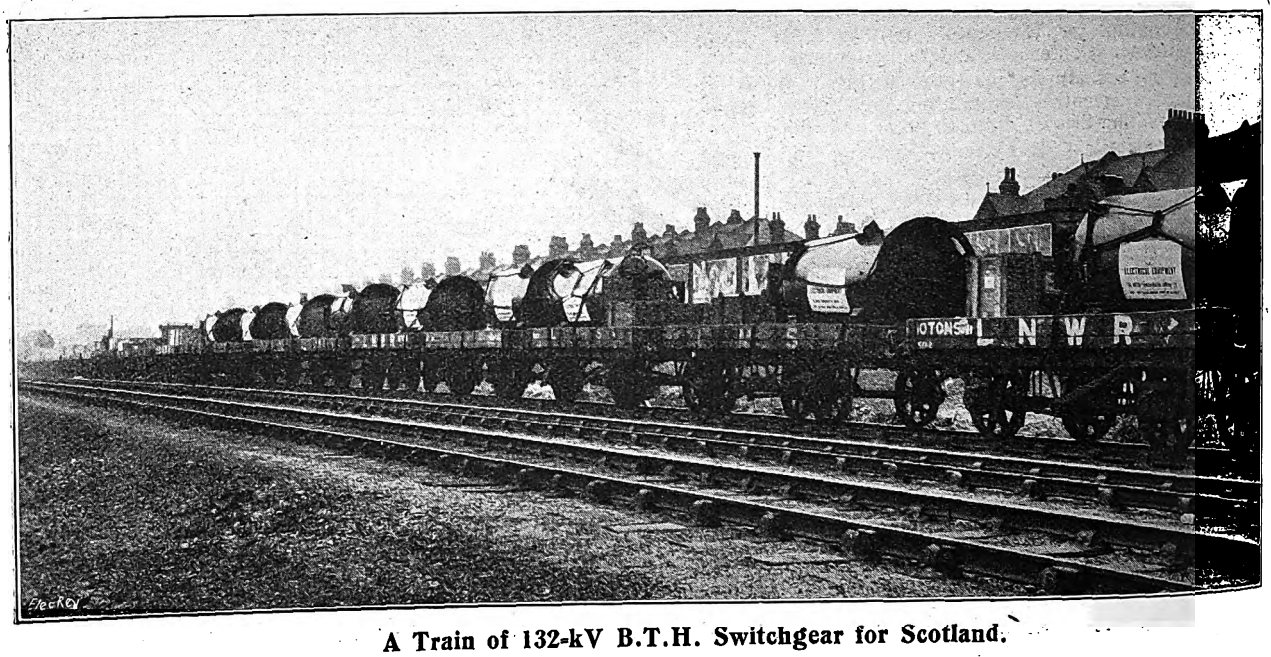
The Electrical Association for Women.

On May 25th members of the Electrical Association for Women had the pleasure of visiting the new power station at Longford, near Coventry. The members thoroughly enjoyed the visit, especially the journey up into the inside of the cooling tower, which was worth every effort needed to reach that point.

A very successful lecture-demonstration was given by Mrs. H. L. Dover, B.Sc.(Lond.), a member of the E.A.W., at the latter's premises at Kensington Court on May 29th. A model thermal-storage electric cooker had been sent from Sweden by arrangement with Mr. R. Borlase Matthews and Dr. A. Ekstrom, and Mrs. Dover's lecture was the result of tests made on the cooker in her own home under ordinary home conditions. Although the consumption of electricity per person was higher than with an ordinary electric cooker, there were very decided advantages, such as a hot-plate always available which would boil much more rapidly than the ordinary hot plate. There were also the further advantages that inferior types of food could be cooked and made just as palatable as the more expensive ones, and the cooker could be plugged into an ordinary outlet. A good discussion followed, in which members of the Women's Co-operative Guild present stated that such forms of cooking would be of benefit to the working woman.

132-kV Switchgear for Central Scotland.

In the accompanying illustration is shown a special train prior to its departure from Willesden for Bonnybridge with the oil tanks and component parts for the last three B.T.H. 132,000-volt outdoor oil-immersed circuit breakers for the first sub-station of the eastern ring of the Central Scotland section of the "grid." As is generally known, the contract for the 132,000-volt switchgear for the eastern portion of this scheme was placed by the Central Electricity Board with the British Thomson-Houston Co., Ltd. All the sub-stations are of the outdoor type, and the principal groups of the switchgear are 45 oil-immersed circuit breakers, each of three single-phase units. Each unit is over 8 feet high to the top of the tank, and about 15 feet to the top of the terminals. A 3-phase group, complete with oil, weighs about 25 tons (see Elec. Rev., May 17th, 1929, p. 871).



A Train of 132-kV B.T.H. Switchgear for Scotland.

B.E.S.A. Publications.

Three electrical specifications have recently been issued by the British Engineering Standards Association. Two are revisions, No. 37—1929, Electricity Meters, and 67—1929, Two- and Three-plate Ceiling Roses, while the third publication is No. 358—1929, British Standard Rules for the Measurement of Voltage with Sphere-gaps. B.S.S. No. 37 is a revision of the 1919 edition, and differs from its predecessor in several important respects. In the first place, the permissible limits of error have been appreciably reduced, the limits for all sizes, grades and types of meters now being within the Board of Trade limits. In the second place, differentiation has been made in several important respects between d.c. and a.c. meters, whereas in the 1919 edition there was no differentiation as regards the majority of the electrical performance requirements. Thirdly, two grades of both a.c. and d.c. types are provided for, namely, a sub-standard grade and a commercial grade. Fourthly, the registering mechanism is now restricted to the pointer type, and must consist of not less than six pointers. A very useful feature of the specification is a folding sheet containing a summary of the performance requirements. This sheet can be removed from the specification and mounted in the test-room for ready reference.

B.S.S. 67, the revision of the 1914 edition, differs from the old specification mainly in that the design has been simplified by the omission of the projecting lugs on the contact-plates, and by the contact-plates of the three-plate ceiling rose not being required to be of different shapes. In addition to the two- and three-plate surface-type ceiling roses, provision is made in the revised edition for semi-recessed ceiling roses, all types being suitable for use in circuits in which the pressure does not exceed 250 volts, and the current does not exceed 5 A. The specification lays down the materials and dimensions of the component parts, and details are given of a suitable gauge to ensure that the holes for the fixing screws are so spaced that a British Standard ceiling rose can be mounted on a British Standard conduit box. It is interesting to note that whereas the old specification restricted the material of the base and cover to "vitreous material," the revision allows the alternative use of "tough non-ignitable insulating material" (mouldings), provided such materials satisfy the requirements of the specification.

B.S.S. No. 358 is a publication as a British Standard of the rules prepared by the British Electrical and Allied Industries Research Association, and is a revision and extension of the material originally presented by the B.E.A.I.R.A. in Technical Report No. L/S2. These new rules supersede the old rules which were given as appendices to several of the British Standard Specifications for electrical machinery. The tables given therein have been approved by the International Electrotechnical Commission, and they cover the whole range of voltages from 10 kV to 900 kV, with six sizes of spheres. In addition to the tables, a series of curves are included to enable interpolations to be made at any intermediate point, with an accuracy equal to the limiting accuracy of the method itself.

Copies of all the new specifications may be obtained, price 2s. 2d. each, post free, from the Publication Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

Appointments Vacant.

Full-time lecturer of electrical engineering at Leicester College of Technology. Maintenance engineer and three junior assistant charge engineers for Bristol Corporation. Switchboard attendant and meter tester for Walthamstow Urban District Council. Meter superintendent and meter repairer for Hull Corporation. Shift charge engineer at Willesden power station, and assistant charge engineer at Brimsdown power station for the North Metropolitan Electric Power Supply Co. Plumber-jointer (e.h.p.) and jointer (l.p.) for Watford Corporation. Assistant charge or relief engineer for Islington Borough Council. (See our advertisement pages to-day.)

Power Stations in London.

With regard to the correspondence which has passed between Mr. W. Townend, town clerk, Fulham, and Mr. W. Tapper, president, Royal Institute of British Architects, and published in the daily Press, we have been asked to draw attention to the town clerk's protest that the president's statement relative to the injury which the discharge of products of combustion may do to the surrounding neighbourhood, &c., is false in so far as it concerns "the existing station at Fulham," and is denied. The president, in reply, explained that the station referred to by him was not that of the Council, and he regretted that any idea that he meant that station should have arisen.

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I.E.E. Golf Competition.

The golf competition in aid of the I.E.E. Benevolent Fund was played at the Hesketh Golf Club, Southport, on May 29th. Fine weather prevailed and some very good cards were returned. The G. P. Dennis Trophy was won by Mr. A. G. Barnard (Liverpool), with a net score of 1 down. Mr. J. O. Balshaw and Mr. F. G. Briant tied for second place with a score of 2 down. In the first division Mr. J. O. Balshaw and Mr. A. G. Barnard tied for first place with a net score of 75, and in the second division Mr. H. Gawthorne returned the best card with a score of 80. In the two-ball foursome the best card was returned by Mrs. Kessler and Mr. W. A. Phillips with a net score of 80½, and for the second best card Mr. F. E. Boot and Mr. F. G. Briant tied with Mr. R. Foster and Mr. R. Turnbull with a score of 81. The putting competition was won by Mr. G. S. King. The total entry was 75, of which 53 took out cards for the various competitions. Mr. S. E. Britton, chairman of the Mersey and North Wales (Liverpool) Centre, presided at the dinner and was supported by Mr. J. Harcourt Williams, chairman of the North-Western Centre. The dinner was held at the Prince of Wales Hotel, Southport, and the prizes were presented by Mrs. J. Harcourt Williams. The event this year was organised as a joint effort with the North-Western Centre and it is hoped that a substantial amount will be handed over to the Benevolent Fund of the I.E.E.

Brighton Students and Electro-Farming.

When students from the Brighton Technical College recently visited the "all-electric" farm of Mr. R. Borlase Matthews, near East Grinstead, the afternoon was so hot that one of the most attractive items of the visit was a walk by the side of Wiremill Lake to the hydro-electric power station. At the top of the lake, where water lilies are now grown for the London market, a water wheel was operated in the times of the Romans, as well as in the days of the Sussex iron workers. To-day power from the lake is being utilised for all the farm purposes to which electricity can be applied, and an unusual feature of the station is that its controls are over a mile away across the fields, near the main farm buildings, where there is also an oil engine as a stand-by. During the past drought the latter has been specially useful at a time of year when all the house and cottage dwellers on the estate become big consumers. The visitors were particularly interested in the erection of a new power line to some new buildings. The supports for the cable are of the X-pole type, about which Mr. R. Borlase Matthews is shortly reading a paper before the International Extra-High-Pressure Conference in Paris. The low cost of these poles, as compared with those of more conventional designs, makes them well worthy of consideration at a time when any contribution towards reducing the cost of electrical distribution is of national importance.

The British Association.

It is announced that the centenary meeting of the British Association for the Advancement of Science in 1932 will be held at York, the city in which the Association was founded.

Educational.

CLIFTON COLLEGE.—Owing to the large increase of the number of visitors who intend to be present at the Guthrie and Percival Commemoration celebrations on June 28th and 29th, it has been found necessary to restrict admission to certain functions to ticket holders only. Old Cliftonians are therefore advised to apply for tickets not later than June 15th.

Full-time courses are provided in engineering, including electrical engineering and electrical communication, at the Northampton Polytechnic Institute, St. John Street, E.C.1. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

The Council has nominated the undernamed gentlemen to fill the vacancies which will occur on September 30th, 1929:—*President*, Col. Sir T. F. Purves, engineer-in-chief, General Post Office; *hon. treasurer*, Mr. E. Leete, London Electric Wire Co. & Smiths, Ltd.; *new members of Council*, Messrs. A. R. Cooper, London Electric Railway Co.; R. S. Whipple, Cambridge Instrument Co., Ltd.; Prof. E. Wilson, King's College, London; Mr. E. E. Sharp, Venner Time Switches, Ltd.

NORTH-MIDLAND CENTRE SUMMER OUTING.—The committee of the N.M. Centre (Leeds), in conjunction with the Sheffield Sub-Centre, proposes that a summer outing be arranged for the whole Centre this year, on Saturday and Sunday, June 29th and 30th, and the place selected is the Palace Hotel, Buxton. Luncheon will be served at the hotel on the Saturday, and during the afternoon various trips, golf, or tennis, can be arranged; after dinner there will be dancing at the hotel. On the Sunday there will be excursions, or golf, during the morning and luncheon at the hotel. It is hoped to inaugurate this outing as an annual social function, and ladies are particularly invited. The committee of the Sheffield Sub-Centre will be responsible for the final arrangements.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We feel compelled to lead off our "Personal" column this week by recording for the benefit of our readers—so many of whom are doubtless as keen golfers as they are engineers—the latest feat of Mr. P. N. RAND, the general sales manager of the English Electric Co., Ltd. Playing at Bramley, Surrey, last week, his shot from the fifteenth tee struck the pin squarely about four inches from the ground and the ball dropped into the hole. The fifteenth is a 120-yards blind hole with a bogey of 3.

The General Election.—The "electrical and allied" representation in the House of Commons remains much as it was before the general election. The following Conservatives retained their seats:—Sir PHILIP DAWSON, Sir KENYON VAUGHAN-MORGAN (Morgan Crucible Co., Ltd.), Mr. GEORGE BALFOUR (Balfour, Beatty & Co., Ltd.), and Sir WALTER PRESTON (J. Stone & Co., Ltd.). Mr. P. J. PYBUS (chairman of the English Electric Co., Ltd.) gained the Harwich division of Essex in the Liberal interest, but Mr. W. PRESTON (W. Sanders & Co.) failed to hold Walsall for the Conservatives. Mr. E. KILBURN SCOTT (Liberal) was unsuccessful at South Leeds. Ald. JOHN ARNOTT, who won South-West Hull for the Labour Party, is chairman of the Leeds Corporation Tramway Committee and an ex-Lord Mayor of Leeds.

Mr. E. MORGAN, chief engineer and general manager of the Wolverhampton Corporation Electricity Department, has been recommended for the position of general manager and engineer of the Sheffield Electricity Supply Department, at a commencing salary of £1,250 per annum. The appointment was to be considered by the City Council this week.

Mr. J. BRIERLEY, traffic superintendent of the Wigan Corporation Tramways, has been nominated for the position of general manager of the undertaking, and the proposed appointment is to come before the Town Council at its next meeting. Mr. Brierley is an Oldham man, and he will succeed Mr. C. Hopkins, who has been appointed tramway manager to the Sunderland Corporation.

Miss ROSALIND HASLETT has been appointed buyer in the Electrical Department of Messrs. Shoolbred's, Ltd.

Mr. JOHN MORRISON, Preston, Lancs., and late of Kirkcaldy, has been appointed electrical and mechanical engineer to the Carmen Valley Gold Mines, Ltd., Colombia.

Mr. R. ALAN S. THWAITES, M.Inst.C.E., M.I.E.E., M.I.Mech.E., of the Yorkshire Electric Power Co., has been elected vice-chairman of the Yorkshire Association of the Institution of Civil Engineers.

The Glasgow Corporation Electricity Committee recommends the appointment of Mr. THOMAS I. CRAIG, now mains district superintendent, as sales manager, at a salary of £600 rising by two-yearly increments of £50 to a maximum of £800.

Consequent upon the resignation of Mr. J. D. PEATTIE, distribution development engineer, the following appointments have been made by the Manchester Corporation Electricity Committee:—Mr. H. Hawkins, h.p. mains engineer, appointed distribution development engineer; Mr. A. W. Crompton, technical assistant, appointed assistant distribution development engineer; and Mr. P. T. Fowler, assistant h.p. mains engineer, appointed h.p. mains engineer.

It is announced that Mr. W. H. NAPIER, Deputy Controller, is to succeed Mr. W. A. Valentine, C.B.E., as Controller of the London Telephone Service.

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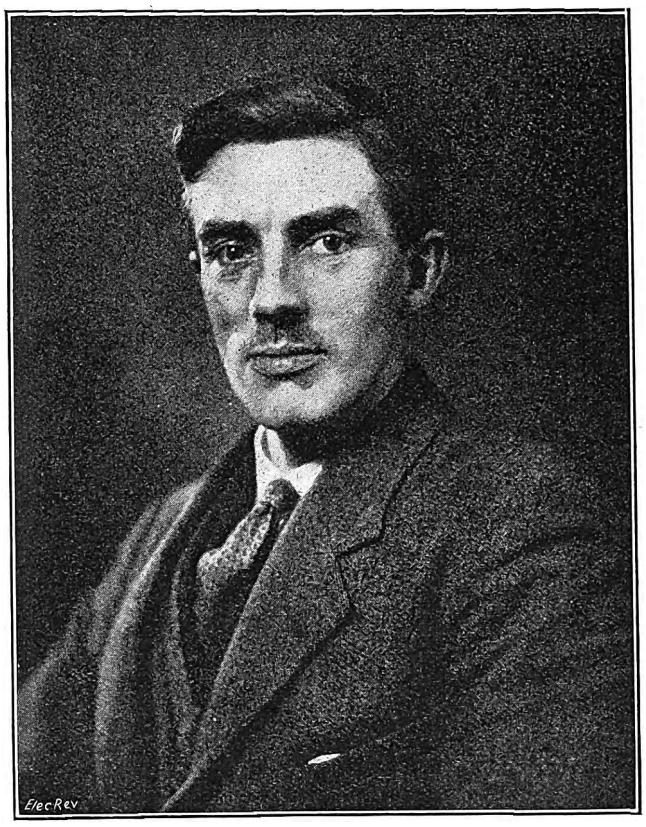
We reproduce herewith a portrait of Mr. C. Elliott, B.Sc., A.M.Inst.C.E., A.M.I.Mech.E., who, as we reported in our last issue, has taken the place of the late Mr. Charles Stanley as general manager of the Birmingham Section of the British Industries Fair. Mr. Elliott, who is 41 years of age, was educated at St. Andrew's College, Dublin, and Victoria University, Manchester. After serving with the Great Central Railway as a pupil-apprentice, he became assistant locomotive superintendent of the Sheffield district. Later he was appointed chief engineer to a large North Wales chemical works, and during his time there prepared designs for new



Mr. C. Elliott, B.Sc.

The new manager of the Birmingham Section of the B.I.F.

buildings occupying 12 acres and costing over £500,000. He next spent seven years in private practice as a consulting engineer in Manchester. As honorary secretary of the Smoke Abatement League, he formed branches and associations all over the country, and he was the honorary organising secretary of the National Smoke Abatement Exhibition held in Birmingham in 1926. Immediately afterwards he was placed in charge of the great Steam Power Section of the 1927 British Industries Fair, and commenced to act as technical assistant manager to the Heavy Section of the Fair under Mr. Stanley. Many of the changes and improvements which have been introduced were due to Mr. Elliott, and the yearly extensions of the Fair buildings have been carried out from his designs.

Mr. John Grice Statter, M.I.E.E., A.M.Inst.C.E., of Messrs. J. G. Statter & Co., is due to arrive at Liverpool on June 10th, by the *Walmer Castle*, after a successful business trip, renewing many electrical acquaintanceships, in South Africa.

The marriage of Mr. R. B. Renwick, son of Sir Harry Renwick, Bart., K.B.E., to Miss Dorothy Mary Parkes, elder daughter of Mr. and Mrs. Harold Parkes, of Alveston, Stratford-on-Avon, will take place at St. Margarets, Westminster, on June 10th.

Mr. F. W. Keen, late assistant engineer to the Harwich Corporation Electricity Department, has been appointed district engineer to the Wessex Electricity Co.

Col. Sir T. F. Purves, engineer-in-chief of the General Post Office, has been nominated as the next President by the Council of the Institution of Electrical Engineers.

Obituary.—Mr. W. Howard Hazell.—Few men in the great printing industry of this country have been more highly respected for many years past than Mr. W. Howard Hazell, chairman of Messrs. Hazell, Watson and Viney, Ltd., who passed away at the age of 59 on May 30th, at his home in London. He had during the war and since, a great zeal for improving the relations of employers and employed, and wrote many articles for *The Times* and other journals on "Industrial Relations"; he was an expert authority on printing costs, had been a president of the Federation of Master Printers, and had much to do with the establishment of the London School of Printing. He served on the Melchett-Turner Committee, was greatly interested in co-partnership, devoted much time to child welfare, and by his friends with whom he faced the immense difficulties of the printing trades during the great war, was most highly esteemed.

Mr. W. F. Oakfield.—The *Siemens Magazine* for June records the death, on May 19th, of Mr. W. F. Oakfield, who entered the service of the Siemens Company in 1880 as assistant to Dr. Obach in the Chemical Laboratory. Mr. Oakfield was in his 67th year.

M. de Lapisse.—The death is announced from Paris of M. J. de Lapisse, president of the Compagnie d'Electricité de Limoges, and a pioneer of long-distance electric power transmission schemes in France.

Mr. J. Shepherd.—The death occurred on May 28th of Mr. Joseph Shepherd, electrical engineer, Bexley, Kent. He was 61 years of age, and was for a number of years assistant electrical engineer to the London County Council. After his retirement he went to Russia as an electrical expert for the British Government, and he was in that country when the revolution took place.

Mr. H. Gleave.—The sudden death is announced, at the age of 30 years, of Mr. Herbert Gleave, who was chief electrician to the Chemical and Metallurgical Corporation, Ltd., Runcorn. He was previously with the St. Helens Cable and Rubber Co., Ltd.

Will.—The late Mr. T. H. Morris, secretary of Ferranti, Ltd., of Manchester, left £5,879 gross and £4,745 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Mainten Manufacturing Co., Ltd.—Private company. Registered May 28th. Capital, £1,300 in £1 shares. Objects:—To acquire the business of wireless engineers and makers of wireless components carried on by H. R. Malby at 126, Portland Road, Hove. The directors are:—H. R. Malby, 126, Portland Road, Hove; A. F. Griffith, 74, Beulah Hill, Upper Norwood, S.E. Registered office: 126, Portland Road, Hove.

Riversdale Radio Co., Ltd.—Private company. Registered May 25th. Capital, £200 in 1s. shares (100 7 per cent. cumulative preference and 3,900 ordinary). Objects:—To adopt an agreement with W. H. Johnson, trading as the Riversdale Radio Co., and to carry on the business of manufacturers or vendors of wireless receiving sets and components formerly carried on by the above at 179, London Road, Kingston-on-Thames. The first directors are:—W. H. Johnson, radio engineer, and Mrs. M. O. Johnson, "The Stump," Riversdale Road, Thames Ditton. Secretary: A. M. Kingsley, "Rowardennan," Rusland Road, Harrow. Registered office: 179, London Road, Kingston-on-Thames.

Tee-Kay Radio, Ltd.—Private company. Registered May 25th. Capital, £100 in 1s. shares (50 7 per cent. cumulative preference and 1,950 ordinary). Objects:—To adopt an agreement with Marjorie O. Johnson, trading as the Tee-Kay Radio Co., and to carry on the business of manufacturers or vendors of wireless receiving sets and components formerly carried on by her at 19, Fairfield West, Kingston-on-Thames. The directors are:—R. A. Kidd, 112, Churchill Road, Willesden Green, N.W.2, cabinet manufacturer; T. Keeling, Caxton House, High Street, Hampton Wick, radio manufacturer. Secretary: A. M. Kingsley, "Rowardennan," Rusland Road, Harrow. Registered office: 112, Churchill Road, Willesden Green, N.W.2.

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Regional Radio, Ltd.—Private company. Registered May 29th. Capital, £500 in £1 shares. Objects:—To carry on the business of radio engineers and contractors, electricians, manufacturers of wireless apparatus and accessories, &c. The first directors are:—A. J. Richardson, Flat 2, Museum Mansions, Great Russell Street, W.C.1; H. Cormack, 51, Lorrimore Road, Kennington, S.E.17 Registered office: 9, Southampton Street, W.C.1.

Protos Electric, Ltd.—Private company. Registered May 27th. Capital, £1,000 in £1 shares. Objects:—To manufacture, export and import and deal in electrical apparatus, and to adopt an agreement between Siemens Schuckertwerke A.G., of the one part, and J. A. Milne, of the other part, for the acquisition by the latter of a licence from the former to sell in Great Britain goods bearing the trade mark "Protos." The subscribers (each with one share) are:—J. A. Milne, 82, Hazelwood Lane, Palmer's Green, N.13, company secretary; W. J. Ellison, 16, Southampton Street, W., bookkeeper. J. A. Milne is the first director. Registered office: New Bridge Street House, 30-34, New Bridge Street, E.C.4.

British Italian Power and Irrigation Trust, Ltd.—Registered May 28th as a public company. Capital, £75,000 in 70,000 ordinary shares of £1 each and 100,000 deferred shares of 1s. each. Objects:—To adopt an agreement with the French, British and Foreign Trust, Ltd., to enter into or acquire and carry out contracts, concessions or grants in any part of the world for the construction, repair, maintenance, operation or control of electric, hydraulic and other works, electric or other lighting, railways, tramways, and other roads or ways; to carry on the business of general contractors, generators, distributors, suppliers, and employers of electricity for light, heat and power; and that of bankers, financiers, &c. The subscribers (each with one ordinary share) are:—W. H. Walford, 10, Lambourne Road, Leytonstone, E.11, clerk; H. W. Brown, 63, Effingham Road, Lee, S.E.12, clerk; and five other clerks. The first directors are to be appointed by the subscribers. Registered office: Dashwood House, 69, Old Broad Street, E.C.2.

Peacock & Waller, Ltd.—Private company. Registered May 27th. Capital, £2,000 in £1 shares. Objects:—To acquire the business of electrical and motor engineers and electricians now carried on by A. T Peacock and F. Waller at Leicester Road, Hinckley, as "Peacock & Waller." The directors are:—F. Waller (permanent), 13, Leicester Road, Hinckley; A. T. Peacock, 15, Leicester Road, Hinckley. The said A. T. Peacock may be a permanent director so long as he holds 250 shares. Solicitor: T. Flavell, Church Street, Hinckley.

Phonetic Electric, Ltd.—Private company. Registered May 25th. Capital, £100 in £1 shares. Objects:—To carry on the business of dealers in, and suppliers, repairers and installers of wireless, radio, and electrical goods of all kinds, gramophones, &c. The directors are:—H. B. J. Dailey (managing director), Beachwood, Mumbles; W. R. Banfield, 8, Newton Road, Mumbles. Registered office: 14a, The Dunns, Mumbles, Swansea.

B.O.W. Patents, Ltd.—Private company. Registered May 27th. Capital, £300 in £1 shares. Objects:—To adopt an agreement with A. Wright and H. J. Osborn, to develop and turn to account the inventions forming the subject of the British, Colonial, and foreign patents comprised in the said agreement, and to carry on the business of electrical and mechanical engineers, &c. The permanent directors are:—A. Wright, 124, Chancery Lane, W.C.2; H. J. Osborn, 124, Chancery Lane, W.C.2; C. R. Belling, Bridge Works, Southbury Road, Enfield, Middlesex. Registered office: 451, Southbury Road, Enfield.

Railway Radio, Ltd.—Private company. Registered May 27th. Capital, £1,000 in £1 shares. Objects:—To acquire any inventions, patents and secret processes in connection with the establishment of radio communication to and from railway trains or other forms of transport; to manufacture and deal in wireless apparatus and radio accessories, &c. The directors are:—Hon. Richard Norton, 35, Catherine Street, Westminster, S.W.; C. E. Raphael, 38, Hill Street, W.1. Registered office: 12-13, South Place, E.C.2.

Official Returns of Electrical Companies.

Midways Electric, Ltd.—Particulars filed of £400 debentures authorised May 2nd, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

England-Richards Fluid-Free Cell Co., Ltd.—Mortgage dated May 17th, 1929, to secure £400, charged on land with repository, &c., thereon, in Waterloo Street, King's Lynn. Holder: Miss M. Lyon, Seaforth House, Heacham, Norfolk.

Gordon White & Co., Ltd.—Satisfaction in full of debenture dated November 27th, 1928, securing £350. (Notice filed May 21st, 1929.)

John Kirkaldy, Ltd.—Satisfaction to the extent of £8,000 on various dates from May 15th, 1909, to May 15th, 1929, of debentures dated December 28th, 1906, securing £12,000.

Electramonic Co., Ltd.—Satisfaction in full on April 5th, 1929, of charge dated March 24th, 1928, securing £15,000.

United Ebonite Manufacturers, Ltd.—Debenture charged on freehold land and premises at Chadwell, and the company's undertaking and property, present and future, including uncalled capital, dated May 16th, 1929, to secure all moneys due or to become due from the company to Martin's Bank, Ltd.

"M.P.A." Wireless, Ltd.—Particulars filed of £35,000 debentures and bonus of 12½ per cent. authorised April 30th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £13,490.

J. Tee & Co., Ltd.—Debenture dated May 17th, 1929, to secure not more than £1,000, charged on the company's property, present and future, including uncalled capital. Holders: Pettigrew & Merriman (1925), Ltd., 2-4, Bucknall Street, W.C.2.

City and General Radio Co., Ltd.—Capital, £250 in £1 shares. Return dated April 12th, 1928 (filed February 22nd, 1929). 102 shares taken up. £2 paid. £100 considered as paid. Mortgages and charges, £500.

Domestic Electric Generators, Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1928 (filed April 16th, 1929). 2,100 shares taken up. £952 paid. £1,148 considered as paid. Mortgages and charges, nil.

Essex Radio Supplies, Ltd.—Capital, £1,500 in £1 shares. Return dated May 17th, 1928 (filed February 14th, 1929). 500 shares taken up. £500 paid. Mortgages and charges, nil.

Bann Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1929 (filed February 2nd). 8,002 shares taken up. £8,002 paid. Mortgages and charges, nil.

Resisto Electric Wire and Tape Co., Ltd.—Capital, £500 in £1 shares. Return dated October 8th, 1928 (filed March 23rd, 1929. All shares taken up. £500 paid. Mortgages and charges, nil.

Austin Brothers Electrical Co., Ltd.—Capital, £1,000 in £1 shares (700 ordinary and 300 preference). Return dated July 30th, 1928 (filed April 2nd, 1929). All shares taken up. £700 paid. £300 considered as paid. Mortgages and charges, nil.

West Wales Electric, Ltd.—Capital, £500 in £1 shares. Return dated September 14th, 1928 (filed April 12th, 1929). 450 shares taken up. £450 paid. Mortgages and charges, nil.

Midland Electric Lamp Co., Ltd.—Capital, £100 in £1 shares. Return dated April 5th, 1929. All shares taken up. £100 paid. Mortgages and charges, nil.

West Insulating Co., Ltd.—Capital, £1,500 in £100 shares. Return dated April 11th, 1929. 10 shares taken up. £500 paid. £500 calls unpaid. Mortgages and charges, nil.

C. J. Thursfield & Co., Ltd.—W. E. Alldrith, Sun Buildings, Bennett's Hill, Birmingham, was appointed receiver and manager on May 18th, 1929, under powers contained in debentures dated January 8th, May 13th, 1929, and October 10th, 1927.

P. Kay, Ltd.—G. C. Jarvis, 115-117, Cannon Street, E.C.4, was appointed receiver by Order of Court dated May 16th, 1929.

Electrical Contracts and Maintenance Co, (1925), Ltd.—Satisfaction in full on May 14th, 1929, of debenture dated February 24th, 1925, securing £250.

City Notes.

Marconi's Wireless Telegraph Co., Ltd.

The annual meeting was held on May 30th, Lord Inverforth (chairman) presiding. In presenting the report and accounts (*vide* ELEC. REV., May 17th, p. 886), the chairman said that the broadcasting patents would expire during this year and 1930, with the result that revenue from this source would probably be substantially reduced in the future. The era

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of "master" patents in broadcast reception had passed, and inventions of the future would be rather in details than in fundamentals. The interests exploited by the Marconiphone Company and by the Sterling Telephone & Electric Co., which was the manufacturing side of the Marconiphone business, had been sold to the Gramophone Company. Payment would be received in shares in the Gramophone Company for the goodwill and in cash for the fixed assets. Referring to the company's claim against the Government for the use of its patents by the fighting forces, a suggestion which had unofficially been made was disappointing, and it would have to be considered at the earliest opportunity whether the Government should be called upon immediately to have the issue arbitrated upon. The company's grounds for agreeing to the cable-wireless merger (details of the scheme were given in the Elec. Rev., April 19th, p. 720) were because the Government had decided that the exploitation of the beam system of wireless telegraphy for Imperial communications was to be taken out of the hands of the company which had invented and developed the system and was to be made a monopoly of the Post Office. The Government licence to the company excluded it from any part in the operation of wireless telegraph services from this country to the rest of the Empire. It was therefore faced with the position in which it had to consider where it would be if its traffic revenues were to be derived only from its foreign services and from its investments in its Dominion and Indian companies. As the company's foreign services were developed and its Dominion companies began to cut into the revenues of the cable companies, it was certain that these companies would embark on a rate war. If the cable companies reduced their rates to the wireless level, the Post Office would further reduce its rates. During recent years there had been an unfortunate tendency on the part of certain British companies operating in foreign countries to dispose of the control of their companies to foreign interests. If an organisation like Cables and Wireless, Ltd., had been in existence during the past 10 years it could have prevented the transfer of these important British companies into foreign hands. The allocation of shares in Cables & Wireless, Ltd., amongst the different classes of shareholders of the company had been criticised by certain holders of £1 shares. The committee which was urging the £1 shareholders not to accept the scheme was taking on itself a serious responsibility, and the directors believed the advice which it was giving was unsound. Regarding the future of the Marconi Company, whilst it would be disposing of all its traffic assets, and Cables & Wireless, Ltd., would own a very large proportion of the shares, it would continue to carry on its sales and manufacturing business and the research incidental to the success of that business. To avoid any danger that the control of Imperial and International Communications, Ltd., by Cables & Wireless, Ltd., might be exercised contrary to the public interest, the Government had insisted on certain safeguards. It would be some time before complete co-ordination of these two organisations could be effected, and until that had been effected the earnings of the company would not reflect the large economies which co-ordination would bring about. The report and accounts were adopted, and resolutions altering the articles of association to comply with the conditions of the merger were passed.

It was reported last week that a writ had been served upon the Marconi Company by the Venture Trust, Ltd., on behalf of holders of £1 ordinary shares. The Trust claims a declaration that the merger scheme is *ultra vires* and inequitable to the £1 ordinary shareholders; an injunction restraining the company from carrying the scheme into effect; and damages and costs.

Cable Companies' Meetings.

Meetings of the Eastern Telegraph Co., Eastern Extension, Australasia and China Telegraph Co., Ltd., and the Western Telegraph Co., Ltd., were held on May 29th, at which Mr. J. C. Denison-Pender (chairman) presided. The chairman during his remarks referred to the cable-wireless merger and the events which led up to it. He stated that dividends would not in future be paid quarterly under the changed conditions. Those shareholders who accepted the change would receive proportions of three classes of shares of a nominal value largely in excess of their present nominal holding, and would receive half-yearly dividends on the preference shares comprised in their new holding, and these would cover a large proportion of the present dividends in the case of those who joined the merger. Resolutions were passed altering the articles of association to comply with the conditions of the merger.

Ever-Ready Co. (Great Britain), Ltd.

Presiding at the annual meeting on May 31st, the chairman and managing director (Mr. Magnus Goodfellow) said that the sales and profits for the year constituted a record, and if the industry had been protected by an import duty, the development would have been greater still, as calculations showed that if portable lamps and dry batteries imported into this country had been manufactured in their own factories some 5,000 additional workpeople would have been employed. A new factory had been purchased and equipped which would contribute a large addition to the company's manufacturing facilities during the current year. The acquisition of Lissen, Ltd., was of great importance. Steps had been taken to bring about a close collaboration between the businesses, and since September 30th, 1928, the end of the year on which their participation was based, the sales of Lissen, Ltd., had increased by over 25 per cent. as compared with the corresponding period of the preceding year. It was clear from the fact that the sales for April and May this year were 25 per cent. above the sales of April and May, 1928, that no question of drawing upon the dividend equalisation reserve was likely in the near future. The report and accounts were adopted.

British Electric Traction Co., Ltd.

The gross profit for the year ended March 31st last was £330,822 (against £311,908), and after deducting expenses and interest there remains a balance of £196,995, which the directors recommend should be applied in payment of the following dividends—6 per cent. preference dividend; 8 per cent. on the preferred ordinary stock; and 5 per cent. on the deferred ordinary stock, leaving a surplus of £40,735. The directors proposed that of this balance, £14,788 (equal to 10 per cent. on the deferred ordinary stock), be capitalised and distributed to the deferred ordinary stockholders in fully-paid deferred ordinary shares of £1 each, to be converted subsequently into deferred ordinary stock. The preference stockholders will then be entitled to a further dividend of 1.67 per cent. (making 7.67 per cent. for the year), leaving a balance of £14,025 to be added to undivided profits account, making that account £186,251. The report announces the retirement of Mr. E. Garcke, the founder of the company.

International Telephone and Telegraph Corporation.

The consolidated balance sheet of the Corporation and its associated companies as at December 31st, 1928, showed total assets of $389,914,333. The total gross earnings of the companies during the past year amounted to $81,234,824, and the net earnings to $23,053,829. After meeting charges of associated companies and interest on debenture bonds there was a net income of $14,596,337. With the addition of a balance of $15,636,018 the total surplus was $30,232,355. After deducting dividends, &c., the earned surplus remaining was $21,471,677, and the capital surplus was $13,238,084, giving a total of $34,709,761. A lengthy report of the companies' world-wide activities appeared in *The Times* and other daily newspapers on Monday last. A list of the associated and affiliated companies included the extensive Mackay Companies, All-America Cables, Inc., the International Standard Electric Corporation and its subsidiaries, and a number of American, South American, European, and Asiatic concerns.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Ace Battery Co., Ltd.
Barford Electric Supply Co., Ltd.
Bell Battery & Accessory Co., Ltd.
C.A.T. Cable Co., Ltd.
Chalk Fuel, Power, Gas and By-Products Corporation, Ltd.
Direct Electrical Co., Ltd.
Electric Light and Power Contracts Finance Corporation, Ltd.
Export Electric Fittings Co., Ltd.
Gray Electrical Co., Ltd.
Neale Magnet Construction Co., Ltd.
Northern Lift & Electrical Co., Ltd.
Portarlington Electric Light & Power Co., Ltd.
Premier Telephone & Wireless Co., Ltd.
Radio Service Co. (Birmingham), Ltd.
South Midlands and Berkshire Electric Light and Power Co., Ltd.
Sparkes Electrical Co., Ltd.
Watford Radio Supplies, Ltd.
Wireless Headphone Distributing Co., Ltd.
Wireless Warehouses, Ltd.

Bahia Tramway, Light and Power Co.

The *Financial Times* reports that negotiations for a settlement of the long-outstanding claim of the company against the Municipality of Bahia have now been concluded. The arrangement provides for cash payments spread over a period of three years, and, it is estimated, should result in a total distribution to the debenture holders of approximately 30 per cent. of the nominal amount of their debentures. In 1914 the company agreed to accept payment for the business, which was sold to the municipality, in the shape of 6 per cent. bonds, which are held by the trustees for the debenture holders. The municipality has defaulted on both interest and sinking fund payments on the bonds and, although an initial payment was made on account of this service (partly in cash and partly in bills, the latter of which have been dishonoured), has attempted to repudiate the bonds.

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Brazilian Traction, Light and Power Co.

The total income from subsidiaries and investments for the year ended December 31st, 1928, was $14,762,619 (Canadian). After meeting expenses and general amortisation, the net revenue is $14,121,604. Two quarterly dividends of 1¾ per cent. on shares of $100 par value and two of 44 c. each on shares of no par value were paid on the ordinary shares, leaving a surplus of $6,053,459, to which is added $8,893,907 brought forward. Of this, $5,000,000 has been transferred to general reserve and the balance carried forward.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Central Electricity Board.—£3,000,000 4 per cent. stock, 1959-89, issued at £83 per cent., partly paid and fully paid.

The undermentioned have been ordered to be officially quoted:—

Agar Cross & Co.—350,000 8 per cent. second cumulative preferred shares of £1 each, fully paid, Nos. 1 to 350,000.

Underground Electric Railways Company of London.—11,996 ordinary shares of £1 each, fully paid, Nos. 7,147,911 to 7,159,906.

Richard Johnson & Nephew, Ltd.

The first annual meeting was held on May 31st, Major E. Johnson (chairman) presiding. In presenting the report and accounts, the chairman said that although the present company was holding its first annual meeting, the private company of the same title was formed in 1900. Although competition with foreign manufacturers was very keen, there was a considerably larger tonnage of unfinished orders than on the date of the formation of the company a year ago. The report and accounts were adopted.

Sphere Investment Trust, Ltd.

The dividends, interest, &c., received during the year ended March 31st last amounted to £32,225, as compared with £46,160 in 1927-28. To this is added £9,431 transferred from a reserve now no longer required for its original purpose. Nothing has accrued with respect to dividends received since the date of the balance-sheet, whereas £17.560 was so accrued last year. Future revenue will be entirely on a cash basis. After meeting expenses and adding £4,745 brought forward, the available balance is £43,374. From this the preference dividend is paid, and it is proposed to maintain the ordinary dividend at 4 per cent., leaving £3,374 to be carried forward. Meeting: June 11th.

Western Union Telegraph Co.

The balance-sheet as at December 31st, 1928, shows total assets of $350,424,344 and a surplus of $86,357,183. The gross operating revenue for the year was $136,449,513, and the balance transferred to surplus account was $15,467,659. At the close of the year the Western Union System comprised 216,169 miles of pole lines; 1,852,069 miles of wire; 3,545 miles of land-line cables; 30,680 nautical miles of ocean cables; and 24,842 telegraph offices.

International Aluminium Co., Ltd.

The net profit for 1928 was £25,711 to which is added £3,982 brought forward, making £29,693. A final dividend of 3½ per cent. on the preference shares has been paid, making 7 per cent. for the year and it is recommended that £10,000 be set against expenses relative to raising of capital, leaving £19,198 carried forward.

Torpoint Electric Supply Co., Ltd.

Edmundson's Electricity Corporation, Ltd., has made an offer to purchase the whole of the issued shares of the company at 26s. 4d. for each preference share and 10s. for each ordinary share, the offer being conditional upon its acceptance by the holders of at least 80 per cent. of both classes of shares.

Hastings and District Electric Tramways Co., Ltd.

The report for 1928 shows that after crediting £487 brought forward, there was a loss of £15,490, as compared with a profit of £8,610 in 1927. The receipts for the year were adversely affected by the change-over from tramway to railless cars, and by the remaking of roads.

Doulton & Co., Ltd.

A dividend at the rate of 5 per cent. per annum is recommended on the ordinary shares for the past year.

International Combustion, Ltd.

A dividend of 6 per cent. has been declared on the preference shares.

Stocks and Shares.

MONDAY EVENING.

WHILE the first effect of the election upon Stock Exchange prices was to bring about a lower range of values in gilt-edged and other investment securities, this tendency quickly gave way to a firmer tone when it became apparent that the public did not intend to sell stocks and shares—at all events at present. It is contended that if a Labour Government comes into office, its majority will be too slender for Ministers to embark upon venturesome Socialistic legislation, and that, accordingly, the work of the country will go on in much the same way as it has been doing of late years. Therefore the prices, on the week, show few changes of consequence, and most of the falls sustained last Friday were recovered at the beginning of this week.

The Central Electricity Board Issue.

Central Electricity Board 4 per cent. debenture stock, which was left with the underwriters to the extent of about 78 per cent., went back to 1¼ discount: afterwards it rallied to ¾ discount. The issue price, it will be remembered, was 83, and the prospectus made its appearance at an unfortunate moment, so far as its probable success was concerned. From the security point of view, the stock is first-class, but the price asked for it looked obviously high, and it is not surprising that the public should have accorded the issue a lukewarm reception. Moreover, it stands outside the range of trustee investments. As the issue becomes absorbed by investors, the price will recover, because people like a stock which is quoted so considerably under par as to render improvement mechanical when, in course of time, the redemption-dates begin to attract attention.

Home Electricity Supply.

Labour majorities are not supposed to be of much use to the market for shares in the electricity supply companies. Midland Counties, in which an active business is doing, are 6d. up at 33s., and Metropolitans 1/16 to 47s. 6d. County of Londons have shed a few pence at 54s. 6d., and Electric Supply Corporation 1/16, at 56s. 3d. Urban ordinary at 2 are ex the dividend of 9 3/5d. Newcastle and District retain their advance to 28s. 9d. Northamptons at 46s. are 1s. higher, and Llanelly ordinary improved upon their previous gain by a further rise, to 16s. 3d. The company's 6 per cent. preference shares stand at 17s. 6d., and the 5 per cent. first mortgage debenture stock last changed hands, at 94½, about a month ago. Lancashire Electric 5 per cent. debenture stock commands 100, the same price as London Power 5 per cent. debenture stock. Isle of Wight 4½ per cent. debenture stock stands, relatively, rather lower at 83½, while Kent Electric Power 4½ per cent. irredeemable debenture is 87½. At 78½ Isle of Thanet 4 per cent. debenture yields £5 2s. on the money. The company's ordinary shares are lower this week at 38s. 3d.

Cables and Marconis Weaken.

Meetings of the Eastern Extension group, and of the Marconi shareholders, held last week, made it tolerably clear that, so far as the cable companies go, the requisite 60 per cent. assent will be obtained without any difficulty in connection with the new wireless and cables merger scheme. There seems to be rather more doubt prevailing in reference to Marconis, where further legal proceedings threaten to impede the smooth interchange of Marconi shares into those of the new combine. The price of Marconis went back to 78s. 9d., and Eastern Telegraph ordinary stock fell to 270. The chairman dealt, at the meeting a week ago, with the matter of the dividend payments, pointing out, as was done here, that the preference distribution would be made half-yearly, and that this would go some way towards compensating shareholders in the Eastern Companies for the lack of the usual quarterly dividends to which they had been accustomed in the past. In the same speech he mentioned that dividends on the "A" and the "B" ordinary shares of Wireless and Cables, Ltd., could hardly be expected to start immediately, but that this matter would be considered when co-ordination had been completed, economies effected, and the way opened to such progress as, in the opinion of himself and his fellow-directors, justified them in recommending acceptance, on the part of their fellow-proprietors, of the new scheme.

International Intercommunication.

Eastern Extensions and Western Telegraphs are also lower. It is remembered that the Labour Party opposed the cables-wireless merger in the last Parliament, before the plan became finally passed. The market in all the cable-wireless descriptions has grown rather more limited than usual. Bargains are being settled in Bank of England deposit certificates, which represent assented shares in the cable companies and in Marconis. Hints are being thrown out, both in this country and in America, as to the possibility of some future agreement of interests between the British communication companies and those of America. Readers will remember that a denial was issued of the report that the International Telephone and Telegraph Corporation had bought the Radio Corporation of

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America. At the time of the statement being published, the further suggestion was put forward that such an arrangement —made between, that is to say, the Radio Corporation and the International Telephone and Telegraph Company—would put the latter into a position of being able to compete with the British companies in all matters affecting the wireless and cable industry. Reports which touch upon these affairs must clearly be accepted with a good deal of reserve. International Telephone and Telegraph stock at 250 has not changed on the week, but American Telephone and Telegraph at 212 is $3 down.

Brazilian Traction.

The Brazilian Traction Company has issued the full figures of its report, and these bear out the favourable impression created by the preliminary figures, which failed to exert any particular effect in the share market. The price of Brazilian Tractions has hardened to 53½. The report shows that gross earnings were higher in 1928 by more than 11 per cent. A good part of the additional income was retained as net revenue. Reserves have been liberally provided for, and the rate of dividend on the common shares has been advanced during the year. The balance forward is increased to five million dollars. The recent issue of shares gave the company over 30 million dollars of fresh capital, the issue being made in connection with the purchase of the City of Santos Improvements Company. Anglo-Argentine Tramways second preference receded to 3⅝, coming into line with the price of the first preference. The latter are entitled to a 5½ per cent. dividend, against the 6 per cent. of the second preference. Mexican utility issues exhibit no alteration in the prices.

Shares in Manufacturing Companies.

General Electric ordinary receded to 52s. 6d., while Associated Electrical Industries strengthened to the same price. Siemens, Johnson & Phillips and Brush ordinary were all quoted ex dividend last week. The first two named regained the deductions of 1s. per share in each case. Brush went ex the full year's dividend of 2s., and the price at 27s. 6d. is practically unaltered, allowing for the dividend. All these amounts are less tax. The Electric Construction Company has reduced its dividend by 2 per cent. to 5½ per cent. for the past year. The company has a dividend equalisation fund of £30,000, from which £10,000 has been taken in order to pay the 5½ per cent. dividend. The profit of £8,738 is £11,800 less than that earned in the previous year. Nominally the price of the shares, 18s. 9d., has undergone no alteration. Ever-Readys are firm at 23s. 6d.

A Rise of £150.

It is refreshing to be able to quote a rise of 150 points amongst the recital of price-movements mainly small and—so far as the falls are concerned—precautionary. British Electric Traction has achieved this gain, and is up to £1,200. Business is marked at this price to-day, Monday. London and Suburban Traction preference eased off to 12s. 6d. The ordinary shares are about 4s. Tube Railway issues show no particular movement. The Home Railway market, as a whole, has been hoping that the companies will draw benefits from the next Parliament, whatever its political complexion. Interest has been aroused by the statement that 2,000 petrol-electric omnibuses, owned by the large electric railway companies, are working in America.

Preference Shares Available.

Amongst preference shares on offer, at the time of writing, are 10,000 Associated Electrical Industries 8 per cents., paying £5 16s. 9d. at 54s. 9d. for the £2 shares; 5,000 Bridgwater and District Electric Supply 7 per cent. at 23s., yielding £6 1s. 9d.; a thousand each of Cornwall Power Sevens (with convertible rights into ordinary shares up to 1932) at 24s. 6d., paying £5 14s. 3d., and Edmundsons Sevens at 25s., giving £5 12s. Of the Australian preference shares, Adelaide Fives, tax free, return £4 11s. 9d., tax free, at 21s. 9d.; Melbourne Electric Eights, of £5 each and liable to repayment at 5¼ between 1930 and 1935, are offered at 5½, to give 7¼ per cent on the money. Amongst Indian issues, Calcutta Electric Supply 5 per cent. tax free preference, obtainable at 22s. 6d., yield £4 8s. 9d., tax free, and Madras 5½ per cent. tax free preference can be bought at 23s., to pay 4¾ per cent. tax free. Probably, upon coming to deal, a prospective purchaser would find he could buy rather more cheaply than these prices indicate.

Telephone Changes.

The Venezuela Telephone Company proposes to increase its capital in order to provide for extensions, and meetings are called for next Monday to authorise the creation of new non-voting "A" ordinary shares. These the board intends to issue upon bonus terms. Oriental Telephones have gone back to 3, and Constantinople Telephones also are lower at the same price. Great Northern Telegraphs shed £1, on the reduction in the profits shown by the report. Atlas Light and Power firmed up to 27s. The iron and steel division presents no feature of especial interest. Vickers are a few pence lower at 10s. 9d. Rubber shares have fallen into somnolence.

Share List of Electrical Companies.

	Nom. £	Approx. Dividend. 1927.	Approx. Dividend. 1928.	Price June 3 1929.	Rise or fall	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 9 10
Chelsea	1	8⅞	8⅞	26/6	—	5 5 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1		8	33/9	—	... —
County of London	1	7½	10	54/6	—	3 13 9
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	56/3	—1/16	3 18 3
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 6
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	47/6	+1/16	3 16 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 9 10
Midland Counties	1	6½	6½	33/-	+6d.	3 19 9
Mid. Elec. Power	1	15	8	37/-	—6d.	4 6 6
Newcastle on-Tyne Ordinary ...	1	6	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	—	5 0 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	2xd	—1/16	... —
Westminster Ordinary	1	8¾	8¾	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/6	—	4 12 9
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	"	3	3½	61	—	5 14 2
do. District	"	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	23/6	—	5 19 9
do. do. Income ...	Bonds	6	6	112	—	5 7 3
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	+½	5 15 6
do. Def.	"	1½	1½	24½	—	6 9 6
Automatic Telephone	1	10	12½	2 1/16	—	6 1 1
Eastern Extension	10	10	10	27	—½	*3 14 1
Eastern Tel. Ord.	Stock	10	10	270	—2½	*3 14 1
Globe Tel. and T. Ord.	10	10	10	28½	—	*3 9 0
do. do. Pref.	10	6	6	11⅝	—	5 5 6
Great Northern Tel.	10	20	—	32	—1	... —
Indo-European	25	10	10	50½	—	*4 19 0
Marconi	10/-	10	20	78/9	—1/16	... —
Marconi-Marine	1	12½	15	3⅛	—	4 15 0
Oriental Telephone Ord.	1	12	12	3	—1/16	... —
Western Telegraph	10	10	10	27	—½	3 14 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 9
do. do. 2nd Pref. ...	5	6	6	3⅝	—⅛	8 5 6
do. do. 5% Deb. ...	Stock	5	5	74½xd	—	6 14 1
British Electric Traction Def. Ord.	"	5	5	1200	+150	... —
do. do. Pref. Ord.	"	8	8	130½	—	6 2 7
Brazil Traction	100	7	8	53½	+½	3 14 9
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	94½	—	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/6	—6d.	... —
London United Tram Deb. ...	Stock	4	4	64	—	6 9 1
Mexico Trams, 5% Bonds	—	5	5	72½	—	6 13 10
Mexican Light Common	100	Nil	Nil	72½	—	... —
do. 7% Pref.	100	7	7	72½	—	9 13 1
do. 1st Bonds	—	5	5	75½	—	6 13 3
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... —
MANUFACTURING COMPANIES.		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	52/6	+1/16	9 5 5
Babcock & Wilcox	1	13	15	64/6	—	*3 18 9
British Aluminium Ord.	1	10	10	51/3	—	9 6 8
British Elec. Transformer Pref. ...	1	7	7	13/9	—	4 0 0
British Insulated Ord.	1	15	15	3¾	—	7 3 6
Brush Ord.	1	10	10	27/6xd	—	3 9 0
Callenders	1	15	15	4⅜	—	5 4 4
do. 6½% Pref.	1	6½	6½	12	—	... —
Crompton Parkinson Ord.	5/-	—	—	1	—	6 6 0
do. 8% Pref.	1	—	8	25/-	—	7 1 3
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	5 15 7
do. 5% Deb.	Stock	5	5	86½	—	5 17 4
Electric Construction	1	7½	5½	18/9	—	4 14 1
Enfield Cable Ord.	1	20	20	4½	—	... —
English Electric	1	Nil	Nil	6/3	—	5 10 3
do. do. Pref.	1	8	Nil	8/3	—	5 16 4
Gen. Elec. Pref.	1	6½	6½	23/6	—3/16	4 1 7
do. Ord.	1	7½	10	2⅝	—	5 6 0
Henley...	1	25	25	6½	—	... —
do. 4½% Pref.	5	4½	4½	4½	—	5 10 4
India-Rubber	1	Nil	Nil	13/9	+9d.	5 9 1
Johnson & Phillips	1	12½	10	36/3xd	+9d.	*4 19 1
Siemens Ord.	1	7½	7½	1⅜xd	—	... —
Telegraph Construction	12	10	10	24½	—	6 13 3

* Dividends paid free of Income Tax.

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Japan's Foreign Electrical Trade.

Figures for 1926 and 1927 Compared.

THE following figures showing Japan's imports and exports of electrical and certain allied goods are taken from the recently-issued annual trade returns of that country for 1927. Comparative statistics for 1926 are also given and notes of increases or decreases added.

Imports.

	1926. Thous. yen.	1927. Thous. yen.	Inc. or dec. Thous. yen.
Submarine telegraphic and telephonic cables (all from Great Britain)	307	1,002	+ 695
Other insulated electric wires—			
Total	1,352	900	− 452
From Germany	1,034	200	− 834
,, United States	72	130	+ 58
Wattmeters—			
Total	825	760	− 65
From Germany	450	430	− 20
,, Switzerland	197	124	− 73
,, United States	158	113	− 45
Other meters—			
Total	2,457	2,690	+ 233
From Great Britain	396	375	− 21
,, France	99	48	− 51
,, Germany	542	694	+ 152
,, United States	1,368	1,490	+ 122
Telegraphic and telephonic instruments and parts thereof— Total...	9,811	5,792	−4,019
From Great Britain	3,202	800	−2,402
,, France	59	142	+ 83
,, Germany	2,082	1,927	− 155
,, United States	4,427	2,900	−1,527
Steam turbines—			
Total	2,560	1,240	−1,320
From Great Britain	279	46	− 233
,, France	90	60	− 30
,, Germany	77	130	+ 53
,, Switzerland	480	190	− 290
,, United States	1,630	770	− 860
Water turbines and Pelton wheels—			
Total	2,210	520	−1,690
From Germany	820	42	− 778
,, Switzerland	425	235	− 190
,, Sweden	630	33	− 597
,, United States	330	40	− 290
Dynamos, motors, transformers, convertors and armatures—			
Total	10,690	7,030	−3,660
From Great Britain	1,140	1,280	+ 140
,, France	90	110	+ 20
,, Germany	1,320	1,090	− 230
,, Italy	169	1	− 168
,, Switzerland	540	520	− 20
,, United States	7,370	3,960	−3,410
Dynamos combined with motive machinery—			
Total	660	1,190	+ 530
From Great Britain	220	70	− 150
,, Germany	160	170	+ 10
,, Switzerland	200	650	+ 450
,, United States	85	300	+ 215

Exports.

	1926. Thous. yen.	1927. Thous. yen.	Inc. or dec. Thous. yen.
Insulated electric wires—			
Total	1,860	1,940	+ 80
To China	464	553	+ 89
,, Kwantung	1,020	950	− 70
,, Hong Kong	33	153	+ 120
,, Dutch India	100	125	+ 25
,, Siam	140	110	− 30
,, Chile	42	—	− 42
,, Argentina	41	12	− 29
Electrical machinery and parts—			
Total	2,100	2,240	+ 140
To China	450	605	+ 155
,, Kwantung	1,400	1,250	− 150
,, Hong Kong	30	130	+ 100
,, India	49	55	+ 6
,, Straits Settlements ...	65	60	− 5
,, New Zealand	50	35	− 15
Telephones and parts—			
Total	250	300	+ 50
To China	45	60	+ 15
,, Kwantung	170	210	+ 40
Electric lamps—			
Total	3,000	3,200	+ 200
To China	485	365	− 120
,, Kwantung	480	390	− 90
,, Hong Kong	60	140	+ 80
,, India	60	95	+ 35
,, Straits Settlements ...	40	60	+ 20
,, Dutch India	9	14	+ 5
,, Siam	20	15	− 5
,, Great Britain	10	90	+ 80
,, France	6	30	+ 24
,, United States	1,480	1,660	+ 180
,, Canada	240	290	+ 50

[Note.—Yen=about 2s. 0d.]

The Situation in Czecho-Slovakia.

A Prosperous Electrical Industry.

INDUSTRIALLY and financially Czecho-Slovakia appears to be in a very favourable position, judging by a recent report on the economic situation by Mr. H. Kershaw, O.B.E., Commercial Secretary at Prague. (Published by the Stationery Office for the Department of Overseas Trade, 1s. 6d. net.) This prosperity is said to be due to low wages and production costs, to the successful export trade which is fostered in many ways, and to an abundance of cheap coal, steady and complacent workpeople, and a high standard of technical efficiency, largely inspired by German example. There have been many suggestions that a "Zollverein" or Customs union should be formed by the Republic and neighbouring States, but there are difficulties in the way of this, and in the meantime Czecho-Slovak concerns are neutralising the effects of tariffs by establishing or participating in works in adjacent countries. Among the industries which are characterised as "flourishing" is the production of electrical and other machinery. The report does not give separate particulars of production or exports of electrical plant. An appendix shows that during 1928 Czecho-Slovakia imported "machinery, apparatus and parts thereof" to the value of 702,410,000 crowns (about £4,300,000), while exports of this class were valued at 559,444,000 cr. (about £3,400,000). It is also shown that 98 tons of "electric machines and apparatus," valued at 6,569,000 cr. (£40,000) were imported from Great Britain during the year. The electrical porcelain industry increased its exports during the year from 12.6 to 17 million crowns (from £77,000 to £100,000). The three high-pressure porcelain factories have established joint selling bureaux at home and abroad with a view to a thorough utilisation of their productive capacity by specialising in production and by making the best of the existing patents. Prospects are said to be not very encouraging owing to the proposals of a number of countries to raise the import duty on porcelain. Severe competition is being waged between the Czecho-Slovakian, American and Japanese porcelain industries. A section of the report deals with cartels and combines, and shows that many Czecho-Slovakian industries have become linked up nationally and internationally. The copper and brass works have formed a union with a view to ending the price conflicts between the Czecho-Slovakian works and those of Austria and Germany. During the period under review negotiations were commenced for the formation of an International Cable Cartel, of which Czecho-Slovakia desires to become a member.

Dealing with communications, the report says that a contract has been concluded for the laying of a telephone cable between Warsaw and the Czecho-Slovak frontier at an estimated cost of 250 million crowns (about £1,500,000), of which 180 millions will be spent in Czecho-Slovakia. A considerable number of new telephone connections with border countries were inaugurated during the year, and for the first time direct telephone communication with the United States was established. The authorities are planning an extension of the broadcasting system, and orders were recently placed for the erection of two 60-kW stations. Generally speaking, an increase in the use of radio apparatus may be anticipated, notwithstanding a certain setback in 1928 which was probably due to temporary causes only. There is very keen competition among sellers of radio apparatus, and it is to be feared that the number of retail traders exceeds the present market requirements. This has at different times led to "cut-throat" competition," with the result that some of the weaker concerns have collapsed. British exporters would be well advised to satisfy themselves as to the stability and *bona-fides* of local firms before establishing connections.

In another section of the report Mr. Kershaw emphasises the value of a knowledge of languages to commercial travellers doing business in or with Czecho-Slovakia.

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The I.M.E.A. Convention—II.

A Report of the Proceedings and Social Functions at the Annual Convention at Torquay.

THE thirty-fourth annual Convention of the Incorporated Municipal Electrical Association was opened last Monday at Torquay in weather that was cloudy, but with sunny intervals. The attendance, the largest yet recorded, reached a total of 1,000, of whom over 30 were engineers responsible for electricity supply undertakings.

The first full gathering of the members was deferred until the evening reception held at the Medical Baths on Beacon Hill by the President, Mr. A. Nichols Moore, supported by the Mayor of Newport, Councillor W. T. Griffiths, J.P. Advantage was taken of the opportunity to renew old friendships, and dancing, that effective social solvent, continued until a late hour.

The following morning saw the beginning of the more serious side of the Convention's business (but how often is "business" synonymous with pleasure!). The proceedings opened in the finely situated Pavilion with the cordial welcome to the members extended by the Mayor of Torquay (Mr. Harry Geen, J.P.), and seconded by Councillor J. Taylor, chairman, Torquay Electricity Committee. The President then delivered his address. At the outset Mr. Nichols Moore made, with the force that the subject deserves, a plea for the better support of the E.D.A. and other associations whose beneficial effect on the industry is incalculable. The chief part of the address was devoted to the development of the theme that the ideal of a cheap and abundant, and also a generally available, supply of electricity can be realised only after the enactment of legislation for organising the control of distribution over wider areas than is generally possible at present. He, in short, advocated the complete "rationalisation" of the electricity supply industry. Mr. Arthur Ellis, in thanking the President, hoped there would not be any early legislation. Though formal discussion of the Presidential address is not permissible, many private debates on the views expressed therein took place during the remaining days of the Convention. These testified to the healthy stimulus given to thought by the President.

At the conclusion of the address the ladies took coffee with Mrs. Nichols Moore, while Ald. W. Walker's paper on "Whitleyism in the Electricity Supply Industry" was read and discussed. To Ald. Walker, himself an engineer, the credit is largely due that Whitley Councils have been a success in at least one important industry, and what he had to say, based on some ten years of practical experience of their working, should prove of interest to many quite outside the sphere of electricity supply. Ald. Walker would give to national agreements approved by Joint Industrial Councils the same validity as now obtains in the case of awards made by Trade Boards. He referred to the scheme for the training of engineers evolved by the National Joint Board as an instance of the work carried out by Whitley Councils other than the negotiation of wages and conditions of employment.

Tuesday afternoon was devoted to a private view of the Electrical Exhibition, a description of which is commenced on another page, and the evening to a reception by the Mayor and Mayoress of Torquay, followed, as on the previous evening, by music and dancing.

Wednesday's programme was a full one—two papers at the Pavilion and two social functions. The morning's business was the consideration of "Recent High Court Cases and Current Legal Problems," brought to the notice of members by Mr. J. H. Rothwell, town clerk of Brighton, and honorary solicitor to the Association. Mr. Rothwell prefaced his "notes" with a tribute to the memory of his predecessor, the late Mr. P. M. Heath. The court case of most topical interest was that relating to the deferred injunction granted against Manchester Corporation in respect of the sulphurous acid emitted from Barton power station—a case which has found so reverberent an echo in the agitation about the projected station at Battersea. The legal problem of greatest practical importance was the question of responsibility for the provision of switchgear with a rupturing capacity adequate for coping with fault conditions when an undertaking is connected to the "grid." Mr. Rothwell would seemingly leave this question to be settled by engineers, a departure, one would imagine, from legal precedent.

The afternoon's paper by Mr. G. Porter, A.M.Inst.C.E., borough electrical engineer of Worthing, was entitled "The Heavy Oil Engine and its Application in Electricity Supply Undertakings." This, the only purely engineering paper of the session, is a most useful contribution to the literature of the subject. Well collated information is given under sections relating to fuel, types of engines, and operation costs. Mr. Porter comes to the conclusion that, generally speaking, the heavy-oil engine cannot compete either for peak or base-load duty with high-efficiency base-load steam plant. He considers, however, that there is a future for this type of engine in the electricity supply industry, for supplying energy to power station auxiliaries and in sub-stations where the capital cost of supplementing the high-voltage feeders is unduly heavy.

A garden party was to be given by the Torquay Electricity Committee in the venerable precincts of Tor Abbey, once the abode of ascetic White Canons, but had to be cancelled owing to rain. An afternoon concert was arranged instead. In the evening members were invited by the Mayor and Mayoress of Torquay to attend a dance at the Medical Baths. The official photograph was to be taken on Thursday morning, and unofficial ones also, if previous years may be taken as a precedent.

Thursday of the Convention week has come to be regarded as "women's day," and their plans included a lecture at the Medical Baths by Miss Partridge to members of the Electrical Association for Women and others on "Women's Work in connection with Rural Electrification in Devonshire," and a private visit to the Exhibition. Meanwhile, the men were to meet at the Town Hall to hear a paper read by Mr. E. J. Jennings, Associate I.E.E., secretary of Birmingham Corporation Electric Supply Department, on the "Standardisation of Methods of Charge." Mr. Jennings was too modest in saying that his paper was "mainly intended for committee members—mostly laymen," as it should certainly be studied by all supply engineers. He insisted on the necessity of paying regard to commercial expediency in tariff-making, instead of relying on "scientific" tariffs aiming at a mythical "equity." He also pointed out the importance of a correct analysis of costs into their standing and running components. Mr. Jennings' preference is for a two-part tariff, the primary charge of which is based upon ratable value tempered by floor area.

The afternoon programme covered a visit to the electrically-operated Long Park Pottery and a drive to Widecombe-in-the-Moor for the ladies (transport and tea being very kindly provided by the Torquay Electricity

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Committee) and private meetings for the local authority committee members and for the A.M.E.E. In the evening the annual dinner was to be held at the Pavilion.

To-day's plans include the annual general meeting at the Pavilion in the morning and two excursions in the afternoon, one over Dartmoor, *via* Dartmeet and Bovey Tracey, the other to Widecombe-in-the-Moor, *via* Hay Tor and Ashburton.

The only item on the agenda for Saturday is a visit to the Torquay electricity works at Newton Abbot, a description of which was given in our last issue.

Presidential Address.

By A. NICHOLS MOORE, M.I.E.E. (*Abstract*).

The work of your Association during the past year has not been distinguished by any new matters of outstanding importance. The past year has, nevertheless, been an exceedingly busy one for your Association, whose work has steadily increased in both volume and variety.

Possibly none of the allied associations is of greater importance to the future of the electricity supply industry than the British Electrical Development Association. Its position is the counterpart of that of the British Commercial Gas Association, but, unlike the latter Association, it can only raise for publicity and propaganda, in an industry which on the supply side alone represents a subscribed capital of some £350,000,000, the comparatively paltry sum of £40,000 per annum, and until it is at least as fully established and as financially strong as the latter Association it will be unable to fulfil its essential purpose. May I urge those municipal electricity supply authorities who have so far declined to become subscribing members to reconsider their decision and give the Association their active support without delay?

The British Electrical and Allied Industries Research Association will be dealt with during the Convention by one who is more competent to do so than I am; I submit that electrical research was never of such importance as it is to-day.

The Electrical Association for Women should need little commendation for support. It has rich possibilities for service on the part of women in the greater development of electricity supply in the domestic sphere, and is making perhaps much greater progress than some of us anticipated.

The work of the British Engineering Standards Association is better known than that of the Conjoint Conference of Public Utility Associations. The latter renders most valuable assistance in composing divergent views and requirements, and through the Conference it is possible for the electricity supply and gas industries to find much in common to which they can jointly give consideration for the benefit of our respective industries and of the public whom we serve.

During the year your Council has given careful consideration to the Draft Regulations issued under Section 51 of the Electricity (Supply) Act, 1926, for the technically correct and equitable allocation of production costs between fixed and running charges, and for the adjustment of the price in accordance with the power factor. Important issues are involved in the provision of the necessary switchgear to be installed in all stations to be connected, either directly, or through secondary lines, to the "grid." The technical requirements are such as must in most cases involve heavy capital expenditure, and, in the case of many of the smaller undertakings, quite possibly constitute what will relatively be a considerable increase in their capital commitments. In the case of those authorities whose stations are "selected," the providing of the necessary monies would appear to be an obligation placed upon the Central Electricity Board. It is more in the interests of the vast majority of "non-selected" stations that your Council has deemed it necessary to take steps to secure from the Central Electricity Board an assurance that, directly or indirectly, undertakings will be relieved of the heavy burden which might otherwise fall upon them.

The Electric Fittings Statutory Committee was appointed by the Electricity Commissioners under Section 48 of the Electricity (Supply) Act, 1926. (My personal views do not necessarily represent the considered opinion of the Council.) The underlying intention of Section 48 of the Act was to confer trading powers upon those undertakings which did not already possess them. It was believed that the inclusion in the Section of an agreed clause, which in a considerable measure was made possible by friendly compromise between the Electricity Supply Authorities and the Electrical Contractors' Association, would dispose of the long-outstanding differences that unfortunately existed between them and obviously retarded greater development, and would have enabled the Committee to achieve in the course of a year definite progress towards the realisation of some common basis for giving effective assistance to the industry. In my opinion, however, the results to date can only be regarded as almost negative in character, for it appears to me that beyond confirmation of an agreed working constitution little has been done; indeed, it can scarcely be claimed that the Committee is yet in agreement as to its main functions and the duties presumably imposed upon it by the Section.

I hold the view that at least one cause for this lack of progress is the disinclination of the contracting interests to give full effect within the Committee and outside to the definite intentions which were clearly conditions precedent to the acceptance of the Section. I submit that whilst it is true that the operation of the Section places upon local authorities definite statutory obligations to which they must conform, but which are not obligatory upon the contracting interests, it is unreasonable for the latter, as a party to the agreement, to be unwilling to recognise that there is at least a moral obligation upon them to observe, so far as possible, a similar basis in their commercial operations. I am glad that within the Committee now there is apparently a disposition to recognise the necessity for so doing. At the same time, there is evidence that some local authorities also are not yet prepared to give effect to the provisions of the Section. Whether this attitude is in any way influenced by the indirect action of conflicting interests within the areas of such local authorities is a matter of opinion, but there are those who hold the view that such is the case, and I will leave it at that. It is difficult to give helpful advice unless there is in the first place an agreed policy and a clear and definite understanding within the Committee upon which is imposed the duty of giving the advice.

Is not the record of progress so far made by the Electricity Commissioners and the Central Electricity Board, and by those associated with them in the practical formulation and construction of the national scheme, more a matter for commendation than for criticism?

It is evident that the area remaining to be dealt with is, comparatively, more sparsely populated, and it may be inferred that the practical commercial problems involved will be more difficult of solution.

Whether the political assurances of cheaper electricity are likely to be realised within the next few years, if at all, is a matter upon which there is a considerable difference of expert opinion. I venture to express the view that such results are not possible of complete realisation until legislation has also been enacted upon a collateral basis for the whole system of distribution. It is the cost of distribution which is the principal factor governing the price of electricity to the ordinary domestic consumer. On a recent occasion the "Grid" was aptly described by a member of the Central Electricity Board as a great adventure, and probably there is much truth in the observation.

It is now becoming a definite conviction that however much the Act might assist in the securing of economic generation, it cannot alone solve the problem of the provision of an ample and economic supply throughout the country. As municipal authorities we are rightly proud of the fact that more than half of the electricity supply industry is being municipally financed and developed successfully under municipal control and administration, and that to-day it can be shown, generally, that the municipal system has resulted in the provision of adequate supplies of electricity at more economic rates than, for the most part, obtain under private company enterprise and control. Will this condition necessarily continue?

Encouraged by Parliament, authorised undertakers are greatly extending their areas and obtaining the control of electricity supplies in those areas, and to facilitate this policy further Acts are from time to time being passed and Special Orders granted. Is it reasonable to assume that the existing system of local-authority control is fitted to administer the business of electricity supplies in such largely increased areas, much of the business perhaps being far removed from the centre of the local authority's direct interests? In considering upon what terms and conditions an electricity supply should be given in a particular part of an area, will not the local authority responsible for providing the supply be disposed to have more regard to the financial liabilities incurred by carrying out its statutory obligations, and to the beneficial results which may accrue to it, than it may be disposed to have to the requirements and interests of those demanding supplies in the extended areas? In other words, will the local authority always be able to consider the question in a strictly impartial manner and have proper regard to the requirements of the potential consumers?

Moreover, the local authorities responsible for financing schemes for the provision of electricity supplies in these extended areas are naturally disposed to have considerable regard to the views of those in their own area who provide the security for the loans which the local authorities raise in order to afford the supplies in the extended areas, for local authorities have to consider, not shareholders, but ratepayers and local politics. It is, perhaps, not surprising that these factors make it exceedingly difficult for local authorities to hold that detached view and act always in that impartial manner necessary to a right consideration of the question. There is, again, the disadvantage of ever-changing representation on the local Councils, making continuity of policy difficult.

A further consideration is the disinclination to accept the ordinary commercial risks attendant upon schemes of development that in the early stages must clearly be non-productive (this statement applies equally, or more so, to private enterprise) with the result that those parts of their areas have remained absolutely undeveloped. To deal with some of these areas distribution companies (financed to a great extent by American capital) are now being formed with the object of acquiring operating powers in such areas, no doubt realising that the national scheme will provide a ready means for obtaining the necessary bulk supplies to meet the potential

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demand upon economical terms to themselves, and, let us hope, economical terms to the consumers.

At the present time 667 authorised undertakers are independently exercising their powers as distributors of electricity under two alternative methods of organisation and control; both methods have their distinct advantages and disadvantages. Now we know that whilst all these authorised undertakers will, within a comparatively short period, only be able to obtain their supplies in bulk through the Central Electricity Board, each individual undertaker will still retain its autonomy as a distributor in matters of policy and administration, in methods of charging for its supplies, and the rates to be charged, restricted only by the statutory maximum and the common law of supply and demand. With a continuance of the present system, therefore, it is conceivable that the benefits which should accrue from the national scheme of generation and main transmission may be definitely limited in extent, because of the absence of a really co-ordinated scheme of distribution upon some national basis as broad in its conception and as practical in its application as the national scheme of generation and main transmission.

So far I have referred only to the difficulties attaching to the greater development of electricity supplies under the existing systems of control and administration. There are also, of course, equally predominating difficulties in securing under present conditions a comprehensive and co-ordinated technical scheme of distribution. Some of the technical considerations which ought to be dealt with on a co-ordinated national basis are, I suggest, the right uses of extra-high-voltage and high-voltage feeding, the confining of direct current areas, the proper superimposing of alternating current distributing systems, the prevention of the use of inadequate mains, the construction of overhead schemes for outlying suburban areas, the provision of industrial and domestic apparatus, the standardisation of methods of charge, and the extension of electricity supplies in rural areas, &c. Good advice is useful, but if it is not going to be taken it is a waste of time and thought.

Is it possible for all the existing interests to be merged into a comprehensive scheme working upon a unified basis of policy, administration and technical direction, and under a central governing control whose aim would be the rationalisation of the electricity supply industry? I mean, not the creation of a monopoly, or the maintenance of prices, nor the extinction of public and private enterprise, as such, but rather the setting up of a community of interests to regulate and develop the electricity supply industry to the fullest extent possible under the most efficient and economical conditions. Such a scheme is possibly within the bounds of practical politics.

In the first place it is perhaps necessary that the business of distribution shall be handled by administrative bodies of increasing size, controlling greatly extended areas, but whether these bodies should be controlled municipally, or by private enterprise, or jointly, is beyond the scope of this address. With such a large proportion of the industry already under municipal control, municipally financed and administered, the municipal position in any such scheme as I foreshadow must be safeguarded. Their right to a general control over their own affairs must be retained, but supplemented by greater freedom and permanency of operation, which is essential in any scheme of development upon national lines. It is obvious, also, that the whole question of affording electricity supplies must be taken out of the realm of local politics.

A similar scheme is already being studied, and in a limited degree tried out, in Germany. The scheme now in operation for the generation and distribution of electricity in Berlin and in a very large outlying area, embracing directly and indirectly all the interests to which I have previously referred, is in the hands of a central controlling body, the Berliner Städtische Elektrizitätswerke Aktiengesellschaft, designated BEWAG. Its status is, in effect, that of a holding company, but all the shares are held by the municipality of Berlin. Its administration is in the hands of a Board of Management, which is assisted by a Supervisory Board consisting of municipal representatives, technical experts, and representatives of the workers. The business of the Bewag is the development of electricity supplies, including distribution, and the provision of electrical apparatus for industrial and domestic purposes, the latter a very essential consideration. There are also two other operating companies which work under agreement with the BEWAG and administer the business of electricity supply within their own areas. I am advised that the scheme is proving itself to be a practical solution of the problem of a real development of electricity supplies upon a co-ordinated basis, and the scheme indicates a possible direction of thought in respect to our own problem.

The national scheme in the Irish Free State under the direction and control of an Electricity Supply Board is pure nationalisation, and quite recently this fact was officially confirmed by Mr. Cosgrave. However, what is required in this country is not nationalisation, but rationalisation; the Irish Free State system is referred to merely as an instance of an attempt by others to solve the same problem as lies before us. The rationalisation of industry may not yet be so clearly understood as it should be, even by some who advocate its necessity. Rationalisation can only be permanently beneficial if the aim is to increase consumption by cheapening production and lowering prices, and from the community's point of view the problem involved is how to gain all the benefits of a large-scale organisation and the highest possible efficiency in production and distribution, whilst avoiding the evils of monopoly and State control.

Whitleyism in the Electricity Supply Industry from a Management Point of View.

By Ald. W. WALKER, M.I.E.E., M.I.Mech.E. (*Abstract*).

The first year associated with the idea covered by the term "Whitleyism" is 1908, because before the name itself was even heard of the initial step was the appointment by the House of Commons in that year of a Select Committee to inquire into the question of "sweating," as raised in a report of a Select Committee of the House of Lords. The Committee recommended the formation of Wages Boards with powers to fix minimum rates of pay, and it was owing to this that the Trades Boards Act of 1909 was passed. In 1916 the Government appointed a Committee under the chairmanship of Mr. J. H. Whitley, M.P. (later Speaker of the House of Commons, and it is from his name that the term "Whitleyism" is derived), which issued four reports, the particular one to which allusion is generally made being an interim report dated March 18th, 1917, containing the statement that "In the interests of the community it is vital that after the war the co-operation of all classes, established during the war, should continue, more especially with regard to the relations between employers and employed. . . . With a view to providing means for carrying out the policy outlined above, we recommend that the Government should propose without delay to the various associations of employers and employed the formation of Joint Standing Industrial Councils in the several industries, composed of representatives of employers and employed, regard being paid to the various sections of the industry and the various classes of labour engaged. . . ." The whole scheme was to be voluntary.

In 1921 the electricity supply industry decided to set up thirteen District Joint Industrial Councils, covering the whole of the United Kingdom, each Council to consist of 24 members, 12 representing the employers and 12 the Trade Unions. Employer members were to be elected by the municipal undertakings and the power companies operating within the area. Trade members were to represent those Trade Unions to which belonged the bulk of the workmen employed in the undertakings within the area. The National Joint Industrial Council was to consist of a maximum of 52 members, 26 to be employers and 26 trade unionists. Thirteen of the employers were to be elected by and from the municipal members serving on the District Councils, and the 13 company members of Council were to be nominated by the power companies Association. The trade union members were to be elected by the national executives of those Trade Unions which were represented on the District Joint Councils. They were the Amalgamated Engineering Union, the Electrical Trades Union, the National Amalgamated Union of Enginemen and Firemen, the National Union of General Workers, the Transport and General Workers' Union, the Workers' Union, the Associated Blacksmiths and Ironworkers' Society. There have been slight variations from this list owing to amalgamations, &c.

The National Joint Council delegated to each of the District Councils the important duty of negotiating a schedule of conditions of work and rates of pay for its own area. The National Joint Council tried to secure some co-ordination and equality between the schedules for the different districts, but found it to be a difficult task. The conditions and wages having been settled by agreement, every workman could know what the conditions were under which he was engaged and the employers, as a whole, wished to make their men comfortable. A test of the value of the agrement to the industry has been the absence of critical disputes and stoppages and a general improvement in the relationship between the management and the men. Means of dealing quickly with anomalies were provided by each District Joint Council appointing eight members (four from each side) as sub-committees, which have proved extremely useful, as they have been able to adjust many matters reported for attention without taking up the time of the District Council beyond that necessary for confirmation. The duty of the National Joint Council has been to co-ordinate the work of the District Joint Councils and all questions and claims of a national character.

Work Done.—The first departure from the programme of leaving to each of the District Councils the negotiations for the alteration of wages was in 1920, when the N.J.C. recommended a general increase of wages for all grades of workmen within the schedule by two stages of 3s. each. In 1921 the N.J.C. arranged for two reductions to take place of 3s. each, and for stabilising the rates after the reduction until November, 1921, when a Negotiating Sub-Committee of the N.J.C. submitted to the full Council a draft agreement regarding wages which was unanimously accepted. This established the principle of a sliding scale of wages based on a datum figure of 120 per cent. above an adjusted rate for 1914 and varying up or down in accordance with the Board of Trade index figure of the cost of living. It provided for an increase or decrease, respectively, of ½d. per hour for every complete six points calculated from the datum figure. This also was a national agreement. In 1922 the employers' representatives on the National Council proposed ". . . that in lieu of the existence of a sliding scale agreement a variation be made on the basis of taking the actual basic rates of each district (as shown by the schedule) and adding thereto the cost of living figure . . ." and agreement was reached in 12 out of the 13 districts, the odd one going to arbitration. Although since the cost of living figure has begun to fall there have been allegations made

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against its fairness, there has never been anything better suggested.

Another scheme put forward by the workmen's representatives, both on the District and National Councils, was for grading undertakings according to the capacity of plant installed. Instead of such an *ad hoc* method, recommendations were made by the National Council and signed by every member of the sub-committeee in favour of additions to the schedule rates of pay to certain specified workmen when appointed by the management to take up duty on new large units. The idea was to provide additional pay for the leading man engaged on the larger units. When the report came before the National Joint Council for confirmation some of the Trade Union representatives, including those who had served on the sub-committee and who had signed the report, were instructed not to vote for it on the ground that it did not give an all-round advance to the whole of the men in the station. On other occasions the failure of some of the Trade Union representatives on the District Councils to accept responsibility has been equally marked, and it is certainly a matter for serious regret that after prolonged negotiations recommendations are turned down by some other set of persons whom the employers have not met and who have not heard the arguments and facts which led up to the decision. It is a serious handicap, but one which it is difficult to remove.

Another claim which took up a large amount of time and led to two references to the Industrial Court for decision was for an increase of the schedule rates for shift workers, as shift workers, although it was well known to those who took part in the making of the schedules that all matters relating to the conditions of shift working were borne in mind by both sides and due regard paid to them, so that the rates were consolidated rates. The Industrial Court on both occasions decided against the claim for extra pay.

Thus, should an increase in the size of a station or other circumstances make it necessary, in the opinion of the management, to change a job which has hitherto been done by day workers into a shift job, it may do so by giving seven days' notice, after which the men can be put on rotating shifts without additional payment, but subject to the conditions as regards holidays, meal-times, &c., of shift workers.

The most critical event since the introduction of Whitleyism into the industry was the general strike of 1926. Despite agreements, and without having regard to the good feeling and amicable relationship which had existed between the two sides, certain Trade Unions represented on the N.J.C. broke their agreements and tried their utmost to involve the industry in the general stoppage, but the majority of the workmen and the whole of the staff in the industry stuck loyally to their jobs and refused to be stampeded. Owing to what had happened the employers refused to continue their association with the N.J.C. until some guarantees could be given by the Trade Unions, and finally a series of resolutions regarding the constitution of the N.J.C. were agreed to, in accordance with which nothing in the nature of a "lightning stoppage" can now take place, as any dispute must be referred to the District and/or National Councils, thus giving time for consideration and adjustment if possible; and undertakers have the right to require that each employee shall sign an agreement that his service is in accordance with the terms and conditions agreed by the National and District Councils. The employers having come to a new arrangement with the Trade Union side, carried out the spirit of the agreement to the full, and the Trade Unions desired strongly to preserve the District and National Councils.

In 1928 the Trade Union representatives on the N.J.C. gave notice to the employers that it was their intention to ask for a *revision of the sliding scale*, and this description of their intended claim was used in all subsequent discussions and correspondence. The surprise of the employers may therefore be imagined when they received, a day or two before the September meeting of the N.J.C., a letter from the secretary of the Trade Union side giving notice to *terminate the agreement*, together with claims for a 10 per cent. increase of all wages, double time for Sundays for shift workers, increased holiday and sick-pay allowance, and increased wages and improved working conditions for certain specified grades. The employers resolved unanimously to resist the application, and also to give notice of an application for a decrease of one penny per hour, which, it was urged, was fully justified and overdue.

As a result a national conference of workmen's representatives resolved that the notice to terminate the agreement should be withdrawn; the agreement of December 17th, 1927, was continued and extended for 12 months ending December 21st, 1929, and the employers did not proceed with their application for a reduction.

The remaining claim was that the grades of switchboard and sub-station attendants and assistants should receive material increases in wages and be given conditions, such as holidays, sick pay, &c., similar to those granted to the technical staff. It was a demand that all workmen of the grades mentioned in the Trade Union claim, whatever their training or status, should be classified as engineers and also as members of the technical staff, and the unreasonable nature of such a claim was argued by the employers. Eventually this part of the claim was modified, and there was general agreement that as regarded the remainder it was desirable to define the line of demarcation between the technical staff and the workmen, so that the causes of friction on this head could be removed. The draft heads of agreement on demarcation were accepted on March 14th last, and are now awaiting incorporation in the general report on the whole of the claims. The clauses are:—

> "Employees engaged as sub-station attendants and switchboard attendants shall be subject to the conditions and schedules of the National Joint Industrial Council,
>
> "*Unless* they have a supervisory status and are engaged on supervisory duties; or are responsible for the control of load distribution; or control sub-stations other than the one in which they are actually engaged; or who, for a temporary period of their training as technical engineers, are engaged on a switchboard or in a sub-station.
>
> "The number of trainees working as switchboard attendants or as sub-station attendants shall not at any time exceed 25 per cent. of the total number of switchboard and sub-station attendants employed at that time."

This out of the way, there was left only the question of increased remuneration as set out in the schedule which formed part of the claim. The claims sought to establish a scale of pay for the grades of men in question very much in advance of anything which had previously been paid, and substantially more than was being paid to qualified engineers who had supervisory duties. This case is included, so far as it has gone up to the time of the paper being written, as an example of the difficulties which are constantly being created by the demand for alterations in the terms set out in the agreement. The employers know the deep resentment which would be aroused in the minds of their principal consumers if the already good wages and conditions in the electricity supply industry were increased, as it could only be done at the expense of the depressed industries. Therefore, the employers are compelled to examine every claim very carefully and to refuse all those which they consider to be unjustified and which would alter radically the existing agreements.

There is one feature of the many claims to which it is not unfair to draw attention. The Trade Union representatives making them have in nearly every case a small proportion only of their members employed in the electricity supply industry, the greater number being engaged in other industries. Agreements governing the conditions in these other industries have been negotiated and signed by the same representatives who serve on the Councils in the electricity supply industry. In the case of the former industries they have made agreements embodying lower rates of pay, no holidays, and other conditions generally much less favourable than those for the electricity supply industry, yet their main efforts appear to be concentrated on getting more still from the electricity supply industry, instead of trying to bring the others nearer to that standard. In other words, they are attempting to increase the advantages of the already favourably placed, but small proportion, of their membership, thereby increasing the wide margin between the two sections of their members, although it is manifest that the cost of the alterations would have to be borne by the depressed industries and would react to the disadvantage of the men employed therein. That the privileged position of the men in the electricity supply industry is realised by those outside is denoted by the great desire to transfer to it whenever an opening occurs. The management want to have contented men under fair conditions, but those conditions must bear a reasonable relationship to those operating in the principal industries in the area in which they are supplying and from which they derive their revenue.

The employers on both the National and the District Joint Councils represent both publicly-owned and company undertakings, and they are responsible to their ratepayers and shareholders, respectively, for managing their concerns in conformity with business methods. On the one hand, this has not been interpreted by the employers as an excuse for ungenerous treatment, or harsh conditions, as is proved by a comparison with those in other industries. On the other hand, it must deter the management from granting applications which they believe to be unjustifiable. Because the cost will fall upon outside persons is no excuse for acting contrary to what reason dictates. Those who have taken part in negotiations have been astonished by the incomplete knowledge of the principles of the administrative and financial side of management. Nothing has been more disappointing than to listen again and again to arguments based on ideas concerning the industry which, if actually practised by those responsible for an undertaking, would ruin it in the shortest period of time. When dealing with working conditions and labour the practical knowledge of the Trade Union officials has always been so useful that the revelation of a wrong conception of the other side of the industry was somewhat of a shock to the employers and a subject of general comment, as it seemed to explain so much. There is no implication of bad faith; the arguments and figures used to substantiate the applications were put forward in perfect good faith.

The author is certain from his knowledge of the employers in the industry that the great majority of them are anxious to have contented workmen, and are prepared to uphold conditions which are reasonable. They have always resented any attempt by an employer to depart from the spirit of an agreement, and have joined with the representatives of the men to get fair play in such cases. They are strong believers in the principle of the Industrial Councils and desire their continuance, but it is useless to deny that the numerous and far-reaching demands are raising doubts whether the organisation is not being used unfairly, and the managers of many undertakings are becoming restive. It is to be hoped that very careful consideration will be given by both sides before making any

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proposal which will materially alter the schedule conditions and that the effect, not only on this industry, but also on the other industries concerned, will be thoroughly investigated.

Although a number of electricity committees have sharply criticised the holidays given under the schedule as being excessive, when compared with those in other industries, or even in other departments of the Corporation, the employers, as a whole, have, on the one hand, declined to support any attempt to obtain a reduction; on the other hand, so far as can be judged, there would be strong opposition to an increase at the present time, especially as the cost would have to be borne by those industries which have no holiday arrangements at all, and are suffering under great depression. A plea had been made that six consecutive days' holiday does not allow a complete week-end, therefore that only short journeys can be made and that the Saturday is lost. To meet this a suggestion was made by the author to a meeting of employers that the public utility services might consider a uniform scheme for holidays for inclusion in the national agreement:—"After 12 months' continuous service each man shall be allowed an annual holiday of ten consecutive days made up on the following basis:—He shall commence his holiday as from stopping time on Friday night and shall return to work on the second Tuesday morning thereafter, and shall be paid for all normal working hours (*i.e.*, 60 hours) falling within that period." This was not discussed, however, on its merits because at the time the Trade Unions were about to table other claims, which they were not prepared to withdraw. Expressions of opinion on this suggestion will be appreciated.

Future Considerations.—The foregoing account of some of the many questions which have been brought before the National and District Councils will be useful for reference. For discussion, however, it is suggested that consideration of the future working of Whitleyism in our industry should be given the first place, and in the forefront should come the question of whether, and if so to what extent, wages and conditions of employment should be dealt with under national agreements instead of separate district settlements. It appeared quite sound, at the beginning, to leave all negotiations for setting up schedules of wages in the hands of the District Councils, but there has been a continuous series of attempts to alter materially the conditions set up under the agreements. If the whole of the claims had been granted, the schedule would have been drastically changed, and employers in some areas have agreed to changes apparently because they appeared to affect only a few men in their particular district, forgetting that they might have a much greater effect in other districts. These features have proved to be as unsatisfactory as they were unexpected.

Many discussions have taken place in the District Councils concerning claims which were obviously of national importance, because of the effect they would have had on the whole industry. It is disconcerting to find how great are the differences between district and district which have been brought about by this detached and water-tight deliberation; for what may be called "key grades" of men, the increase in wages paid in 1928 above what was paid in 1914 ranges from 91 to 130 per cent.; from 71 to 107 per cent.; from 83 to 121 per cent., and so on.

On matters of conditions of employment a similar policy has worked out the same way. Serious consideration must be given by employers to this problem. The writer offers the following suggestion:—First, that any claim which would, if established, substantially alter the existing conditions and would appear to be a radical departure from those ruling in other districts, should be made to the National Joint Council; secondly, that a central organisation should be set up in charge of a thoroughly competent industrial officer who would keep complete statistics of all wages and conditions of employment, both of our own industry and of industries generally. This officer and his department would be at the service of the representatives of all the districts and of all employers' secretaries and committees, so that information on every phase of a claim would be readily circulated. It would enable the local employers to have before them reliable figures of wages paid to similar classes of men in the principal industries within their own district, and by our own industry in other areas. It would include all former decisions, if any, on the matter at issue, and the personal services of the chief officer at any conference, or in connection with arbitration proceedings, or reference to an industrial court. In other words, our industry would be brought into line with other industries, both privately and publicly owned; I need only cite gas and tramways as instances. The services of such an officer would be invaluable to the employers, who are finding their work most onerous, and must, in the author's opinion, either be granted special aid, or become inefficient. It is not realised that whole days have to be spent in examining a claim, calculating the cost of allowing it, whether it is equitable and how it conforms with the practice in other industries, marshalling the facts and arguments, and then carrying on the negotiations. The knowledge throughout the industry that a thoroughly efficient organiser was behind the National Council would automatically increase its prestige and probably have the effect of bringing in the undertakers which are at present outside the organisation.

Many of those actively employed in the work of Electricity Committees and District Councils do not realise the importance of the industry nor the financial issues involved. The annual wage and salaries bill published by Commissioners for 1925-6 was £7,979,000. Assume the present total cost of wages and salaries to be about £8,000,000; 1/10th of 1 per cent. (or 2s. per £100) in wages per annum would produce £8,000 per annum. The ascertained number of manual workers and staff is 43,042 (say, 43,000) and $\frac{£8,000}{43,000}$ personnel equals 3s. 9d. per employé per annum. The average Trade Union subscription is 8s. 4d. per annum, or 2d. per week (for protection organisation only, excluding special benefits); also with the subscription of the staff members, *i.e.*, £4 per annum (E.P.E.A. spends £12,000 per annum).

The Commissioners have sanctioned various amounts up to 11s. 6d. per man per annum for subscriptions to the Council and Board, thus making the figure of 3s. 9d. appear very low. On the estimated figure of 43,000 (staff and manual workers) 1d. per hour for one week would produce £8,510, and a sum of, say, £9,000 per annum would be a modest figure for the cost of National and District organisations for both the Councils and Boards. Probably the only equitable scheme would be for the Districts to raise subscriptions based upon the number of employees, the figures to be ascertained, say, every three years. The present figures are (workmen only):—

District No.	Area.	No. of employés.	Percentage to total.
1.	North-East Coast	2,445	6.20
2.	Yorkshire, North Lincolnshire, &c.	4,798	12.17
3.	North-Western	8,008	20.31
4.	South Wales	1,100	2.79
5.	West Midlands	3,065	7.78
6.	West of England	1,089	2.76
7.	East Midland	1,639	4.16
8.	East Coast	941	2.39
9.	Home Counties	2,353	5.97
10.	London	8,828	22.39
11.	South Coast	1,559	3.96
12.	Devon and Cornwall	710	1.80
13.	Scotland	2,887	7.32
	Totals ...	39,422	100.00

The author also suggests for discussion the question of making the areas of the District Councils coincide with the electrical areas set up, or to be set up, by the schemes of the Central Electricity Board, which would, if Scotland remains as one district as at present, reduce the number of District Joint Councils from thirteen to eight and carry with it the advantage of bringing all the workmen within each area under the same rates of pay and conditions of service.

Of the many questions of principle which still require solving, one is whether or not the decisions of an Industrial Joint Council should be compulsory on the industry. The employers have always said they were prepared to adopt this as part of the constitution, but they would make no move until the Trade Union side intimated that it wished the question to be discussed. The question was advanced by the vote in favour at the Trades Union Congress at Scarborough. When it is remembered that by the constitution governing our National and District Councils no resolution can become operative until it has been approved by a majority of both sides of the Council, there does not appear to be any insuperable objection to making the findings compulsory. The attitude of the Ministry of Labour throughout (whatever the Government in power) has been one of benevolent neutrality.

As long ago as 1912 a committee under the chairmanship of Sir George Askwith was directed by the Government to ascertain what was the best method of securing the due fulfilment of industrial agreements, and an agreed Bill passed its second reading in May, 1924, but it was not possible to proceed with the measure owing to political conditions; it awaits re-introduction, and its prospects are not rosy unless it can be given Government support. Whether or not support from the electricity supply industry should be given to the Bill is a matter for each side of the Industrial Councils to consider separately, and then, if agreed, joint action could be taken. It is important to note that even if the Bill became law it would not be compulsory for any industry unless adopted by a resolution of the two sides forming the Industrial Council for the industry; therefore it does not appear to be in conflict with the claim for self-government by the industry, and it would certainly prevent a small minority within an industry keeping the whole in a state of unrest.

The author suggests that such a measure is the logical outcome of the Whitley scheme. It provides a means for healing the sore caused by a few concerns refusing to conform to the conditions under which the remainder have agreed to work, whilst at the same time the safeguards against tyrannical use are ample.

Joint Boards.—The other application of Whitleyism to the electricity supply industry is that of the National and District Joint Boards for dealing with all matters relating to the technical staff. A salary scale has been arranged and conditions of service agreed, being national in extent. The industry has to look to the trained staff for its future technical leaders, and it is most gratifying to know that the organisation under the control of the Joint Board has been completed by a scheme of training for power-station engineers which, it is hoped, will provide a sufficient number of properly trained men to meet the requirements of the industry. The trainee must, on the completion of the course, pass the examination for Associate Membership of the Institution of Electrical Engineers in order to qualify for registration.

A pleasing aspect of the National and District Boards is the

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smoothness with which they are working. Arbitration is assured on any matter of whatever nature which the District Joint Boards have failed to settle.

As a result of changed and changing conditions brought about, or to be brought about, in connection with generation by the schemes of the Central Electricity Board, and the changes in the problems and methods of distribution, it has been realised for some time that an alternative way of fixing the basic salary would have to be found, as the present method does not meet the altered conditions. Both sides have been considering the problem separately, and the E.P.E.A. has prepared a draft schedule and the employers are now engaged in examining it in the light of their own ideas on the subject.

Some Notes on Recent High Court Cases and Current Legal Problems in Connection with the Generation and Supply of Electricity.

By JAMES H. ROTHWELL, C.B.E., Honorary Solicitor.
(*Abstract.*)

The legal cases of importance recently decided are as follows:—

Farnworth *v.* Manchester Corporation. This action was first tried at the Manchester Assizes, and upon the plaintiff's appeal was heard by the Court of Appeal in December last. The case will probably be taken to the House of Lords.

The plaintiff, Mr. Arthur Farnworth, is a farmer owning property in the neighbourhood of a large electrical power station erected by the Manchester Corporation under powers of a local Act of 1914 at Barton-on-Irwell, and he brought an action against the Corporation claiming an injunction to restrain them from so working their electricity power station as to commit a nuisance by emitting fumes heavily charged with sulphur and sulphur compounds to the damage of property which he occupied, and from interfering with his comfort and health. He also claimed compensation for the damage caused to him.

The Manchester Corporation admitted the nuisance, but contended that, as the power station was of the precise kind which Parliament had authorised, the plaintiff could not succeed in his action, as the local Act, so far as it authorised the construction of the power station, did not incorporate the usual "nuisance" clause which provides that a Corporation is not to be exonerated from proceedings for nuisance.

Mr. Justice Talbot held that the defendants had succeeded in showing that the station was of the kind which Parliament had authorised to be built at the place in question, and that no means which science and knowledge could suggest could have avoided the nuisance complained of. He accordingly gave judgment for the Corporation.

The Court of Appeal by a majority of two to one reversed this decision, so that at the moment there are two legal minds in favour of the Manchester Corporation and two in favour of Mr. Farnworth.

Lord Justice Scrutton said that it was clear that the station, in using the coal which it did use, discharged such a quantity of sulphur that the fumes, which were mixed with moisture, were not dispersed in the atmosphere, but descended on Mr Farnworth's land, and in view of the fact that larger stations were being erected, *e.g.*, at Birmingham, and were likely to be erected on agricultural land, the legal incidence of the damage was of great importance. The fact that a generating station on the land was authorised by Parliament, and that it was worked without negligence, did not, when there was a nuisance clause in the Act or Order, relieve the undertakers from paying compensation for damage done amounting to a nuisance. Lord Justice Scrutton was of the opinion that the "nuisance" clause was incorporated in the Local Act of 1914.

His Lordship further stated that the Corporation never seemed to have considered when that station was built, to be worked on a larger scale than had ever been done before in England, what would be the effect of so large a quantity of sulphurous fumes on the surrounding neighbourhood. It was a striking fact that no similar damage was known in any other case, and the Corporation was unable to explain why it alone should cause damage.

The only conclusion one can arrive at at this stage is that in order to resist an injunction or damages for such a nuisance as was proved in this case, the undertakers must prove to the satisfaction of the Court that it is the inevitable result of operating a generating station that it should damage adjoining agricultural land by sulphur deposits, notwithstanding that they may have taken all reasonable precautions to explore the cause of and remedies for that damage, or adopted all reasonable precautions to prevent it.

It is interesting to note that the operation of the injunction was suspended for a year to enable the defendants to adopt measures to terminate or mitigate the nuisance.

Lord Justice Scrutton also made this significant remark: "The case showed the necessity for Parliament and other authorities concerned giving more careful attention to the provisions for compensation for damage caused by those enormous developments of electrical power stations. Promoters should not be allowed, by abstaining from asking in express words, for the exclusion of any duty to make compensation for damage done—a privilege which in his judgment they would not get if they had asked for it expressly—to argue afterwards that their duty to compensate had been indirectly excluded by obscure inferences."

The second case is that of the Attorney-General *v.* London and Home Counties Joint Electricity Authority.

By a scheme made by the Electricity Commissioners under the Electricity (Supply) Act, 1919, a Joint Electricity Authority was constituted as the Joint Electricity Authority for London and part of the Home Counties. The scheme did not transfer, as presumably it might have done, to the defendants any of the powers of local authorities to take over electrical undertakings; but the scheme did give the Joint Electricity Authority power to promote Bills in Parliament for the purpose of the scheme. The Joint Electricity Authority prepared a Bill which purported amongst other things to transfer to it the powers of local authorities to take over electrical undertakings within its area. The defendants had no income other than the contributions by the owners of electrical undertakings within their area. Four electrical undertakers within the area applied in February last to the Chancery Division for an injunction to restrain the Joint Electrical Authority from applying any of their funds towards the costs or expenses incurred or to be incurred in relation to the preparation of this Bill, and to restrain them from employing any of their officers or servants in the preparation and promotion of the Bill until the authority should be authorised by Parliament so to do.

Mr. Justice Astbury came to the conclusion that the Joint Electricity Authority had no power to employ its funds for the promotion of the Bill in question. When limitations were imposed by a scheme it was not "for the purposes of the scheme" to promote a Bill to get rid of those limitations, or to acquire powers for the purchase of those undertakings when those powers had been deliberately withheld.

The next case of general interest is G. Scammell & Nephew, Ltd., v. Attlee and others. The plaintiffs in this case brought an action against seven individual members of the Electricity Committee of the Stepney Borough Council, claiming from the defendants damages for the effect of an alleged conspiracy whereby in breach of a contract the supply of electricity for power was unlawfully cut off from their premises during the General Strike in May, 1926. The plaintiffs succeeded in the court of first instance, but the defendants appealed successfully, and judgment was entered for them with costs.

The important point of general interest which emerges from this case is that where a defendant, whether he be an individual member of a committee or council of a local authority, or an official of the local authority, pleads the six months' limitation imposed by the Public Authorities Protection Act, 1893, as the period within which an action must be brought in respect of his conduct, the plaintiff can defeat that plea by proving on sufficient evidence that the defendant was not really intending to act in pursuance of his statutory authority, but was using his pretended authority from some improper motive, such as spite, or for a purpose entirely outside statutory justification.

Where defendants were purporting to execute a statute, as in the case in question, the burden of proof is on the plaintiffs if they allege the existence of a dishonest motive and the absence of any honest desire to execute the statute, and such existence and absence will only be found to be proved on strong and cogent evidence.

On the facts of the case in question, the Court of Appeal held that there was no evidence on which the jury could find that the members of the Committee were not intending to carry out their statutory duties when they determined to get a supply of light by sacrificing a supply of half the power.

Lord Justice Scrutton said: "I think the members of the Committee made a mistake in not, at any rate, making more inquiry about the Government supply of men and protection, and very likely they showed a lack of courage. But mistakes may well be made, and a weak action may well be taken in the intended execution of the statute, without dishonesty or lack of good faith. The necessity for action was urgent, the risks of danger serious, and the Committee took a view that they could best perform part of their duty by abandoning part. I may disapprove their decision without convicting them of dishonest pretence, of which I see no evidence."

As the writ was issued more than six months after the matters complained of, the defendants were protected by Section 1 of the Public Authorities Protection Act, 1893.

The last case referred to is that of the Caerphilly Urban District Council v. Griffin, decided in December, 1927. The plaintiffs, a local authority empowered to supply electricity, sought an injunction under Section 23 of the Electric Lighting Act, 1909, to restrain the defendant from supplying electricity to certain consumers in the area. By that section the plaintiffs had a monopoly in the area, subject to the proviso that "this monopoly should not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supplying of electrical energy to consumers."

The defendant in the case had primarily two businesses. In the course of those businesses the defendant provided plant to light his shop and residence, and he afforded a supply of electricity to one of his shops which he had leased to Messrs. Woolworth, and also to a covered market for the purpose of attracting tenants and developing his property.

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The Court held that the supply of electrical energy in this case was only incidental to the defendant's two businesses, and was not his primary business. The action therefore failed and was dismissed.

It is interesting to note that even with these limitations electrical undertakers have a greater monopoly than have gas and water undertakers. The main protection to gas and water undertakers is not any specific monopoly clause, but the fact that an unauthorised undertaker cannot open the highway for the purpose of laying mains to supply gas or water. A general impression prevails that an unauthorised undertaker may do this with the consent of the road authority. Such is not the fact. A road authority who permits such an unauthorised disturbance of the road service is liable to proceedings by way of indictment as well as the unauthorised undertaker, and would be liable to action by any third party as the result of any damage caused to that third party in using the road.

It must be borne in mind, of course, that this same protection of non-disturbance of a road surface is available to protect electricity undertakings, such as the one referred to in this case, from private persons spreading their competitive activities too far under the cloak of the supply of electricity not being their primary business.

If undertakers choose to alter their system, frequency or pressure for their own purposes, the interests of consumers must be adequately safeguarded, but the form of consent to the alteration given by the Commissioners might be improved without injustice to consumers. The expense involved in replacing d.c. wireless apparatus with a.c. apparatus is altogether disproportionate to the amount received in revenue, and there is also the possibility that some persons might seek to gain some personal financial advantage out of the impending change.

The Commissioners have a somewhat free hand to modify their consent; and the measure of control which undertakers have by statute over apparatus connected to their systems would appear to entitle them to insert in their agreements with consumers a clause requiring notice to be given before any new apparatus, other than lamps, is connected to the supply. The undertakers could not reject any intended apparatus which would not be likely (*a*) to cause damage, (*b*) to interrupt the supply to other consumers, or (*c*) to cause the consumer to exceed his declared maximum demand. Moreover, no consent of the Commissioners can impose as a condition precedent to compensation a condition that apparatus shall have been approved.

It might be suggested that a further proviso should be added to the form of consent to the effect that if a consumer installs any apparatus after the date of the newspaper advertisement of the intention to apply for the Commissioners' consent to the change, such consumer shall not be entitled to require the undertakers to alter such apparatus or to pay compensation in respect thereof, if the arbitrator shall determine that the installation of such apparatus was not necessary or was made with a view to obtaining compensation from the undertakers.

A considerable amount of time has been devoted to settling a model hire-purchase agreement, and considerable care has had to be exercised to avoid the agreement being construed as one for sale and purchase. It would be an advantage if all undertakers who embark on the hire-purchase policy would adopt this model form of agreement with as little amendment as possible.

Section 12 of the Electricity (Supply) Act, 1926, has an important bearing upon existing and future supplies of electricity in bulk to other authorised undertakers.

Section 12 does not affect contracts entered into before the passing of the Act, and therefore, unless there is a clause in the agreement making some provision for variation of charges, the agreement must be left to expire or be determined before any modification can take place, except when the parties voluntarily agree to modify the terms.

The section will apply to contracts entered into since the passing of the Act, where there is a clause as to variation of prices as soon as the bulk supplier takes energy directly or indirectly from the Board. When this comes to pass it will be open to authorised undertakers who take the bulk supply to demand Section 12 prices, and in default of agreement to refer the matter to the Electricity Commissioners for their decision. Pending Section 12 coming into full force each undertaker must act according to the prices clause in the agreement.

As to contracts not yet entered into, it is competent for the contracting parties to arrange their own terms, but before doing so they should consider the model clauses which have been specially settled, having in view the early operation of Section 12.

In regard to the question of liability in case money is stolen from an electricity prepayment meter, only one case has been reported in the recognised Law Reports. This was a case of supply of gas by prepayment meter, but I conceive the position would be the same in the case of electricity. In the reported case the money was stolen through no negligence on the part of the consumer, and the Court held that the consumer by putting the money into the box had paid for the gas, and was not liable to pay again.

The Law Report does not indicate that there was any special agreement between the consumer and the undertakers.

I conceive that the liability would be the same in regard to damage to the meter where it is caused without negligence of the consumer, and in the absence of a special agreement.

In Brighton the application form which all consumers are required to sign contains the following among other conditions:—

> "Where the supply is through a prepayment meter, the consumer shall pay for all electricity registered by the meter at current rates, notwithstanding any insufficiency of prepayment, and, in addition, one halfpenny for every unit of electricity consumed, in lieu of meter rent. Should the meter be tampered with and money unlawfully extracted therefrom, the consumer shall make good the amount missing, and also pay for any damage which may be done to the meter, lock or fittings."

The reported case would not, of course, apply where a condition of this sort had been entered into by the consumer.

A point of financial interest has been considered arising out of a proposal to vote money out of the funds of the electricity undertaking for the years 1929-30 before the completion of the year when the reserve fund is not up to the required limits provided for in the 5th schedule of the Electricity (Supply) Act, 1926.

In this case a grant out of electricity funds before the completion of the year is not "net surplus" within the meaning of these words as used in the 5th schedule of the Electricity (Supply) Act, 1926. The power in this schedule is now the only one existing which enables an undertaking to apply money in aid of local rates; and it applies only to the net surplus, which of course cannot be ascertained until the end of the financial year, and if, after March 31st, 1930, the reserve fund does not amount to more than one-twentieth of the aggregate capital expenditure on the undertaking, the net surplus must go to the reserve fund until that condition has been fulfilled.

A somewhat technical problem arises in the carrying out of the South-East England Electricity Scheme, 1927. Under Section 8 of the Electricity (Supply) Act, 1926, the Central Electricity Board is to construct the main transmission lines required for the inter-connection of selected stations one with another, and with the systems of authorised undertakers in accordance with the scheme. Section 51 defines "transmission line," whilst "main transmission line" is defined by Section 36 of the Act of 1919.

Existing switchgear was installed by a corporation (whose station is a selected station) controlling its generating plant and outgoing feeders, and was designed to meet all requirements for years to come, but not in contemplation of a connection to a main transmission line of the Board's system.

Before the generating station is connected to the grid under the scheme, it will be necessary to install switchgear of much higher disruptive capacity.

The estimated cost of installing the necessary gear is upwards of £200,000, and it has been assumed that this expense would be borne by the Board, the gear being necessary for the control of the Board's transmission line within the meaning of Section 36 of the Act of 1919.

The Board, however, contended that the gear is required, not for the control of their line, but solely for the protection of the corporation's system, and in fact will form part of the corporation's system.

In the case of a selected station the financial result of this decision of the Board would not be serious, as the interest and sinking fund upon the extra capital expenditure would be borne by the Board under Section 7 of the Act of 1926.

It is for the technical experts of the Association to agree that gear of this nature, whether provided in a selected station or in connection with any system of an authorised undertaker (whether selected or not), is primarily "switchgear necessary to and used for the control of" the main transmission line within the meaning of Section 36 of the Act of 1919.

The I.M.E.A. Exhibition.

In accordance with the usual practice at the I.M.E.A. Conventions of recent years, an excellent exhibition of electrical domestic apparatus is this year being held in the Old Torbay Hospital, Torquay, where some 38 or so manufacturing concerns and other organisations are displaying their products. The following are some notes on the exhibits:—

Included in the items on the stand of the Bastian Meter Co., Ltd., is the 1929 model Bastian patent water heater. This year's improvements are both in general design and detail. The heating element, which is now immersed in the water entirely, is made so that both the resistance and the containing tube are easily withdrawn, and as the deposit chiefly settles on the heating tube, a new one can be inserted at low cost and without taking down the heater. The loose lid also has the advantage that towels and linen can be aired on it. In the "W" types are fitted wall brackets and outlets at the bottoms for joining to existing piping. Mercury-break thermostats are fitted in types 800.

In the Mascarini steam boiler for a.c., type 320, the water itself acts as a resistor, and in consequence the apparatus is very safe, since, if the water supply fails, the boiler stops

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working. The control arrangements are very neat indeed, and the boiler can be arranged automatically to take a constant load, to supply steam to meet demand, and to take surplus load from a network; for instance, as a motor is switched on or off the motor load would be given up or taken by the boiler, thus preserving a steady load on the supply.

Messrs. BELLING & Co. are showing a new series of electric cookers with all-metal boiling plates and a new boiler-griller plate with an all-metal top. The "Baby Belling" cooker, is also on show, as is a number of electric immersion heaters suitable for fitting into any existing tanks or cylinders, and for use in conjunction with ordinary domestic hot-water systems. New sizes have been introduced, so that the range now offered covers all sizes of tanks or cylinders, and the loadings range from 250 W to 3 kW. Practical demonstrations are given of the new "Parmotor" relay which is designed for automatically controlling electrical circuits, and is claimed to be more reliable, more flexible and cheaper than a time switch. It has a very wide application, including the thermostatic control of electric water heaters, cookers, electrically-heated rooms, street-lighting control, shop-window lighting, night signs, traffic control, &c.

The exhibit of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION, which is staged in the board room on the ground floor of the Old Torbay Hospital, illustrates, by actual examples where possible, the various "Services to Members" which the Association is able to render. The principal items consist of kinematograph-film displays; E.D.A. literature; examples of layouts and copy for electricity supply local advertising; window displays, including an entirely new one which the Association hopes to produce in the coming autumn; an exhibition of posters; and a collection of reports dealing with special subjects which have been prepared by E.D.A. sub-committees, *e.g.*, industrial electric heating, electric furnaces, rivet heating by electricity, electrical refrigeration, rural applications, and hire and hire-purchase and deferred-payment schemes. The remainder of the exhibit consists of a complete report of, and examples of material used in, national electrical development campaigns which have been conducted by the Association. A special handbook, "E.D.A. Service to Members," is available at the stand.

The BRITISH ELECTRIC TRANSFORMER CO., LTD., has on show a new "Tricity" table-type cooker suitable for 12 persons, and embodying the latest ideas. This exhibit also includes a kitchen kettle, recently patented, embodying a double automatic safety device. It is believed that this kettle is the first of its kind, inasmuch that protection is ensured against boiling dry, in addition to switching off whenever the kettle is lifted up. Cookers in alternative vitreously-enamelled and black and nickel finishes are also shown fitted with enclosed and open boiling plates. In the "Sunray" parlour on this stand is a new model "Sunray" lamp which incorporates hot-wire bars with the "Sunray" principle, in addition to standard "Sunray" designs.

Some interesting items of electro-medical apparatus for use in the home are to be seen on the stand of BRITISH QUAIN SUNLIGHT, LTD. The B.Q. sunlight bath is a soundly-constructed and well-insulated apparatus for tonic treatment at home, without medical supervision. It is claimed that the radiation from this apparatus is practically identical with Alpine sunlight. One outstanding feature of the bath is that when not in use as such, it makes a highly-efficient electric

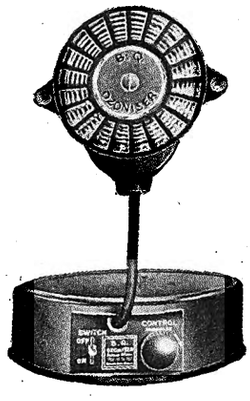

Fig. 1.—The "B.Q." Ozoniser.

fire. It is supplied for all voltages to work off lighting or power supplies on either a.c. or d.c. A nickel-plated telescopic stand may be supplied with this model. The B.Q. "Ideal" sunbath lamp is a twin-arc model mounted on a telescopic stand giving a 20-A radiation at half this current. The model works equally satisfactorily from either a.c. or d.c., and is particularly recommended for nursing homes, clinics, &c., and for home treatment under medical supervision. The balancing resistance which is connected to the reflector may be used separately as an electric fire. The B.Q. ozoniser (fig. 1) represents, it is claimed, a distinct advance in providing an inexpensive easily-controlled apparatus for purifying, deodorising and revitalising the air in such places as crowded offices, theatres, shops, kitchens, &c. This apparatus is arranged for use with any fan or in any convenient place where there is a current of air. When switched on it immediately emits pure ozone in quantities which are regulated by the control knob, and which vary from the merest trace to the maximum output which is sufficient to completely purify and refreshen the air in an ordinary sized room in five minutes. It works with equal efficiency on a.c. or d.c., and has a loading of about 40 watts. The B.Q. electric fan is supplied primarily for use with the ozoniser.

A special exhibit by BURNLEY COMPONENTS, LTD., is a boiler fitted with a "Burco" automatic safety cut-out, which opens the circuit immediately the boiler is run dry. The cut-out is of robust design, and the switch contacts are large enough, it is claimed, to cope with 20 A at 250 volts, without burning the contacts. The cut-out is clamped to the pan bottom. Two parallel contact fingers close a circuit between two pairs of contact pillars, and the cable and element connections are completed to the contacts. The contact is maintained against the pressure of a coil spring by means of a stud, which is made in two portions soldered together. When the pan of the boiler has boiled dry, the solder melts, thus allowing the stem of the stud to telescope into the head, the coil spring forcing the contacts apart. The switch can be reset by inserting a new fuse plug or resoldering the used one in a few seconds. The user can easily renew the fuse plug from the inside of the boiler. A "Burco" combination boiler, another item on this stand, is specially designed for sterilising or for heating milk for cafés, &c. The liquid container is fitted inside the water container, which is heated by elements. The heat is applied through the boiling water, and milk may be raised to a temperature of 180 deg. F. by this means.

Another "Burco" exhibit is a special boiler which may be used for soup boiling or fat rendering. This has an outer casing of porcelain enamel, and the pan is of velvet-blued steel welded at all seams.

CARRON COMPANY is showing for the first time two new models of electric cookers. The "M" type cooker has an

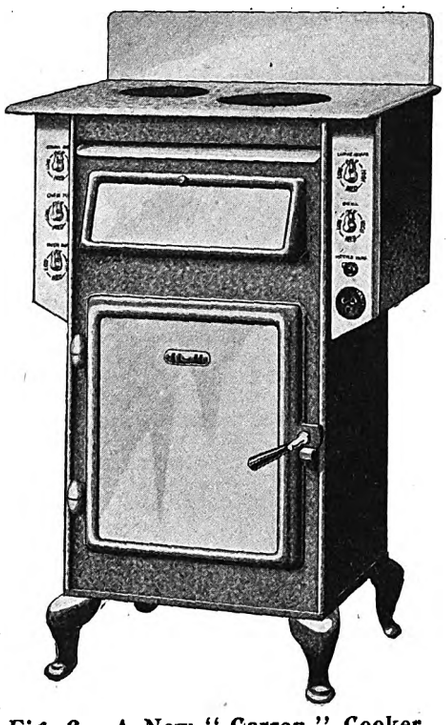

Fig. 2.—A New "Carron" Cooker.

oven constructed on the one-piece, completely-removable principle, heated by means of side and bottom elements, while the "P" type cooker incorporates an oven heated by elements disposed at the top and bottom of the oven. We understand that these two cookers are to be the forerunners of a whole series of cookers of larger and smaller dimensions. A very attractive cooker on this stand is a medium-sized top- and bottom-heated cooker which is finished in a pleasing colour scheme of pale-green and cream. A similar model is finished in mottled grey-blue enamel, which is also a new departure for this company. These cookers, fig. 2, bear a strong resemblance to the old No. 310 Carron cooker, but a close examination of the new type reveals many improvements in design and manufacture. One of the side- and bottom-heated cookers is a "de luxe" model in mottled-grey enamel finish, and another is a standard-finish cooker with certain parts, including the hob, feet and baseplate, in mottled-grey enamel, the remainder being stove black enamel. A number of original features and improvements are incorporated in this design, including a side-hinged hob to allow access to the under hob assembly and connections when the cooker is situated in a confined space. There are also on this stand selections of the fires and irons manufactured by the company.

On the stand of CREDENDA CONDUITS CO., LTD., are examples of the latest models of "Creda" electric cookers. Various detail improvements have been incor-

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porated since these were shown at the Convention last year at Bath, chief amongst which are improvements in the wiring arrangement for the boiling plates, and an improved type of grill pan. Oven-temperature indicators are now fitted which are easier to read, it is claimed, than the ordinary mercury oven thermometers. Samples are also exhibited of two new "Creda" wash boilers, C23 and C24, which have been designed to meet the needs for cheap and

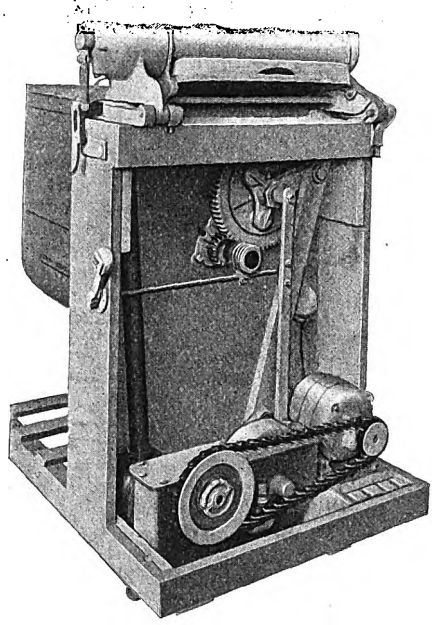

Fig. 3.—Driving Mechanism of "Ewbank" Washer.

efficient appliances of this nature, and the exhibit is completed with samples of the latest types of "Creda" automatic water-storage heaters and "Credalux" street-lighting fittings.

Some of the specialities of the Dowsing Radiant Heat Co., Ltd., which are being shown are the "Wireless" (*i.e.*, cordless) electric ironing system, including the latest types of irons produced for use with it, the latest pattern of "Solarium" luminous ray bath, and a new form of protective device for water vessels, such as sterilisers. The last-mentioned apparatus is the subject of a provisional patent, No. 7361/29.

The following are among the exhibits of Messrs. Drake and Gorham Wholesale, Ltd. A 1½-gal. and a 4½- to 55-gal. "Inventum" hot-water cisterns. The former is of the push-through type, and the latter of the gravity-feed type, as approved by water-supply authorities. The new "Inventum" barber's cistern is fitted with a new mixing tap giving a very wide range of temperature control. A new bedwarmer is of the accumulator pattern and heavily nickel-plated. There is no solder incorporated in this bedwarmer, the whole job being of pressed metal. The bedwarmer is claimed to be absolutely fool-proof, as it cannot be placed in the bed with the current on. A new bathroom heater has white-enamelled adjustable brackets for wall or ceiling mounting, and is equipped with a "pull cord" pattern switch. Working on this stand is a model of a relay system operated by the Parmotor thermo-switch, with one pilot wire from a supply point for remote control. This model is designed to show control of street lighting on one side of the relay, and night-tariff water heaters on the other, both definitely under the control of the supply authority.

A new electric cooking plate shown on this stand is of very simple construction. Other Drake & Gorham exhibits include "foster mothers" for chickens, an e.h.p. ring-main controller (fully interlocked and mistake-proof) a "Metesco" e.h.p. oil switch-fuse, and a selection of "Inventum" fires. The fires are fitted with chromium-plated reflectors, which are practically untarnishable.

Among the items shown by Electric Fires, Ltd., is a 5-gal. thermal-storage water heater mounted on a framework and complete with a ball-valve tank, a basin for the draw-off water and sump, and a pump for the return of water to the high level, the whole being a portable and self contained unit for demonstration purposes. A 2-gal. thermal-storage water heater is arranged on a trunnion for easy inspection by visitors of all the working parts. A 10-gal. open-type ball-valve tank with low loading is also being shown, as is a 10-gal. combined hot-water tank and ball-valve chamber, all contained in one outer casing. Another interesting "Heatrae" exhibit is a small tank suitable for direct connection to the water supply and for the delivery of hot water to one point only. A few samples of Heatrae electric fires on this stand were chosen to demonstrate the three standard types of fire bars used by the firm to suit varying conditions. A small combined cooker-radiator is also included. Other Heatrae exhibits include hot pipes, towel rails, warming plates, a wash boiler, whistling kettles, low-temperature radiators, immersion heaters, and oil heaters.

The Lighting Service Bureau of the Electric Lamp Manufacturers' Association of Great Britain, Ltd., is this year responsible for three exhibits at the Convention. The first exhibit consists of a series of display panels illustrating lighting effects for use in electricity showroom windows. These panels are executed in a distinctly modern style, while the model interiors preserve a fascinating realism by virtue of the exactness of their detail. The following are the fields of lighting covered by the display: Two panels arranged to feature modern lamps, two panels demonstrating shop lighting, two panels illustrating home lighting, one panel demonstrating school lighting, and one panel depicting industrial lighting. It is the intention of the Bureau to loan these panels free of charge in sets of four to supply authorities for periods of two or three weeks. One part of the above exhibit is on view in the exhibition hall, and another section in the Torquay Electricity Department Showroom. The second display consists of a luminous sign situated on the front of the exhibition building, reading "I.M.E.A. Exhibition." This sign has been specially built with a new form of letter which has great possibilities for shop-facia purposes and for all short-range sign-lighting work.

The third lighting display consists of the special lighting features in the room on the ground floor of the exhibition, in which the display panels previously mentioned are exhibited. This room is lighted by a large central fitting of very modern construction, conforming to the latest standards of architectural lighting, while supplementary lighting novelty is provided by the two luminous columns which are installed at each side of the entrance doorway. Other interesting lighting features in this room are a lighted ornament display panel and a glareless lamp-display cabinet.

The Electrical Association for Women has displayed in an attractive manner the Association journal, "*The Electrical Age for Women*," and various leaflets which are distributed by the organisation.

Electrolux, Ltd., are showing various products, including the cleaner, refrigerator and floor polisher.

The "Ewbank" electric washer, which has recently been introduced by Messrs. Entwistle & Kenyon, Ltd., is the main feature of this company's exhibit. The machine is an all-British production. Some of the claims put forward for this machine are: the rollers are unusually large, and are made of guaranteed quality rubber, 2 in. in diameter and 16 in. long. Risk of injury is claimed to be removed by the adoption of a spring-assisted release to the wringer control, which allows the rollers to be under the operator's absolute and instant command. Risk of damage to user, machine, or motor is reduced to a minimum by the fitting of automatic friction drive to the clothes container and wringer rollers. This feature overcomes the common trouble of premature failure of the motor, owing to its being burnt out through overload. The driving mechanism, fig. 3, and motor are under lock and key, being entirely encased away from water or dirt, while the chamber is so arranged that every part is of easy access. The gear box of special design allows the strong drive to run in oil, thereby relieving the user of the troublesome task of continually using an oil can. When not in use the machine can be folded into a useful kitchen table. The consumption of the machine is one unit in four hours.

On the stand of Ferranti, Ltd., are to be seen electric thermal-storage water-heating equipment, thermostats, load-levelling relays, and accessory control equipment. A small-

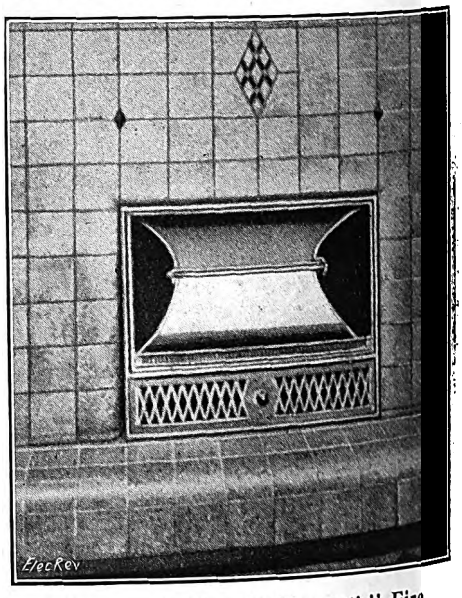

Fig. 4.—A New "Ferranti" Fire.

scale working model of a household water-heating installation is also a feature of this display, and the company is also showing a new range of "Ferranti" parabolic reflecting fires of improved design. Fig. 4 shows one of these fires. The outstanding feature is probably the large parabolic trough, which has, it is claimed, its angles of radiation definitely fixed according to the results of experiment. The reflecting surface is very highly polished, and the polish is rendered

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permanent by a special process of plating with a heavy deposit of chromium. The heating element is of the "Globar" type. The fires have 2-heat control and the loading is 2½ kW.

The latest addition to the range of "Met-Vick" products is an electric iron "de luxe," fig. 5, which is a feature of the display by METRO-VICK SUPPLIES. This iron is available in either nickel-plate or blue vitreous-enamel. A pressed-steel table stand is supplied with the iron. The rating is 550 watts, and the weight 5¼ lb. An improvement has been effected in the method of securing the flexible to the connector. A special cable clamp is fitted, which takes, it is claimed, all the pull off the actual connection, and the risk of breakage of the flexible at this point is entirely eliminated. This iron can also be supplied fitted with a new-type earthing connector and 3-core asbestos-braided flexible. The recently-introduced "Met-Vick" self-regulating kettle and the automatic kettle, both of which have already been described in detail, are also being shown. Demonstrations are also being given with the gyratory washing machine and the "Met-Vick" model "A" wash boiler. Storage water heaters and various types of immersion heaters are also included in the exhibit. The new "Met-Vick" bakelite lampholders and ceiling roses recently placed on the market are worthy of inspection, and samples of these accessories are available for testing purposes. The ceiling roses are provided with fixing holes of 2-in. centres, suitable for B.E.S.A. conduit boxes. By cutting away small portions of the rims, which are notched for that purpose, the roses can be used for surface-wiring systems. Pillar-type terminals of adequate size are provided for looping in, and the M.-V. patent cord-grip is embodied which, it is claimed, will support 56 lb. The lamp holders incorporate special cord-grip for all types of flexibles, special microme-alloy non-rusting springs, and the M.-V. patent solid plungers. For the illumination of the stand several fittings of modern designs have been installed. These include panel-type electroliers and brackets fitted with Gilbert-Riley glass-

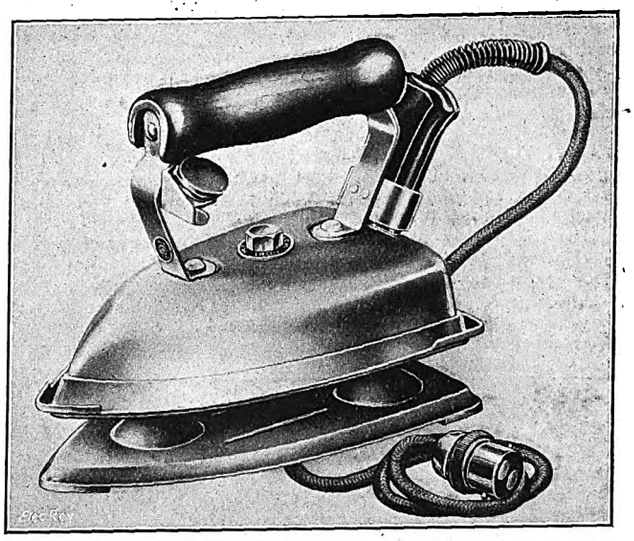

Fig. 5.—The "Met-Vick" Electric Iron "de Luxe."

ware. The new model "B" Savage health motor is also being demonstrated.

The Horseferry Road Sub-station.

Some notes on synchronisation and good time-keeping, together with details of recently installed metal-clad high-voltage switchgear.

IN November, 1895, when Ferranti's bold introduction of alternating current had proved it to be the most economical method of generating and distributing electricity in bulk, Mr. F. Hope-Jones forecast, in an electrical journal then known as *Lightning*, the electric clock of the future as one driven by a small continuously-running synchronous motor, geared down to make a mantelshelf clock and plugged into the consumer's a.c. supply circuit.

That is exactly what the Warren synchronous motor has achieved: it is self-starting under load, it reaches a synchronous speed in a second or two, it measures only 2½ inches square, and it consumes about 4 watts, or less, at 110 volts and a periodicity of 50 cycles per second, thus consuming only 3 or 4 units per annum.

Its construction will be recalled from published descriptions.*

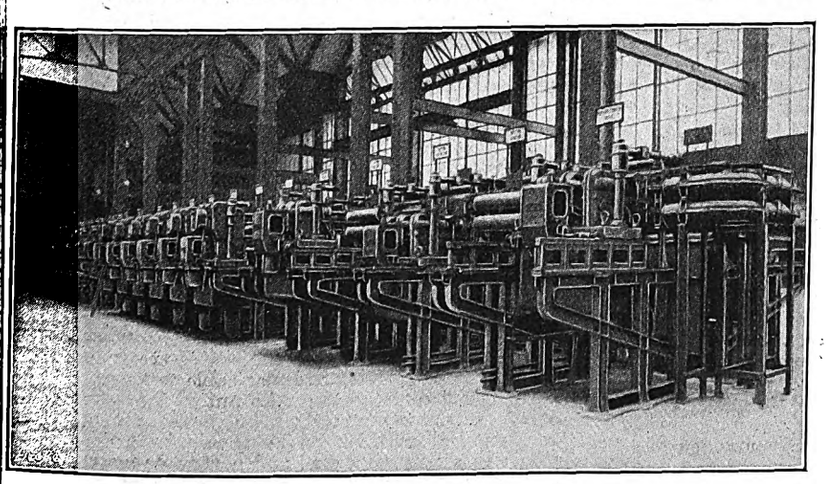

Fig. 1.—Metal-clad 22,000-volt Switchboard at Horseferry Road Sub-station, 30 sets.

An electro-magnet with its winding is provided with copper shading rings, which produce a rotating field; an iron armature is situated within the field and rotates in absolute synchronism with the frequency of the supply, owing to hysteretic drag. The spindle carrying the disk is geared down so that the main spindle revolves either once a minute, or once a second, as desired. All the moving parts are enclosed in a dust-tight housing containing oil in which the working parts are immersed.

Correspondents in the United States tell us that successful efforts are being made to keep the average frequency of their alternators in generating stations at a constant speed. For the purpose, the Warren Company supplies a good Graham dead-beat clock with a seconds pendulum as a master in each generating station, and provides a seconds hand concentric with a "Telechron" seconds hand, so that any lag, or advance, is revealed at once.

The linking-up of generating stations in Britain under the control of the Central Electricity Board will demand something better, and it is satisfactory to know that the London Power Co., Ltd., is combining the use of "Telechron" synchronous motors with the "Synchronome" system of electric clocks, which will give the various station engineers in the London area exceptional facilities for keeping their alternators in synchronism, not only at any given moment, but also true to time over a long period. In order to secure the correct speeding of the main alternators and synchronous phase operation of sub-stations, a Warren master frequency meter† has been installed in the Company's Horseferry Road station by Messrs. Everett, Edgcumbe & Co., Ltd., with whom the Synchronome Co., Ltd., collaborated in substituting its system in the various control stations, instead of ordinary clocks.

There is a great future before this method of wholesale distribution of uniform and fairly accurate time; how great and how soon it will arrive it is not easy to forecast; all we can say at present is that its star is in the ascendant. The tide of engineering development in the generation and distribution of light and power electrically has definitely turned in its favour. The use of alternating current is on the increase, and the linking-up of stations implies standardisation of periodicity, which demands accurate phase synchronisation, and that in turn demands good time-keeping.

The Horseferry Road sub-station is at present the main distribution switching centre of the London Power Company's interconnected system, and at that point five of the power stations and important distributing stations in the 22,000-volt system are linked together. Power will be supplied

* ELEC. REV., February 18th, 1927, p. 277.

† ELEC. REV., January 20th, 1928, p. 127.

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through the switchboard from the Deptford generating station and eventually also from the Battersea station, at present under construction, and feeders radiate therefrom to the St. Martin's Lane, Shorts Gardens, Amberley Road, and Pelham Street distributing stations, as well as to the rotary convertors and transforming plant situated in the Westminster Electric Supply Corporation's sub-station on the same premises. If not the biggest, it is one of the largest installations of its kind in this country.

The main board consists of 30 metal-clad Metropolitan-Vickers switches, fig. 1, fitted with duplicate busbars and oil circuit breakers having a short-circuit rupturing capacity of 500,000 kVA. The space available was insufficient to accommodate the board in one length, and it has therefore been erected in two sections, fig. 2, arranged back-to-back with a passage-way between them to allow access to the cable boxes. The larger section of the board contains 22 units, and the smaller section 8 units, with space for extensions as and when required; the busbar chambers on the two sections are interconnected. The original installation consisted of ten units only, and they were fitted with removable isolating plugs for effecting the change from one busbar to the other. The extension equipment was applied at a later period and included certain refinements of design and additional features to facilitate operation. In this case, selection of the busbars is made by a 3-pole oil-immersed selector situated in the hood of the circuit breaker and operated by a hand-wheel from the front. The selector switch is of the break-before-make type, and an interlock prevents the operation of the selector switch until the oil circuit breaker is in the open position.

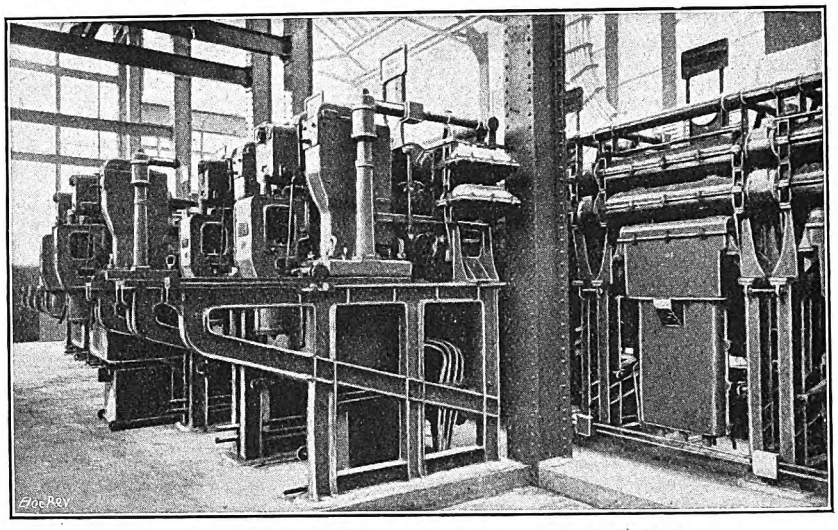

Fig. 2.—Back-to-back Arrangement of Switches.

The general design of the gear is similar to that of standard metal-clad equipment operated on the horizontal draw-out principle, with all the necessary interlocks. On the feeders which supply the Horseferry Road system special metering equipment is installed in duplicate. It consists of two special withdrawable carriages containing the current and voltage transformers necessary for operating Thomas pattern averaging recorders for metering purposes. Both sections of busbars are divided by bus-section units, and provision has been made for the addition of two further units that will control reactor equipment which, when it is installed, can be connected in either busbar as and when required. The busbars can also be coupled together by a switch when necessary.

All the type "K" oil circuit breakers are arranged for remote electrical operation from a vertical control board, which carries the usual instruments and relays and is surmounted by a mimic diagram on which the positions of the circuit breakers are indicated automatically by semaphores and indicating lamps. A special feature is that a white lamp on each panel shows to the operator whether the trip circuit is in good order or not, and the lighting-up of a green lamp indicates that the corresponding circuit breaker has been tripped automatically by the action of the protective gear; when this occurs a Klaxon horn gives audible warning to the operator and continues to do so until the control switch of the operated circuit breaker has been placed in the "off" position. All instruments are operated on the induction principle, and the system of protection adopted depends upon the circuit controlled and ranges from overload and leakage relays to a balanced voltage Merz-Beard equipment on the outgoing feeders.

Electric Steel Works in France.

La Société d'Etudes et de Construction Métallurgique, of Paris, has secured a contract for the equipment of the new electric steel works which are being established in Lorraine by the Société Minière et Métallurgique. At first two furnaces, one of 20 tons and one of 10 tons, are to be installed.

Legal.

Torquay Corporation Fined.

The Mayor, Corporation and burgesses of Torquay were the defendants in a case heard by the Torquay magistrates on May 27th, being summoned for failing to cover a high-pressure cable with insulating material, in consequence of which neglect Nicholas G. Perring was killed on April 4th last. A second summons charged them with failing to so insulate the cable to prevent danger as was reasonably practicable. The Corporation entered a plea of "Not guilty."

Mr. B. G. Saywell, a solicitor in the department of the Director of Public Prosecutions, said that the proceedings were instituted under the Factory and Workshop Act, sections of which applied to trades certified to be dangerous. Any breach of the regulations contained in the Act was punishable by a fine of £10, and if a person were killed in consequence of such a breach there was liability to a penalty of £100, part or whole of which might be passed on to the deceased person's family. The offence in this particular case took place at a sub-station in the Torbay Road, which would come under the definition of a factory. There was a regulation which laid down that all cables in such places should be covered with insulating material, or so placed and safeguarded as to prevent danger, so far as was reasonably practicable. The sub-station was equipped with transformers, h. and l.p. switch-fuses and cable boxes. On April 4th Charles Edmonds, an electrician employed by the Corporation, accompanied by Perring, entered the sub-station to wind a time switch. He heard a groan, and, turning round, saw Perring grasping one of the h.p. cables. He pulled Perring away by the coat, applied artificial respiration, and sent for medical assistance, but Perring died. The piece of cable was cut, and had since been subjected to a test. It appeared that a joint had been made in it, the ends having been fixed together with a brass ferrule. This joint had been covered with a few layers of empire tape. It appeared that the joint was made about eight years ago, when the equipment was installed in the sub-station. In 1924 an inspector visited Torquay and called attention to the treatment of conductors, and also to the manner in which the sheathing was done. Ten different instances in various parts of the system were particularly referred to. The inspector visited the sub-station again in 1928, and the Corporation's attention was again called to the need for satisfactory protection of the h.p. cable, but apparently nothing was done at that particular sub-station.

Evidence in support of the summonses was then called. Charles Edmonds described what happened at the sub-station on April 4th. Replying to Mr. P. H. W. Almy, solicitor for the defence, witness said that only authorised persons were allowed to enter sub-stations, and they had to take a mate with them. Perring was aware of the dangers of the stations. Mr. Kenneth Preston, divisional electrical inspector, stated that he had the piece of cable cut away, and on examination found a joint made by a brass ferrule, which had been covered with a few layers of empire tape. Such a cable should be out of reach or sheathed in lead. Vulcanised rubber covering was dangerous. He had tests made with the cable, and it was found that the insulation broke down at the joint at 900 V. In September, 1924, and again in April, 1928, he wrote to the Torquay electrical engineer calling attention to the need for sufficiently protecting h.p. cables. Cross-examined, Mr. Preston said that he did not agree that where only skilled and authorised men entered, such a high standard of protection was not needed as in places where the general public entered. As a matter of fact it was skilled persons who most frequently met with accidents. He did not think that the work prescribed by his letter of July, 1928, to the electrical engineer had been carried out.

Opening the case for the defence, Mr. Almy submitted that the regulations imposed by the Act were in excess of what was practicable. This particular cable was covered with insulating material, but the man who put in the brass ferrule in order to prevent an unsightly bulge did not make the insulating material as thick as he should have done. The sub-station was a very tiny one, and a very dangerous place, and no one was allowed there without special authority. It was impossible for anyone to say exactly how Perring met his death, and it was certainly not due to the Corporation's neglect. So far as the inspector's letter of September, 1924, was concerned, the whole of the points in it were dealt with.

Mr. H. F. G. Woods, borough electrical engineer, produced for the inspection of the magistrates the time sheets of the men who were employed in carrying out alterations at the sub-station in accordance with the suggestions of the divisional electrical inspector. What was then regarded as up-to-date gear was installed, but to-day it would not be so regarded. A fortnight before this accident occurred they were asked to install lead-sheathed cables. Mr. Woods declared that

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modern practice was in advance of Home Office regulations. Witness pointed out that Perring had no key to the substation, and could only go there with an authorised expert, and that, to all appearances, the piece of cable was perfectly safe.

The magistrates found the case proved, and fined the Corporation £100 and ten guineas costs.

Correspondence.

Correspondents should forward their communications* as early as possible. *No letter can be published unless we have the writer's name and address in our possession.

Resonance Control.

I shall be glad to know whether any manufacturer in this country is prepared to offer apparatus suitable for what is known as "resonance control." The system is used for the control of power lines during a peak period, and is operated by super-imposing a higher or lower frequency on the line in order to operate relays which, in turn, cut out switches which control water heaters and other domestic apparatus. I believe that similar systems have been in effective operation both on the Continent and in America for some time past, but so far have not seen any reference to British apparatus. The period of control is determined by the station operator, and need not exceed five- or ten-minute intervals for any given line.

Any information on this subject will be highly appreciated by

Resonance.

June 3rd, 1929.

The Compulsory Earthing of Prepayment Meters.

With reference to the letter under the above heading in our issue of May 31st, page 992, signed by "W. Overs, foreman, Crompton Parkinson, Ltd.," the company informs us that it does not employ anyone of that name, and disclaims responsibility for the statements in the letter. Unless someone can really answer the original question, this correspondence must now close.—EDS. ELEC. REV.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

30,222. "Headlights for motor-cars and other vehicles." F. H. Bluemel, H. E. R. Thomas and Bluemel Bros., Ltd. November 10th, 1927. (311,350.)

30,444. "Loud speakers and associated filter circuits." H. Green and Celebritone, Ltd. November 12th, 1927. (311,430.)

32,861. "Piezo-electric quartz resonator or oscillator." Radiofrequenz Ges. and H. Eberhard. December 4th, 1926. (281,728.)

33,959. "Tubular electric lamps." E. Pye and S. J. Heale. October 15th, 1928. (311,065.)

1928.

747. "Voltage-regulating means." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 9th, 1928. (311,351.)

813. "Process and apparatus for effecting chemical reactions in gases by means of electrical discharges." P. H. Hull and Imperial Chemical Industries, Ltd. January 10th, 1928. (311,352.)

2,895. "Drumstick fastening for suspension insulators." F. Berg. January 30th, 1928. (311,199.)

3,228. "Thermionic valve circuits." Siemens & Halske Akt. Ges. February 5th, 1927. (Addition to 279,452.) (284,706.)

3,311. "Electric switchgear." Allis-Chalmers Manufacturing Co. March 24th, 1927. (287,544.)

3,360. "Power generation and transmission systems." English Electric Co., Ltd., and C. J. Caldbeck. February 2nd, 1928. (311,201.)

3,674. "Electrolytic production of sterilising agents, germicides, and the like, and processes of applying such agents." United Water Softeners, Ltd., and E. B. Higgins. February 6th, 1928. (Cognate application 35,345/28.) (311,253.)

3,727. "Electric rectifiers." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). February 6th, 1928. (311,254.)

3,733. "Electrical accumulators." W. Haddon and J. M. Burnett. February 6th, 1928. (Cognate applications 3,734/28, 3,735/28 and 3,736/28.) (311,303.)

3,747. "Wireless receiving apparatus." F. Oliver. February 7th, 1928. (311,356.)

3,764. "Variable condensers." W. Rogers and Wingrove & Rogers, Ltd. February 7th, 1928. (311,209.)

3,798. "Apparatus for charging and discharging electric storage batteries." H. C. Hodges. February 7th, 1928. (311,214.)

3,878. "Charging stations for storage batteries." Siemens-Schuckertwerke Akt. Ges. February 25th, 1927. (285,901.)

4,021. "Electrical control switchboards." W. A. Coates and Associated Electrical Industries, Ltd. February 8th, 1928. (311,262.)

4,023. "Electric reproduction of sound." L. G. H. Cantle. February 8th, 1928. (311,305.)

4,046. "Apparatus for indicating electrically the value of a quantity at a remote point." General Electric Co., Ltd., and C. C. Garrard. February 9th, 1928. (311,307.)

4,145 "Train-control systems." Associated Telephone & Telegraph Co., and A. E. Hudd. February 9th, 1928. (311,309.)

4,169. "Adjustment devices suitable for use with variable electric condensers." Soc. Belge Radio-Electrique. February 9th, 1927. (285,048.)

4,238. "Arrangements for generating a progressive movement of a body susceptible of being subjected to the influence of electromagnetic fields." M. Surjaninoff. February 11th, 1927. (285,089.)

4,362. "Electrical control systems for elevators, hoists, and the like." Associated Electric Industries, Ltd. (Westinghouse Electric & Manufacturing Co.). February 11th, 1928. (311,445.)

4,366. "Acoustic devices such as loud-speakers." Electrical Research Products, Inc. May 11th, 1927. (Addition to 290,235.) (290,239.)

4,388. "Aerial systems." C. S. Franklin. February 11th, 1928. (311,449.)

4,389. "Employment of wireless apparatus." S. Richardson. February 11th, 1928. (311,450.)

4,392. "High-frequency signalling over wires." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). February 11th, 1928. (311,451.)

4,398. "Electric couplings, terminals, and the like." C. R. Cook. February 11th, 1928. (311,452.)

4,547. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. H. Paulett and C. Gillings. February 13th, 1928. (311,460.)

4,553. "Diaphragm for sound reproduction." H. Sachs and K. Locke. February 13th, 1928. (311,461.)

4,848. "Electromagnetic brakes." W. L. Spence. February 16th, 1928. (311,464.)

4,948. "Audio-frequency thermionic amplifiers." W. S. Smith and N. W. McLachlan. February 16th, 1928. (311,466.)

5,026. "Electric relays and like electroresponsive devices for use, for example, in electric protective systems." British Thomson-Houston Co., Ltd., and W. H. Lawes. February 17th, 1928. (311,469.)

5,318. "Electromagnetic drive units for loud-speakers and the like." G. W. Parr. February 20th, 1928. (311,476.)

6,045. "Wireless receiving apparatus." N. Bonavia-Hunt. February 27th, 1928. (311,485.)

6,052. "Electromagnetic acoustic devices for the interconversion of mechanical and electric oscillations, such as loud-speakers." British Thomson-Houston Co., Ltd., and R. D. Parry. February 27th, 1928. (311,486.)

6,117. "Manufacture of magnet cores for Pupin coils and the like." Felten and Guilleaume Carlswerk Akt. Ges. February 26th, 1927. (286,202.)

6,260. "Illuminated advertising devices." K. Rabes. October 22nd, 1927. (299,297.)

7,915. "Electric motor-driven centrifugal pumping units." Drysdale and Co., Ltd., and W. Drysdale. March 15th, 1928. (311,502.)

8,881. "Systems for producing high-frequency electric oscillations." British Thomson-Houston Co., Ltd. March 30th, 1927. (287,927.)

10,231. "Temperature compensators for use in magnetic measuring instruments." A. C. Spark Plug Co. April 8th, 1927. (288,313.)

10,811. "Wireless receiving apparatus of the crystal type." E. H. Sumner. April 12th, 1928. (311,524.)

10,965. "Wireless receiving apparatus." H. P. Hinton and Associated Electric Industries, Ltd. April 13th, 1928. (311,526.)

11,340. "Electric switches." Edison Swan Electric Co., Ltd., and F. Shergold. April 17th, 1928. (311,528.)

14,391. "Electric relays and contact-makers." H. R. G. Moore and L. C. B. Johnson. May 16th, 1928. (311,558.)

15,503. "Electrical ignition system for internal-combustion engines." R. Bosch Akt. Ges. July 14th, 1927. (293,851.)

15,969. "Electrically-heated dispensing pumps." W. H. Crawford. May 31st, 1928. (311,569.)

16,431. "Electric switches." G. Marr. June 6th, 1928. (311,572.)

16,712. "Mercury-vapour rectifier." Akt. Ges. Brown, Boveri et Cie. June 11th, 1927. (292,075.)

17,473. "Multi-lamp electric lighting apparatus." General Electric Co., Ltd., and E. L. Randall. June 16th, 1928. (311,579.)

18,501. "Manufacture of commutators." International General Electric Co., Inc. June 30th, 1927. (293,039.)

21,011. "Variable electric condensers." F. Pavlan January 21st, 1928. (304,583.)

22,074. "Electrical generating and distributing systems for internal-combustion engines." A. E. White (Indian Motocycle Co.). July 30th, 1928. (311,605.)

22,456. "Alternating-current induction motors." J. Gize. August 2nd, 1927. (294,966.)

23,305. "Sparking-plug for internal-combustion engines, and method of manufacturing the same." L. Bruzzone. August 13th, 1928. (311,611.)

23,699. "Headlamps of motor road vehicles." P. F. Howse. August 17th, 1928. (311,612.)

24,580. "Sparking plugs for internal-combustion engines." A. Coenders and C. Potz. August 27th, 1928. (311,617.)

30,001. "Means for reducing the eddy-current losses in the windings of alternating-current machines." International General Electric Co., Inc. (October 19th, 1927. (299,013.)

30,163. "Ignition testers for internal-combustion engines." Luderswerk Ges. and G. Slupinski. October 18th, 1928. (311,633.)

31,614. "Galleries for electric lamps." J. McLean. October 31st, 1928 (311,640.)

31,818. "Electric power systems for ship propulsion and other purposes." British Thomson-Houston Co., Ltd. November 1st, 1927. (299,812.)

32,671. "Aerial systems." Marconi's Wireless Telegraph Co., Ltd. November 8th, 1927. (300,211.)

35,613. "Electric discharge devices." British Thomson-Houston Co., Ltd December 2nd, 1927. (301,744.)

38,269. "Electric shuttle-operating devices for power looms." A. Jasicek and F. Polnauer. December 28th, 1927. (303,119.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 29th :—

Eldrive, Silence, Efficiency (lettering and design). No. 500,435. Class 6. Electric motors and parts thereof.—Electro-drives, Ltd., Curtis Buildings, Park Royal, N.W.10.

Varatio. No. 501,845. All goods in Class 6.—Variable Power Transmissions, Ltd., Britannia Works, Bassein Road, Shepherd's Bush, W.12.

Davco. No. 501,684. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Daventry & Co., Ltd., Mellings Yard, Friargate, Preston.

The Warrior (lettering and design). No. 501,032. All goods in Class 8.—J. Bridge & Sons, 31, West Warrior Square, Southend-on-Sea.

Embob. No. 497,468. Class 13. Electric irons, soldering irons, electric terminals, adaptors, switches, &c.—Maurice Bobin, 15, Farringdon Avenue, E.C.4.

MacKrolite. No. 500,290. Class 13. Lamps for motor vehicles.—Krolite, Ltd., Terminus Works, Gorgie, Edinburgh.

Visor. No. 500,152. Class 15. Reflectors, shades, globes and similar articles for use in connection with electric lighting, all being made of glass.—Benjamin Electric, Ltd., Tariff Road, Tottenham, N.17.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYR.—Workshop, for James Bowie & Co., Newmarket Street; the manager.

BARKING.—Factory, Creeksmouth; Coal Conversion, Ltd. Public health offices, Town Yard; Special U.D.C. Committee.

BEXHILL.—40 houses, Burnt House Farm; Gilbert Bros., Broadstairs. Schools; Church of England managers. Additions, British Legion Club, Station Road; J. H. Lye.

BEXLEY.—Houses (36), Broomfield Road; James and Norman. Development of Goldsmidt estate; Tuckett, Webster & Co.

BISHOP'S STORTFORD.—Nurses' home, for Board of Guardians; Elcock & Sutcliffe, architects, Northumberland Avenue, W.C.2.

BOGNOR.—Council buildings; C. Cowles Voysey, architect. Masonic hall (£5,000); J. Draper, architect.

BOURNEMOUTH.—Lecture hall, Malmesbury Park Road; Natural Science Society. Alterations, 719-735, Christchurch Road; W. S. White & Co.

BRACKLEY.—Re-erection of Cottisford Manor (mansion), for Mr. Bertram.

BROMLEY (Kent).—Additional 63 houses, for the T.C.; borough surveyor.

BUCKHURST (Essex).—Houses (54), Hurst Road estate, for Mr. Stokes.

BUCKLOW.—Housing scheme (34), Royle Green Road, Northenden, for R.D.C. (deposit £2 2s.); R. C. Cordon, engineer and surveyor, 24-26, Station Buildings, Altrincham.

CARSHALTON.—Houses (32), Banstead Road, for V. Shire.

CHELMSFORD.—Development, building estate near Sandford Road; R. P. Burgess, Braintree.

CHERTSEY.—R.C. church; Boy & Murley, Ltd., builders, Reading.

CROYDON.—Factory, Osborne Way; J. W. Hall. 33 garages, 6 workshops and bakery, Russell Hill Place; J. P. Oldacer.

DARENTH.—Workrooms, for training colony (£7,432); Frost and Sheehan, Ltd., Westminster, for M.A.B.

DIDCOT.—Senior school (250 places), for Berks. E.C. (£11,000); director of education, Reading.

EDINBURGH.—Cinema, for Provincial Cinematograph Theatres, Ltd. (£50,000); architects: W. E. Trent, London, and J. Jerdan, Edinburgh.

FALKIRK.—Cinema; John McKessack & Son, architects, West Regent Street, Glasgow.

GLASGOW.—Extensions, Parkhead 'bus depôt (£28,000); tramway manager.

GUILDFORD.—Conversion of Malthouse Tap into shops and flats, Portsmouth Road; H. E. Smith.

HEMSWORTH.—Infirmary block, for the Board of Guardians; clerk.

HERTFORD.—Re-erection of sawmill, Cole Green, for A. G. Mousley.

IRISH FREE STATE (Dublin).—Electric lighting installation at the Courthouse, Kilmainham, for County Council; J. P. Tierney & Co., consulting engineers, 44, Kildare Street.

JARROW.—Boys' central school (200 places); Roman Catholic rural dean.

KINGSTON-ON-THAMES. — Reconstruction of premises, Thames Street, for Wolfe & Hollander, Ltd., Tottenham Court Road, W.1.

KIPPEN (Stirling).—Extensions, Dun Eaglais, for Sir D. Y. Cameron.

LEAVESDEN.—School, for St. Pancras Board of Guardians; Herts. Education Committee.

LIVERPOOL.—School of commerce, for E.C. (£28,240); Roberts & Sloss.

LONDON (Poplar, E.).—Warehouse, High Street; W. J. Foster. Extensions, granary and laboratory, Alpha Road; J. Jarvis & Sons, Ltd. Buildings, Tredegar Works, Ordell Road; Wood Bros. Warehouse, 151, Bow Road; D. H. Klausner. Warehouse, 3-6, King Street; Commercial Structures, Ltd.

(Hornsey, N.).—Alterations and additions, Summerland Cinema, Summerland Gardens; A. Ferriss.

(Greenwich, S.E.).—Infant welfare centre, Shooters Hill Road (£3,150), for the T.C.; borough surveyor.

(Charlton, S.E.).—School (520 places) on Charlton Park housing estate, for L.C.C.

(Hither Green, S.E.).—Nurses' home, Park Hospital (£31,500); Paine & Hobday, architects for M.A.B.

(Wimbledon, S.W.).—Town hall (£139,113); Galbraith Bros., Ltd., Camberwell, S.E. Reconstruction, shops and houses, 67, 67a, and 69, Ridgway; E. Iles.

(Hammersmith, W.).—Library and child welfare centre, Wormholt estate, for B.C. (£10,670); A. E. Russel, contractor, Belgrave Works, Boundary Road, E.17.

LUMLEY.—School (216 places), for Durham E.C.; F. Willey, architect, 34, Old Elvet, Durham.

LUTON.—Town hall (£250,000), for T.C.

MANSFIELD.—Plaza Kinema; C. H. Hill, builder.

MERTHYR TYDFIL.—Extensions, General Hospital, including X-ray department, operating theatre, and nurses' quarters; Johnson, Richards & Rees, architects (returnable deposit of £10 10s.).

MIDDLESBROUGH.—Re-erection of warehouse, factory and workshops, for Dickson & Benson, Ltd. (£40,000 to £50,000).

NEW BARNET.—Elementary school, Cromer Road; Herts. Education Committee.

NEWCASTLE-ON-TYNE. — Rebuilding business premises, Northumberland Street, for Messrs. Chapman.

NEWPORT (Isle of Wight).—Reconstruction of Royal County Hospital (£15,000); John Seely, architect, London.

ROCHDALE.—Housing scheme (44), Rathbone Street; borough surveyor.

RYDE.—Reconstruction, Royal Isle of Wight County Hospital (£15,000); John Seely & Paul Paget, architects, 3, Queen's Square Place, Queen Anne's Gate, Westminster, S.W.1.

SCUNTHORPE.—Additions to secondary school, Doncaster Road, for Lindsey C.C. (deposit £2 2s.); Scorer, Gamble and Co., architects, Bank Street, Lincoln.

SLOUGH.—Houses (500), Farnham Road, for W. Gradwell and Co., Ltd.

SMETHWICK.—Extensions, Holly Lane Hospital; Roland Fletcher, borough engineer (returnable deposit of £2 2s.).

SUTTON (Surrey).—Houses (41), Green Lane, Worcester Park, for Messrs. Shuttleworth. Houses (22), Morden Way, for Braddy & Randall.

TADCASTER.—Extensions, Garforth Hospital (£9,500), for the R.D.C.; clerk.

TIVERTON.—Additional 29 houses, for the T.C.; borough surveyor.

TRANENT (East Lothian).—Roman Catholic school (£20,000); priest-in-charge, St. Martin's.

WAKEFIELD.—Two shops and village hall at Middlestown, for Middlestown Co-operative Society; S. P. Fairhurst, architect, Eastthorpe House, Mirfield, Yorks.

WATFORD.—Auxiliary pumping station, waterworks, for the T.C.; W. W. Newman, borough engineer (returnable deposit of £2 2s.).

WELLINGBOROUGH.—Boys' secondary school for Northants E.C.; Talbot Brown & Fisher, architects, Burystead Place (returnable deposit of £2 2s.).

WESTON-SUPER-MARE.—Extensions, public library, for the U.D.C.; Fry, Paterson & Jones, architects, 8, Waterloo Street (returnable deposit of £2 2s.).

YORK.—Workshops, Dennison Street; Welding Engineers (York), Ltd. Additions, Clifton Dale; H. Colman and Sons, Ltd. Alterations, Fishergate; National Glass Co. Extensions, Parliament Street; Marks & Spencer, Ltd.

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The

Electrical Review

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For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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Research in the Electrical Industry.

IN his Presidential Address to the I.M.E.A. last week (an abstract of which was given in our issue of June 7th) Mr. Nichols Moore stated that "electrical research was never so important as it is to-day." Unfortunately, the truth of what might appear almost a platitude is still quite inadequately recognised, when the practical test of financial support is applied, by most undertakings in the electricity supply industry. To this industry the ultimate benefits of research must accrue and by each of its members a due share of its cost should be borne. Continuous study and experiment must be carried out, if the conditions due to growth of load and the technical developments thereby necessitated are to be met in the most economical way. It will, we think, be conceded that the necessary research cannot be carried out so efficiently by individual interests as it can be by those interests acting in collaboration through the medium of a specialised body, such as the British Electrical and Allied Industries Research Association, usually referred to more shortly as "E.R.A."

Apart from the indirect advantages to the electricity supply section of a healthy state of affairs in the electrical industry as a whole, the more obvious ways in which it would be benefited through a proper provision for co-operative research are: (1) reduction in development charges, as reflected in the capital cost of apparatus; (2) greater reliability of apparatus throughout a probably longer life; (3) reduction in operation losses, and (4) reduction in maintenance costs. Investigations into the behaviour of switchgear under fault conditions may be mentioned as an example of the kind of research that is of direct importance to the supply industry.

Failure to interrupt short-circuit currents properly may be so disastrous in its consequences that heavy expenditure is justified in guarding against it. In two of the addresses delivered at the I.M.E.A. Convention reference was made to the cost of high-duty switchgear (in one case estimated at upwards of £20,000) to be incurred by an undertaking when connected to the grid.

The appeal of Mr. Nichols Moore for a more liberal support of E.R.A. was under-scored by the Chairman of the Electricity Commissioners at the I.M.E.A. annual dinner last Thursday week. The income of E.R.A. must be increased by at least 50 per cent. if it is to function

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effectively, and the fact that Sir John Snell travelled to Torquay at risk to the early recovery of his health for the purpose of placing the facts before a representative gathering is an indication of how seriously the position is regarded by one able to speak with full authority.

Finance is the crux of the situation, since technical skill is, beyond question, available to use any funds provided to the best advantage. It was therefore appropriate that Sir John's speech should have been addressed to an assembly, a large proportion of which was composed of men in a position of responsibility for sanctioning payments of this kind. Members of electricity committees have, as representatives of the ratepayers, the duty of checking waste of money. They have, as it is, to pass for payment subscriptions to several of the "allied associations" (as Mr. Nichols Moore called them) whose practical value they may imperfectly realise. In addition to this negative duty they have, we submit, the more positive duty of spending money on those objects which will make a return that is none the less remunerative because its effect is not immediately discernible in the trading account. The ability to do this is surely the test of the business man, but he must first know the essential facts.

The claims of the Electrical Research Association to financial support from the electricity supply industry have been pressed more than once in these columns—notably in our issue of February 17th, 1928, p. 283, when we advocated that much wider publicity should be given the Association's aims and achievements. It is very much to be hoped that the well directed publicity at the I.M.E.A. Convention will meet with the response that the appeal merits.

The Quest of Markets.

Now that the new Government and the electorate have had time to make a first estimate of what the new situation may involve, and that Cabinet Ministers have been examining their relation to their particular duties, we may perhaps be permitted to emphasise suggestions that we stressed a few weeks or months ago on unemployment as a national problem and one largely affected by world trade and Empire development. Concerning unemployment, it might be excellent if those whose departmental duty it is to produce safe schemes for dealing with the evil, assisted by some authoritative student of affairs with an impartial mind, were to collate all the promises and declared intentions so moderately passed over the broadcast, or delivered earlier in speeches, regarding possible remedies, so that some Cabinet committee could form a considered judgment regarding what could and should be done with confidence of support. Such a non-party inquiry was advocated by us in our issue of November 23rd, 1928 (p. 877). When writing of unemployment, we deprecated the subject being dealt with by men with political axes to grind, and advocated instead of men representing every shade of opinion sitting round a table together, sincerely bringing their whole-hearted and united knowledge, experience, genius, and sympathy to devise ways of relieving the situation with expedition. Unless we are mistaken, the nation, irrespective of party, is in a more or less chastened mood, and as the subject of unemployment is our greatest and most urgent issue we should prefer to see a non-party inquiry held quickly and any practical and really promising measures proceeded with without delay.

We will only touch upon one other matter at the moment, hoping that that too will be regarded as non-political. We refer to something which it should delight the heart of this Government to make: greater progress than in the past in the Department of Overseas Trade. We are constantly hearing it said that the only practical remedy for unemployment is to enable British overseas trade to revive and thus produce work. A measure designed to this end was the appointment of an Economic Mission to Brazil and Argentina (Elec. Rev., May 31st, 1929, p. 948). Let the new Government appoint quickly a number of such Commissions to visit possible markets and report upon them without delay. Can we drop excessive Party feeling for a time and push our trade?

Callender's Meeting.

The shareholders who attended last week's meeting of Callender's Cable and Construction Co., Ltd., must have been as gratified at the way in which the report was presented as at the satisfactory position which that report disclosed. Both Sir J. Fortescue Flannery, the chairman, and Sir Tom Callender, the managing director, made interesting comments upon the company's activities during the past year. We refer our readers to our "City Notes" for a report of the proceedings, but would like to mention one or two interesting points. The purchase of W. T. Glover and Co., Ltd., was an important development in which, apparently, some of the company's "friends" in the industry are participating, although the company carried out the million-pound transaction entirely on its own. The company can be congratulated upon a continuance of the flow of "bread and butter" orders to its works. It is this type of business which gives stability; special and large orders are, of course, very desirable, but they often mean a great deal of work for incommensurate profit and subsequent emptiness unless big contracts are ready to fill their space.

The chairman, in common with the heads of most other large electrical manufacturing concerns, stressed the importance to the company of its overseas business. It is always pleasing to hear of a British company strengthening and increasing its business in foreign and Dominion markets. Sir Tom Callender made a brief analysis of the company's overseas work during the past year. He "surveyed the world from China to Peru," and found Callender's in many places on the way—India, Burma, Persian Gulf, Jerusalem, Argentina, Chile, Brazil, South Africa, &c. A great deal of this business can be credited to Sir Tom's own activities. He has done for his company what a few other outstanding heads have done for theirs, and what we desire official Economic Missions to do for the country and its trade in general.

The B.B.C. Resignations.

The series of staff resignations which has taken place at the London headquarters of the British Broadcasting Corporation lately, culminating in Captain P. P. Eckersley's resignation of the post of chief engineer as from the end of September next, has caused considerable concern in public and technical circles alike. The termination of the services of important officials who have helped in no small measure to build up an organisation that is rendering public service and is regarded all over the world as an example to be emulated, cannot be contemplated without perturbation, and naturally causes one to wonder what the effect of the loss of men who have given long and good service will be on the future of broadcast radio-telephony in this country.

It will be recalled that some few years ago the National Physical Laboratory suffered a somewhat similar loss of skilled technical men who had proved their capacity because it was unable to pay salaries commensurate with those offered as an inducement to men of known worth to transfer their services to industry. In the case of the B.B.C., however, the suggestion that the financial consideration is one with which the Corporation is unable to compete cannot be seriously countenanced; the revenue derived from the service by the Corporation and the Treasury, through the General Post Office, is very considerable, and the proportion allocated to salaries is by no means clear from the published accounts. Moreover, hints and insinuations relative to recent "incidents" at headquarters are too persistent to be ignored altogether. Public fear that the intricate organisation may be jeopardised is not to be wondered at, and its anxiety to know the reason why can be well appreciated.

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Interlinked Swiss Stations.

One of the most recent electrical developments in French Switzerland has been the interconnection of the transmission systems of two Swiss companies.

By H. EALES.

THE Swiss "Compagnie Vaudoise," with its important power-station of Peuffeyre (of which mention has already been made), has made arrangements whereby the transmission system of the former can be linked with those of its other stations. Not only so, but by an agreement with the "Energie de l'Ouest Suisse" Company, the energy can also be transmitted to the Geneva-French frontier, thence to be passed on to a French company at Bellegarde, to which the Compagnie Vaudoise, subject to exportation laws, has promised as much as 25 million kWh per year for a period of ten years, with a maximum demand of about 3,500 kW.

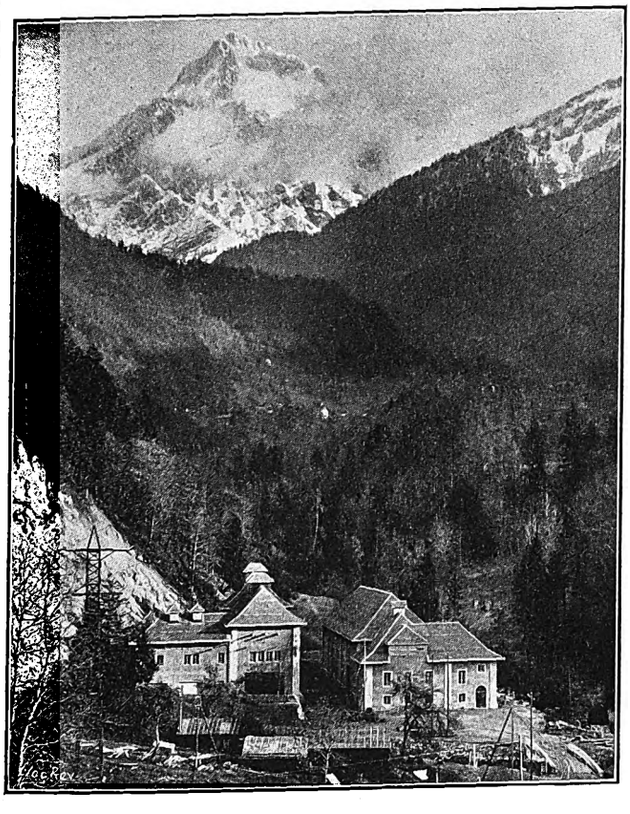

Fig. 1.—The Peuffeyre Power Station.

In order to carry out this plan successfully, certain adjustments have been necessary between the two Swiss companies, and the Compagnie Vaudoise has had to install a branch-line from Peuffeyre, fig. 1, *via* Malapalud-Montcherand, fig. 2, to the E.O.S. station at Romanel, whence the energy is conveyed to Geneva and across the frontier. By the agreement with the E.O.S. the Compagnie Vaudoise must so arrange its regulation that the power factor at which the energy is furnished at Romanel will correspond with that of its customers, which is guaranteed by the latter to be at least 0.85 at the Geneva-French frontier. The electricity supplied by the Compagnie Vaudoise must be at a pressure of 58 kV, the variation not to be more or less than 3 per cent., for the use of the Bellegarde Company, but the E.O.S. reserves to itself the right to raise that pressure to about 110 to 120 kV. The figures corresponding to these exchanges are as follows:—

Summer: Peuffeyre will yield from 0 to 11,000 kW over the Peuffeyre-Malapalud-Moncherand cables, divided thus: from 0 to 4,000 kW over the Malapalud to Romanel line, and from 0 to 11,000 kW over the Malapalud-Montcherand-La Dernier route.

Winter: a yield of from 0 to 5,000 kW by the works of La Dernier-Montcherand over the Montcherand-Malapalud-Peuffeyre lines, divided thus: from 0 to 3,000 kW over the Malapalud-Romanel cable, and from 0 to 2,000 kW over the Malapalud-Peuffeyre-Sublin route.

The Compagnie Vaudoise has installed a regulating station at Malapalud, capable of compensating for the variations of the voltage of the E.O.S. lines and those of the company, thus furnishing a junction between the two lines, and at the same time allowing a certain independance to each concern; the line thus works at a constant voltage between its two ends, Peuffeyre-Malapalud, with zero potential drop between them. The pressure on the line Peuffeyre-Montcherand is regulated automatically at the Peuffeyre works by varying the excitation of the alternators, and at Montcherand by means of a synchronous auto-transformer of 5,000 kVA installed in a sub-station close to the Montcherand works, so organised as to be used as a transformation, regulation, and distribution station. The connection of Moncherand with La Dernier, some 13 km. away, is insured by two overhead three-phase wires at a pressure of 40,000 V, with the neighbouring works of Montcherand by means of two underground three-phase cables at 13,500 V, and with the chief station of the Peuffeyre by means of overhead three-phase wires at a pressure of from 60,000 to 120,000 V. Engineers visiting Bex, or Glion, or the Rhone Valley, have no doubt admired the excellent installation at the Peuffeyre power-house, situated in that charming part of the canton of Vaud, with fine views over the Alps, and the Lake Léman.

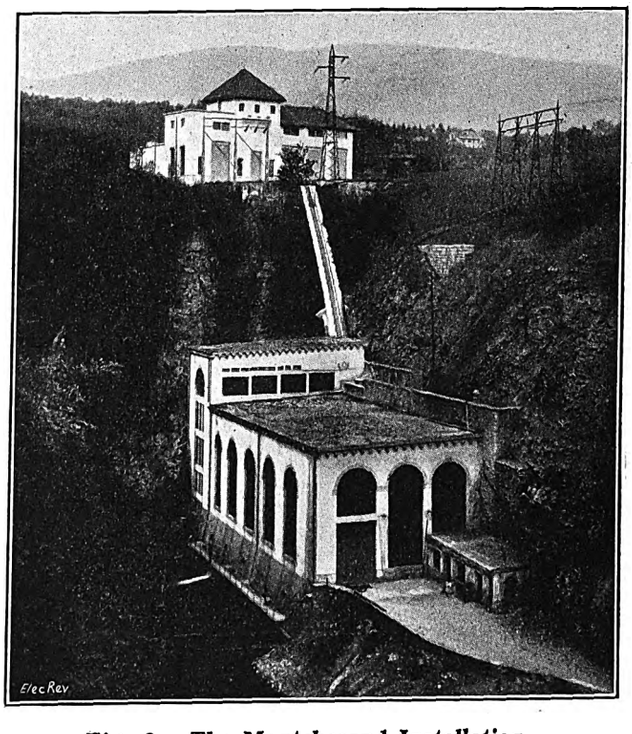

Fig. 2.—The Montcherand Installation.

The chief characteristics of the transformers at Montcherand are 5,000 kVA power for each three-phase winding, with a frequency of 50 cycles per second and a weight of 48 tons, oil included. Short-circuiting dis-

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tortion is avoided by means of a special spring-arrangement, preventing any possible distortion of the limbs.

Besides the synchronous compensator already referred to, of a forced ventilation type, running at a speed of 750 r.p.m., with an applied pressure of about 13,500 V on the current produced, there are two induction regulators for three-phase at 50 periods per second. One of them is branched between the circuit regulated at about 13,500 V of the principal transformers and the circuit of variable pressure (12,000 to 14,000 V) of the alternators of the Montcherand power-station. The function of this particular induction regulator is specially to limit the action of the synchronous compensator to the yield of wattless current necessary for the Montcherand-Peuffeyre line to the exclusion of that absorbed by the Compagnie Vaudoise. The other induction regulator is branched on between the circuit regulated at about 40,000 V from the principal transformers, and the outgoing circuit for the feeders supplying the line at the same pressure, variable according to the load of the feeders. This apparatus is calculated for 10,000 kVA, and both regulators are driven by a little three-phase motor. All the machines are furnished with thermometers, and an automatic electric warning is conveyed to the Montcherand works when the oil overheats.

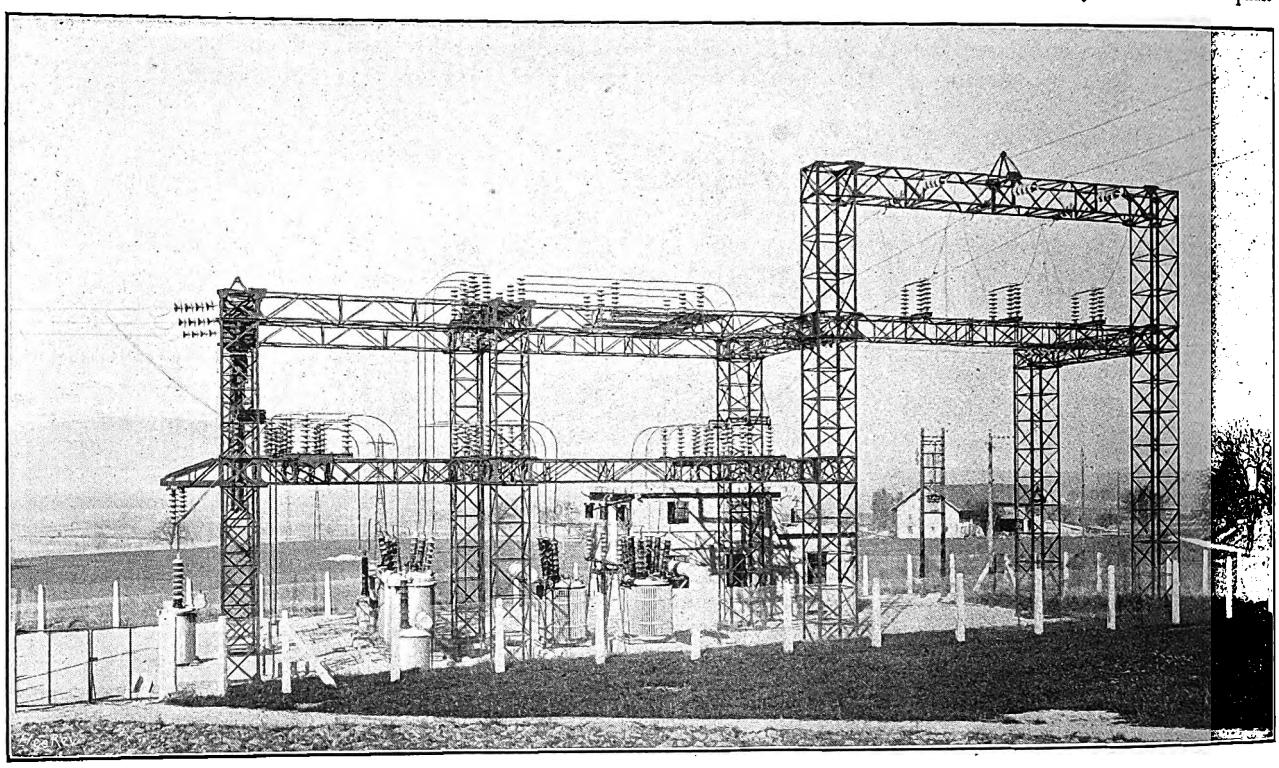

Fig. 3.—The Malapalud Sub-station.

The arrangement of the Malapalud station is somewhat different, as the latter is an outdoor sub-station, fig. 3, in the open country, situated at the juncture of the 58/116-kV Peuffeyre and Montcherand line, forming the link between the Compagnie Vaudoise and the "Energie de l'Ouest Suisse," at the point where the voltage of the latter line is the same, *i.e.*, Fully-Romanel-Geneva.

It has been installed in order to regulate automatically the power-factor between the two systems, and has a powerful quick-break switch of 120 kV, as well as the parallel connection necessary for operating the link between the two systems. The regulation of the power-factor is insured by a three-phase oil-immersed in-

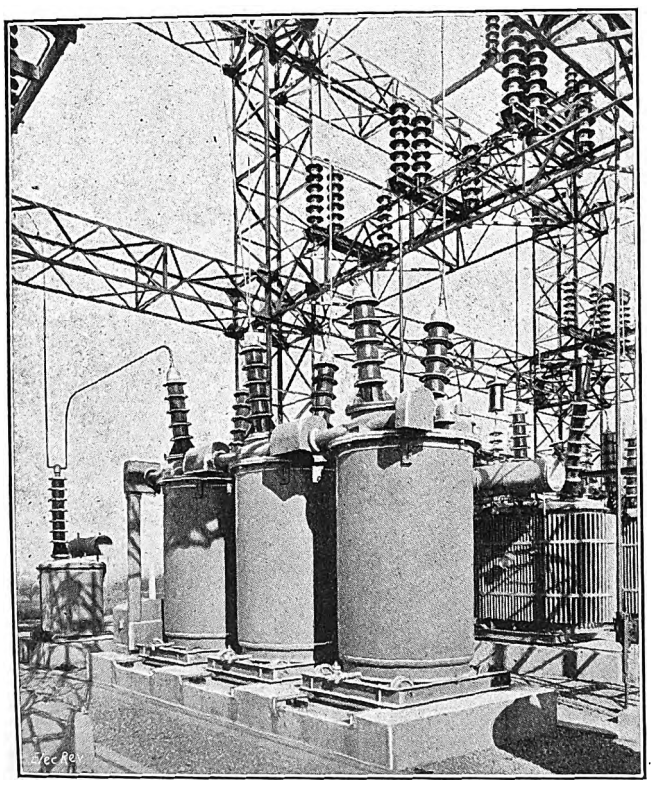

Fig. 4.—The Main Circuit Breaker.

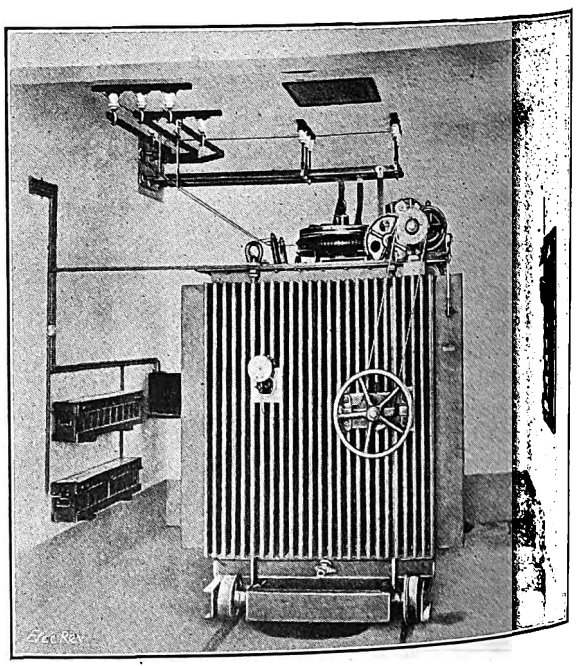

Fig. 5.—A Regulating Transformer.

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duction-regulator with a nominal capacity of 4,700 kVA. The pilot-motor of the machine is driven by a p.f. regulator in such a way as to keep the power-factor of the Malapalud-Romanel line at a predetermined value that is adjustable at will. All the machinery, together with switchboards, storage batteries, &c., is housed in a small stone building, while the 120-kV switch installation is in the open-air. The induction-regulator is branched on to the 58/116-kV Malapalud-Romanel line by means of two transformers as follows:—(*a*) An oil-immersed three-phase excitation transformer of 360 kVA for feeding the rotor of the transformer. It also comprises a coil at a pressure of 100 V which furnishes the current necessary for the p.f. regulator and for the synchronising instruments; (*b*) a three-phase oil-cooled series transformer of 410 kVA to feed the stator of the regulator.

The outdoor installation comprises the principal oil-cooled circuit-breaker of 350 amperes, fig. 4, with a short-circuit breaking capacity of 3,200 A, consisting of three single-pole sets connected mechanically. The apparatus is shock-proof, and operated by a servo-motor. Starting takes place under maximum current by means of relays set up in tanks, and acting upon time-relay regulators placed in the starting-box. The starting-spool is fed with direct current at 40 V, yielded by the accumulator batteries. This switch is connected electrically with that of the rotor of the induction-regulator, so that it is the chief switch that is set going first, thus starting the circuit-breaker of the rotor. The total losses in the regulator and the two transformers are 17 kW at no load and about 37 kW at full load.

There are three other transformers, *i.e.*:—(*a*) One single-phase oil-cooled pressure transformer for feeding the synchronisation instruments; (*b*) two oil-cooled current transformers with a yield of 25/5 A and 50/5 A, according as to whether operation takes place at 116 or 58 kV, to feed the p.f. regulator. By a system of bus-bars and section-breakers one can switch off the whole installation of the power-factor regulating gear should trouble arise, and in the case of the latter getting out of order the connection between the two systems can be ensured through the principal transformer.

The illustrations are reproduced by courtesy of M. Demierre, editor of the *Bulletin Technique de la Suisse Romande*, and of M. Nicole, director of the "Compagnie Vaudoise."

Applications of the Willans Line.

The significance of graphs and the indications they are capable of providing of the operating conditions of an electric power station.

By ROY BALDWIN.

THE use of graphs in practice is frequently avoided on account of the trouble of drawing them. Many of us have our doubts about our capability of drawing a symmetrical curve by freehand, and standard curves are not always at hand, yet the practical utility of graphs is well recognised. Graphs may be divided into three classes: (*a*) regular curves, (*b*) irregular curves, and (*c*) straight-line curves. The last mentioned are the simplest to draw and the easiest to understand; and it is best to use them whenever possible.

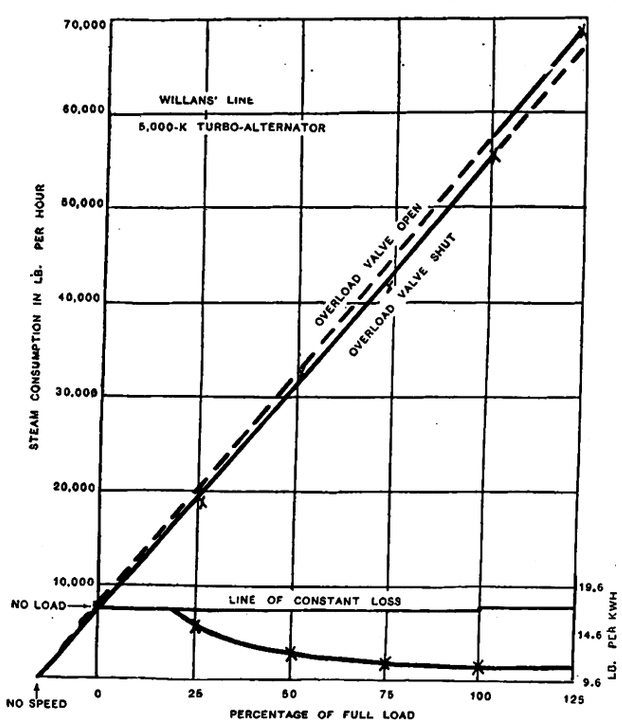

Fig. 1.—Willans Line for 5,000-kW Set.

If a straight-line graph is drawn of the total consumption of a turbine, and the line produced until it cuts the zero ordinate, the result is what is known as a Willans line. Mr. P. Willans first used this particular type of graph in relation to high-speed engines, but it is now frequently used for turbines. Fig. 1 shows a Willans line for a 5,000-kW set; the average line has been drawn from the consumption figures, and produced until it cuts the ordinate, that point indicating the steam consumption of the turbine when running light, and it may be checked by actual test. Produced further, the line reaches the abscissa at a point at which the speed of the turbine is zero.

The formula of the curve is of the nature $y = a + bx$, the constant losses, or the steam consumption at no load, being represented by a and b, is the slope of the curve, which is the tangent of the angle multiplied by the ratio of the scales used. Thus in this particular instance the formula is—

$$\text{Steam consumption} = 7{,}500 + 9.6 \text{ kWh}.$$

It will be noticed that the overload test is on an entirely different line, having a formula of its own. This is due to the fact that there is an extra set of nozzles in use; the no-load consumption is thus increased, due to the extra friction of the steam, and the slope of the curve is slightly raised. It is obvious that the two lines must meet at the point of no speed. The dotted part of the overload line is the estimated consumption at the various loads with the overload valve open.

It is often desirable to compare the steam consumption per kWh at various loads, and it may be done by a further construction. From the previous formula, where x = total kWh, the total consumption $= a + bx$. Dividing by x we get—

$$\text{Lb. per kWh} = \frac{\text{Total consumption}}{\text{Total kWh}}$$

$$= \frac{a + bx}{x} = \frac{a}{x} + b.$$

Thus b is now the constant figure and it may be imagined as the theoretical consumption at infinite load. The varying factor is merely the no-load value divided by the kWh. Thus, if a line of constant loss (or a) is drawn across the graph from the no-load point, a curve a/x may be drawn in the enclosed space, and if the

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valuation of the base line is fixed at b instead of zero, a consumption per kWh-curve is obtained which has been corrected to the Willans line. Such a curve is shown in fig. 1; for convenience the scale has been increased a hundredfold.

It will be noticed in the figure that the line of constant loss for overload rises on account of a being greater;

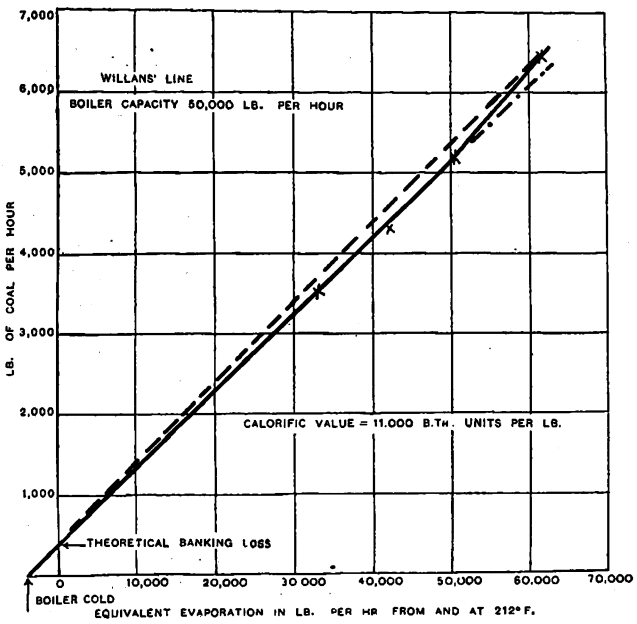

Fig. 2.—Willans Line for 50,000-lb. Boiler.

similarly, the consumption curve a/x will be slightly higher. There is also another addition that should be made due to the value of b being larger. This further correction may be avoided by drawing the curve higher, or, for practical purposes, it may be neglected.

A multiple-nozzle-governed turbine may be regarded as a machine with a series of overload valves; thus a series of steps will be obtained such as shown at full load in fig. 1. An average straight line drawn between the test points will give only approximate results. There is no single formula for such a case, but a number of formulæ with the constants increasing as each fresh nozzle comes into action.

Owing to the practice of only testing boilers in the region of full load, the utility of the Willans line for this purpose is not so great; however, the law still holds true and an example is shown in fig. 2. The calorific value of the coal in this case was 11,000 B.th. units per lb.; the coal for all four tests was taken from the same consignment and the laboratory analysis of the various samples closely agreed.

It will be seen in fig. 2 that the overload test is considerably above the projected average line, due to increased losses, such as unburned coal in the ash. It might seem at first sight that this is a parallel case to that of fig. 1, but it is not so. The opening of the overload valve of a turbine immediately alters the factors of the line, which remain constant with a varying load. In the case of a boiler, however, the factors are altering with every variation of the load, so the correct line is a curve upwards from the point of highest efficiency. For practical purposes this line may be drawn straight, generally from the full-load test figure as shown in fig. 2, although it must be remembered that this part of the graph does not follow the $a+bx$ rule.

Having shown that the consumptions of both turbines and boilers may be reduced to the Willans line with some measure of exactness, one naturally wonders if such a line may be drawn for the station as a whole, showing the relation between the coal consumption and the energy generated. If the calorific value of the coal is subject to wide variations, the figures will not follow the straight-line law. If the heat in coal varies 1,000 B.th. units, there will be an error of approximately ± 5 per cent., but in practice this discrepancy might not be so great, as when the quality of the coal increases the stoker, from habit, tends to keep the grate speed and thickness of the fire the same, unless the efficiency of combustion has been carefully watched. The use of old and inefficient plant over a long period and inefficient combustion also cause variations in the straight-line law, but these errors tend to even out in the long run.

If the input of coal and the output of electricity are reduced to the same common heat unit, variations in the calorific value of the coal will be automatically allowed for. In fig. 3 the unit chosen is 10^9 British thermal units: as in fig. 1, the a/x curve has been drawn in the area of constant loss and the value of the base line fixed at b; the scale is doubled. This curve gives the heat units of input required per heat unit of output, and the reciprocal multiplied by a hundred gives the thermal efficiency of the station; $100/b$ gives the maximum efficiency possible under the present conditions, but this must not be confused with the theoretical maximum efficiency, which is quite a different thing.

Another method of correcting for the varying heat content of coal is to base the line on the equivalent calorific value. It is not surprising that owing to the lack of standardisation in the chemistry of coal, equivalent figures are seldom used, yet equivalent evaporation has been in use for many years. In fig. 3 the same line may be used for the coal consumption in 10^5 lb. for an equivalent calorific value of 10,000 B. th. units per lb. Lines for other equivalent values may be drawn radiating from the point of no input.

The principle of the straight line may be also applied to the financial side of the undertaking with sufficient accuracy to be of interest, and in this respect it bears a resemblance to Pareto's law in economics. The capital charges, &c., will naturally form part of the constant costs. Repairs and maintenance will increase both of the constants, if the charges have been properly allocated, as, strictly speaking, they are a factor of the output. For instance, if a boiler has to be rebricked in a certain month, the cost should be spread over the months that the boiler has been working, not charged to the month when the repair was made; this may need a little extra calculation, which is necessary if accurate figures are to be arrived at. The cost of the coal is sub-

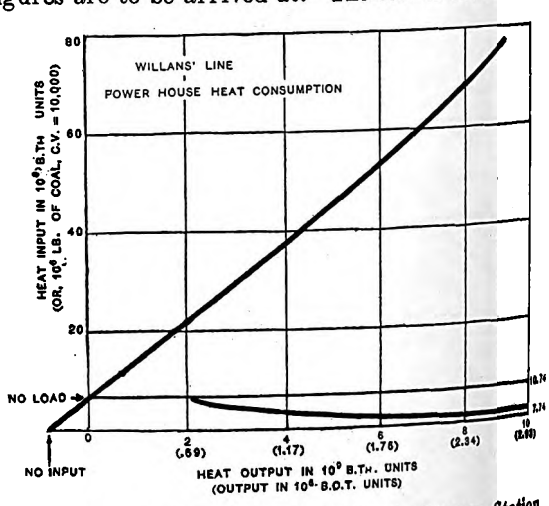

Fig. 3.—Application of W.L. to Power Station.

ject to the same source of error as the weight, but if the coal is bought on a calorific basis, as it should be, this irregularity will no longer occur. The constant loss of coal will form part of the constant cost; thus when considering a supply on a two-part tariff basis, this should be included in the charge. The straight-line graph of costs clearly shows the object of splitting the tariff into two parts, and it could be used for convincing consumers.

In conclusion, it may be said that the usefulness of the Willans line is becoming better known. Many of the large power stations in this country and on the Continent recognise it as a standard form for recording data, and the formulæ derived therefrom are confidently used. Thus, one may look to its increase and extended use in the future.

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Amalgamation and Specialisation.

A Weakness of Modern Industrial Conditions.

By H. C. PARSONS, F.I.S.A.

WE are to-day living in an age of amalgamation and specialisation. In every trade, profession, and industry the modern tendency is to split up the organisation into sub-divisions, each dealing with a particular portion of the trade, or profession.

This state of affairs is largely the result of amalgamation amongst our large industrial concerns, and the formation of combines having one huge head office and one centralised organisation, for controlling the whole of the business incorporated in the combine. It is interesting to consider for a few moments the effect of this particular aspect of specialisation and sub-division upon the future requirements for all-round capable commercial men.

Economically, specialisation is the concentration on and perfection of one particular phase, or function, of industry, and as each industry, or trade, is in itself specialised, so does each of the different departments to which the various portions of work are allocated become specialised in its own particular sphere. The old order is rapidly giving place to the new, and the capable all-round business man who could take charge of the complete business machine is slowly, but surely, giving place to the young departmental head, who has not had the advantage of a good all-round routine training in the various functions of his company's business, but has specialised in one particular branch, be it buying, accountancy, advertising, salemanship, or any other of the multifarious branches comprising a modern industrial organisation.

To a large extent offices and factories are becoming "mechanised" and the human element is being reduced to a minimum by making the being practically as much a machine as the one he, or she, operates. There is hardly any phase of office routine work that the machine has not invaded. Adding machines, calculating machines, time clocks, addressing machines, stamping machines, and others, all carry out operations formerly done by book-keepers and other clerks. By the use of such aids to efficiency persons operating them are in time bound to become experts in their alloted tasks, and whilst this certainly tends to cheapen labour, to reduce the margin of error to which the human element was always subject, and to execute the work more quickly, it does not tend to the same all-round efficiency, or personal interest, in the work that was conduced by the older order of things.

Whilst it is fairly easy to obtain and train a routine worker for one or more of the various duties in an office to-day, it is much more difficult to find an all-round expert for the control of the routine work of various departments. The writer does not for one moment wish in any way to deprecate the use of modern office machinery, which undoubtedly is a great boon, nor the very efficient organisation of many of the great industrial combines, but simply to point out one great weakness that is bound to make itself felt in years to come, unless opportunities are given the rising commercial generation to gain more all-round experience.

It is possible, of course, for any young man to gain all-round theoretical knowledge of the various phases of business life whilst carrying on his duties as a specialist in one, but, if he is on the staff of a large combine, his opportunities for practical experience in other departments will be very limited. It is here that the up-to-date private firm can afford ambitious young men, and women, opportunities for gaining all-round experience that would be denied them by the larger concerns. In the majority of cases the commercial managers of the smaller companies have been through several, if not all, the different departments of the organisation, and therefore have a practical knowledge of the whole organisation, although perhaps not expert at some of the routine work.

It may be argued that the executive head of the office should not be concerned with the routine work of the organisation, but should apply himself to the higher and more complicated phases of the business. This point must of course be considered, but the commercial manager who has had no experience of the routine work of his organisation, and has to entirely rely upon others to control it, is not likely to be head of an efficient and contented staff, unless he is very lucky in his choice of departmental heads, or is able to pay salaries to attract the best men to his business.

The same weakness is apparent in workshop and factory practice as in the office. To be a really efficient and all-round engineering works manager, for example, will require many years of practical workshop experience, experience that it will be hard to get even with personal self-sacrifice for a few years. Modern requirements are so specialised to-day that it requires years to acquire a good working knowledge of machine-shop practice, tool-shop practice, foundry work, pattern making, and drawing office work, before an efficient all-round works manager can be produced.

It is the avowed practice of some of our industrial concerns to take young men from the universities and train them for the higher posts by putting them in the different departments for certain periods. Whilst this method may have its advantages from a social point of view, it hardly leads to the encouragement of ambitious young men who cannot claim the advantage of a university education, neither is it conducive to getting the best out of the executive staffs, who well know that their chance of attaining to the higher posts is very remote.

Not only is all-round practical knowledge to be considered, but also the effect of the various routine duties upon the staff. Some duties are undoubtedly monotonous and somewhat tend to depress the employé; it is here that a practical knowledge of the work is of considerable help in allotting the tasks to the most suitable workers.

Economists attribute a good deal of the prosperity of America to standardisation and specialisation of both industry and labour. Whilst both undoubtedly tend towards the cheapening of a commodity and higher efficiency in organisation, they also lead to a much larger number of purely routine workers in industry and a shortage of all-round experienced business men.

As previously mentioned, the writer wishes solely to draw attention to one of the weaknesses of modern commercial organisation, which, if continued, will tend to leave our future business heads dependent very much on an army of individual specialists for the running of their businesses, knowing very little themselves of the actual internal organisation of their own concerns.

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Trade Marks and Trade Names.

In this article the author points out the differences, which are not generally appreciated, between infringement, trade libel, and passing-off in connection with trade marks, and also treats of registration in a general manner.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE number of legal disputes recorded in the columns of the Electrical Review on the subject of the infringement of trade names and trade marks indicates one of two things—either that there is a growing inventiveness on the part of the members of the electrical world to such an extent that several inventors think out the same device at the same time (a thing not unknown), or that there is a widespread ignorance or disregard of the law relating to trade marks. Most probably it is the latter, for it is extremely improbable that the maker of an electrical accessory should quite by accident hit upon some trade mark or design which almost coincides with that used already by some well-established manufacturer of a similar accessory. Still, there are cases, especially in the matter of trade names, where an accidental coincidence may take place. In the electrical world descriptive names are necessarily limited, and such names as "radio," "magnetic," and "electron," while being themselves at first merely ordinary dictionary words, may acquire a certain trade significance when applied to the products of a certain manufacturer.

The basis of the law relating to trade marks is protection to the trader on the one hand and to the public on the other. Before the trade-mark legislation of the last century the trader whose trade name or mark was copied had to rely on the ordinary law of libel or deceit for his redress. This branch of the law was made applicable to such cases, first on the ground that the infringement of a trade name was a fraud on the public, and secondly on the ground that the issuing of an inferior article under the established name of another trader might be a libel on the trader whose name was used. The action for "trade libel" still exists. A leading instance is provided by the famous Thorley case, in which the proprietors of a cattle food issued an advertisement warning the public not to buy cattle food purporting to be "Thorley's" unless it bore the signature of Joseph Thorley. At the same time they issued a circular stating that another firm (named by them) was foisting upon the public an article which was not genuine. The firm named brought an action and won, on the ground of trade libel.

The law of deceit as applied to trade names takes the form of the familiar "passing off" action. This was commonly the action brought for the protection of traders before the Trade Marks Acts. It is still useful as being applicable to those cases where a trade mark has not been registered, or where the name or mark which is infringed is not such as could be protected under the Trade Marks Acts. The protection given to traders under these Acts is much better than that afforded by the old actions for libel or passing-off. For the protection is absolute. There is no need to prove deception (as in the case of the passing-off action) or to prove damage, as in the case of trade libel. All that has to be proved is that the offending trader has copied another's registered mark. This is not always an easy matter, although it may sound simple. Most of the trade-mark actions to-day are fought over the question of fact, whether the offending mark does in fact copy the registered mark, or whether the thing that is copied is part of a "trade mark."

It becomes necessary to consider at the outset what exactly a "trade mark" is. By Section 3 of the Act of 1905, a "mark" is "a device, brand, heading, ticket, name, signature, word, letter, numeral, or any combination thereof." A "trade mark" is a "mark used or proposed to be used upon or in connection with goods for the purpose of indicating that they are the goods of the proprietor of the trade mark by virtue of manufacture, selection, dealing with or offering for sale." The wording of this definition indicates another advantage which is given to traders by the Trade Marks Acts. A mark "proposed to be used" can be registered. It need not ever have actually been used. But in the old form of action for passing-off, the plaintiff must show that he has used the trade mark for such a length of time as to establish an exclusive right to it. Under the Trade Marks Acts no use of the mark need be proved.

The mark must be intended for use in this country, and if not used for five years after registration may be struck off the register. Moreover, the mark must be intended for use "upon or in connection with goods" for the purpose of showing whose goods they are. A mere name devised to indicate an invention, such as "leather cloth" is not a trade mark. But "Rexine," indicating a special manufacture of leather cloth, is a trade mark. The rule laid down by the judges is that "it is essential that the name should indicate not the article only, but also that the article is manufactured by the person claiming the trade mark." It is not, however, necessary that the actual name of the trader should appear. So long as the mark is used in connection with goods, it does not matter how it is used. It may be on the wrapper, on the article itself, or on a tag tied to the article. But it must always appear somewhere when the goods are sold. To put it only on the packing case where the public will not see it when the goods are sold over the counter will not entitle it to the rank of a trade mark.

Under the Trade Marks Acts a register is kept of all trade marks. A mark may be registered when it falls within the following classes:—(1) The name of a company or individual represented in a particular manner; (2) a signature; (3) an invented word or words; (4) a word having no reference to character or quality, and not being a geographical name or surname; and (5) any other distinctive "mark."

The invention of a trade mark is not so easy as might be supposed, and the register should be searched in order to prevent any collision with similar marks afterwards. The Registrar may refuse to register a mark on the ground, among others, that the mark is similar to one already registered; nevertheless, collisions do occur, and it is better to be wise before the event.

Registration in Part "A" of the register gives the applicant the right to the exclusive use of the mark for ever. But during the first seven years of registration the mark can be attacked by any person on the ground either that the mark was obtained by fraud, or that it is scandalous, deceptive, or immoral. And the correctness of the register may be questioned by any person who claims a superior title to the mark, or can otherwise show that registration ought not to have been made.

Part "B" of the register contains trade marks which were in use before the Act for at least two years. Registration in Part "B" confers only a limited right. When an infringement takes place, the mere fact of

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infringement will not confer a right to obtain a legal remedy (as will registration in Part "A"). The defendant can show that, although his mark copies the registered mark, it is not such as would lead to confusion, nor is it calculated to deceive. So that no exclusive right is conferred by registration in Part "B," only a right to prevent deception or confusion. In this way the action for infringement under Part "B" is somewhat similar to the passing-off action. In both the question of deception is raised, and the action succeeds or fails on the strength of the evidence as to the deception of the public. In the trade-mark action the plaintiff has only to prove infringement, and the defendant must *disprove* deception; but in the passing-off action the plaintiff must *prove* at the outset that the defendant has deceived the public by the passing-off of his goods as those of the plaintiff. As to what actually constitutes an infringement, and the evidence which will prove or disprove it, is a matter for further discussion.

Teaching Electricity.

The author advocates the inclusion of "non-technical electricity" in the primary school curriculum.

By N.S.

ELECTRICITY in the school curriculum is not a suggestion; it is a necessity. The time has come when compulsory lessons in elementary electricity are as essential to the growing generation as lessons in civics and morals. To realise this, it is only necessary to consider how vital electricity has become in everyday life, and how deeply and thoroughly it has permeated the entire social and national fabric. Although the definition of electricity has so far proved an unsolvable riddle to engineers and scientists, all are aware of the illimitable benefits it confers on mankind, and that to-day it ranks as the most vital factor in improving the standard of living, and in adding to the comforts of all and sundry.

It does, or can, provide our homes with heat, our factories with power, and our homes, shops, factories, streets and even roads with light. It forms the basis of the telephone, wireless, and innumerable other conveniences of modern civilised life, which add so much to our comfort, or deduct so much from our daily expenditure of energy.

This is a time when much is being said and written about electricity—about the "Grid"; cheaper rates of charge; hire-purchase systems; methods of selling and of advertising. It is almost incredible that the simplest, cheapest, and most effective and permanent form of advertising has been overlooked. The juvenile mind is the most receptive, and no subject lends itself so well to being made attractive to the average boy and girl as "electricity in the service of man."

However, it is not from the point of view of advertisement that this article is primarily written, but because of the national necessity for the inclusion of the subject of electricity in the primary school curriculum.

It is axiomatic that if any radical reform in the social code is to be effected, the simplest and most successful method is by inculcating it into the minds of the younger generation. It is not suggested that a radical reform in electricity is necessary, but there is a necessity for a wider utilisation of its benefits, and a greater realisation of its potential possibilities.

Let us see first why electricity should be taught in the schools—then how it should be taught—and finally—what results we might reasonably expect from its teaching. Electricity has become part of "our daily bread." It touches the life of each individual in so many different spheres than an elementary knowledge of it should be in the possession of all.

In every field of activity where it has been applied, its beneficial influences have been conclusively proved. Its wider adoption is only limited or retarded by the "electrical" ignorance and indifference of the ordinary public. It spells advancement, and there seems to be ingrained in the human make-up a conservatism against all forms of advancement. Such conservatism can only be overcome by education—not, as many erroneously believe, by "push" sales methods or extravagant and indiscriminate advertising—and the obvious place to apply this education is in the primary schools.

If a general conception of electricity and its uses were implanted in the juvenile mind, it would be the first and most important step in eradicating conservatism, overcoming the present widespread indifference, and would tend to produce enthusiastic crusaders in the cause of electricity.

It is not a "dry" subject, and if properly presented, would prove so interesting that the young student would be anxious to delve deeper into its secrets and possibilities. We have only mastered the rudiments of electricity, and while present advancement is certainly rapid, it would be many times more so, if universal electrical education were adopted.

It is necessary that the public should be educated in regard to the cost of electricity, for the average man in the street does not view this matter in the correct perspective. Let teaching follow the line that the cheapness of electricity cannot be judged solely by £.s.d. standards, but by standards of life, of comfort, and of convenience, for the supply of electricity is not a commodity but a service; and that service which attains nearest to perfection in modern civilised life.

The main thing is not to teach the growing generation "electricity," but to teach it to think electrically and to live electrically. The more essential and simple elementary facts should be taught, but the main programme should deal with what electricity is doing for mankind, what it can do for mankind, and what it will do for mankind.

Stress should be laid on those little everyday applications of electricity which add so greatly to our comfort, convenience and amusement; on those bigger applications in commercial and industrial life, which add so greatly to our national wealth and have proved so vital in raising the standard of living of all grades of society; and on those finer applications in medical science and similar spheres, which are doing so much to alleviate suffering and to increase the individual and national welfare.

The inclusion of this extra subject will not lay a great burden on the teaching profession, for it is not suggested that any attempt should be made to impart technical knowledge of electricity to primary school children. Many of the leading men in the electrical world would not consider it beneath their dignity to compile for the guidance of teachers a small book which would adequately meet the requirements without loading it with terms or technical knowledge, which would confound the juvenile mind.

The direct result of this electrical education would be the gradual and sure elimination of the universal in-

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difference, replaced by an enthusiasm for everything electrical. A wider knowledge would lead to the wider adoption of electrical methods with increased demand for electricity and electrical appliances. This is what all branches of the electrical industry are clamouring for, through all kinds of societies, committees, and advertising channels. The wider application of electricity will inevitably result in cheaper electrical supply and cheaper appliances. This is what the public is waiting for.

National interest would be a vital force in stabilising the electrical industry, which, by virtue of its innumerable ramifications is, or should be, the most vital industry to the nation.

Indirectly, this education will give an impetus to electrical research, invention and development, and it is difficult to anticipate just where electricity will stand when the present generation has grown to manhood. It is sufficient that it will be imbued with the electrical idea; and will be ever ready to contribute in all ways to this branch of science, which has already proved so vital to modern civilisation.

Radio Battery Eliminators.

Some notes and advice on the practical aspects of anode-circuit battery eliminators which should be serviceable to the user.

By F. E. SCHOFIELD, A.M.I.E.E.

ANODE-BATTERY eliminators are now considered to be a necessary part of the equipment of any wireless receiver having three or more valves, providing a mains supply of electricity is available. A properly designed eliminator is capable of superior performance to that of any form of h.p. accumulator, or dry battery, principally owing to the fact that a steady unfailing supply of energy is assured.

Now that a.c. is becoming recognised as the standard form of supply for general domestic use, and we are rapidly approaching a standardised supply voltage of 230 volts, it is becoming possible for the manufacturer to provide a standard eliminator. This will not only result in a reduced cost, but will eventually produce a more economical and possibly more efficient article.

Anode-battery eliminators can be divided into two sections: the rectifier, the sole function of which is to provide a unidirectional current; and the filter, which smooths out the irregularities of the rectified supply. The rectifier portion can be divided into two main types: valve rectifiers and metal-plate rectifiers. The valve rectifier scores on the matter of cheapness and, providing the maximum rectified current drawn from it does not exceed about 30 or 40 milliamperes, it gives a perfectly satisfactory performance. It is, therefore, the best type to use for the ordinary form of three- or four-valve set, using valves of the ordinary standard type. This form of eliminator will supply sufficient h.p. current to operate the usual forms of cone or horn types of loud-speaker, and give adequate volume for everyday household requirements. For the five- or six-valve superset, particularly when fitted with low-frequency valves of the super-power type, or when moving-coil loud-speakers are in use, the metal-plate type of rectifier is to be preferred. The latter form of rectifier is also to be preferred for large amplifiers for concert or dance halls and public-speaking equipment of the permanent (non-portable) type.

The metal-plate rectifier comprises a copper-oxide disk assembly which receives a supply of a.c. from a transformer at a pressure a little in excess of the desired rectified pressure. The difference between the two pressures represents the losses in the copper-oxide unit. This is the first advantage of the metal rectifier; it is possible to utilise a plain type of transformer with one primary and one secondary winding only, which not only ensures simplicity in the design of the transformer, with a consequent reduction in manufacturing costs, but also enables the designer to concentrate on producing a more efficient instrument.

The second advantage of this type of rectifier is that high plate voltages can be obtained for the last one or two stages of the amplifier without introducing excessively high transformer secondary pressures. In the case of the valve rectifier, using the standard form of full-wave rectification, the secondary of the transformer must be a centre-tapped winding, each half of which must give the required rectified pressure, plus an amount to cover the losses in the valve. Even for quite modest forms of valve-type eliminators it is possible to have a total pressure of 500 volts, or even more, across the ends of the secondary winding.

The amount of current which can be drawn from the copper-oxide rectifier is limited by the permissible temperature rise of the plates. If the temperature rises above the critical figure, breakdown of the oxide film is liable to occur and the rectifier may be permanently ruined. To guard against this possibility the rectifiers are carefully rated and marked with their carrying capacity by their makers and, in addition to arranging for the satisfactory ventilation and cooling of the elements, it is usual to stipulate a temperature rise which must not be exceeded under any condition. With these quite ordinary precautions the rectifier can be assumed to have an almost unlimited life, and with reasonable care will last for years. It is a simple matter to provide a sufficient number and size of elements to meet any ordinary demand, and currents up to 200 milliamperes, or more, can be very easily obtained at pressures up to 400 volts, if necessary. Providing the ventilation is efficient and the temperature rise is kept within the maker's limits, this part of the equipment, when once installed, can be practically forgotten. As regards cost, the metal-plate rectifier is obviously more costly to produce than the valve type, but against the cost we have to consider valve renewals and the extra cost of the transformer with its minimum of two centre-tapped secondary windings, one of which, as stated above, may have to withstand a working pressure of 500 volts, or more.

Referring to the filter, here there is more scope for the individual efforts of the manufacturer, but the basic principle covers a series of two or more reservoir condensers, and one or two smoothing chokes. It is customary to provide one condenser immediately after the rectifier and a further one after each choke. The larger the condenser the more even will the pressure curve become, but against this, consideration must be paid to the maximum output of the rectifier, to ensure that the latter itself, whether of the valve or plate type, is not overloaded at the moment of charging-up the condenser after discharge. It is usual in this country to confine the choke to the positive pole only, as this arrangement is found to give quite satisfactory results. When the supply is particularly "rough," and in almost all cases of d.c. eliminators, chokes on both poles may be used.

The last, and to the user the most important, part of an anode-battery eliminator is the means provided for obtaining different voltage tappings for energising the various valves, or stages. If the eliminator is to form an integral or permanent part of a factory-made wireless

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receiver, the eliminator should be designed to feed one voltage only into the receiver, and the latter should be fitted with some form of anode-feed system. The most satisfactory arrangement is the method so ably sponsored by Messrs. Ferranti, Ltd.,* in which the anode supply to each valve, or stage, is fed through a separate wire-wound fixed resistance of a value suitable to the plate current and voltage of the stage, and each resistance is provided with its own individual by-pass condenser, connected between h.t. negative and the valve end of the resistance. This arrangement entirely prevents interaction, or "motor-boating" as it is more commonly called, from taking place; the unwanted h.f. component is harmlessly by-passed through the condenser to earth. There is, further, a distinct advantage in fitting these condensers as near to the valve circuit as possible, thereby cutting out long leads. From this point of view it is preferable to incorporate the resistances and condensers in the set itself, with a corresponding simplification of the eliminator.

When, however, the eliminator is designed to be retailed as a separate instrument for use with existing sets, it becomes necessary to introduce means in the eliminator to provide the various different voltages. It is a somewhat different proposition to design an eliminator that will be adaptable to all types of receivers. In contrast to American practice, it is becoming increasingly evident in this country that the simple potentiometer resistance as a means of obtaining a number of variable tapping points is not entirely satisfactory, and in certain types of receivers this method of tapping can be traced as a direct cause of instability. The most satisfactory arrangement, and the method which is now almost standard, is a modification of the anode-feed system, in which variable resistances of the carbon compression type are provided for each tapping required, and each resistance is fitted with its own by-pass condenser, connected between the receiver side of the resistance and h.t. negative. Variable resistances have the advantage that the anode voltage to each part of the receiver can be varied between quite wide limits, and the most satisfactory operating point obtained. The only objection which can be raised to this form of resistance is the risk of packing of the resistance material, which defect will not occur to any serious extent in a well made and well designed article, providing care is taken not to overload it. There, however, seems to be a tendency on the part of some makers to rate the capacity too highly, with the result that the resistance tends to run hot. This should be avoided, and if overheating occurs the current should be reduced by increasing the resistance, *i.e.*, turning the knob so as to reduce the pressure on the carbon contents. When anode-bend detectors, or screened-grid h.f. valves, are to be supplied it is preferable to provide means for preventing minute fluctuations in the anode current. It is usual in such cases to arrange for a suitable resistance to be connected across the full h.t. supply of the eliminator and to provide a tapping point, which may be either fixed or variable, to give the correct voltage. To prevent interaction, a separate resistance must be provided for each tapping required and each tapping must have a by-pass condenser connected as before described.

One defect of the present form of anode-battery eliminator is the inability to vary the maximum tapping voltage to suit the load on the eliminator. From the above it will be gathered that the maximum voltage which can be obtained from any particular eliminator is decided by the secondary voltage. Unfortunately, all wireless receivers do not require the same maximum anode voltage, and the amount of current necessary depends entirely on the number and type of valves fitted to the receiver. Owing to the inability to obtain perfect pressure regulation in the transformer, it is usual to find that an eliminator designed for a maximum output of 100 milliamperes at 200 volts will have a no-load e.m.f. of from 300 to 350 volts. If such an eliminator is connected to a simple three-valve receiver with a demand of from 20 to 30 milliamperes at 120 volts it is obvious that the maximum h.t. tapping will be at a figure too high for the set and an excessive strain will be put on the condensers and other components. It is useless to specify what the maximum current output of the eliminator is without providing a curve, or chart, indicating the output voltages at various loads from the maximum down to the minimum. Even when this data is available it is obvious that the resistances must be capable of absorbing an additional 100 to 150 volts if necessary. Several instances of trouble have come to the writer's attention from this cause. Either due to mistaken enthusiasm on the part of the purchaser, or inadvised pressure on the part of the salesman, eliminators have been purchased of comparatively heavy current outputs with a view to meeting future requirements, and the eliminator has been used for a time to supply two- or three-valve sets of the simpler types used in conjunction with small cone loud-speakers, and having a current demand of a quarter to half the maximum output available. In consequence, the receiver generally receives too high a plate voltage, unsatisfactory performance results, and the owner may be the victim of a very unpleasant experience if he is ill-advised enough to touch any part of the output side of the eliminator whilst it is supplying current.

Means should, therefore, be provided in every eliminator for adjusting the secondary voltage to suit the output of the filter section and to suit the immediate requirements of the user. This can be arranged by providing three or four tappings on the secondary winding and furnishing a table indicating the maximum h.t. output of each tapping and the pressure variation with various loads on each. An alternative method that is used to some extent in America is to fit a series resistance on the primary side of the transformer to permit of a certain amount of regulation being carried out without disconnecting the receiver, and if necessary without switching off the current. This resistance must, however, be of sound construction throughout, as it will be connected permanently on the mains side of the transformer and will have to withstand the full mains supply voltage to earth. The fixed tappings on the secondary winding would appear to be the most suitable arrangement for general use, as it does not entail any additional apparatus and cannot easily be abused. If, in addition, a complete chart, or curve, is provided for each tap of the secondary it will be an easy and interesting operation to select the most suitable pressure for each receiver, paying due regard to the maximum voltage demanded by the last valve and the total anode current required for all stages. The correct anode voltages for the intermediate stages would be taken care of by means of the existing variable resistances without any risk of overloading either the resistances or the valves.

* ELEC. REV., May 3rd, 1929, p. 807.

Motors for Colliery Winding Engines.

In a recent issue of *La Revue de l'Industrie Minerale*, Mr. Pauzat discusses the question of the use of asynchronous *versus* d.c. motors in connection with colliery winding engines. The author bases his remarks on the results obtained with the electrically-operated winding engines installed at the No. 4 and No. 5 pits of the Drocourt Co., one of which is operated by an asynchronous motor and the other by a Ward-Leonard type d.c. motor. the coal-raising operations at the two pits being practically identical. From the point of view of installation cost, the ratio is as 2 for the d.c. motor to 1.2 for the asynchronous motor; consequently to warrant the extra outlay, the d.c. machine should possess distinct advantages. The author admits that the d.c. motor is capable of great flexibility as regards range of operation, but he submits that the drawbacks of asynchronous motors in this connection have been greatly exaggerated. Another advantage of the d.c. motor is the possibility of recuperating energy on the descent of the cages, an advantage which is not possible with asynchronous motors, except at the expense of simplicity and strength. On the other hand, the consumption of asynchronous motors for similar work is 12 per cent. less than that of the d.c. type.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Cable Ferrule.

The object of an invention by Mr. P. L. DeVoy, 95, Milton Road, Stoke Newington, N.16, is to provide an improved metal ferrule for the jointing of electrical cables and wires, fig. 1. While the ferrule is cylindrical throughout its length and of a similar size to the cable to be jointed, an internal section of oval shape allows a space of 1/16 in. at either side of the cable for the insertion of molten metal through three holes in the body of the ferrule. A grub screw at equal distance from either end of the ferrule is provided for the purpose of securing the ferrule to the cable ends whilst jointing, and two pins of

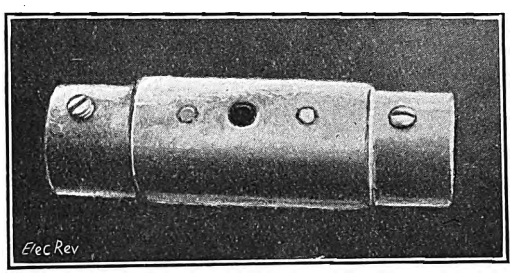

Fig. 1.—Cable-jointing Ferrule.

a similar dimension to two of the three holes in the body of the ferrule are provided; these pins are bullet nosed, so as to prevent them cutting through the wires when driven in. When the cavity inside the ferrule has been filled with molten metal, and before that metal has been allowed to cool, these pins are inserted in the two holes, making contact with the respective cable ends. The action of driving the pins into the interior of the ferrule distorts the cable ends out of their regular course and causes the wires to occupy the space of the oval cavity inside the ferrule, and any surplus metal is forced out of the remaining hole. The sweating of the joint is then completed and the ferrule and cable ends become one homogeneous mass, with the diameter at the centre of the ferrule of a larger dimension than that at either end of the ferrule. The possibility of the cables being drawn out through any exceptional stress is thus avoided.

Light-weight Motors and Generators.

The special feature of "Victory" d.c. machines, fig. 2, which are made by Messrs. R. W. Crabtree & Sons, Ltd., Water Lane, Leeds, for Victory Dynamos & Motors, Ltd., David Street, Leeds, is their small weight and size for a given output and speed, making them specially useful for traction and marine work. The bodies are of high-permeability dynamo steel of special formation, so that the quantity of metal required purely for magnetic reasons is reduced to a minimum which, together with the special design and arrangement of poles, allows of great saving in weight and size, and ample room for all coils in very small machines, as well as in larger sizes. The core is built of thin laminations of annealed mild-steel of high permeability, insulated to reduce eddy-current losses, and truly balanced to prevent vibration and pressed up

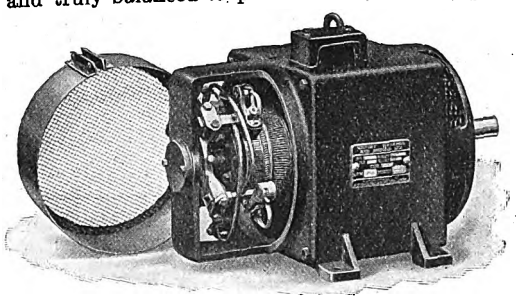

Fig. 2.—A "Victory" Machine.

under heavy hydraulic pressure. The armature coils are wound with double cotton-covered rectangular strip (except in the smaller sizes), on formers of special design to give coils exactly the shape required. The slots are skewed to make each coil enter the field smoothly to ensure silent running and assist commutation and stability. The commutator is self contained, and the socket is designed to admit the maximum quantity of ventilating air into the armature. Ball and roller bearings are fitted as standard, but plain oil-ring bearings can be fitted at the driving end if desired. A solid cast fan is mounted direct on the armature end support with well locked screws. The machines are made in seven frame sizes, covering capacities from 3 to 50 h.p. in the case of motors, and from 1¼ to 40 kW in the case of generators.

A Ring-main Isolating Switch.

In our review of the electrical exhibits at the North-East Coast Exhibition in our issue of May 24th, p. 940, we illustrated a ring-main circuit breaker which is being shown at the exhibition by Messrs. Reyrolle & Co., Ltd., Hebburn-on-Tyne. We have now received the following particulars of the apparatus of this type produced by the makers. The isolating switches are of the oil-immersed quick-make and quick-break type, and are suitable for pressures up to 11,000 V. Separate switches are provided for each cable of the ring main, and each of these can be placed in any of three positions, namely, "on," "off," and "earth," a definite stop being provided so that it is impossible to move the switch accidentally from "on" to "earth." On changing over to the "earth" position, the cable concerned, having been earthed in this way, is safe to handle, and at the same time an interlock is released which makes it possible to remove a cover over a testing socket. A plug connector can then be inserted, and the cable tested, after the switch has been moved to the "off" position. The interlocking is such that the switch cannot be thrown over to the "on" position if the cover is open. If it happens that when a cable is being tested it is made alive from the other end, no serious damage results, because the testing plugs supplied are provided with a small air-gap to discharge any excess pressure. The switch-fuse for protecting the consumer's property is itself oil-immersed. The fuse elements are supported from a steel lid, and this is made to swing clear of all live parts when replacements are necessary, or when it is required to inspect the fuse. The whole equipment is very solidly constructed, and, since it is proof against flooding, it can be safely installed in underground manholes, or in other places where flooding is likely to occur.

A New High-Efficiency Telephone.

The convenience of telephones of the microtelephone pattern is generally recognised, but in the past their inferior transmission efficiency and articulation, as compared with fixed-

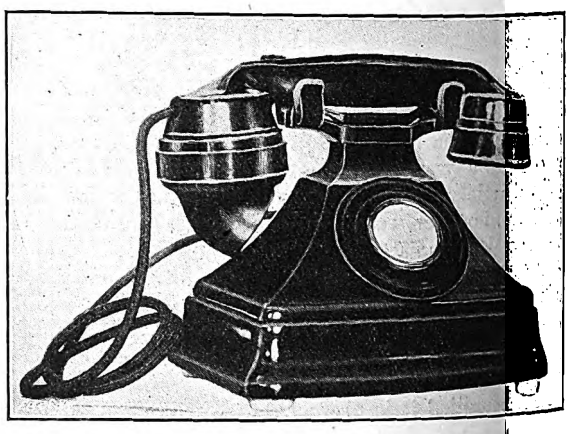

Fig. 3.—"Neophone" Non-Automatic Instrument.

transmitter instruments of the solid-back type, as well as their tendency to "howl" and "fry," has prevented their adoption for the public telephone service. As the result of a number of years research work, Messrs. Siemens Bros. and Co., Ltd., Woolwich, have, in co-operation with the Post Office engineers, produced the "Neophone," a telephone with an entirely new design of immersed-electrode inset transmitter which, in conjunction with a special anti-side-tone circuit, it is claimed, not only positively eliminates "howling," "frying," and excessive side-tone, as well as maintaining its efficiency, irrespective of the position in which the microtelephone is held, but is actually superior as regards articulation, and considerably better in speech-transmission efficiency than the standard solid back transmitter. As increased efficiency incidentally enables higher-resistance local lines to be employed without reducing the speech transmission efficiency, far-reaching economies in line plant may be effected. It is interesting to note that in the construction of the "Neophone" a moulded insulating compound has been largely employed, the case, microtelephone handle and the cradle all being made of this material. The pattern adopted by the Post Office uses a separate bell set, but a special design of bell set which can be used as a base on which to mount the telephone set, makes provision for a complete instrument for those who prefer the combined type. Fig. 3 shows a "Neophone" of the non-automatic type. Although the Post Office has placed a contract with the manufacturers for 50,000 instruments, it will, of course, be some time before they are available in sufficient quantities to meet the demand.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Wages in the Contracting Industry.

The National Federated Electrical Association announces that the rates of wages for journeymen electricians in the electrical contracting industry will be as follows as from the second pay-day in June (for the period covered by that pay-day), and will remain in force up to and including the period covered by the first pay-day in October, 1929:—Grade A: 1s. 10½d. per hour (including the increase of 5 per cent. which came into force on the first pay-day of May), representing a ½d. decrease; Grade B: 1s. 7½d. (no change); Grade C: 1s. 6d. (no change); and Grade D: 1s. 4½d. (½d. decrease).

This alteration affects the rates of plumber-jointers in the electric cable-making industry in the Greater London Area. The new rate for these men is 1s. 10½d. per hour, and that of plumber-jointers' mates 1s. 6d. per hour.

E.L.M.A. Activities.

In our last issue we made mention of the displays which the Electric Lamp Manufacturers' Association had arranged in connection with the I.M.E.A. Convention at Torquay. We reproduce herewith a view of the lighting room (fig. 1) arranged by the Association in the exhibition which was a feature of the Convention. An attractive brightly lighted centre-piece flanked by a recess containing examples of table lighting fittings, &c., occupied one wall. On another side two models, equipped with dual lighting systems, demonstrated good and bad lighting in factories and schools. Prominence was given to opal and Pearl lamps as a desirable alternative to the clear-glass type. In the centre of the ceiling a panelled fitting of modern design was fixed.

The Electric Lamp Manufacturers' Association has recently published two booklets which should prove of considerable assistance to contractors, supply authorities, and others interested in correct lighting. The first (Brochure 2) illustrates and describes the street lighting exhibit which has been arranged at the London Lighting Service Bureau. We dealt with this at some length in our issue of March 22nd (p. 517). The other (Brochure 3) deals with a series of window displays which E.L.M.A. has produced for electrical showrooms. The series comprises four sets, each of which is designed to demonstrate correct and incorrect illumination in certain situations. One of the sets is seen in the first illustration; another, in a window of the Torquay Corporation Electricity Department's showroom, is depicted in fig. 2.

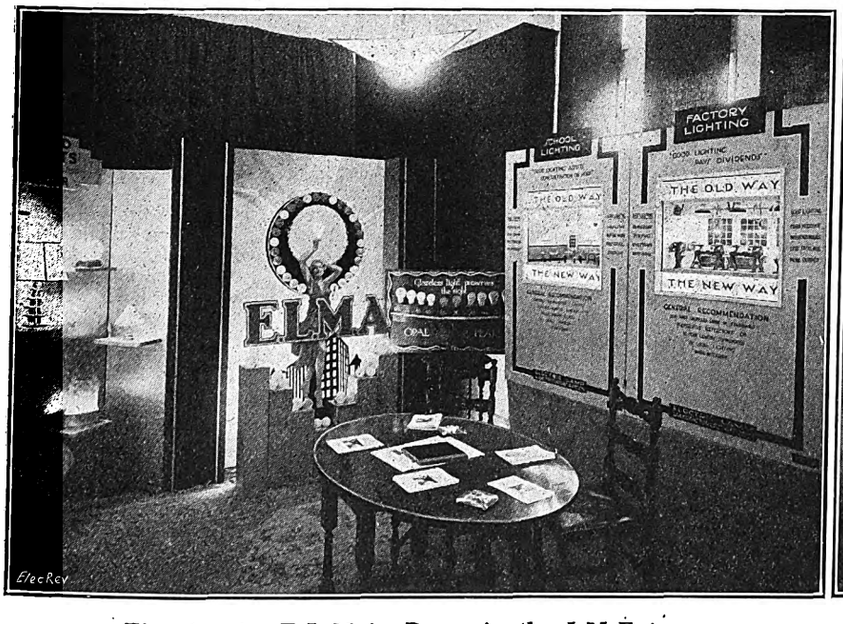

Fig. 1.—An E.L.M.A. Room in the I.M.E.A. Exhibition.

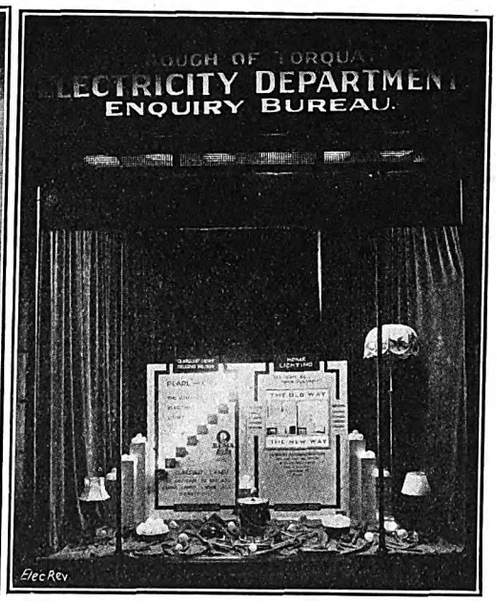

Fig. 2.—One of the E.L.M.A. Window Displays.

Exide Convention at Brighton.

The annual Exide Battery Convention was held at Brighton on Monday, Tuesday, and Wednesday this week. At the opening of the Convention a civic welcome was extended by the Mayor of Brighton, Alderman H. J. Galliers, J.P., in the Royal Pavilion. Over four hundred "Exide" service agents attended the Conference from all parts of the British Isles. The annual Convention banquet took place in the Royal Pavilion on Tuesday evening. It is particularly interesting to observe that the Mayor, who spoke at the banquet, is the local "Exide" service agent.

The "Small" Manufacturers' Advantages.

In an article in a recent issue of *Printers' Ink*, New York, the general manager of a small electric motor manufacturing company in the United States gives his reasons for asserting the secure place of the small manufacturer in the business and economic scheme. Small overhead costs and the possibility of closer supervision and personal contact of the management with the employés are, he claims, great advantages. Also, generally speaking, the small manufacturer can turn out more product in value per employé per thousand man-hours of effort than can the larger firm. The suggestion is offered in the article that the small manufacturer should stop trying to compete with the large firm in the matter of price and should concentrate instead on lines where the large firm is vulnerable. Among these he mentions the greater opportunity for special service without demoralising the organisation, and the personal contact of the heads of the firm with buyers. A third advantage is greater adaptability, *i.e.*, the shorter time required to reorganise for changes. This ability to make quick turns, it is pointed out, can be made to react considerably to the advantage of the alert small manufacturer.

Patent System Reform.

The proposals for the reform of the British patent system recently put forward by the British Science Guild have been reviewed by a committee of the Bar Council, the members of which included Sir Duncan Kerly, K.C. (chairman), Mr. James Whitehead, K.C., the Hon. Stafford Cripps, K.C., and Mr. Trevor Watson. The views of this committee are of particular interest in view of the recent appointment by the Board of Trade of a Departmental Committee under the

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chairmanship of Sir Charles Sargant, to consider the same subject. The Bar Council commends the report of the Guild, which was the work of a committee whose chairman was Dr. W. H. Eccles, F.R.S. Commenting on some particular points, the committee expresses the view that a patent ought not to be invalidated by mere "paper" anticipations—that is, by the publication many years ago of ideas which were stillborn and have never become known to the trade. It agrees that there should be stronger remedies against unwarranted threats by which persons wrongly claiming to possess patent rights may seek to prejudice rival manufacturers, and also supports the proposal that appeals from the decisions of the Comptroller of Patents should be heard by a special judge in chambers instead of by the Attorney-General or Solicitor-General as at present. The only proposals made by the Guild which elicit opposition from the Bar Council are those whereby the judicial duties of the Comptroller of Patents would be extended. They hold that he should not be empowered to act as a court of first instance for the trial of infringement actions; but they propose as alternative remedies for the admittedly high cost of patent actions (*a*) arbitration by consent of the parties, and (*b*) agreement between the parties whereby the issues to be tried in court should be restricted.

The Marking of Imported Glassware.

Following upon the inquiry into an application for an Order-in-Council requiring the marking of imported illuminating glassware, a Board of Trade committee under the Merchandise Marks Act, 1926, last week commenced the hearing of a similar application in respect of scientific glassware. The applicants were the British Chemical Ware Manufacturers' Association and the British Lampblown Scientific Glassware Manufacturers' Association. There were objections by the China and Glassware Section of the London Chamber of Commerce, the British Laboratory Ware Association, and other manufacturers' groups. Mr. Moritz, K.C., for the applicants, said that imported scientific glassware was already subject to a safeguarding duty. The applicants asked for the inclusion of silica ware in the Order. Counsel pointed out that before the war practically all of the scientific glassware used in this country was imported, but by the end of the war an industry had been created in this country. Already the British and the best Continental manufacturers marked their products, and as the glassware was already subject to Customs examination, the difficulty of enforcing a marking Order would be considerably lessened. Mr. Moritz further said that the applicants would be satisfied, in certain cases, with the marking of the containers. The two main trade unions concerned supported the application.

The opponents, while not objecting to the marking of specific articles, opposed the general marking of scientific glassware on the grounds of the cost involved, and stated that the marking of the glass would convey the impression that the whole apparatus was foreign. A number of expert witnesses gave evidence in favour of the application and were cross-examined by Mr. Macaskie, who appeared for the opponents.

On June 10th evidence was to have been given against the application on behalf of Philips Lamps, Ltd., but the applicants intimated that they did not object to the exclusion of X-ray tubes and protective lead glass from the proposed Order. Later in the proceedings it was stated that the General Electric Co., Ltd., was able to supply satisfactorily all the machine drawn tubing required. The inquiry concluded on June 11th and the Committee will report to the Board of Trade in due course.

Installation Work at Manchester.

The proposal that the Electricity Department should carry out installation work in municipal houses was again raised at a recent meeting of the Manchester City Council. The member who raised the matter said that this would provide a check upon private contractors, and prices would be reduced. Ald. Dagnall, the chairman of the Electricity Committee, said that the work would require the employment of a special staff which would at times have nothing to do. The proposal was rejected.

Salesmanship and Languages.

Speaking at the recent British Music Industries Convention, Mr. F. W. Goodenough, chairman of the Committee on Education for Salesmanship, said that the Committee's first step had been to arrange with the Board of Education to make an investigation of the methods of teaching modern languages in this country, and a comparison of our educational facilities with those of other countries. Too often the representatives of British firms did not speak or write the language of a potential buyer, and many export firms still conducted their correspondence with foreign buyers in English, quoted in English currency, and sent out wholly English catalogues.

Patents, Designs, and Trade Marks.

The 46th report of the Comptroller-General of Patents, covering the year 1928, has been published. It shows that 38,556 applications for patents were received (against 35,469 in 1927); provisional specifications numbered 24,071 (against 22,476); complete specifications numbered 24,045 (against 21,397); and 17,695 patents were sealed (against 17,624). There were 24,746 applications for the registration of designs (against 22,707), of which 23,899 (21,009) were accepted. Trade-mark applications numbered 12,684 (against 12,381) and 6,818 (against 7,543) were registered. The staff of the Patent Office totalled 698, and there was a surplus of receipts over expenditure of £147,840, the revenue amounting to £544,740. The report says that there are no striking developments to record. The increased activity in invention which has been manifested during the past few years was still more marked in 1928. At the commencement of this expansion in the numbers of applications, the greatest increase was shown in the chemical and electrical industries, but other industries have followed suit, and the activity is now widely distributed over the whole field of invention. In the electrical industries the developments in high-pressure distribution consequent upon the schemes of the Electricity Board are reflected in the large number of applications for protection systems and switchgear. There has been continued activity in dry surface rectifiers for electric currents. Automatic telephones, copying or picture telegraphs, and television apparatus show marked increases in the number of applications, and are responsible for increases in inventions connected with the speed governing and synchronising of electric motors. In connection with thermionic valves, the developments of the screened-grid and other forms of multiple-electrode valves and of valves with indirectly heated cathodes are prominent. Applications relating to electric heating are increasing, especially in respect of induction furnaces and apparatus for domestic purposes. The number of applications relating to gramophones and like sound recording and reproducing apparatus, including sound records and the associated working of such apparatus with kinematographs, is nearly double that of the year 1927. The main activity has been in connection with loud-speakers, electrical reproducing devices ("pick-ups") and synchronised sound and picture reproduction ("talkies").

Australian Electricians' Wages.

The March *Bulletin* of the Electrical Employers' Association of New South Wales shows that the rates of pay of electrical workers in the State are as follows:—Shift electricians, installation electricians, electrical fitters, battery fitters and cable jointers: £6 1s. per week, or 2s. 10 4/11d. per hour. Electrical mechanics and linesmen: £5 15s. per week, or 2s. 8 8/11d. per hour. Arc-lamp trimmers, £5 3s. per week, or 2s. 5 5/11d. per hour. Leading hands receive 9s. per week above their usual journey rates. Electricians in charge of plant with a capacity of less than 75 kW receive £6 6s. per week; and those in charge of larger plant, £6 18s. Labourers are paid at the rate of £5 per week. The wages of apprentices range from 16s. per week in the first year to 55s. 5d. in the fifth year.

Book Notices.

"E.T.Z. Gesamtinhaltsverzeichnis" (general index of the Elektrotechnische Zeitschrift for the 25 years 1903-1927 and of volumes 1-18 of the "Archivs für Elektrotechnik" and of the Verband Deutscher Electrotechniker "Fachberichhefte" 1926 and 1927). Issued by the Verband Deutscher Electrotechniker and the Electrotechnischer Verein under the editorship of Dr. Franz Moeller (Julius Springer, Berlin), 1928.—This large volume (653 quarto pages) forms an admirably arranged index to the 25 volumes of the "E.T.Z." ending in 1927, thus covering practically the whole of recent electrical engineering work in Germany and in most other countries. The first 76 pages are occupied by an alphabetical subject key index giving references to the actual index. Then follows the classified subject index arranged under 48 headings with numerous sub-sections. This occupies the next 386 pages. The book concludes with an alphabetical name index of authors' names and others. Every reference is to a year and a page in the volume for that year and also indicates whether the article is an original one, a reference, a letter, &c. The leading position which the "E.T.Z." has occupied for many years in German electrical engineering has ensured that practically all new work is recorded in its volumes so that this index should prove a valuable addition to the electrical reference books.

"Electrical Transmission and Distribution." By R. O. Kapp. Vol. VII. "Instruments and Meters." Pp. viii+276; figs. 23. Price 6s. net. Vol. VIII. "Auxiliary Plant." Pp. viii+130; figs. 10. Price 3s. net. London: Sir Isaac Pitman and Sons, Ltd.

"The International Aspects of Electrical Communications in the Pacific Area," by L. B. Tribolet. Pp. vii+282. London: Humphrey Milford. Oxford University Press. Price 11s. 6d. net.

"Faraday House Journal," Vol. xiii, No. 3, Summer Term, 1929.—In addition to the usual notes and notices, this issue contains a *frontispiece* portrait of Dr. A. Russell and the continuation of his article on "The Theory of the Transformer," which merits considerable attention.

"Ondes et Electrons." By P. Brigout. Pp. 245; figs. 57. Paris: Libraire Armaud Colin. Price 9 fr.

Great Britain's Radio Exports.

Statistics published by the *Wireless and Gramophone Trader* show that the exports of radio apparatus from this country during March were valued at £86,632, of which valves accounted for £13,994. The Netherlands was the principal market, taking goods valued at £17,472 (valves £2,530). Australia's share amounted to £13,459 (valves £3,090), and other leading customers were:—Argentina, £8,831 (valves

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£735); Chile, £6,421 (valves £368); India and Burma, £3,985 (valves £313); Irish Free State, £3,919 (valves £755); France, £3,807 (valves £351); and Belgium, £3,547 (valves £543).

New Zealand's Electrical Imports.

The imports of electrical machinery into New Zealand during March last attained a value of £126,997, as compared with £154,000 in the corresponding month of 1928.

Trade Announcements.

RADIO INSTRUMENTS, LTD., 12a, Hyde Street, W.C.1, has appointed Mr. G. M. Paterson, 122, West Campbell Street, Glasgow, as its sole representative for Scotland.

The SOUTH-EAST KENT ELECTRIC POWER CO., LTD., has opened offices and showrooms at 4, The Exchange, Queen Street, Deal.

The TRENT ELECTRIC WIRE WORKS, LTD., has removed to larger and more central premises at 1, Dyott Street, Shaftesbury Avenue, W.C.1. (Telephone: Temple Bar 3791.)

Messrs. WARD & GOLDSTONE, LTD., have opened a branch establishment at Upton's Yard, 49a, Briggate, Leeds, where large stocks of all the company's manufactures will be kept. The telephone number is 26812 Leeds, and the telegraphic address "Multum, Leeds." Mr. L. Kohn, who has been for many years the company's resident representative in Yorkshire, will be in charge of the depôt.

SPHINX ELECTRIC, LTD., Sphinx House, Hatton Garden, E.C.1, has appointed Capt. Gilchrist to represent it in Lancashire. His address is 14, Fountain Street, Manchester (Telephone: City 4208).

The Newcastle office of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., and METRO-VICK SUPPLIES is being transferred on June 17th to Metro-Vick House, Northumberland Road, Newcastle-upon-Tyne. (Telephone: Central 6202-5.)

Bankruptcy Proceedings.

R. BENNETT, wireless dealer, lately of 107, Devons Road, Bow, E.—A sitting of the London Bankruptcy Court was appointed to be held last week before Mr. Registrar Warmington for the public examination of this debtor, against whom a receiving order was made on April 23rd, at the instance of Brahams (Houndsditch), Ltd., creditors for £87. The Official Receiver reported that the debtor had not attended under the proceedings, and nothing was known regarding his present movements. The examination was adjourned *sine die*.

E. R. MILLWARD, trading as "West of England Radio," 67, High Street, Barnstaple, wireless engineer.—The public examination herein was to have been held on June 4th, but the debtor's solicitor produced a medical certificate and stated that the debtor would not be in a fit state to attend to business matters for three months. The hearing was adjourned.

J. A. HENDERSON (Hendersons), electrical contractor, 28a, Basinghall Street, E.C.—Receiving order made May 30th, on debtor's own petition. First meeting held June 12th. Public examination July 5th, both at Carey Street, W.C.

S. H. SKIPPER (S. H. Skipper & Co.), electrical engineer, 35, Broad Bridge Street, Peterborough.—First meeting held June 11th, at the Official Receiver's office, 41, Sidney Street, Cambridge. Public examination, July 12th, at the Law Courts, Peterborough.

H. A. HYDE, wireless dealer, late of 2, East Street, Bromley.—First and final dividend of 4s. 1¾d. in the £, payable June 14th, at the Official Receiver's office, 29, Russell Square, W.C.

B. H. WISHAW, electrical and wireless engineer, Bakewell Road, Matlock.—First and final dividend of 1s. 3d. in the £, payable June 18th, at the Official Receiver's offices, 22, Regent Street, Park Row, Nottingham.

O. C. LAY (Home Wireless Installation Co.), accumulator specialist, 2c & 2d, High Street, Wandsworth.—First and final dividend of 3s. 1d. in the £, payable June 19th, at the Official Receiver's office, 29, Russell Square, W.C.

J. H. GORDON, electrical engineer, 21, Leeds Road, Ilkley.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds, released May 23rd.

H. NUTTALL (J. A. Hartley & Co.), electrical agent and factor, 1073, Chester Road, Stretford.—Trustee, Mr. F. Murgatroyd, Official Receiver, Byrom Street, Manchester, released May 29th.

A. M. EDWARDS (Mansell Edwards & Co.), electrical engineer, 111b, High Street, Blackwood, Mon.—Trustee, Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff, released May 23rd.

A. H. CRUMP (Selwyn Electrical Engineering Co.), electrical engineer, 184, 202 & 220, Walworth Road, S.E.—First and final dividend of 4s. 7d. in the £, payable at Carey Street, W.C.

K. P. J. JOLIVARD, electrical engineer (K. Jolivard & Co.), 66, Victoria Street, S.W.—Application for discharge to be heard June 21st, at Carey Street, W.C.

P. L. LITTON (Moore & Litton), engineer, plumber, and electrical engineer, 12, Bath Road, and 50, Culverland Road, Exeter.—Trustee, Mr. W. R. Cocks, Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter, released May 23rd.

Company Liquidations.

ELECTRIC FACTORS (BLACKPOOL), LTD., wireless and electrical factors, 2, St. John's Walk, Blackpool.—The statutory meeting of creditors was held recently at Blackpool. Mr. James Todd, the liquidator, submitted a statement of affairs which showed ranking liabilities of £3,288, all of which were due to unsecured creditors, and net assets of £1,971, or a deficiency, so far as the creditors were concerned, of £1,317. The company was registered on January 21st, 1928, with a nominal capital of £500, the first directors being Messrs. H. Gilpin and G. Gilpin. Last October Mr. G. Gilpin died. Early in May a writ was issued against the company, and it was decided that voluntary liquidation should take place. The accounts to January 20th last showed cash sales of £1,024, and credit sales of £4,956. For the same period, the credit purchases were £5,711, and the cash purchases totalled £1,472. There was a gross profit of £2,545, but a net loss of £74. At the date of the liquidation there were 14 suing creditors. The deficiency was accounted for by loss on trading, bad debts, and goods loaned out on hire-purchase in respect of which records were not available. It was decided to confirm the voluntary liquidation of the company with Mr. Todd as liquidator, and an advisory committee was also appointed consisting of the representatives of Messrs. Corfield & Cripwell, the Chorlton Metal Co., and Mr. P. S. Booth. The following are creditors:—

	£		£
Abbey Cables, Ltd. ...	83	Mullard Wireless Service Co., Ltd.	46
British Electric Transformer Co., Ltd.	30	Metro-Vick Supplies, Ltd.	51
British Thomson-Houston Co., Ltd.	60	Bankers	735
Baugatz, L. (Berlin) ...	66	O'Brien, R., & Co. ...	93
Chorlton Metal Co., Ltd.	51	Pye Radio, Ltd.	42
Clarke, H., & Co., Ltd.	33	Philips Lamps, Ltd. ...	214
Celestion Radio, Ltd. ...	30	Rawson, H. G.	45
Efandem Co.	49	Reeves & Co.	39
Formo	32	Rhineland Cable Co. ...	46
Ferranti, Ltd.	57	Siemens Bros. & Co., Ltd.	74
Graham Amplion, Ltd. ...	45	R.I. & Varley, Ltd. ...	38
Gilpin, H.	379	Wright & Weaire, Ltd. ...	25
Harwell, Ltd.	32	Ward & Goldstone, Ltd.	33

E. O. JONES & SONS, LTD., timber merchants and electricity suppliers, Welshpool, Mont.—A meeting of creditors was held recently at Shrewsbury. Mr. C. S. Asbury, the liquidator, submitted a statement of affairs which showed ranking liabilities of £9,218 and net assets of £4,413, leaving a deficiency, so far as the creditors were concerned, of £4,805. The company was registered in August, 1925, and took over an existing business. The capital was £250, but was eventually increased to £5,000. The issued capital at the date of the liquidation was £4,150. It was pointed out that up to about September, 1927, the business showed a balance to the credit of profit and loss account of £90. The directors installed electrical plant for working the sawmill machinery, and also entered into a contract to provide a bulk supply of electricity to Welshpool. The installation of the necessary electrical plant and machinery was expensive; engines were obtained on the hire-purchase system, and an overdraft was obtained at the bank. The turnover since removal to the new works had been disappointing, and there had been losses. It was hoped that arrangements could be made for the sale of the electrical side of the business. It was decided to confirm the voluntary liquidation of the company with the present liquidator, and a committee of five of the principal creditors was also appointed.

JOSEPH TABBUSH & CO., LTD., wireless engineers, 11, Queen Victoria Street, E.C.—Under a compulsory winding-up order made against this company on February 11th, 1929, upon a creditor's petition, the statutory first meetings of the creditors and shareholders were held last week at Carey Street, W.C., before Mr. J. Barwick Thompson, Official Receiver. The company was formed in December, 1926, to carry on business as radio and electrical engineers. It appeared that no statement of affairs had been lodged, and in the absence of a quorum the meetings were formally adjourned. A proof of debt for £640 was lodged on behalf of the petitioning creditors in respect of unpaid taxes.

ATTAIX, LTD.—A meeting of members is called for July 8th at 32, Finsbury Square, E.C., to hear an account of the winding up from the liquidator, Mr. K. M. Scott.

GALLETTI'S WIRELESS TELEGRAPH & TELEPHONE CO., LTD.—A meeting of members is called for July 10th at the offices of Messrs. Kemp, Chatteris, Nichols, Sendell & Co., 36, Walbrook, E.C., to hear an account of the winding up from the liquidator, Mr. H. J. Page.

PRESTEIGN ELECTRIC CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. Stephenson, Victoria Hall, Llandrindod Wells.

EASTNOR TRAMWAY TRACTION & ELECTRICAL CO., LTD.—A meeting of members is called for July 6th at National Buildings, St. Mary's Parsonage, Manchester, to hear an account of the winding up from the liquidator, Mr. A. J. Adams.

Dissolution of Partnership.

RELIANCE ENGINEERING CO., mechanical and electrical engineers, 339, Richmond Park Road, East Sheen.—Mr. E. Pobjoy and Mr. G. T. Boote have dissolved partnership. Mr. Pobjoy will attend to debts and continue the business on his own account.

Unemployment.

The number of registered unemployed on May 27th was 1,132,300. This represented an increase of 27,638 since May 13th, when the total was 1,104,662. Figures are not available for the week ended May 20th (Whit Monday).

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New Catalogues and Lists.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for June. A number of large "Osram" lighting installations are illustrated and described in this issue; there is a special article on the "Pearl Osram" lamp; and notes on the company's screen-grid receiving sets, installation accessories, cooking equipment, &c.

The company has also produced a brochure on street lighting practice containing illustrations of its standards and lanterns and views of actual installations.

Tungsram Electric Lamp Works (Great Britain), Ltd., 72, Oxford Street, W.1.—Two illustrated folders drawing attention to the reduced prices of the company's lamps.

Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.—A well-produced booklet containing various tables of conductors, and a price list of "Callender" cables.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.—Leaflet No. S.5110 referring to Igranic newspaper conveyors and installations installed at Newcastle for the *Evening World*.

A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—A leaflet, priced and illustrated, drawing attention to the company's fans. Also a stock list of motors, domestic appliances, switchboard, instruments, &c.

British Insulated Cables, Ltd.—Price list No. H.116 of cab-tire sheathed cables and flexibles. Publication No. C.101, describing the various applications of "Copperweld" material.

The Arora Co., Loughborough.—A pamphlet drawing attention to "Arora" cookers and immersion heaters. Illustrated and priced.

English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Three illustrated publications dealing with power equipment for all industries, Fullagar oil engines, and truck type switchgear.

Ateliers de Constructions Electriques de Charleroi, Charleroi.—Stock list for June of the company's motors, transformers, centrifugal pumps, &c.

Mr. D. M. Lumsden, Millburn, Almondbank, Perth.—Two illustrated leaflets, with price list, describing the "Lumsden" quartz mercury vapour lamp and small sun lamp.

Messrs. Mawdsley's, Ltd., Dursley, Glos.—A folder and blotter drawing attention to the company's motors. Also a map of the United Kingdom backed with a sliding card by which the distances between the chief towns can be ascertained.

Cantie Switches, Ltd., Leighton Works, Carlton Road, Nottingham.—Leaflet No. 120, advertising "Cantie" ironclad switches.

Calendar-blotters for June have been received from the Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1; S. Rogers & Co., Ltd., 15, Fitzroy Street, Tottenham Court Road, W.1; Pope's Electric Lamp Co., Ltd., Elasta House, 5, Arthur Street, New Oxford Street, W.C.2; Warren Bros. (Middlesbrough), Ltd., 91 & 93, Grange Road, Middlesbrough; and Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.

John Thompson Water Tube Boilers, Ltd., Imperial House, Kingsway, W.C.2.—An illustrated folder showing actual installations, and sectional drawings of the company's boilers.

Italian Foreign Electrical Trade.

The appended table shows the Italian imports and exports of electrical machinery and apparatus during the first quarter of the current year, as compared with the corresponding three months of 1928. The values have been converted to sterling at an exchange rate of 92.60 lire to the £. It will be seen that both imports and exports show an increase—the former of £129,148 and the latter of £124,879.

	Imports. Jan. to Mar. 1929.	Imports. Jan. to Mar. 1928.	Exports. Jan. to Mar. 1929.	Exports. Jan. to Mar. 1928.
	£	£	£	£
Accumulators and parts	14,824	6,290	4,304	15,163
Incandescent lamp bulbs	16,790	9,776	24	—
Electrical measuring instruments	13,003	6,276	640	125
Electrical apparatus, miscellaneous	185,953	138,066	28,518	28,342
Telegraph, telephone, and radio apparatus	292,562	212,458	4,533	7,406
Electric furnace and other carbons	40,194	29,006	1,485	2,097
Insulated cables	2,830	14,116	104,066	10,826
Generators, "without collectors"	49,854	65,769	4,062	4,323
Generators, with "collectors"	68,856	63,376	78,245	42,791
Glass and porcelain insulators	8,085	11,765	3,250	1,425
Arc lamps	80	56	—	—
Incandescent lamps ...	116,650	116,655	23,357	15,680
Static transformers ...	1,786	800	3,645	2,892
Insulating tubes	36	85	759	820
Electricity meters	28,188	36,232	525	132
Insulated wire	8,162	7,979	13,083	13,595
Totals	£847,853	£719,705	£270,496	£145,617

Social Events.

The tenth annual athletic sports meeting of the General Electric Co., Ltd., was held at the company's sports ground, Preston Road, Wembley, on June 7th. Although the event was not favoured with the brilliant weather which contributed so largely to the success of the preceding year's meeting, the rain which threatened held off and the extensive programme of 51 events was carried through without interruption. As in previous years, G.E.C. amplifiers were installed to assist the stewards in getting together the competitors for the various events, and in place of the usual band an excellent programme of music was broadcast by Gecophone Orchestrola equipment, the records being supplied by the Gramophone Co. Considerable keenness was displayed by the competitors, who were inspired to great endeavours by the enthusiasm of a large and appreciative gathering of employés and friends. The numerous and valuable prizes were distributed by Lady Hirst, who, with Sir Hugo Hirst, received an ovation. Sir Hugo, in thanking the company for their reception, briefly mentioned his visits to the various G.E.C. organisations in Australia, and the sports meetings held "down under." The day's proceedings were brought to a pleasant conclusion with community singing, interspersed with items rendered by G.E.C. artistes, and dancing on the green.

Brook Motors, Ltd., recently celebrated its 25th year of existence. The salesmen and branch managers were called together on May 27th for a conference, which lasted until the 29th. At this conference the various methods employed in the selling and distribution of electrical machinery were discussed. On June 1st all the employés and their friends were taken to Blackpool by special train, meals being provided both going and returning. A thoroughly enjoyable day was spent. For the twenty-fifth year in succession the company was favoured with a fine day—a remarkable record. The party arrived back in Huddersfield at about 11 p.m.

On May 29th, the first re-union dinner of the Association of Ex-Siemens' Men was held, with Mr. Frank Wallis (English Electric Co., Ltd.) in the chair. The hon. secretary reported the number of members who had joined, and a large number of names of probable members were suggested to him. Some fifty members attended the dinner and concert, and a very enjoyable evening was spent. Membership of the Association is confined to ex-members of the Siemens' organisations, and the qualification for membership is that applicants should have served at least one year on the staff of these organisations, the annual subscription being merely a nominal one. The hon. secretary is Mr. J. Snow Huddleston, Dagenham Dock, Essex, who will be pleased to give full particulars of the Association.

A cricket match between the works and office staffs of Simplex Conduits, Ltd., took place on June 4th, at Hall Green. The office batted first, securing only 44 runs. Although two works' members retired after a lengthy innings and one did not bat, the works score at the close stood at 131.

The fourth annual sports meeting of the Hackbridge Electric Construction Co.'s Sports Association is to be held at Moleseys Road, Hersham, on June 22nd.

Recent Contracts.

The English Electric Co., Ltd., has received an order from the Darlington Corporation Tramway Department for six complete four-wheel, single-deck, railless 'buses. Each 'bus will have seating accommodation for 32 passengers. The equipment will consist of a single 60-h.p. motor and standard foot-operated controller, and rheostatic braking is provided.

Among the more important lighting installations recently carried out with "Osram" lamps and fittings made by the General Electric Co., Ltd., are those in the Malvern Town Hall, Melbourne; the Plaza Cinema, Liverpool; and the Grosvenor Dancing Academy, Chester.

Messrs. W. Crockatt & Sons, Ltd., Glasgow, state that in addition to the order recently received from the well-known shipowners, Messrs. Hugh Hogart & Sons, for 30 of their "Simplex" valve reseating machines, they have just received an order for 13 similar machines from Messrs. Franco Tosi Societa Anonima, Legnano, Italy.

The South African Radio Market.

A South African correspondent of the *Times Trade and Engineering Supplement* says that although the Union market for radio apparatus is worthy of attention there are certain adverse factors which have to be overcome before there can be a great expansion of demand. The number of licensed listeners has grown very slowly and at the end of 1928 was only 16,710. The potential market is much larger, for the white population approaches 2,000,000, some 70 per cent. being outside the urban areas. There are broadcasting stations in Johannesburg, Cape Town and Durban, while others in Port Elizabeth and Bloemfontein are projected. The existing stations are difficult to pick up outside their immediate areas, due largely to atmospherics, and consequently five-sixths of the listeners are to be found in the regions near the stations. The sale of American sets is growing but English-made apparatus is in a strong majority; there is no local manufacture. "Super-selective" sets employing three or four valves are in demand and there is also a sale for super-heterodyne, "all-mains" and portable sets. It is pointed out that instructions and publicity matter should be in both English and Afrikaans. The

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use of a number of available advertising media is advised. The writer thinks that much good might be done if a high-power short-wave station were erected.

For Sale.

Messrs. Henry Butcher & Co. will sell by auction at 126-128, New King's Road, Fulham, S.W., on June 19th, surplus plant, machinery, stock and stores of a motor-car accessory manufacturer. Aldershot Borough Council have for sale water tube boilers, chain grate stokers, feed pumps, steam dynamos, &c. (See our advertisement pages to-day.)

The E.C.A. and E.D.A.

At a recent meeting of the Council of the Electrical Contractors' Association it was decided to make a donation of £200 to the British Electrical Development Association, in addition to the annual subscription of £400, as in the previous two years. The Council also approved a donation of £50 to the Electrical Association for Women.

American Electrical Manufacturers' Organisation.

Formal approval has been given by the Board of Governors of the National Electrical Manufacturers' Association to the reorganisation of divisions each composed of a number of sections, or manufacturing industries, having related interests. This action is designed to more closely co-ordinate sectional activities. The divisions which have already been organised and are now formally approved are the appliance, insulating material, radio, refrigeration, transmission and primary distribution, utilisation and control, wiring devices and wiring materials. An industrial heating division and a lighting division have also been authorised, but are not yet organised.

The F.B.I. Delegation in Spain.

The Madrid correspondent of *The Times* reports that Sir George Grahame, the British Ambassador, entertained the delegation of the Federation of British Industries under Lord Gainford at luncheon on June 5th. The Ministers of Public Works and National Economy and several departmental officials were present. The delegates had their first contact with the Spanish Government on June 4th, and they were to leave for Barcelona on June 6th. The "frank and full" exchange of views has been limited to the presentation of the carefully-prepared *exposé* of the British case submitted to the Minister of National Economy, supported by some examples of tariff hardships. In a short speech the Minister of National Economy offered to employ his best endeavours to improve trade relations between the two countries.

Catalogues Wanted.

E.P.I., LTD., Inner Temple, Dale Street, Liverpool, ask for catalogues and prices, with full details, of small electrical refrigerator plants.

New Cable Factory in Sweden.

According to *Nya Dagligt Allehanda*, the Allmanna Svenska Elektriska, A.B., in addition to the enlargement and modernisation of its plant at Västeras, is to begin the construction of another large cable factory in the vicinity of Stockholm. This factory will not only supply the requirements of the A.S.E.A. combine, but will also produce for export.—*Reuter's Trade Service* (Stockholm).

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during April last amounted to £51,464, bringing up the total for the first four months of the year to £202,122, as compared with £151,600 in the corresponding period of 1928.

New Swiss Company.

A company has been formed at Schwanden, Glarus Canton, with the title of Die Sernf-Niederenbach Kraftwerke Gesellschaft, to establish a plant to utilise the water power of the Rivers Sernf and Niederenbach.

Swedish Electrical Exports.

The exports of electric motors, generators and allied machinery from Sweden during the first two months of this year reached a value of £237,720, as compared with £361,830 in the corresponding period of 1928. There was also a decline in the exports of Swedish telephone and telegraph apparatus from £97,630 to £71,150.

The Dutch Radio Trade.

According to the *Wireless and Gramophone Dealer*, the exports of radio apparatus from Holland during 1928 had a value of £1,833,335, as compared with £766,415 in 1927. France was the principal market, taking goods valued at £275,000; Germany (£233,330) was second and Great Britain (£205,830) third. Holland's imports of radio equipment were valued at £788,335, against £401,416 in 1927. Germany (£348,335) was the leading supplier, Great Britain (£146,665) taking second place.

It is stated by our contemporary that the Philips concern is making vigorous efforts to dominate the Australian market, and has made "amazing" progress during the past two years. This has caused the Americans to lose ground, but the British contribution to the trade is relatively small.

German Trade with China.

The report for 1928-29 of the German Chamber of Commerce in Shanghai deals, among other matters, with the trade in machinery for China, which is controlled from that port. The imports of electric motors and generators from Germany in 1928 are estimated to have represented about 16,000 h.p., including 2,500 h.p. in generators for central stations. Having regard to the unfavourable conditions prevailing, it is stated that the imports of German low-pressure apparatus, chiefly for telephony and telegraphy, could be considered normal.

Hungarian Electrical Exports.

The exports of electrical machinery and appliances from Hungary during last year attained a value of £669,910, as compared with £567,870 in 1927.

Patent Application.

Application has been made for the extension for a further period of 4½ years of patent No. 28,527, of December, 1913, granted to R. Amberton, for "Improvements in or Relating to Electrical Control Systems and Switch Mechanism therefor."

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price June 11th.	Fortnight's inc or dec.
a Acid, Oxalic ... ... per lb.	5⅝d.	
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	8½d. to 4d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£18 10s.	...
a Sulphur, Commercial ... ... ,,	£11	...
a ,, Roll ... ... ,,	£11	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	3⅝d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£95 to £100	...
b ,, Wire ... ... per lb.	1/1 to 1/9	...
b ,, Sheet ... ... ,,	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£1°4	£4 inc.
Grade II... ... ... ,, ,,	£130	£3 inc.
Grade III ... ... ,, ,,	£72	£1 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	10⅞d.	...
c ,, Tubes (solid drawn) ... ,,	1/1 to 1/1¼	...
c ,, Wire, basis ... ... ,,	11½d.	...
c Copper Tubes (solid drawn) ... ,,	1/9½	...
c ,, Bars (best selected) ... per ton	£110	£2 dec.
c ,, Sheet ... ... ,,	£110	£2 dec.
c ,, Rod ... ... ,,	£110	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£94 15s.	5s. inc.
d ,, ,, Sheets ... ,,	£48 10s.	...
d ,, ,, Wire Rods ,,	£91 15s.	5s. inc.
d ,, ,, H.C. Wire per lb.	11½d.	⅛d. inc.
f Ebonite Rod... ... ... ,,	2/8 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	nom.	...
h India-rubber, Para fine ... ... ,,	11½d.	...
l Iron, Pig (Cleveland No. 3.) ... per ton	70s.	1s. 6d. inc.
l ,, Wire, galv. No. 8. P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£25	...
g Mercury ... ... per bot.	£22 2s 6d. to £22 5s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up	...
p Phosphor Bronze, plane castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/5	...
p ,, ,, rolled strip & sheet ,,	1/3¾	...
p ,, ,, wire... ... ... ,,	1/6¼	...
o Platinum ... ... per oz.	£13 17s. 6d.	...
d Silicium Bronze Wire ... ... per lb.	1/2¾	½d. dec.
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton	£203 to £ 08 10s.	£6 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

In their letter dated June 8th Messrs. James Forster & Co. stated that the lead market remained very steady all last week with slight fluctuations. Although the General Election is out of the way and the reparations question practically settled, there is so far very little revival in demand from consumers, either in this country or on the Continent. The demand, however, has been slightly better, the Russians buying a fair quantity of lead in Germany, which has relieved the situation there, while in this country the home trade is busy, and booking moderate quantities of lead.' The cable trade, however, is still out of the market for anything but small quantities. The tone of the market is decidedly steadier than it has been for the past few weeks, but ample supplies of metal are due to arrive before long from Australia, Burma, and Mexico.

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Lighting and Power Notes.

Australia.—NEW SOUTH WALES.—A Bill has been introduced in the New South Wales Parliament, states the *Electrical Engineer of Australia and New Zealand*, to authorise extensions to the Port Kembla steam generating station and electrical distribution system of the Public Works Department. The station has at present an installed capacity of 8,100 kW, but provision is to be made for extension to 25,000 kW as required. It is proposed that the distribution system, by means of which bulk supplies are conveyed to several local authorities, shall be extended in several directions. The northern line to Wollongong will be extended to Bulli; the southern line to Nowra is to be continued to Jervis Bay; an interconnecting line will be constructed from Kiama to Moss Vale, *via* Jamberoo and Robertson, and spur lines from Moss Vale to Bundanoon, and from the Avon dam to Picton. Provision is to be made also for transmission lines to interconnect the system with other distribution systems. It is estimated that the proposed works will cost about £800,000.

TASMANIA.—The same journal reports that unprecedented floods occurred during the first week of April over almost the whole of Tasmania, causing considerable damage. The electric supply to Launceston suffered a serious interruption, the City Council's hydro-electric power station on the South Esk River at Cataract Gorge being swept away by flood waters. The station contained a turbine driving a 1,000-kVA alternator, and four 450-h.p. turbines driving 400-kVA alternators. Fortunately this was not the principal source of the city's supply, for a large quantity of energy is purchased in bulk from the State hydro-electric department, transmitted from Waddamana power station at the Great Lake. Owing to the floods, however, the bulk supply also was interrupted, but was speedily restored, and was able to meet the full demand.

Barnstaple.—ELECTRICITY SUPPLY.—At the request of the Instow Parish Council, the Rural District Council has instructed the Bideford and District Electric Supply Co. to proceed at once with the provision of a supply of electricity for the parish. Underground cables are to be used along the front, and overhead lines in other thoroughfares.

Batley.—YEAR'S WORKING.—It was reported to the Town Council, on June 6th, that the Electricity Department had had a successful year and, despite reductions in the charges for lighting and power, there was a gross profit of £11,026, as compared with £13,389 in the previous year. The chief reason for the reduced profit was that over £4,000 expended in respect of capital works had been charged to revenue account. The net profit was £4,576.

Bingley.—YEAR'S WORKING.—A net loss of £2,106 on the working of the electricity department for the past year was reported to the Urban District Council on May 27th. The loss was attributed largely to reduced sale of electrical energy for power purposes, in consequence of the depressed local industrial conditions. There was also a reduction of income from traction supplies due to curtailment of tramway services. The gross profit of the year amounted to £5,669. There was an increase of £1,800 in loan charges, due chiefly to a capital expenditure of £14,000 during the year in extending supplies to outer districts. As the supply becomes more established in these districts this burden will be reduced. The total number of consumers (1,882) showed an increase of 284 on the previous year, and the total energy sold an increase of 50,200 kWh. A reduction in the charge for electricity was introduced during the year.

Birkenhead.—LOAN.—The Corporation Electricity Committee is seeking sanction to a loan of £25,000 for mains and services.

PURCHASE OF PLANT.—The Electricity Committee has agreed to accept the offer of the Wallasey Electricity Committee to pay £16,500 for the purchase of the electricity plant at Moreton. The Committee has also agreed to the offer of the Wallasey Electricity Committee to reduce the kW charge for the bulk supply of electricity to the city from 18s. 9d. to 17s. per quarter.

Blackburn.—YEAR'S WORKING.—The report of the Electricity Department on the working of the electricity undertaking for the year ended March 31st last shows a gross profit of £135,848. After deducting £69,086 for interest, &c., £61,569 debt repayment, and £12,181, capital expenditure charged to revenue, there is a deficiency on the year of £7,888. The deficiency carried forward from a year ago was £77,289, giving a total of £85,177, of which £30,000 was charged to rates. With the provision in this year's estimates for £20,000, there is £35,177 to carry forward. A 10 per cent. increase in charges yielded £16,439. Additional borrowing powers of £97,574 were granted during the year, making a total of £1,906,267. The capital expenditure against this was £1,838,646. There is £66,144 in the sinking fund, the net debt amounting to £1,295,939. Electricity sold increased by 1¼ million kWh, excluding the bulk supply to Preston, the total energy sold for all purposes being 27,868,939 kWh, an increase of 3,397,425, or 14 per cent.

Brazil.—HYDRO-ELECTRICAL DEVELOPMENT.—Good progress is being made with the work on the extensive Serra do Cubatao hydro-electric development scheme of the San Paulo Tramway, Light and Power Co., Ltd. During 1924 and 1925 a prolonged drought reduced the volume of the Tiete and Sorocaba rivers to below normal, and as an emergency measure the Rasgao plant (32,000 h.p.) on the Tiete river, about 25 miles below San Paulo, was constructed. The Cubatao hydro-electric plant is situated near the San Paulo-Santos road, and at present has a capacity of 96,000 h.p. Arrangements, however, are being made to install another pipe line and place an additional unit of 60,000 h.p. into service. The four principal generating plants of the company—Sorocaba, Rasgao, Parnahyba and Cubatao—are so interconnected that any one of them may be shut down and the entire system supplied with power from those remaining in operation. Eventually this system will be connected with the generating plants supplying the Rio de Janeiro district of Brazil.

Burnley.—MAINS EXTENSIONS.—The Electricity Committee has approved an extension of an existing e.h.p. main from Holmby Street sub-station to the cold stores, at a cost of £4,602.

Continental.—SWEDEN.—It is reported that the construction of the power plant on the Indal River to exploit the Kraangede rapids is to begin in 1932 and is to be completed in 1936. The total cost of the undertaking is estimated at Kr. 14,000,000. The plant will have an initial capacity of 50,000 kW, but it is possible that it will be extended to 150,000 kW.—*Reuter's Trade Service* (Stockholm).

RUSSIA.—According to the *Elektritchestvo*, the Soviet Central Electrotechnical Board has approved the construction of a power station in the Briansk district, the boilers of which will be adapted for peat firing. In connection with the new plant a 110-kV ring distribution system is to be installed. The Board has also approved plans for the extension of the power station at Sebastopol in order to supply electricity in the Krim Peninsula. The scheme includes the erection of 60-kV transmission lines between Sebastopol and Sympheropol, and between Sebastopol and Ilta.

SWITZERLAND.—Nine large hydro-electric power stations are at present in course of construction at Ruchlig-Arrau, Ctampsee, Dixance, Handeck, Ryborg-Schworstadt, Orsieres, Sembrancher, Monte Piottino, and an extension at Laufenburg, which will have a total capacity of 478,500 h.p.

Dover.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. R. C. Harpur) for the year ended March 31st last show a total revenue of £50,502, as compared with £51,755 in 1927-28, and working expenses of £24,599, as against £23,760, leaving a gross profit of £25,903 (£27,995), to which was added a balance from the previous year of £2,925, and interest, £64, making £28,892. Capital charges, &c., absorbed £21,936, and there was a net surplus of £6,956, as compared with £8,960 in the preceding year. The sales of electricity increased from 2,969,320 to 3,157,516 kWh. The average price obtained per kWh fell from 4.18d. to 3.84d.

LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £3,000 for services.

Eastbourne.—OVERHEAD LINES.—At a meeting of the Corporation Electricity Committee, held recently, the plan prepared by the consulting engineer showing the route of the overhead transmission lines to the parishes of Eastdean and Westdean was submitted and approved. It was noted that the line between Huggett's lane, Willingdon, and the Friston waterworks would operate at 33,000 V, that the Central Electricity Board would pay for this line or a portion thereof, and that the Corporation would pay the capital charges on it until it was taken over by the Board and continued to Newhaven. At Friston the Central Board is to erect a transforming station, and at this point it is proposed to carry a line through Friston to Eastdean at a pressure of 11,000 V, which will be the property of the Corporation.

Epsom.—LOANS.—The Urban District Council has applied for sanction to loans of £1,000 for assisted wiring, and £1,200 for a new switchboard.

Exeter.—ELECTRICITY SUPPLY PROGRESS.—The annual report of the city electrical engineer, issued recently, shows that the number of consumers at the end of the year was 7,175, an increase of 757. Electricity sold totalled 5,975,699 kWh, an increase of 934,677 kWh. The total length of mains is now approximately 140 miles. Since the completion of the recent alterations the cost of production has been considerably reduced, and when the additional new plant is in operation will be reduced still further. The Electricity Committee has resolved to apply for sanction to loans totalling £20,000 principally for mains, sub-stations and equipment to serve the east of the city, while a further loan of £2,000 is being applied for in connection with mains to serve the southern area.

Gainsborough.—GENERATING STATION.—The Urban District Council, on June 3rd, rejected a proposal from the Yorkshire Electric Power Co. to take over the Council's generating station. The company supplies the town with electricity in bulk to supplement that from the local station, which has recently been acquired by the Council.

Hull.—HIRE-PURCHASE SCHEME.—At a meeting of the Corporation Electricity Committee held recently, the engineer reported that he wished to introduce a scheme of hire and

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hire-purchase of cookers and other domestic apparatus for consumers in the area. The cooker scheme would include free maintenance and repair by the Department during the period of hire, and also the necessary wiring and installation. The majority of the wiring installations would be carried out to the department's specification at an agreed rate by approved contractors, and the repair and maintenance by the department's own staff. In view of the uncertainty of the capital required to finance the scheme, the engineer was of the opinion that as a commencement £25,000 of the existing reserve fund should be allocated for this purpose. He was authorised to proceed with the scheme.

NEW COOLING TOWER.—At a recent meeting of the Corporation Electricity Committee, the engineer reported that it would be necessary in the near future to augment the cooling tower capacity at Sculcoates power station, and it was decided that an additional cooling tower be installed. This will require further pumping plant and a certain amount of piping to connect up the cooling tower. The total cost of the scheme is estimated at £22,000.

STREET LIGHTING.—The Health Committee has adopted a scheme for electric lighting of the roads at the infectious diseases hospital, at a cost of £1,000.

Irish Free State.—DUNGARVAN.—The Electricity Supply Board has made an offer of £5,000 for the purchase of the Dungarvan electricity undertaking. A special meeting of the shareholders was held, and the offer read and submitted for consideration. The amount offered would give the shareholders 10s. 4d. for every £1 of their holding, and in view that 10 per cent. is being paid as dividend, the offer was considered inadequate. The meeting appointed a deputation to wait upon the Supply Board and endeavour to secure terms that would not entail a loss to the shareholders.

Isle of Wight.—SPECIAL ORDER.—The County Council has reported that at a further conference of the representatives of the Island local authorities held recently, it was resolved to recommend the local authorities to support the application by the Isle of Wight Electric Light and Power Co., Ltd., for a Special Order to cover that portion of the Island where existing local Orders now apply, and that each of the local authorities should appoint two delegates with powers to settle the terms of agreement with the company. Under the company's proposals ten existing Orders would be replaced by one Order for the whole island. The system of supply would be changed from d.c. to a.c., and the price throughout the island would be:—Lighting: 8d. per kWh. Power, 3d. to 1½ per kWh on a modified sliding scale. Heating: 2d. per kWh, subject to a sliding scale on the basis of 8 per cent. interest on the capital. The charge for minimum consumption would be based on half-yearly periods (one summer and one winter period) instead of quarterly as at present.

Leeds.—PURCHASE OF PLANT.—The City Council has received a proposal to buy, at a cost of £44,500, all the cables, mains, fittings, buildings, machinery, and apparatus of the Yorkshire Electric Power Co. in the Hunslet, Tadcaster and Wharfedale rural districts, which were added to the city by local Act of Parliament in 1927. A similar suggestion has been made in respect of the powers of the Electrical Distribution of Yorkshire, Ltd., in the Eccup district for the sum of £500.

Leek.—LOANS.—The Urban District Council has applied for sanction to loans of £2,500 for cables, &c., in connection with a supply of electricity to Longsdon, and £2,490 for laying a new feeder cable.

Leyton.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £24,590 in connection with the change-over scheme from d.c. to a.c.

Liverpool.—MAINS EXTENSIONS.—The Extensions Sub-Committee of the Electric Power and Lighting Committee is to undertake a number of extensions to h.p. mains in several of the outside districts. The work in Booker's Avenue and Greenhill Road will involve new h.p. mains estimated to cost £2,877, l.p. mains £1,136, sub-station equipment £2,000, and an h.p. cubicle in the Holmefield Road sub-station £200. In the Borrowdale Road and Greenbank Drive area, h.p. mains will cost £1,980, l.p. mains £7,660, and the equipment of a sub-station £2,000. It is intended to change over the installations and apparatus on consumers' premises to a.c. at an approximate cost of £1,416.

Northern Ireland.—ELECTRICITY SUPPLY PROGRESS.—Speaking in the Northern Parliament on June 5th, the Minister of Commerce stated that the development of electricity services was making steady progress. At the present time no less than one-third of the population had a public supply of electricity available. It was hoped that within a few years' time the majority of the factories might be able to obtain cheap power from e.h.p. transmission lines in their vicinity. Such a transmission line now ran between Belfast and Lisburn, but it was only the first link in the chain. Before the end of the year another link would run from Holywood to Bangor, and would be extended to Newtownards. He looked forward in the near future to extensions in the Lagan Valley, and to the linking up of the principal towns in County Antrim.

OMAGH (CO. TYRONE).—At the meeting of the Urban District Council held recently, the Council adopted a recommendation from the Finance Committee regarding the proposed electric lighting scheme for the town. The Committee recommended that the lighting area be within a radius of one and a-half miles from the gasworks; that the mains be carried underground from the power station to Market Street; that overhead lines be erected through all the principal streets, and that public lamps be provided. It was decided to confirm the appointment of Mr. Spalding as engineer in connection with the scheme, and to make application for a loan for the work.

Peterborough.—EXTENSIONS TO PLANT.—The Town Council has decided to place before the Central Electricity Board particulars relating to the present generating plant and boiler plant, and the suggestions of the manager of the electricity undertaking for extensions estimated to cost £65,000.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

DONCASTER.—For domestic users: From 12½ per cent. to 10 per cent. on ratable value (minimum charge 35s. per year), plus ¾d. per kWh. Power supply to tramway undertaking: 10 per cent. discount on present charges (1d. per kWh). The reduction operates from April 1st last.

CAERNARVON.—*National Electric Construction Co.*—Lighting: From 7d. to 6d. per kWh.

PENMAENMAWR.—Lighting: From 8d. to 7d. per kWh. Heating and cooking: To 1d. per kWh.

Salford.—LOAN.—The Corporation Electricity Committee is seeking sanction to a loan of £5,230 for the erection and equipment of sub-stations.

Sefton.—ELECTRICITY SUPPLY.—It was reported, at a meeting of the Town Council held recently, that, in connection with the proposed supply of electricity by the Liverpool Corporation, the Corporation is now awaiting an Order. The Council, after being informed that local landowners desired to supply farms and cottages in the area for the winter, decided to approach the Liverpool Corporation to point out that there was nothing to prevent it from proceeding with its Fringe Order to supply Ince Blundell.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at an estimated cost of £24,891.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order for the Worksop Urban District Council authorising it to extend its area of electricity supply by the addition of the parish of Whitwell. Application has also been made by the York Corporation for an amendment of the York Electricity (Extension) Special Order so as to provide that the area of supply to be described in the proposed Order shall include the township of Warthill and part of the township of Boroughbridge.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Trent Valley and High Peak Electricity Co., Ltd., to supply electricity in the rural district of Hayfield and part of the rural district of Glossop Dale.

Stalybridge.—LOAN.—The Stalybridge, Hyde, Mossley and Dukinfield Electricity Board is to seek sanction to a loan of £25,000 for new electrical machinery.

Stone.—ASSISTED WIRING SCHEME.—The Urban District Council has adopted an assisted wiring scheme, and has also decided to install slot meters when required.

Walthamstow.—PURCHASE OF LAND.—Application has been made to the Electricity Commissioners by the Urban District Council for consent to extend the site of the Council's generating station.

Wrexham.—LOAN.—The Town Council has applied for sanction to a loan of £800 for installing and equipping a sub-station at the Abbot leather works and a transformer kiosk at Old Acton smithy.

York.—RECTIFYING PLANT.—The Corporation Electricity Committee has recommended the installation of rectifying plant at the Groves sub-station, at an estimated cost of £1,460, with a view to further supply in the Groves district. The alternative would be a change-over to a.c. at an estimated cost of £4,000.

Tramway and Railway Notes.

Australia.—BRISBANE (Q.).—We have received from Mr. G. R. Steer, general manager of the city tramway undertaking, a copy of his report and the statement of accounts for the year ended December 31st last. The total revenue amounted to £810,954, as compared with £814,312 for the preceding year. Working expenses were £594,126, as against £613,285, and there was a special expenditure of £13,586 on various changes of premises, leaving a gross profit of £203,243 (£201,027). After providing for interest on loans, depreciation, amortisation and sinking fund, there was a net surplus of £6,118, as compared with a surplus of £17,313 in the previous year. The number of car miles run increased from 6,535,833 to 6,570,228, but the number of passengers carried fell from 78,057,620 to 77,703,264; this is attributed to the great in-

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crease in the number of private motor-cars, the temporary depression in trade and operation of privately-owned motor-'buses. The revenue per car mile dropped from 29.02d. to 28.88d.

Barrow.—YEAR'S WORKING.—At a recent meeting of the Town Council the report on the working of the tramway undertaking for the year ending March 31st was submitted. The total income was £34,066, as compared with £36,333 in 1927-28. Working expenses amounted to £28,627, as against £29,602, and after meeting other charges there was a net loss of £9,672, as compared with a loss of £8,541 in the preceding year. The total deficiency at the end of the year was £19,588, of which £8,645 has been included in the general rate for the current year, leaving a deficit of £10,943 to be carried forward. The car-miles run during the year decreased by 12,405.

Continental.—ITALY.—The work of electrification having been completed, electric trains are now running between Rome and Sulmona, and between Alessandria and Ovada.

Exeter.—CONSULTANT'S REPORT.—Mr. A. R. Fearnley, of Sheffield, the expert called in by the Corporation Tramways Committee to advise as to problems of extension and the future of the tramway undertaking generally, has submitted his report, in which he has recommended that no further expenditure be made upon the system except such as is sufficient to keep it in immediate operation. He states that the tramway is efficiently managed and operated, but points out that a considerable amount of track renewal will be required during the next few years, involving an estimated outlay of over £12,000, and also that a considerable amount of rail grinding will be necessary, corrugation having reached a serious stage. Having in mind the existing conditions in the centre of the city, which render tramway operation unsuitable, also the amount of capital expenditure involved (£20,750) in the proposed extension to Whipton, he has recommended that, instead of constructing the proposed extension, the Corporation should at once obtain three double-deck top-covered motor-omnibuses at an estimated cost of £1,798 per 'bus. He has advised the Committee against the adoption of the railless-car system.

Leeds.—TRAMWAY SCHEME DEFERRED.—The Corporation Tramways Committee has deferred consideration of the question of obtaining Parliamentary powers for the running of a tramway service along Easterly Road until the Corporation is promoting a Bill in Parliament.

Liverpool.—YEAR'S WORKING.—It is reported that the working of the Corporation tramway undertaking for the year ended March 31st last resulted in a net surplus of £154,000, of which £75,000 has been contributed to the borough fund.

London.—DERAILMENT.—A considerable delay was caused in the evening of June 6th by the derailment of a train on the Tube Railway at Kennington. The train was almost full of passengers, but no one was hurt. The cause of the derailment has not yet been discovered.

Manchester.—YEAR'S WORKING.—We have received from Mr. R. S. Pilcher, general manager of the Corporation tramway undertaking, a copy of the report of the Tramways Committee, together with the statement of accounts for the year ended March 31st last. The revenue accounts show a total income of £1,814,705, as compared with £1,856,592 in the preceding year, a decrease of £39,977. The report states, however, that of this decrease over £20,000 was lost in the latter part of the year, during which a spell of very severe weather was experienced. Working expenses increased from £1,476,480 to £1,487,487, resulting in a smaller gross profit at £327,218, as against £380,112. To the gross profit was added a balance from the motor-omnibus system, interest, and an unemployment grant, making a total of £358,211 available, against which was charged loan and bank interest, rent of leased lines, &c., leaving a balance of £193,798. This was transferred to appropriation account with a contribution of £14,693 from the 'bus account to sinking fund, and disposed of as follows: Sinking fund and loan instalments, £115,675; street improvements, £12,407; renewals fund (net surplus), £80,408. The previous year's working resulted in a surplus of £146,138. The capital expenditure amounted to £277,094, the chief items being £57,737 for permanent-way, £85,676 for buildings and fittings at Hyde Road depôt, £39,053 for rolling stock, and £41,056 for motor-omnibuses. The total now spent on the undertaking stands at £4,443,696. The number of passengers carried decreased from 328,013,199 to 322,815,254, but the car miles run increased from 24,182,506 to 24,456,250. The average total revenue per car mile fell from 18.426d. to 17.808d., and the total consumption of electrical energy increased from 46,966,311 to 48,818,166 kWh. Complete overhead equipment was erected in Heywood, and the following lines were constructed: Market Place, Middleton; Oldham Road and Mills Hill to Chadderton boundary; Rochdale Road, Middleton, to Castleton boundary; Manchester Road, Heywood (in progress). During the year 27 single-truck cars were converted into vestibule double-truck cars, and the number of cars in stock at the end of the year was 953.

Sheffield.—NEW TRAMCARS.—The Corporation Tramways Committee has authorised the general manager to proceed with the construction of ten double-deck tramcars, to be built in the tramway workshops.

Southern Railway.—ELECTRIFICATION.—The expenditure of £597,000 has been sanctioned by the Southern Railway for three important extensions of its suburban electrified system. These additions, which will increase the number of track miles electrified to 800, will, it is hoped, be completed in time for the summer service of 1930. The first portion of 27½ miles, between Hounslow and Whitton Junction and Windsor, involves the lengthening of station platforms at Feltham, Staines and Wraysbury, and the erection of sub-station buildings at Ashford and Datchet. The second section of the proposed scheme is between Dartford and Gravesend, a distance of 14 miles, and will necessitate the lengthening of platforms at Greenhithe (including the rebuilding of the station), Northfleet and Gravesend Central. A sub-station will be erected at Northfleet, while Stone Crossing Halt and Swanscombe Halt are to be reconstructed. In connection with the third section, of eight miles, between Wimbledon and West Croydon, the principal works are the construction of a halt at Waddon Marsh, between Beddington Lane Halt and West Croydon, and the linking up of certain sidings to form an independent goods line between West Croydon and Beddington Lane. A twenty-minute service of trains will be run during business periods, and a thirty-minute service at other times. The popularity of the electrified system on suburban routes is revealed by the fact that last year 6,500,000 more passengers were carried than in 1927, and in that year the increase was 11,500,000 over 1926.

Telegraph and Telephone Notes.

Belgium.—TELEGRAPH CABLE SYSTEM.—It is stated that the new cable connections established by Belgium last year with neighbouring countries, and for connection with England, have proved to be inadequate owing to the growth of the traffic. Under the circumstances proposals are now under consideration for the execution of further extensions at an estimated outlay of 200,000,000 fcs.

International Telephony.—ENGLAND-ITALY.—The British Post Office announced on June 8th that a "through" telephone circuit between London and Milan had been brought into operation. The new circuit will permit of a more rapid service between this country and Italy.

South America.—RADIO CONCESSIONS.—Further extension of the wireless rights of the International Telephone and Telegraph Corporation, of New York, is evident from the announcement that the South American Republic of Colombia has granted to All-America Cables, Incorporated, an affiliated concern, a concession for the construction of a wireless station at Bogota (the capital of Colombia), and two coastal stations, one on the Atlantic and the other on the Pacific. Peru also is reported to have granted rights to the same company.—*Reuter's* (New York).

The Telephone Service.—GROWTH.—Official statistics published in the *Telegraph and Telephone Journal* show that the total number of telephones in operation at the end of the financial year (March 31st) was 1,754,641, a total increase of 123,450, or 7.6 per cent. The various increases are shown in the following table:—

	Total, 1928.	Total 1929.	Increase.	Increase of or
London	578,322	626,714	48,392	8.4
England and Wales (excluding London)	883,435	948,934	65,499	7.4
Scotland	148,934	157,169	8,235	5.5
Northern Ireland ...	20,500	21,824	1,324	6.5
	1,631,191	1,754,641	123,450	7.6

The number of public call offices (including kiosks) working at March 31st last was 25,864, of which 5,599 were connected with London exchanges, and 20,265 with provincial exchanges; the net addition for the year was 1,810, or 7.5 per cent. Of the net increase of 1,810 call offices, 1,591, or 88 per cent., were kiosk call offices. On March 31st last the kiosks connected with London exchanges numbered 1,273 and those with provincial exchanges 5,005, a total of 6,278 kiosks, practically a quarter of the call offices now working. During the year 193 new exchanges were opened under the rural development scheme of 1922, bringing the total number of exchanges open under that scheme up to 1,267, in addition to which a further 79 were in course of construction at the end of March. The total number of exchanges working at March 31st, 1929, was 4,476.

CABLE FIRE.—A fire, similar to others which broke out within a few days of each other in September, 1928, occurred in a tunnel under the Thames Embankment, London, on June 6th. The tunnel accommodates electricity cables, gas and hydraulic mains, and telephone and telegraph cables. Telephone and telegraph services were interrupted, and the British Broadcasting Corporation's land lines were placed out of commission.

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TOLL EXCHANGE.—With a view to speeding up service, the Postmaster-General announces that a number of additions have been made to the towns already served by the Toll exchange, instead of "Trunks."

MANX CABLE.—The cable ship *Faraday* finished laying a telephone cable between Norbreck, near Blackpool, and Port Greenough, Isle of Man, during the night of June 5th.

The Telegraph Service.—TIME EXTENSION.—The Post Office authorities announce that from July 1st the hours during which telegrams are accepted and delivered will be extended to 9 p.m. at all head offices which now observe an earlier closing time, and also at a certain number of sub-offices in the country.

Radio Notes.

Australia.—PROGRAMME TENDERS.—The Federal Government has accepted the tender of Union Theatres, Ltd., Fullers Theatres, Ltd., and Messrs. Frank Albert and Son for the supply of programmes for a national broadcasting service on the basis of a payment to the tenderers of 12s. from each listener's licence fee.

France.—BROADCASTING BILL.—The broadasting Bill of M. Germain-Martin, Parliamentary Under-Secretary to the Post Office, has been deposited before the Chamber of Deputies, and referred to the Commission of Public Works. The principal terms of the Bill are, according to *World-Radio*, as follows:—No transmitting station can be erected, or worked, except by the State, or concessionaires under the control of the State. No concession will be given for a period of more than twenty years. Any transmitting station can be suspended by a Government decree.

A Broadcasting Committee will be formed which will meet every two months and will study all questions; it will consist of forty-three members appointed by the Prime Minister, and will include a representative of each Ministry interested in broadcasting, and representatives of intellectual, artistic, scientific, economic, and social groups, together with representatives of the Press and of listeners.

A National Office of French Broadcasting will be formed to look after development, the working of the State transmitting stations, and the national laboratory of radio-electricity, under the authority of the Prime Minister, administered by a Board consisting of fifteen members. The Budget will be provided from three sources: (1) by an annual tax of Frs. 20 on each crystal set and Frs. 50 on each valve set; (2) by a tax of 4 per cent. on the selling price of all valves; (3) by grants, legacies, donations and sundry receipts.

All wireless sets must be declared within a month of the Bill becoming law, and all purchases of sets must be declared by the buyer within eight days of the purchase. Dealers also will have to make declarations of sets sold by them. Fines of from Frs. 50 to 200, plus five times the amount of tax evaded, will be inflicted in case of non-declaration. The concessionaires or directors of transmitting stations must be of French nationality. Advertising matter must not occupy more than one-tenth of the programme of each station.

The Cabinet will fix by a decree the number and situations of the State and private transmitting stations, which are conceived of as falling into three classes, of very high power, regional power, and local-service power, respectively. The last-named will depend largely on private initiative for their support. There will also be a powerful station on a short-wave, which will broadcast several times a day for the benefit of the French colonies. The Bill is meeting with a good reception.

The Prague Plan.—NEW WAVE-LENGTHS.—Of special significance is the table of new British wave-lengths presented by the B.B.C. in a description by Capt. P. P. Eckersley of the Plan de Prague, for the table in question contains not only the reallocation of wave-lengths as from June 30th when the Prague plan takes effect, but also the provisional reallocation of wave-lengths on the opening of London's regional transmitter at Brookman's Park for a second programme some few months hence.

Capt. Eckersley explains in the article, which accompanies the table in the June 7th issue of the *Radio Times*, that on the suggestion of the Czecho-Slovakian Government a conference of representatives of the European Governments was held in Prague last April to discuss wave-lengths with the work of the International Union of Broadcasting as a basis. Every interested Government was represented at Prague and the official delegations were composed of Post Office officials. The conference finally ratified the Plan de Prague, essentially a modification of the Brussels plan, which involves sacrifice for Britain as it does for Germany and Sweden, countries favourably placed because of their early start in the broadcasting field. However, complete agreement has at last been reached with the seal of officialdom upon the labours of the experts and, except in minor details, it is unlikely that there will be any changes for some years to come; far greater agreement on wave-length allocation has been achieved in Europe than in North America. Britain has, as always, ten exclusive waves; the shorter waves, unfortunately, have to be used, and it is better to have a shorter wave unheterodyned than an apparently much better and longer wave jammed. It is hoped to open the London station for double-wave working towards the end of this year. There will be further changes, not in wave-lengths, but rather in the wave-lengths used by the different stations, as the regional scheme develops and new stations are opened and old ones are superseded. At present there will be no changes in the principal wave-lengths of the Daventry (5XX) and (5GB), Manchester, Glasgow, London, and Cardiff stations.

The Union Internationale.—LAUSANNE SESSION.—The annual general assembly of the Union Internationale de Radiophonie which has just concluded its sessions at Lausanne, elected Vice-Admiral C. D. Carpendale, C.B., controller of the British Broadcasting Corporation, to be its president for the fifth year in succession. This assembly was notable, among other things, for the fact that for the first time the French Government took up active membership, which, in conjunction with other adhesions actual or pending, brings practically all European broadcasting within the Union. As a result of the recommendation of a conference of all European administrations concerned with wireless, held at Prague recently, the Union is now the recognised centre for all broadcasting questions of an international character. The first step taken at Lausanne in implementing this decision was to adapt the former statutes to the new conditions and to provide for the management and finance of the wave-length checking centre at Brussels, which has been in existence for some time, but has now been officially made the master-regulator for Europe.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 15th. State Electricity Commission of Victoria. Two 750-kVA transformers and spares. (B.X. 5325.)*

July 23rd. Posts and Telegraphs Department. Telegraph instruments. (B.X. 5323.)*

June 25th. Underground and aerial telephone cables. (B.X. 5346.)*

Belfast.—June 17th. Electricity Department. H.p. combined cubicle and truck type switchgear and transformer kiosks, one 1,000-kW rotary convertor, one 500-kW rotary convertor, d.c. switchgear, h.p. armourclad switchgear, and h.p. truck-type switchgear for sub-stations. (May 31st.)

Denmark.—COPENHAGEN.—June 21st. Municipal Council. Switchgear for the "Faelledveg" sub-station extensions. (B.X. 5367.)*

East Grinstead.—June 17th. Electricity Department. Supply, laying and jointing of a system of l.p. cables, complete and ready for use. (May 31st.)

Edinburgh.—June 17th. Education Committee. Electrical installations at Colinton, Davidson's Mains, Gilmerton, Granton, Juniper Green, Willowbrae, and Milton House Schools. Specifications, &c., from Executive Officer, Education Offices, Castle Terrace, Edinburgh.

Egypt.—CAIRO.—July 15th. Ministry of Interior. One 250-kVA Diesel engine-driven a.c. generating set, with switch and control gear. (B.X. 5331.)*

August 13th. Supply of an electric power station with underground and overhead network for the town of Maghagha. (B.X. 5318.)*

Holywood.—July 2nd. Urban District Council. Laying and erection of l.p. underground and overhead mains and h.p. cable, erection of l.p. switchboard, h.p. armour-clad and truck-type switchgear, and 3-phase transformers. (See this issue.)

Hull.—June 20th. Electricity Department. Supply of stores for 12 months from July 1st, 1929. (June 7th.)

India.—SIMLA.—July 8th. Indian Stores Department. 30-kW oil engine-driven generating set for the Military Engineering Services, St. Thomas Mount, Madras. (B.X. 5364.)*

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Leeds.—June 17th. Education Committee. Electrical wiring of schools during midsummer vacation. Particulars from Education Offices (architect's section), Calverley Street, Leeds.

London.—CENTRAL ELECTRICITY BOARD.—June 17th. Supply, delivery and erection of 33-kV and lower voltage switchgear for the North-West England and North Wales Electricity Scheme, 1928. (May 17th.)

July 22nd. Supply, delivery and erection of central indicators and telephones for the Central Scotland Electricity Scheme, 1927. (June 7th.)

LONDON COUNTY COUNCIL.—July 8th. 150 complete bodies for tramcars, 150 sets of swing bolster bogie trucks, 150 electrical equipments for tramcars, &c., and 150 magnetic track and wheel brake equipments. (June 7th.)

Newport (Mon.).—June 22nd. Electricity Department. One 1,250-kW motor convertor and switchgear. (June 7th.)

New Zealand.—WELLINGTON.—August 7th. Posts and Telegraph Department. Enamelled and silk-covered resistance wire. (B.X. 5322.)

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

September 4th. Government Railways. Motor generator. (B.X. 5308.)*

AUCKLAND.—August 19th. Auckland Electric Power Board. Single-phase transformers. (B.X. 5324.)*

Nottingham.—June 28th. Electricity Department. Supply of general stores for the electricity undertaking for 12 months from July 1st, 1929. (June 7th.)

South Africa.—PRETORIA.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. (B.X. 5273.)*

August 1st. Telephone cable. (B.X. 5345.)*

PIETERSBURG, TRANSVAAL.—August 13th. Municipal Council. Steam-raising plant, engine alternators, and switchgear. (A.X. 7983.)* H. and l.p. cable, lamps and sundries. (B.X. 5312.)*

JOHANNESBURG.—June 27th. South African Railways and Harbours. 2,200- and 600-V cables and accessories. (B.X. 5343.)*

June 20th. City Council. Supply and delivery of h.p. and l.p. cables. (B.X. 5342.)

Stafford.—July 2nd. Staffordshire Education Committee. Installation of electric light at Kingswinford Brockmoor Council school. (June 7th.)

Sunderland.—July 8th. Electricity Department. Paper-insulated, lead-sheathed cable, rubber-insulated wire, meters, gasfilled and vacuum lamps. (June 7th.)

Turkey.—CONSTANTINOPLE.—July 4th. Administration Générale des Chemins de fer et Ports d'Etat. Wires, cables and general lighting accessories. (B.X. 5368.)*

Uruguay.—PORT AUTHORITIES.—July 22nd. 300-kilo electro-pneumatic drop-hammer. (A.X. 7974.)*

West Ham.—June 17th. Education Committee. Installation of electric lighting at Fyfield open-air school extension, and installation of water-heating apparatus at Balaam Street School, Plaistow. (May 24th.)

Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Three 225,000-lb. boilers with economisers, air heaters, fans, &c. (June 7th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Gas Committee. Accepted:—
Trident electric scaling machine.—Liverpool Patents Co., Ltd.
Electricity Committee. Accepted:—
Cable (£1,276).—Macintosh Cable Co., Ltd.; and (£1,982), Hackbridge Cable Co., Ltd.
Overhead lines (£4,484).—W. T. Henley's Telegraph Works Co., Ltd.

Colchester.—Town Council. Accepted:—
E.h.p. generator panel and two l.p. a.c. feeder panels, earthing cubicle, and cable connections (£1,650).—Electrical Construction Co., Ltd.
E.h.p. cable (£5,883), supply and erection of overhead l.p. distribution lines, and poles in the Wivenhoe Urban District (£2,494), and e.h.p. and l.p. cable (£13,108).—W. T. Henley's Telegraph Works Co., Ltd.
Three 11,000- and 6,600-volt kiosks (£1,275).—Crompton Parkinson, Ltd.

Derby.—Town Council. Accepted:—
Pipe work for the new turbo-alternator and two additional boilers (£5,073).—Aiton & Co., Ltd.

Hull.—Telephones Committee. Recommended:—
Cable (£1,295).—W. F. Dennis & Co.
Mental Hospital Committee. Accepted:—
Wiring pavilion at Tilworth Grange (£118).—Clarke and Graham.
Tramways Committee. Accepted:—
Standard electric lamps.—Clarke & Graham.
'Bus electric lamps.—General Electric Co., Ltd.

Leeds.—Electricity Committee. Accepted:—
Cables.—(£2,450), W. T. Henley's Telegraph Works Co., Ltd.; (£3,084), Enfield Cable Works, Ltd.; (£5,225), Macintosh Cable Co., Ltd.; (£906), Hackbridge Cable Co., Ltd.; and (£2,743), Greenwich Cable Works, Ltd.
Works transformers (£2,170).—Hackbridge Electric Construction Co., Ltd.
Tramways Committee. Accepted:—
Two rail grinders (£1,043).—Equipment & Engineering Co., Ltd.
200 yards guard rail (£270).—Edgar Allen & Co., Ltd.
1,150 yd. conduits (£304).—Leeds Fireclay Co., Ltd.

Liverpool.—City Council. Accepted:—
Supply of two h.p. metal-clad switch units for the Waterloo sub-station (£741).—Ferguson, Pailin, Ltd.

London. — CAMBERWELL. — Baths Committee. Recommended:—
Additional electric lighting at Wells Street baths (£119).—W. M. Williamson.

Manchester.—Education Committee. Accepted:—
Electrical installations.—At Burnage School, Sudlow and Co.; and at Higher Ormond Street School, Seddon and Sons.
Electricity Committee. Accepted:—
Repairs to Dickinson Street battery.—Tudor Accumulator Co., Ltd.
Three 1,000-kVA transformers.—British Thomson-Houston Co., Ltd.
One 11,500-kVA auto-transformer.—Hackbridge Electric Construction Co., Ltd.
33,000-V feeder protective gear.—A. Reyrolle & Co., Ltd.
H.p. steam pipework at Barton works.—Foster Bros., Ltd.
Tramways Committee. Accepted:—
Cadmium copper trolley wire.—R. Johnson & Nephew, Ltd.
Tramway rail bonds.—British Insulated Cables, Ltd.
Mild steel electrodes.—Welding Equipment Co., Equipment & Engineering Co., Ltd.; and Quasi-Arc Co., Ltd.
Cleansing Committee. Accepted:—
Electric cable for Water Street depôt.—R. H. Clampnett and Co.

Oldham.—Electricity Committee. Accepted:—
Two transformers.—Ferranti, Ltd.

Reading.—Town Council. Accepted:—
Electrical blowing apparatus for the organ in the large Town Hall (£267).—H. Willis & Son, Ltd.
Electrical wiring in connection with above.—Reading Electric Supply Co., Ltd.

Rotherham.—Electricity Committee. Recommended:—
Two pairs truck type switches (£256 per pair).—A. Reyrolle & Co., Ltd.
Spare armature (£215).—Metropolitan-Vickers Electrical Co., Ltd.
Rectifying plant (£2,375).—Brown, Boveri, Ltd.

Salford.—Tramways and Motor Omnibus Committee.
12,000 electric traction lamps (£437).—Nelson Electric Co., Ltd.
Commutator spares (£364).—Manchester Armature Repair Co., Ltd.
Insulating tapes.—L. Andrew & Co., Ltd., and Hamnett and Andrew.
Gear and pinion wheels (£1,039).—British Hele-Shaw Patent Clutch Co., Ltd.
Axles.—J. Baker & Co. (Rotherham), 1920, Ltd.
Steel tires (£839).—Brown, Bayley's Steel Works, Ltd.
Brake blocks (£720).—National Rail & Tramway Appliance Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
Two 11,000-V feeder panels (£468).—A. Reyrolle & Co., Ltd.

Torquay.—Electricity Committee. Accepted:—
"Liptak" type of flat furnace arches for two boilers (£1,024).—Stirling Boiler Co., Ltd.
One 2,000-kVA Scott transformer group (£906).—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear (£696).—British Thomson-Houston Co., Ltd.
Voltage regulator for Paignton (£1,400).—English Electric Co., Ltd.

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Forthcoming Events.

Diesel Engine Users' Association.—Friday, June 14th. Caxton Hall, Westminster, S.W. 6 p.m. "Repairs to Diesel Engine Parts by Electro-deposition." Mr. C. H. Faris.

National Physical Laboratory.—Tuesday, June 18th. Teddington. 3 to 6 p.m. Annual Inspection by General Board.

Electrical Contractors' Association.—June 26th to 28th. Bournemouth. Annual Conference.

Overhead Lines Association.—Friday, July 5th. Summer meeting. Charabanc tour in the Mid-Cheshire Area.

Notes.

Ultra-violet Rays in Rubber Manufacture.

In the course of a leaderette on the above subject in our June 7th issue, page 996, the "Fade-Ometer" (Willmott, Son and Phillips, Ltd.) was referred to as a mercury-vapour lamp in a suitable housing, which is, of course, incorrect, as the instrument consists of a carbon-arc lamp.

The system referred to is applied by the Dunlop Rubber Co. and all its subsidiaries, and also many of the larger tire manufacturers, while artificial sunlight treatment has been provided for its employés by the Dunlop Co., which has opened an ultra-violet-ray clinic at its works for the purpose.

International Communication.

Colonel Sosthenes Behn, president of the International Telephone and Telegraph Co., was heard on June 7th by the American Inter-State Commerce Committee of the Senate which is considering Senator Couzens's Bill, which seeks to establish a general communications commission to control radio and cable telegraph and telephone activities. According to *The Times*, Colonel Behn pleaded that the Government should not only remove the ban imposed by the White Law upon mergers of wire, wireless, and cable communications, but should even encourage them. The policy of the United States Government in preventing such mergers, he declared, was in singular contrast with that of other Governments occupying an equally important position in the field of international communication, and if the United States was to hold its own mergers should be permitted. A decision was reached that the Commerce Committee should investigate the whole field of communications, including transmission of power.

Colonel Behn outlined his plans for a world-wide communication system employing every known method of transmitting information. He gave details of the proposed purchase of the Radio Corporation of America by the I.T.T. and the plans for a new cable between the United States and South America, from New York to Cuba, thence to Venezuela, Brazil, and the Plate, to supplement the three existing west coast cables. He also spoke of the plans for transandean communication between Chile and Peru. Mr. Behn declared, says the *Daily Telegraph*, that before August the transatlantic radio-telephone service between Buenos Aires and Madrid would be opened. Eventually, if the company were allowed to purchase the Radio Corporation, millions of telephones in the United States, Canada, and Cuba would be connected with South America and Europe. The American Telephone and Telegraph Co. was planning a transatlantic telephone to supplement the three radio channels now in use for the radio-telephone service between the United States and Europe. He said it was paying the Radio Corporation 400,000 shares of its stock for the radio facilities of the latter corporation. The estimated value of the facilities is $20,000,000 to $25,000,000, in addition to which he would get the Radio Corporation's contractual relations with foreign companies.

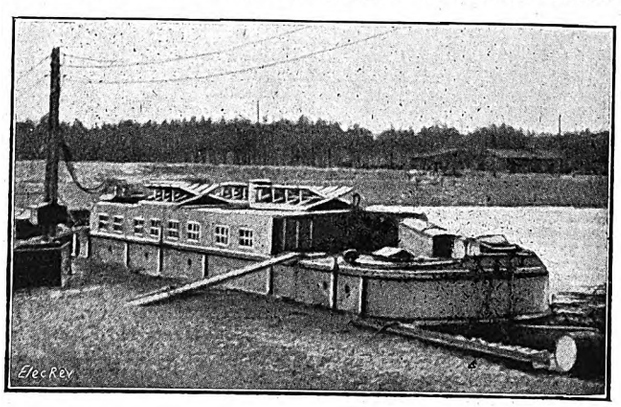
The French newspapers too make reference to Col. Behn's activities: for example, one paper announces that an extremely close agreement has just been concluded between Société Française Radio-Electrique and the Western Electric Co. Under the terms of the agreement the Société Française Radio-Electrique acquires all the patents of the Western Electric Co. concerning wireless telephony, and in future the S.F.R. will only manufacture "American material." Monsieur Chireix will be placed at the head of the department for the manufacture of transmitting apparatus, and Commandant Brenot will be placed at the head of the department for receiving apparatus. At the same time it is declared that the Thomson-Houston and Western Electric Companies and Materiel Telephonique, Ltd., undertake not to concern themselves with wireless telegraphy and telephony in France. The paper comments on the effect the agreement will have on the industry in France, and while some of the reports may be somewhat distorted the following statements are understood to be reliable:—

Regarding international communication, an agreement has been drawn up between the Compagnie Française de Cables Telegraphiques and the Compagnie Radio France for the co-ordination of their technical and commercial resources. This agreement between the two great French transoceanic telegraphic routes will gives the public the benefit of the combined advantages of cables and wireless. The co-operation of the two companies, will, in fact, according to expectation, allow for the sending of messages by either available mode of transmission, thus lessening delays en route and assuring safety in transmission. The French T.S.F. group and P.Q. Cables, on the other hand, have come to an agreement with the American International Telephone and Telegraph group comprising the All America Cable Co., Commercial Cable Co., and Postal Telegraph and Cable Co., for the exploitation of submarine cables and wireless stations in the Antilles, and also a co-operative agreement for the collection and distribution of telegrams to the United States. This agreement should come into force on April 1st next.

Regarding the radio-electrical industry, very important agreements for the French radio-electrical industry were signed on December 31st, 1928, between the Compagnie Générale de T.S.F. and "Le Matériel Telephonique," a French branch of the International Telephone and Telegraph Corporation. Under the terms of these agreements, which will come into force on April 1st next, the Compagnie Générale de T.S.F. and its branches and French associated companies will have the rights for France and her colonies, protectorates and mandates, and for all applications in the field of radio, to all patents, patent rights, and inventions, which Le Matériel Telephonique now possesses, or may hereafter possess. The latter will receive rights under the patents and inventions of Compagnie Générale de T.S.F. for certain foreign countries. Technical co-operation between the two company groups will make these agreements effective. In consequence of these agreements the Compagnie Générale de T.S.F. and its branches, Radiotechnique, Radiola, &c., will sell to the French public, in addition to their own apparatus, that of the L.M.T. (loud-speakers, radio equipment, &c.).

A Floating Electric Power Station.

A recent issue of an A.E.G. journal contains a short description of an interesting floating Diesel engine power station recently equipped by the A.E.G. concern, for the supply of power for the construction of a lock on an island waterway near Berlin. The station is equipped with three M.A.N.



A Floating Power House.

airless-injection, four-stroke, four-cylinder Diesel engines, each developing 150 b.h.p. at 300 r.p.m. directly coupled to A.E.G. three-phase alternators, each with an output of 125 kVA at 400 volts, 50 cycles. There is also an auxiliary set for an output of 10 kVA. The work on the lock has now been proceeding without a hitch for nearly eighteen months, without any failure in the supply of current to the pumps. Although only four-cylinder Diesel engines were installed, the vibration of the hull of the boat is stated to be not very noticeable. It is, however, recommended that six-cylinder engines should be used with a view to a more favourable distribution of the stresses on the float.

Association of Consulting Engineers.

The annual general meeting of the Association of Consulting Engineers was held in London on May 27th, Mr. H. Howard Humphreys being in the chair. The report of the Committee for 1928-29 shows that during the year two members died, three resigned, and thirteen new members were added, so that the membership is now 123. The accounts show that the income, £512, balances the expenditure.

Prevention of Fumes from Power Station Chimneys.

The *Liverpool Post and Mercury* reports that during a discussion at a meeting of Liverpool City Council on June 5th on the possible danger to public buildings from noxious fumes and grit emitted by the proposed station at the Clarence Dock, it was stated that Mr. P. J. Robinson, the city electrical engineer, had discovered and patented a device which would mitigate, if not abolish, acid fumes, such as sulphur dioxide, and all perceptible grit and dust. The device had been submitted to two scientific experts, who were satisfied that it would fulfil what was required of it.

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Low-temperature Carbonisation.

The systematic study of the low-temperature coal carbonisation processes promised to be of material assistance in restoring the prosperity of the coal fields, said Dr. M. A. Matthews in the course of a recent lecture at the Sir John Cass Technical Institute, London. Dr. Matthews pointed out that the fact that there were at present in Great Britain 43 companies, representing a capital of eight million pounds sterling, directly interested in the low-temperature carbonisation of coal showed how commercially important the processes had become. When the chemical nature of low-temperature tar was more fully understood there could be no doubt that many further uses would be found for it. Among the products which could be obtained from low-temperature tar were lubricating oils, fuel and Diesel oils, powerful disinfectants from tar acids, and resins suitable for use as paints, varnishes, insulating material, &c., while the pitch had been found useful in the manufacture of roofing material and as a binding agent for patent fuel.

It is announced that work has just begun on the erection of extensive refineries on the banks of the Humber at Killingholme, where British low-temperature tars will be treated by the gyro vapour-phase cracking process. Capital to the extent of nearly half a million pounds has been subscribed for this important project of motor-spirit and oil-fuel production from British coal oils.

Appointments Vacant.

Borough electrical engineer (£1,000) and distribution assistant for the Torquay Corporation. Mechanical draughtsman for Electrical Department of Buenos Ayres and Pacific Railway. Power-station shift engineer for Hastings Corporation. Wireless engineer for the Government of Nigeria. Teacher in electrical engineering at Jarrow secondary school. Stores clerk for Basingstoke Electricity Department. Assistant electrical engineer for Clacton Urban District Council. (See our advertisement pages to-day.)

Safety of Life at Sea.

A plenary session of the International Conference on Safety of Life at Sea was held at the Foreign Office, London, on May 31st for the purpose of considering the adoption of the Convention which had been prepared as a result of the discussions in Committee during the period since the Conference opened on April 16th (see ELEC. REV., April 26th, p. 768.)

Vice-Admiral Sir Herbert Richmond, K.C.B., President of the Conference, was in the chair, and the meeting included the delegates of all the Governments represented at the Conference. Senator Rio (French Delegation) having presented the draft Convention, and the chairman of the technical committees of the Conference having spoken in turn to the effect that the draft carried out the views of the committees over which they had presided, Admiral Richmond moved the adoption of the Convention. In the course of his summary of the work of the Conference he said, according to the *Board of Trade Journal*, that the great importance of radio-telegraphy as a means of promoting safety of life at sea had been fully demonstrated in 1914, and in the years that have passed there had been remarkable developments. A comparison of the Berne international list of ship radio stations with Lloyd's register of shipping showed that, out of the total of 11,000 merchant steam ships and motor ships of 1,600 tons gross and upwards owned by the maritime countries of the world, no less than 10,000 were so equipped. To make the equipment fully effective for life-saving purposes, however, it was not sufficient that a ship in distress should be able to send out calls for assistance. Provision must be made for the reception of such calls by other ships in a position to render aid. The Conference, therefore, devoted a great deal of time to the organisation of "watch keeping" on all vessels carrying the equipment. The organisation at which the Conference had aimed had been greatly facilitated by recent developments in regard to the automatic alarm signal. The International Radio Convention, signed at Washington in 1927, prescribed the conditions with which such apparatus must comply before it could be accepted as effective. After exhaustive tests made by the Naval and telegraphic services of different nations, several types of apparatus had been accepted as complying fully with the Washington requirements, and automatic alarms of those types had for some time proved their efficiency on a large number of both passenger and cargo ships. In the circumstances the Conference had been able to bring under the Convention in regard to radio-telegraphy, subject to certain conditions of exemption, all ships engaged in internatonal voyages, except cargo ships of less than 1,600 tons gross.

It may be added that the Institute of London Underwriters recently agreed to suspend the additional premiums charged on the insurances of vessels calling at St. John, New Brunswick, when equipped with wireless direction-finding apparatus.

Sweden's Largest Power Station.

The Hammarsforsen power station, the latest and most modern in Sweden, has been put into operation. Situated in the north of Sweden in the most important sawmill and pulp-mill districts of Sundsvall and Hernoesand, to which it supplies electrical energy, it belongs to the well-known Kreuger and Toll Company. The plant is now designed for three water turbines, each of about 16,000 h.p. capacity, with facilities for future extensions. The installation has been made and the equipment delivered by the Nydqvist and Holm and the Asea concerns. In 1796 the great Indal River, of which Hammarsforsen is a part, formed a lake with an area of twelve square miles, called the Ragunda Lake, at the outflow of which there was a cataract, called Storforsen, 130 feet high, one of the most imposing waterfalls in Europe. The Storforsen, however, caused considerable trouble to the timber-floaters, as their logs were often dashed to pieces by its violence. They therefore began to dig a by-pass canal for timber floating and thereby unexpectedly caused a catastrophe, which in one single night emptied Lake Ragunda of its 35,000 million cubic feet of water, silenced the Storforsen Falls for ever, and made the river cut itself an entirely new course down to the sea. The water had been deflected into the new canal dug by the lumbermen, a forty-feet-high wave of water swept along everything in its way: trees, sawmills and entire farms. The bottom of the former lake is now fertile farmland, and of the Storforsen, now called the "dead falls," there remain only empty cauldrons and curious rock formations cut by the torrent which came to such a sudden end. In the new course of the Indal River the Hammarsforsen Falls were formed, together with several others, and it is intended to build new plant and enlarge the Hammarsforsen one, whereby delivery of electrical energy over long-distance lines to the southern and central parts of Sweden will be possible.

Motor-car Testing.

Engine testing at the Hillman motor car works at Coventry has recently been improved, due to the installation of automatic electrical testing sets specially designed and manufactured by the General Electric Co., Ltd. Six of the sets have been installed, each consisting primarily of a large steel-plate cubicle which accommodates the electrical testing machine (which runs either as a motor or generator) in the lower part, and the various control apparatus in the upper part. The control apparatus comprises a main contactor panel and various relays, grid resistances, meters, push buttons, speed-regulating handles, &c., and above the cubicle is a series of coloured lamps, so that the stage of the test which is being carried out may be ascertained at a glance. On each side is a seating, on to one of which an engine may be readily clamped while another engine on the other seating is under going test, and running in either direction of rotation can be obtained with ease. The electrical machine first drives the engine in order that the wearing parts may become eased; subsequently the engine is fitted with a carburettor, plugs, magneto, &c., and it is then started in the usual way, and drives the electrical machine, which functions as a generator and feeds back to the line. The testing set thus fulfils the dual function of giving a preliminary "conditioning" run while subsequently it enables the engine to be thoroughly tried under load conditions. The whole of the motoring run is controlled by a special sequence drum, which governs the speed from its initial value of 300 r.p.m., accelerating gradually as required until 50,000, or any other fixed number of revolutions has been completed, when one of the special signal lamps is lit. Automatic relays safeguard both engine and apparatus, one cutting off the current to the machine if the engine shows signs of seizing, and another preventing any acceleration if the initial friction does not decrease at a certain rate. The pressing of a second button enables the electrical machine to be connected to a section of the resistance grids in order that the engine may be run very slowly under its own power while adjustments are being made to the valve tappets, &c., in readiness for the full-speed generating run. The latter is accomplished by pressing the "re-start" button, when the set automatically speeds up again and the engine begins to fire. It is caused to feed back into the line by the simple adjustment of a hand wheel, and then the final run takes place, during which the engine under test supplies some proportion of the electrical power required in the factory. The apparatus is safeguarded by relays, to take care of any overload, shut down the set if the field circuit of the generator were to fail, and come into action if the connection to the electricity mains were to be broken, either of which faults would remove the load from the engine. By means of an automatic paralleling device and field relay, should an engine seize, it would be disconnected from the line, but should it overcome the trouble it would pick up its load again. As rotation in both directions can be provided, separate accelerating contacts are fitted with interlocks, so as to function only for the correct direction of rotation in each case. Further, the set will test engines of four and eight cylinders, one change-over switch making all the necessary modification in the circuit. Another useful provision is swivelling meters, so that they are convenient to in sight of the tester at either side.

A Large Electric Generator.

One of the largest generators of electric power in the world was formally placed in operation at the Hell Gate station of the United Electric Light and Power Company in New York City, U.S.A., on May 29th. The machine, built by the Westinghouse Electric and Manufacturing Company, has a capacity of 165,000 kilowatts, or approximately 222,000 horse-power. The next largest set, which is located in the same station, is rated at 214,000 horse-power, while the next in size develops less than 150,000 horse-power. In comparison, the world's largest water-power generator develops about 80,000 horse-power. The set is remarkable for its compactness, rather than

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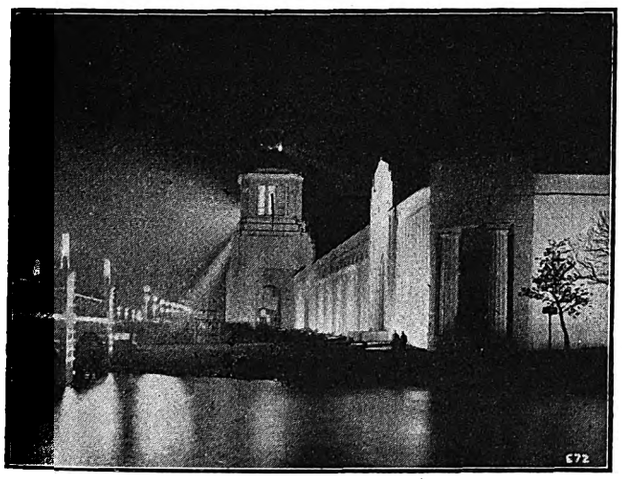
its size; close by in the same station is a 67,000-horse-power machine which was installed a few years ago, and although the new set develops more than three times the power of the older one, it is less than twice as large. In constructing the machine, a new type of insulation was developed and arc-welded steel shapes were largely employed in place of iron castings. The studs which hold the two halves of the high-pressure cylinder together were drilled with stepped holes in order to permit the insertion of special instruments to give the studs precisely the right tension and to check the tension by exact measurements.

The set is of the cross-compound type, that is to say, one turbine is operated by high-pressure steam and the other by steam exhausted by the first. Each turbine drives an electric generator rated at 80,000 kilowatts and, in addition, the low-pressure turbine drives a third generator, which is rated at 5,000 kilowatts and supplies power for use in the station. The two main generators are enclosed in a single semi-circular housing into which cooled air is blown for ventilating purposes, which gives them the appearance of a single machine. Steam is supplied at 265 lb. gauge pressure and 700 deg. F. total temperature, and is discharged into the condenser at a pressure of 1 inch mercury absolute. To condense it, 155,000 gallons of cooling water are pumped through the condenser every minute. The dimensions of the set are: length 91.5 ft., width 40 ft., height above floor line 27.5 ft., weight 1,300 tons, speed 1,800 revs. a minute. The Hell Gate station is now said to be the largest power house in the world, with a total capacity of over 800,000 horse-power; of the nine sets in operation there, five were supplied by the Westinghouse Company.

North-East Coast Exhibition Floodlighting.

As we have already pointed out, one of the principal attractions of the North-East Coast Exhibition is the wonderful coloured flood-lighting of the buildings and grounds. The scheme, which is claimed to be the most extensive and effective scheme of coloured floodlighting ever attempted in this country, should contribute in no small measure to the success of the Exhibition. At dusk thousands of visitors remain especially to see the switching on of row upon row of B.T.H. floodlight projectors from which coloured beams of light flash out until within a minute or two the whole of the Exhibition buildings and the grounds are bathed in soft multi-coloured light. In the general floodlighting colour scheme, amber predominates, while the colour effects in the floodlighting of the Palaces of Engineering and Industries include all the hues of the rainbow, producing some remarkable and artistic contrasts. The accompanying illustrations of the lighting cannot do more than give a slight impression of the actual effects, which must be witnessed to be appreciated. The whole of the floodlighting sheme was arranged by the British Thomson-Houston Co., Ltd., in conjunction with the consulting engineers, to the approval of the architect, Mr. Millburn.



Floodlighting Effects at N.E. Coast Exhibition.

A Compressed-Air-Break Switch.

Before the Berlin Electrotechnical Association on May 28th Herr Biermann delivered a lecture on what was stated to be a promising invention of the Frankfort electrical engineer, Prof. S. Ruppel. The subject was a new kind of large switch for controlling electrical circuits, which functions in compressed air, in place of the customary oil-break switch. It is claimed that the advantage of this form of switch specially lies in the avoidance of the danger of explosions. Moreover, the use of the new switch will render superfluous the import of considerable quantities of oil from abroad. It is stated that already efforts have been made in America to develop a compressed-air switch, but without success. The problem is said to have first been solved by Herr Ruppel through a special constructive improvement of the compressed-air nozzle and the development of the switch which, in extensive tests, it is claimed, has resulted in attaining the efficiency of the largest oil-break switch.

A New Ceylon Power Station.

The Stanley power station, Colombo, Ceylon, the new power station erected by the Department of Electrical Undertakings at Kollonnawa, was officially inaugurated by the Governor of Ceylon on March 5th. Mr. S. Pitkeathly, director of the Electrical Undertakings, who introduced the Governor, said that the completion of the station was the first important step in the electrical development of the colony. It had been designed to meet the needs, not only of the inhabitants of Colombo, but also of those who lived much further afield. It also formed an integral and most important part of the Laxapana hydro-electric scheme. He paid a high tribute to the work of Mr. Wimalasurendra, who, in collaboration with Messrs. Preece, Cardew & Rider, consulting engineers, was responsible for the design and layout of the whole station.

B.S.S. for Keys and Keyways, Splines and Serrations.

An enlarged and comprehensive British Standard Specification in two parts, No. 46, parts 1 and 2, 1929, covering all types of keys, has now been published in two parts by the British Engineering Standards Association. A specification for steel key bars of four different qualities of steels is included in part I, which supersedes the 1909 and 1924 editions, and tables of dimensions are given for the following types of keys and keyways: rectangular and square parallel keys; rectangular and square taper keys; plain and gib-head taper keys; peg-feather keys; woodruff keys; and tangential keys. A standard for the taper and method of keying for coned shaft ends is also included.

Part 2 covers splines and serrations, and tables of dimensions have been drawn up for the following spline shafts and the corresponding holes: 4 and 6 splines (shallow and deep); multiple splines; and serrations. The table of multiple splines has been prepared on the basis of 8 splines per inch diameter, and is put forward as a tentative standard.

In both parts of the specification there is a fully illustrated nomenclature section in which definitions are given for all the various types of keys. It is hoped that this section, which has been prepared in the closest collaboration with industry, will result in uniformity in the use of terms, and it should prove of great value to engineering colleges and technical institutions in particular.

Copies of each part may be obtained, price 2s. 2d. each, post free, from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

The Consumption of Electricity.

Returns recently rendered to the Electricity Commissioners show that the amount of electricity sold to consumers by authorised undertakers in Great Britain in the year ended December 31st, 1928, was 7,602 million kWh, representing an increase of 752 million kWh, or about 10.9 per cent. on the figure for the previous year. Comparative figures for the period 1922 to 1928 are set out below. They represent the amount of electricity retailed direct to consumers and are exclusive of intersales in bulk between authorised undertakers.

Year.	KWh sold to consumers. Millions.	Increase on previous year. Actual. Millions.	Per. cent.
1922	3,645	—	—
1923	4,339	694	19.0
1924	4,998	659	15.2
1925	5,515	517	10.3
1926	5,724	209	3.8
1927	6,850	1,126	19.6
1928	7,602	752	10.9

Over a period of six years, since 1922, the annual sale of electricity to consumers by authorised undertakers in Great Britain has thus increased at an average rate of about 660 million kWh per annum.

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Institution Notes.

Institution of Electrical Engineers.

The Société Française des Electriciens has drawn up an excellent programme of visits for the party of members of the Institution of Electrical Engineers which left London this week for Paris. On Wednesday, June 12th, visits were to be paid to the electric power stations at St. Ouen and Gennevilliers, the million-volt laboratory of the Compagnie Electro-Ceramique at Ivry, and the Ecole Superieure d'Electricité, while in the evening a banquet was to be held. On Thursday the morning was to be devoted to a visit to the wireless telegraphy station at Ste. Assise, and the afternoon to a pleasure trip to the Palace of Versailles. On Saturday, June 15th, the visits will include the new power station at Issy-les-Moulineaux, and the Office des Inventions at Bellevue to see the big electro-magnet which has been installed there. On June 16th the party will proceed to Eguzon by special train to inspect the hydro-electric power station at that place, afterwards proceeding to Bordeaux. On June 17th Pau will be visited in order to see one of the rectifying stations of the Midi Railway, the following day being devoted to an inspection of other electrical plant connected with that railway. June 19th will see the visitors at Pierrefitte-Nestalas and Lux, where other works will be inspected; on June 20th a visit will be paid to a nitrogen factory at Lannemezan, the outing concluding with a pleasure trip to the walled city of Carcassonne and to Toulouse.

The Students' Section summer tour will be held this year in Paris and Northern France, commencing on August 3rd and finishing in London on August 13th. The programme is as follows:—Leaving London on the afternoon of August 3rd, Saturday night and Sunday will be spent at some French seaside resort. Monday and Tuesday will be spent in visiting a rural electrification scheme area around Calais, after which the party will proceed to Rheims through the battlefield area. An insulator factory will be visited in Rheims, and the party will then proceed to Paris, where it is hoped to include visits to a generating station, a radio station, a telephone factory, an aerodrome, and several other places of general interest. It is estimated that the cost of hotel expenses and travelling will not exceed £12 per person

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. H. F. G. WOODS, borough electrical engineer of Torquay, takes up his new appointment as general manager of the East Devon and Exe Valley Electric Supply Company this week.

At the first meeting of the new committee, Mr. NICHOLAS G. GEDYE, O.B.E., B.Sc., M.Inst.C.E., was elected chairman of the committee of the Association of Consulting Engineers (Incorporated) for the ensuing year.

The Bristol Corporation Salaries Committee recommends increasing the salary of Mr. T. H. GAIT from £500 to £600 per annum.

Mr. J. B. HILL, B.Sc., Dundee, has received an engineering appointment in connection with a Brazilian hydro-electric development in that country. Mr. Hill was formerly with the Metropolitan-Vickers Electrical Co., Ltd.

Mr. D. M. PITT has relinquished his post with the Cambridge Instrument Co., Ltd., to return to the domestic side of the industry as London sales manager to Electrical Utilities, Ltd.

The *Sydney Morning Herald* reported on May 1st that Mr. A. MAUGHAN, managing director of the Australian General Electric Co., was leaving on the following day for the United States. He is to visit England.

Having completed 25 years in the service of the English Electric Co., Ltd., at Stafford, Mr. J. W. BRIGGS, superintendent of the Switchgear Department, has been presented upon his retirement with a gold English lever watch, a wallet containing Treasury notes, and a handbag for Mrs. Briggs. Mr. C. E. Fairburn, general manager, made the presentation.

The Stockport Town Council has confirmed the appointment of Mr. G. H. OLDROYD as deputy electrical engineer, with an increase in salary from £650 to £700 per annum. Mr. Oldroyd was appointed on probation for one year.

It is reported that Capt. Eckersley, chief engineer of the B.B.C., whose resignation is referred to in our leaderette pages, will be succeeded by Mr. NOEL ASHBRIDGE, B.Sc., assistant chief engineer. Mr. Ashbridge has been associated with Capt. Eckersley for several years, having occupied a position at the Writtle station of the Marconi Company.

On Wednesday, last week, the Sheffield City Council confirmed the appointment of Mr. E. MORGAN, borough electrical engineer of Wolverhampton, as chief engineer and general manager of the Sheffield Electricity Department in succession to Mr. S. E. Fedden.

Mr. ALAN KIRK, A.M.I.E.E., has relinquished his appointment with Engineering Works (Electrical and General), Ltd., and has joined the staff of Messrs. Troughton & Young, Ltd., Knightsbridge, S.W.1.

Obituary.—SIR SYDNEY HUTCHINSON.—The death occurred at West Kensington on June 10th of Sir Sydney Hutton Cooper Hutchinson, late Director-General of Telegraphs in India. Sir Sydney, who was 76 years of age, received his early training under Sir William Preece and joined the Indian Telegraph Service in 1871; he became Director-General in 1905 and retired two or three years later. He was a member of the Institutions of Civil and Electrical Engineers.

Will.—Mr. DAVID D. WARREN, the late chairman of the Metropolitan Electric Cable & Construction Co., Ltd., left personal estate valued at £324,522.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Metro Stores, Ltd.—Private company. Registered June 3rd. Capital, £2,000 in £1 shares. Objects: To acquire the business carried on at 302b, Kentish Town Road, N.W., as the Metro Stores, to adopt an agreement between H. A. Hough and S. E. Boyden, and to carry on the business of manufacturers of and dealers in electrical, magnetic, galvanic, wireless, and other apparatus, gramophones, kinematographs, sound and light receiving, recording and reproducing devices, loud speakers, radio transmitting and receiving apparatus, musical instruments, mechanical and electrical engineers, &c. The first directors are:—S. E. Boyden, 1, Palmeira Avenue, Westcliff-on-Sea, merchant (director of Boyden & Smith, Ltd.); R. A. Croston, 162, Westborough Road, Westcliff-on-Sea, solicitor.

Vibratone Co., Ltd.—Private company. Registered June 6th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in all kinds of electrical instruments, apparatus, machines, accessories, and goods, &c. The subscribers (each with 1 share) are:—A. E. Flint, 140, Tollington Park, N.4, clerk; J. A. Woodhouse, 50, Victoria Road, New Barnet, Herts., solicitor's clerk. The first directors are to be appointed by the subscribers. Secretary: G. Peckham. Solicitors: E. C. Kilsby & Son, 21, College Hill, E.C.4.

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"K.K." Syndicate, Ltd.—Private company. Registered June 8th. Capital, £100 in 1s. shares. Objects:—To acquire the invention No. 16,360 of 1929 relating to electrical storage batteries and the like, and to carry on the business of electrical and general engineers and manufacturers, &c. The first directors are:—E. B. Howard, secretary; and B. Quint, engineer, both of 19, Cousin Lane, E.C.4.

Electrolytic Spelter Co., Ltd.—Private company. Registered June 8th. Capital, £10,000 in £1 shares. Objects:—To carry on the business of merchants, brokers, metallurgists, and dealers in metals of all kinds, producers, workers and sellers of metals and metallic substances or products, founders of zinc and any other metal, platers of zinc or other metal by hot or electrolytic process, &c. The subscribers (each with one share) are:—E. J. Burrows, 29, Lyndhurst Road, Highams Park, E.4, solicitor's clerk; E. L. Davies, 1a, Herbert Road, Plumstead Common, S.E.18, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.2.

Geo. Crossley & Son, Ltd.—Private company. Registered June 10th. Capital, £2,000 in £1 shares. Objects:—To acquire, as from April 5th, 1929, the business of dealers in electrical accessories carried on by G. Crossley and G. B. Crossley as the Crossley Electric Co. at 4, South Street, Manchester, and to carry on the same and the business of electric light, power and radio engineers, manufacturers and installers of wireless apparatus, heating accessories, departmental telephones, electrically-illuminated signs, electric bells, &c. The first directors are:—G. Crossley, "Marshmead," Bramhall, Ches.; G. B. Crossley, "Marshmead," Bramhall, Ches. Registered office: 4, South Street, Manchester.

T. G. Hunter & Sons, Ltd.—Private company. Registered June 6th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, electrical, mechanical, heating and domestic engineers and general ironmongers, &c. The subscribers (each with one share) are:—T. G. Hunter, 2, St. James's Square, Manchester, engineer; Miss G. P. Hunter, Langley House, Victoria Park, Manchester. T. G. Hunter is sole permanent governing director. Registered office: 3, St. James's Square, Manchester.

Easitime, Ltd.—Private company. Registered June 1st. Capital, £1,000 in £1 shares. Objects:—To acquire the business of a merchant and dealer in electrical appliances, &c., heretofore carried on by C. J. L. Green at 45, Hallewell Road, Edgbaston, Birmingham. The directors are:—C. J. L. Green, 45, Hallewell Road, Edgbaston, Birmingham; W. K. Powell, "Kennersley," Stanway Road, Shirley, Birmingham. Secretary: W. K. Powell.

Northern Cables, Ltd.—Private company. Registered June 5th. Capital, £500 in £1 shares. Objects:—To carry on the business of electricians, electrical, mechanical and general engineers and contractors, manufacturers of, and dealers in wireless component parts and accessories, telegraphic, telephonic, wireless and television apparatus and appliances, wires, cables, batteries, dynamos, generators, accumulators, &c. The directors are:—J. R. Ellison, "Hollinbank," Heckmondwike, Yorks., chemical manufacturer; E. H. Crowther, "West Holme," West Park Street, Dewsbury, rag merchant; G .H. Carter, 17, Silver Hills Drive, Bradford, electrical engineer. Registered office: Wells Mills, Northgate, Huddersfield.

Official Returns of Electrical Companies.

James Keith & Blackman Co., Ltd.—Satisfaction in full on May 15th, 1929, of debentures dated December 10th, 1901, to May 6th, 1919, securing £4,550.

Gravesend Welding & Electrical Engineering Works, Ltd.—Capital, £1,500 in £1 shares. Return dated May 15th, 1928 (filed January 31st, 1929). 1,200 shares taken up. £1,200 considered as paid. Mortgages and charges, nil.

County Electrical Co. (Pendleton), Ltd.—Capital, £2,000 in £1 shares. Return dated July 16th, 1928. 1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Portable Accumulators, Ltd.—Capital, £4,400 in 4,000 preference shares of £1 each and 8,000 ordinary shares of 1s. each. Return dated December 31st, 1928 (filed February 6th, 1929). 3,300 preference and 7,474 ordinary shares taken up. £2,668 14s. paid (14s. per share on 3,300 preference and 1s. per share on 7,474 ordinary). £15 calls unpaid. Mortgages and charges, nil.

Southwold Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated May 27th, 1929. 16,654 shares taken up. £154 paid. £16,500 considered as paid. Mortgages and charges, nil.

Mold Accumulators, Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated October 5th, 1928 (filed April 27th, 1929). 350 preference and 363 ordinary shares taken up. £713 paid. Mortgages and charges, £200.

Reilly & Brookes, Ltd.—Capital, £2,500 in £1 shares. Return dated June 19th, 1928 (filed February 7th, 1929). 1,940 shares taken up. £1,940 paid. Mortgages and charges, nil.

C. Barnett, Ltd.—Debenture dated May 22nd, 1929, to secure £1,000 charged on the company's property, present and future, including uncalled capital (subject to £1,000 first debentures, but ranking *pari passu* with a second debenture for £250). Holder: C. Manning, 5, Great Chapel Street, W.1.

Record Corporation, Ltd.—Capital, £35,000 in 20,000 ordinary shares of 10s. each and 25,000 preference shares of £1 each. Return dated February 26th, 1929. 20,000 ordinary and 10,252 preference shares taken up. £10,252 paid on the preference shares. £10,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

Upfields Wireless, Ltd.—Capital, £300 in £1 shares. Return dated March 26th, 1929. All shares taken up. £300 paid. Mortgages and charges, nil.

Great Western Ignition Co., Ltd.—Capital, £2,000 in £1 shares. Return dated March 21st, 1929. 950 shares taken up. £950 paid. Mortgages and charges, nil.

C.A.C. Valve Distributing Co., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1928 (filed February 2nd, 1929). All shares taken up. £2 paid. £98 considered as paid. Mortgages and charges, £250.

William Simms & Co. (Felixstowe), Ltd.—Capital, £4,000 in £10 shares. Return dated January 31st, 1929. 203 shares taken up. £30 paid. £2,000 considered as paid. Mortgages and charges, nil.

Grosvenor Battery Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 10th, 1929. 3,000 shares taken up. £3,000 paid. Mortgages and charges, nil.

Mersey Cable Works, Ltd.—Capital, £40,000 in 10,000 preference and 30,000 ordinary shares of £1 each. Return dated December 12th, 1928. 19,901 ordinary shares taken up. £19,901 paid. Mortgages and charges, £12,500.

Park Royal Engineering Co., Ltd.—Mortgage on the premises at Park Royal Engineering Works, Cumberland Avenue, Willesden, dated May 21st, 1929, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £12,000.

City Notes.

Callender's Cable and Construction Co., Ltd.

The accounts of this company were abstracted in our issue of May 31st (p. 977), and the annual meeting was held on June 6th, Sir J. Fortescue Flannery (chairman), who presided, referred with regret to the death of Mr. E. Gurney Buxton, a director. Turning to the past year's working, he said that during 1928 there was some restriction on the cable industry, and few large contracts were placed for heavy mains. Most of those engaged in electricity supply held their hands pending the completion of the Government "grid" scheme. The company had secured a contract for the southern section of England, and this contract represented a value of approximately £500,000. Owing to wayleave difficulties, the scheme had not been put in hand until the last few weeks, but work on the first section of the mains near the South Coast was now in full operation. The effect of the "grid" would be to increase the quantity of underground cable required for distribution and general services The orders obtained for ordinary underground cables and for the wires and cables required inside premises represented a satisfactory business, which tended to increase. Progress had been made by the technical staff in research work to assist in producing cables for service at still higher pressures than those now employed, and this had been of assistance to the company in obtaining the order for 66,000-V mains, recently placed, to connect the various local generating stations in London, thus also giving to these stations supply from the Government network. One of the three such districts in London had been entrusted to the company. The overseas business was increasing, and during the year a contract for the cables for the new dockyard at Takoradi was carried out; and both on the Gold Coast and in Nigeria considerable developments of electricity were taking place by means of mains manufactured at the Erith works. The establishment in India had been fully maintained, and in all parts of that country, as also in the Malay States, steady and continuous progress was being made. In China a certain amount of business was being done, in spite of the terrible condition in which that country still remained, and the wisdom of maintaining throughout that difficult period the branch in Shanghai was being fully justified. The factory at Erith had, therefore, been well supplied with work, but the company could have done with more had heavy-mains contracts been more plentiful. An unusually large amount of rubber work had been manufactured at the Anchor works, the output, excepting for the war years, proving a record one, not only in sales in this country, but also in export to the Dominions and foreign countries. There was every indication, both at Erith and Leigh, that the production for the current year

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would be highly satisfactory. Referring to the purchase of W. T. Glover & Co., Ltd., he said that the negotiations were brought to a critical state by the information that other important firms, both British and foreign, were anxious to purchase. The amount involved was over £1,000,000, and as a decision in the matter had to be taken immediately, sufficient shares in the company were sold to a leading firm of bankers to provide the prompt cash. Some of the company's friends in the industry became interested in the purchase, but the provision of the sum had to rest with Callender's alone, and the payments were made in the early part of this year. As a result of the association with other cable manufacturers in research and investigation, substantial economies had already been introduced which had reduced manufacturing costs and prices. Reports regarding the Okonite-Callender Cable Co. showed that the use of the American company's cables was steadily increasing. It was proposed to establish a pension fund for employés and to set aside £10,000 as a first contribution towards it. After the payment of dividends, the amount carried forward would be £570,246, so that there would be in reserve and carried forward a sum of approximately £1,000,000, part of which it was proposed to capitalise.

In seconding the adoption of the report and accounts, Sir Tom Callender (deputy chairman) referred to the forthcoming E.H.P. Conference in Paris and the honour which had been paid to the company by the selection of Mr. Hunter, as representative of the Institution of Electrical Engineers, and Mr. Watson, head of the research department, to read a paper on the expansion of conductors in super-tension mains. He also referred to various contracts placed with the company in India, South America, &c., particularly the electric lighting of Benares and Jerusalem.

The report and accounts were adopted, and the proposal to capitalise £186,000 from the reserve fund and to issue it in the form of fully-paid ordinary shares to the ordinary shareholders, in the proportion of one new share for each five held, was approved.

Lancashire Electric Light and Power Co., Ltd.

The annual meeting was held on June 3rd. Mr. A. Shepherd (chairman) presided, and in presenting the report and accounts of the company and its associate, the Lancashire Electric Power Co., said that with regard to the power stations at Radcliffe and Padiham, the plants had run well throughout the year, the maximum load at Radcliffe having risen from 48,200 to 51,400 kW, and at Padiham from 13,000 to 16,500 kW. There had been no extensions to the 33,000-V system, but the 11,000-V system had been increased by about six miles and the 2,000/3,000-V mains by nearly eight miles, the greatest activity being in connection with the l.p. supplies; over 48 miles of new distributing mains had been provided during the year. The electrical energy sold had increased by 17.7 per cent. from 175,433,756 to 206,608,807 kWh. Referring to the Kearsley station which was in course of erection, the complete scheme for this station consisted of four units of 42,000 h.p. each, but it was capable of extension, and it was anticipated that so far as the first two units were concerned the station would be in operation in the autumn of this year. Up to March 31st last approximately £390,000 had been expended on this station, and a further sum of £500,000 would be required to complete it. In addition to this sum, further expenditure on mains, &c., in connection with the general progress of the company would, to December 31st next, call for a further amount of £400,000. Under the North-West England and North Wales scheme, the company's three generating stations were all "selected," and it was expected that both Kearsley and Padiham would be operated as base-load stations, in which event some extension of boiler plant at both stations would be necessary. The report and accounts were adopted.

Electric Supply Corporation, Ltd.

The accounts for the past year show gross earnings of £109,100 and a net profit of £53,563, as compared with £54,996 in 1928. Of this, £4,389 is transferred to the renewals and depreciation fund, and it is proposed to pay a final dividend of 7 per cent. on the ordinary shares, making 11 per cent. for the year, as for 1928. The Dollar and Jedburgh undertakings have been disposed of and the net proceeds have been transferred to the depreciation fund. The Hitchin undertaking has changed over to bulk supply. During the year the whole of the share capital of the Steyning Electric Light Co. was acquired at 21s. 6d. per share. Applications have been made for Special Orders extending the areas of the Alton, Haywards Heath, Petersfield and Steyning undertakings; and to authorise the transfer of the Exmouth undertaking to a local company in exchange for shares. Arrangements have been made to dispose of these shares and those of the Wellington Company upon satisfactory terms. Meeting: June 17th.

International Aluminium Co., Ltd.

The annual meeting was held on June 4th, Mr. K. M. Clark (chairman) presiding. Referring to the company's activities in Norway, the chairman said that their associated company—A/S Haugvik Smelterverk—installed and brought into commercial operation an up-to-date aluminium factory which produced during 1928 upwards of 4,000 tons of metal. Early last year, when conditions were favourable, the second stage of the development in Norway was proceeded with, and this factory was brought into operation at the beginning of this year. The factories in Norway were, therefore, now producing 8,000 tons of metal per annum, with a corresponding reduction in manufacturing costs. The works at Hebburn-on-Tyne continued to produce alumina at full capacity at reasonable costs, and were well maintained. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Aeonic Radio, Ltd.—1,250,000 new shares of 2s. each, fully paid, Nos. 2,250,001 to 3,500,000.

Brompton and Kensington Electricity Supply Co., Ltd.—21,432 ordinary shares of £1 each, fully paid, Nos. 351,017 to 372,448.

Underground Electric Railways Co. of London, Ltd.—4,702 ordinary shares of £1 each, fully paid, Nos. 7,159,907 to 7,164,608.

Madras Electric Supply Corporation, Ltd.

The net profit for the year ended December 31st, 1928, was £65,935 (against £63,667 for 1927), after providing £25,000 for depreciation and renewals (against £18,000). The addition of £6,656 brought forward makes available £72,591, and after transferring £9,855 to general reserve it is proposed to pay a final dividend of 5½ per cent., free of tax, on the ordinary shares, again making 8 per cent., tax free, for the year. A balance of £6,906 is carried forward. The meeting was held on Wednesday last.

Cia. Hispano-Americana de Electricidad.

Speaking at the recent annual meeting in Madrid, Mr. F. de A. Cambo (president) said that the dividend had been raised from 14 to 15 per cent. (gold). The conservative dividend policy of the company had enabled it, without straining its cash resources, to construct a great modern super-station in Buenos Aires. Excellent results were being obtained from that station, thanks to the expert technical management of the Société Financière de Transport et d'Entreprises Industrielles, of Brussels.

Marconi's Wireless Telegraph Co., Ltd.

The Committees representing the holders of the company's £1 ordinary and preference shares propose to form an investment company to exchange its shares with the Marconi shares. The shares will be of 5s. denomination to render them more easily marketable. Further action is suspended, however, until the result of the proceedings which the Venture Trust, Ltd., is taking against the Marconi Co. is known.

Great Northern Telegraph Co., Ltd.

At the general meeting in Copenhagen, on June 7th, the chairman stated in reply to a shareholder that a settlement of the account outstanding with the Japanese Administration, referred to in last year's report, had recently taken place through the payment to the company of approximately £143,000, by which amount the revenue for 1929 would be augmented.

Electric Construction Co., Ltd.

This company's financial results for the past year were given in our issue of May 31st (p. 977). The report states that the increased demand for electrical products referred to last year was maintained, and the volume of work produced by the company exceeded that of any previous year. Competition, however, has been keener than ever, and selling prices have been so reduced as to leave little or no margin over the cost of production.

Ruston & Hornsby, Ltd.

The net profit for the year ended March 31st last was £82,709, after providing for depreciation and debenture interest (against £73,096). The ordinary dividend is maintained at 2½ per cent., free of tax, and the carry forward is increased from £24,157 to £32,116.

General Electric Co. (America).

In addition to the regular dividend of $1 per share, the common stock is to receive an extra dividend of $1 per share. The dividend on the special stock is 15 per cent.

Leatherhead and District Electricity Co., Ltd.

An issue of £20,000 of 5½ per cent. first mortgage debentures is being made by the company.

O. C. Hawkes, Ltd.

An interim dividend of 3 per cent. has again been declared on the ordinary shares.

Calcutta Tramways Co., Ltd.

The accounts for the year ended December 31st, 1928, record a profit of £180,990, as compared with £163,349 for 1927. To this is added £7,758 brought forward, making £188,747. After meeting the debenture interest, preference dividend, &c., it is proposed to pay a final ordinary dividend of 10d. per share, free of tax, making 1s. 2½d., tax-free for the year (against 1s.

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per share for 1927). A balance of £11,020 remains to be carried forward. The meeting was to be held yesterday (Thursday).

French Companies.

The *Compagnie Générale d'Electricité* states that the works were fully occupied in 1928, but the profits were not satisfactory owing to low sale prices due to competition. The production of electricity by the subsidiary companies largely increased and the "participations" were augmented. As mentioned in a previous issue a dividend at the rate of 17 per cent. is being paid out of net profits of 21 million fr., as compared with 14 per cent. in the previous financial period of 18 months. At the recent annual meeting the chairman directed attention to the growing danger of American influence in the economy of Europe and to the necessity, in order to avert this danger, for bringing about a cartel of European industry in a national and international framework, similar to those which had been formed in individual branches as, for instance, steel, aluminium, &c.

The *Compagnie Radio-Maritime* reports a net surplus of 2,991,000 fr., including the balance brought forward, the dividend being 25 per cent.

The *Société des Appareils et Compteurs Garnier*, after providing for depreciation, reports net profits of 719,000 fr. for 1928. The dividend is at the rate of 96 fr. per old share and 83.50 fr. per new share.

The *Compagnie Générale de T.S.F.* states that the net profits increased from 9,209,000 fr. in 1927 to 9,828,000 fr. last year. The dividend is 50 fr. on the "A" and "B" shares, as against 25 fr. and 50 fr. respectively for 1927.

The *Société d'Electrochimie et d'Aciéries d'Usine* reports net profits of 15.7 million fr. for 1928, as compared with 12.8 millions in the previous year. The dividend is increased from 12 per cent. to 14 per cent.

The *Compagnie Française pour l'Exploitation des Procédés Thomson-Houston* reports net profits of 22,141,000 fr. for 1928, against 17,883,000 fr. in the previous year. Including the amount brought forward, the sum available for disposal is 26,621,000 fr., and the dividend is maintained at 6 per cent. on the capital of 300,000,000 fr., leaving 5,070,000 fr. to be carried forward.

The *Compagnie des Lampes*, which belongs to the French Thomson-Houston group, records net profits of 19,106,000 fr. for 1928, as compared with 18,105,000 fr. in 1927, the dividend remaining at 14 per cent. It is proposed to increase the share capital from 60,000,000 to 70,000,000 fr., and most of the new shares will be applied to the purchase of two small lamp factories, the balance being offered to the existing shareholders.

Belgian Companies.

The *Société Générale Belge d'Entreprises Electriques* reports that the electricity undertakings continued to develop in 1928, and the number of customers at home and abroad further increased. The net profits amounted to 10,898,000 fr., permitting of the payment of a dividend of 70 fr. per share.

The *Société d'Electricité et de Mécanique* (*Thomson-Houston and Carels systems*) states that on the whole 1928 was a favourable year, as the various departments were in full activity. The net profits were 8,250,000 fr., but in order to strengthen the financial situation it is not proposed to make any distribution, almost all the profits being allocated to the general redemption fund.

The *Société des Ateliers de Constructions Electriques de Charleroi* states that the industry was prosperous during 1928, and the company's works were fully occupied. Despite the increase in Customs tariffs the orders received for export were substantially higher. All the efforts of the directors were devoted to the development of sales abroad. The net profits last year amounted to 12,815,000 fr., and the dividend is at the rate of 35 fr. per share.

Swiss Companies.

The *Société Suisse d'Industrie Electrique* reports an increase in the net profits from 2,919,000 fr. in 1927 to 3,384,000 fr. last year. The dividend is maintained at 8 per cent. on the share capital of 30,000,000 fr.

The *Swiss-American Electricity Co.*, Zurich, after placing 1,000,000 fr. to reserve, records net profits of 7,904,000 fr. for 1928-29, which is the first year of activity. The preference shares are to receive a dividend of $6, the "A" shares 6 per cent., and the "B" shares 5 fr. per share.

The *South American Electricity Co.*, Zurich, reports profits of 2,377,000 fr. for the year ended April 30th, 1929, as compared with 3,155,000 fr. in the previous financial period of 17 months. It is proposed to maintain the dividend at 7 per cent.

German Companies.

The *C. Lorenz Co.*, Berlin, intends to maintain the rate of dividend for 1928 at 6 per cent.

The *Rhenish Electricity Co.*, Mannheim, is paying a dividend of 9 per cent. out of net profits of 1,385,000 marks in 1928, as compared with the same rate and profits of 1,403,000 marks in 1927.

The *Accumulator Works Co.*, Berlin, proposes to pay a dividend of 8 per cent. out of net profits of 2,190,000 marks in 1928.

The *Transradio Company for Wireless Overseas Traffic*, Berlin, reports considerable progress for 1928. The accounts show a net profit of 1,391,000 marks, against 1,387,000 marks in 1927; the dividend remains at 8 per cent.

The *Land & Sea Cable Works Co.*, Cologne-Nippes, states that orders were satisfactory in 1928, but it was impossible to raise sale prices to meet the increased costs of production. Out of the net profits of 334,000 marks (337,000 marks in 1927) it is intended to again pay a dividend of 10 per cent.

The *Elektra Company*, Dresden, which is mainly a holding company, reports that the net profits in 1928 amounted to 1.92 million marks, as against 1.91 millions in the previous year; the dividend remains at 12 per cent.

The *Electricity Company* (*late Schuckert*), Nuremburg, has raised its dividend from 8 per cent. to 11 per cent. for 1928-29 as a result of the further progress of the undertakings in which the company is interested and the rationalisation measures carried out in the case of the parent and subsidiary companies.

Stocks and Shares.

MONDAY EVENING.

THE General Election has almost ceased to be a factor of any immediate consequence in the Stock Exchange markets. Prices recovered without difficulty from the depression into which they were at first plunged by the early results showing the Labour Party to be in such force. With the new Cabinet constituted, surprise and pleasure are expressed at the Labour Party being able to put so workmanlike a body into the field of government. Those prices which, earlier on, had been unfavourably affected by the fear of a considerable Socialist majority were soon restored to their former levels. The only dull spot in the markets with which we deal is that concerned with cable stock and shares, and with the shares in the Marconi Company. Quiet discussion is aroused concerning the probable policy of the new Government in regard to the Safeguarding Acts. Smethwick Corporation expresses grave concern at the transfer of the Shropshire, Worcestershire and Staffordshire Electric Power Company to one that is "controlled by a foreign undertaking and supported by foreign capital."

Cables and Wireless Weaker.

In explanation of the weakness that has attacked Eastern Telegraph ordinary stock and the shares of the associated companies, Eastern Extension, Western Telegraph and Globe, attention is directed to the somewhat pessimistic prophecy in regard to dividends that was indulged by Mr. J. C. Denison-Pender, at the meetings of the cable companies at the end of last month, though it may be doubted whether the chairman intended to convey more than an impression of conservatism to those who had been expecting the full 7½ per cent. to be paid straight away on the "A" shares of the merger company. Moreover, the news that the Venture Trust, Ltd., had served a writ upon the Marconi Company on behalf of the holders of £1 ordinary Marconi shares led to nervousness on the part of some of the cable stockholders, who asked whether, in the event of the injunction being granted, and the subsequent suit successful, this would mean the abandonment of the whole plan of Wireless & Cables, Ltd. The action is to be heard on the same day as this paper appears. In the meantime, Marconi shares are ⅛ down at 76s. 3d. The £1 shares reacted to 4¼, and the 7 per cent. cumulative participating preference gave way to the same price. Eastern Telegraph ordinary stock has fallen 5 points to 265; Eastern Extension and Westerns are both 10s. lower at 26½. Burndept Wireless have hardened a shade to 4s. 7½d. for the 5s. fully-paid shares. The accounts are expected to be made public at an early date, and, according to advance anticipation, they are likely to make a good showing. Canadian Marconi improved to 33s. 9d.

Brush Bonus.

The Brush Electrical Engineering Company has circularised its shareholders offering them their individual proportion of the sum of £4,764 standing to the credit of undivided profits account, and representing the shareholders' proportion of the surplus under the co-partnership scheme for the last three years. This is in accordance with a resolution passed at the last meeting, which resolution further provided that each shareholder should be at liberty, at his option, either to take the proportion of distribution in cash, or to require that it should be applied in payment of ordinary shares at par, to be converted into ordinary stock of the company. The result is that each holder of 100 shares will receive £1 5s., less tax, at 4s. in the £, which he can either sell in the market, or have converted into stock. The price of the shares is unchanged at 27s. 6d. Siemens have been a feature of strength with a further advance of 5s. to 32s. 6d. The reason for this is the statement, made a few weeks back, to the effect that closer co-operation between the British company and two or three of the other Siemens companies operating abroad is in contemplation. Siemens 10 per cent. preference have advanced to 32s. 3d.

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Manufacturing and Equipment.

Associated Electrical Industries ordinary shares and General Electrics have been up to 53s. 6d., but reverted to the previous figure of 52s. 6d. Callenders are a good spot at 87s. 6d., which, although showing no change, maintained the rise which took place a week or two ago. The company's report made its appearance a fortnight ago, and details were furnished therein of the new issue to which proprietors are entitled to apply, this being one new share for nothing, in respect of every five shares held. Sir Tom Callender, the deputy chairman and managing director, received a very sincere and cordial appreciation of his work at the meeting when these resolutions were carried. Henleys have risen 3/16 to 6 5/16. Half-a-crown was lost by British Insulated at 3⅝. In the engineering division, Babcock & Wilcox declined to 63s. 9d. Vickers went to half-a-guinea, then recovered to 10s. 9d. An active business in Ever-Ready shares left the price unchanged at 23s. 6d. Telephone Manufacturing are dull at 5s. 9d.

Telegraph and Telephone.

Japan has arrived at an agreement with the Great Northern Telegraph over the account that was under discussion for more than a year, and has paid £143.000 to the company. This was announced at the general meeting held recently in Copenhagen. The money comes in, of course, as an extraordinary receipt, but the shareholders will feel none the less satisfied on that account. Anglo-American Telegraphs keep steady. International Telephone and Telegraph is about 250; American Telephone and Telegraph rallied to 215. The Interstate Commerce Committee of the American Senate listened last week to an extremely interesting exposition of the International Company's ambitions in regard to the employment, for a world-wide communication system, of every known method of transmitting information. The American Telephone and Telegraph Company contemplates a transatlantic telephone to supplement the three radio channels now in use. Business men, it is common knowledge in the city, are beginning to realise the value of the telephone service between this country and the United States. When the cost is reduced, there can be no doubt as to the rapid extension of the public's appreciation on this side of the Atlantic.

B.E.T. and Mr. Garcke.

British Electric Traction deferred stock has put on another 150 points, as it did in the previous week. The price is 1350 middle, and stock has changed hands up to 1375. Salient figures from the report were given on page 1022 of last week's ELECTRICAL REVIEW. Mr. Emil Garcke, who founded the B.E.T. in 1896, is retiring from all active participation in the business, and, in recognition of his services, Mr. Garcke is to be allowed to subscribe for 5,000 British Electric Traction deferred shares at their par value of £1. Translated into stock, at the nominal market price of 1350, this is equivalent to making a present to Mr. Garcke of £67,500, less the £5,000 he will pay for the shares, assuming, of course, that he could sell at the quotation mentioned. But prospects point to a yet higher value being reached.

Electricity Supply Shares in Demand.

Noticeable activity obtains in the shares of provincial electricity supply companies. For a day or two after the General Election results appeared there was a distinct halt. Shareholders began to ask whether the American buying interests would change their acquisitive policy in view of the advent to power of a Labour Party known to look darkly upon anti-Socialist finance. But no sellers appeared. Prices therefore remained hard. Renewed buying of provincial shares set in. Clyde Valleys are 2s. up to 35s. 9d. The new shares show a small gain at 15s. 6d. premium. Midland Counties have risen to 34s., Midland Electric Power to 37s. 6d., Richmonds to 46s. 9d., and Yorkshire Electrics at 36s. 6d. are a florin better. Newcastle-on-Tyne moved up to 27s. The new Lancashires at 28s. 3d. are somewhat sluggish, but can be expected to go better when all the stags are out. Northamptons put on another 1s., to 47s. Of the London shares, County ordinary strengthened to 55s. 6d., and Londons to 28s. A gain of 9d. in Whitehall Electric 7½ per cent. preference has raised the price to 24s. 9d.

Home and Foreign Traction.

Central London ordinary assented stock is a point higher at 73; otherwise the Underground group shows dullness. Metropolitan consolidated is ½ down at 60½. Underground incomes have gone back to 111, and the shares to 23s. The United States is tackling seriously the matter of conserving its oil resources. President Hoover convened a conference for this (Monday) afternoon, to talk over the matter. Restriction of oil might lead to higher prices for petrol, and contraction of L.G.O.C. profits. The other London traction issues are dull, London and Suburban preference at 12s., and London United Tramway preference at 7s. being each 6d. down. Brazilian Tractions rose 2 points to 56 on the lately-issued report. Improvements in the Mexican issues include 2 dollars in the Tramways 5 per cent. bonds, and in the Power and Light preferred shares, both advancing to 74½.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Approx. Dividend. 1927.	1928.	Price June 10 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8¾	26/6	—	5 5 8
City of London	1		10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1		6	23/-	—	5 4 4
Clyde Valley	1		8	35/9	+2/-	... —
County of London	1	7½	10	55/6	+1/-	3 12 9
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	56/3	—	3 18
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	28/-	+6d.	5 0 0
Metropolitan	1	9	9	47/6	—	3 16 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	34/-	+1/-	3 16 6
Mid. Elec. Power	1	15	8	37/6	+6d.	4 5 4
Newcastle-on-Tyne Ordinary ...	1	6	6	27/-	+9d.	4 9 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	—	5 0 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	2	—	... ...
Westminster Ordinary	1	8¾	8¾	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	+9d.	6 1 2
Yorkshire Elec.	1	8	8	36/6	+2/-	4 7 9

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	73	+1	5 9 7
Metropolitan	"	3	3½	60½	−½	5 15 8
do. District	"	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	23/-	−6d.	6 1 9
do. do. Income ...	Bonds	6	6	111	−1	5 7 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	2 1/16	—	6 1 1
Eastern Extension	10	10	10	26½	−½	*3 15 6
Eastern Tel. Ord.	Stock	10	10	265	−5	*3 15 6
Globe Tel. and T. Ord.	10	10	10	27¾	−¾	*3 12 0
do. do. Pref.	10	6	6	11¾	—	5 5 6
Great Northern Tel.	10	20	—	31½xd	—	... —
Indo-European	25	10	10	50½	—	*4 19 0
Marconi	10/-	10	20	76/3	−⅛	... —
Marconi-Marine	1	12½	15	3⅜	—	4 15 0
Oriental Telephone Ord.	1	12	12	3	—	... —
Western Telegraph	10	10	10	26½	−½	3 15 6

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅜	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	3⅜	—	8 5 6
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	"	5	5	1350	+150	... —
do. do. Pref. Ord.	"	8	8	130½	—	6 2 7
Brazil Traction	100	7	8	56	+2½	3 11 5
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	91	—	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	−6d.	... —
London United Tram Deb. ...	Stock	4	4	64	—	6 9 1
Mexico Trams, 5% Bonds	—	5	5	74½	+2	6 14 3
Mexican Light Common	100	Nil	Nil	72½	—	... —
do. 7% Pref.	100	7	7	74½	+2	9 8 0
do. 1st Bonds	—	5	5	75½	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... —

MANUFACTURING COMPANIES.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	52/6	—	2 5 6
Babcock & Wilcox	1	13	15	63/9	−9d.	*4 14 4
British Aluminium Ord.	1	10	10	51/3	—	*3 18 9
British Elec. Transformer Pref. ...	1	7	7	13/9	—	9 6 8
British Insulated Ord.	1	15	15	3⅝	—	4 3 3
Brush Ord.	1	10	10	27/6xd	—	7 5 6
Callenders	1	15	15	4⅜	—	9 9 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... —
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 1
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	5½	18/9	—	5 17 1
Enfield Cable Ord.	1	20	20	4¼	—	4 14 1
English Electric	1	Nil	Nil	6/3	—	... —
do. do. Pref.	1	3	Nil	8/3	—	... —
Gen. Elec. Pref.	1	6½	6½	22/6	—	5 10 0
do. Ord.	1	7½	10	28 3/16	+1/16	8 10 1
Henley...	1	25	25	6 7/16	—	5 6 0
do. 4½% Pref.	5	4½	4½	4¼	—	... —
India-Rubber	1	Nil	Nil	13/9	—	5 10 1
Johnson & Phillips	1	12½	10	36/3xd	+5/-	4 12 1
Siemens Ord.	1	7½	7½	32/6	—	*4 15 8
Telegraph Construction	12	10	10	24½		

* Dividends paid free of Income Tax.

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Swedish Electrical Developments.

Manufacturing and Foreign Trade.

INTERESTING details are given in *Swedish Export* of electrical developments in Sweden during 1928.

Swedish manufacturers of electrical goods, in common with those of other countries, have had a larger turnover than in preceding years, but the financial result has hardly improved in a corresponding degree, which must be attributed to the extremely severe competition.

Several fresh investments of capital, as well as certain mergers of old firms, have taken place. The L. M. Ericsson Telephone Co., which had earlier acquired the control of the Svenska Radio A/B, the representatives of the Marconi interests in Sweden, is now also the owner of the large Sieverts Cable Works. Partly on this account the capital was raised by about 20,000,000 kronor. A still larger issue of new shares was made by Electrolux, which called for fresh capital of 48,000,000 kronor. The Jungner Accumulator Co. has also raised its capital to over 5,000,000 kronor.

During the year the Asea Company extended its organisation abroad by opening up offices in Bombay, Calcutta and Melbourne. The Russian business has been organised under the designation, the Swedish Electro-Concession Asea in U.S.S.R. The aggregate exports of the company have increased considerably, and this applies to all the products subject to export.

Messrs. Luth & Rosén are now devoting themselves almost exclusively to geared motors and telpher cars, which are now enjoying a good demand, both in Sweden and abroad. A number of large convertors have, however, also been delivered.

There has been a good demand for the specialities of Elektromekano, of Hälsingborg, which include lighting generators for trains, squirrel-cage motors, convertors, &c., as well as for its general line of generators and motors. The Asea and Elektromekano have delivered 200 motors installed in the American liner *Kungsholm*.

The Elektrolux concern has during 1928 completed its programme for organising the manufacturing of its vacuum cleaners, refrigerators and floor polishers, and it now possesses factories with a large output in England, France and Germany, in addition to the Swedish establishment. It has also commenced manufacturing washing machines, but this apparatus has not so far attracted so much attention as the other products, at any rate, in Europe.

The Elektriska A.B. Volta participated in the export of vacuum cleaners, England especially being a good market.

While Sweden is importing electric wire and cable, as well as wiring material in general, to a very great extent, the export of the Swedish cable works' products is growing steadily. The export of insulated wire and cables in 1928 was valued at 4,300,000 kronor, as compared with 3,200,000 in 1927. There has also been great activity in the storage battery, electric heating appliance, and radio branches of the industry.

The Swedish imports and exports of electrical machinery, apparatus and goods during the past two years are shown (by weight) in the appended tables.

IMPORTS.	1927. kg.	1928 kg.	Inc. or dec. kg.
Electrotechnical porcelain	1,319,900	1,537,373	+ 217,473
Electric locomotives, tramcars and hoists	1,561,204	750,507	− 810,697
Motors, generators, transformers	930.856	1,267,618	+ 336,762
Vacuum cleaners	31 884	36 864	+ 4,980
Incandescent lamps	159,086	179,375	+ 20,289
Carbon for elecl. purposes ...	2,181,846	2,426,391	+ 244,545
Electric "strong-current" instruments	672,903	724,727	+ 51,824
Telephone and telegraph apparatus	16,666	5,647	− 11,019
Wireless material	249,165	351,581	+ 102 416
Totals	7,123 510	7,280,083	+ 56,573
EXPORTS.			
Electrotechnical porcelain	78,677	76,403	− 2,274
Electric locomotives, tramcars and hoists	975,350	968,971	− 6,379
Motors, generators and transformers	10,895,049	13,066,291	+2,171,242
Vacuum cleaners	1,126,306	1,183,609	+ 57,303
Incandescent lamps	8,608	12,091	+ 3,483
Carbon for elecl. purposes ...	445,761	688.411	+ 242,650
Electric "strong current" instruments	997 086	1,103,882	+ 106,796
Telephone and telegraph apparatus	706,488	859,588	+ 153,100
Wireless material	104,286	101,335	− 2,951
Totals	15,337,611	18,060.581	+2,722,970

Electrical Progress in Poland.

Large Developments in Hand.

THE recently issued report for 1928 of the Société Force et Lumière of Brussels and Warsaw contains a lengthy reference to the electrical developments which are taking place in Poland. In 1923-24 the company entered into an agreement with the Power and Traction Finance Co. (Poland), Ltd., London, to finance, under the British Trade Facilities Act, the establishment of the various undertakings under Force et Lumière control.

According to the Force et Lumière report the output of electricity in Poland in 1927 amounted to 1,742 million kWh, as compared with 1,441 million kWh in 1926. It is estimated that Poland can consume 5,000 million kWh per annum, so that there is still ample room for further development in the country. More than half of the towns and cities of Poland are still not provided with electric lighting. The best equipped districts are those of Warsaw, Lodz, Pomerania, Lublin, Kielce, Wilna, and Silesia, which comprise the most populous sections.

Hydro-electric power is relatively undeveloped, most of the electricity being generated in steam stations. Many of the stations are situated in the coal-mining district near the mines and steel works which are the main consumers. The possibility of electrifying the oil-producing area of Boryslaw has been investigated, and activities in that direction have already been commenced. It is expected that the realisation of the scheme will result in large savings in the quantity of petroleum and natural gas now consumed for power purposes by the various mines. The reserve hydro-electric power in the district of Pomerania and in the region of the Carpathian Mountains is estimated at 1,000,000 kW. The greater number of hydro-electric stations are at present located in Pomerania, where the flow of the rivers is particularly favourable.

The consumption *per capita* of electricity in Poland at present averages only 26 kWh per annum, ranging from 300 kWh in the industrial region of Upper Silesia to 2 kWh in the eastern provinces bordering Russia. Many improvements have been made in the electrification of the country during the last few years. Among the works recently undertaken or effected is the supply of electricity to the port of Gdynia from the hydro-electric station at Grodek, Pomerania. All port installations at Gdynia will be electrified, and a contract for the supply of electricity has been signed recently between the Polish Ministry of Industry and Commerce and the Grodek Co., of Torun. At present Gdynia is supplied from a small hydro-electric station at Rutki. The Grodek Co. has undertaken to construct an overhead 60,000-V transmission line from Grodek to Gdynia, a distance of about 84 miles. At the same time a new power station will be constructed by the Grodek Co. at Zur, on the Czarnawoda River in Pomerania, with a capacity of 10,000 h.p. Electrification works undertaken by the Verdatok concern were recently completed in the industrial district of Jaslo-Krosno. Rapid progress has also been made in electrifying the Silesian Basin. The electrification of one of the most industrialised districts of Poland, Radom-Kielce, is of great interest to the country, and is being effected by the formation of a Union of central electric power stations of the Radom-Kielce district. The system of the Union will in the future be connected with the State h.p. network, the construction of which is projected, and will cover the district of Radom-Kielce. The annual production of the Union is estimated at approximately 60,000,000 kW.

The initiative of the coal mines of the districts of Dombrowa and Cracow resulted in the establishment of a union of central electrical power stations of the Dombrowa-Cracow Basin, known under the name of Zetkop. This organisation is planning the installation of a distribution system which will at first cover the territory of the Dombrowa-Cracow district, and later be extended to Olkisz, Czestochowa, Lodz and Warsaw.

The Electrification Union of Chelmno-Swiecie-Torun has undertaken the extension of its system to all districts in Pomerania. It planned to construct during 1928 over 50 miles of new h.p. distribution lines. After the completion of this system 22 communes in the district of Torun are to be electrified, 20 in the district of Swiecie, and 10 in Chelmno.

At present there are in Poland three organisations engaged in electrical research and industry, of which the most important is the Association of Polish Electrical Engineers, established for the purpose of propagating electrotechnical science, drafting regulations, and revising the terminology. Technical interests of electrical undertakings are being watched by the Association of Polish Electrical Stations, while a third society, the Association of Electrical Undertakings, serves the purpose of furthering Polish electrotechnical industry and trade.

Estonian Foreign Electrical Trade.

During March last electrical machines, apparatus and implements valued at 98,447 kr. (£5,400) were imported into Estonia. Exports of the same class had a value of 17,475 kr. (£950).

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The I.M.E.A. Convention—III.

A Report of the Proceedings and Social Functions at the Annual Convention at Torquay.

TORQUAY may now be added to the number of towns which have provided a store of pleasing memories for those privileged to attend the annual Conventions of the I.M.E.A. One came away with the impression of a most successful week from both the social and more serious aspects. The only flaw was the wet weather on Wednesday, which made it necessary to cancel the garden party. This disappointment had some compensation to engineers in that it permitted a fuller discussion of the paper on heavy-oil engines; also the Corporation kindly invited members to attend a concert, followed by tea, in Prince's Gardens. The same spell of rain was responsible for the absence of an official photograph this year, but an attempt has been made by us to fill the gap to a small extent with private views of members going about their business.

Back: Mr. C. W. Salt, Mr. W. C. Bexon, Mr. J. H. Parker, Mr. H. Wilson.
Front: Mr. J. W. Burr, Mr. A. C. Cramb, Mr. A. P. MacAlister.

Fig. 1.—Six Chief Electrical Engineers with their Former Chief.

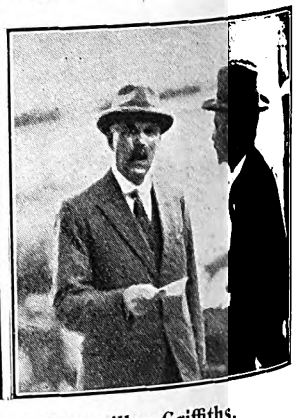
Though one speaks of "the more serious aspect" of the Convention, that is not to accord to it a greater importance. It is to the social side of these Conventions that one looks to provide the atmosphere of good feeling which promotes good understanding. If members happened to differ in their views, they differed; but they could feel (and later remember) that those with whom they disagreed were reasonable and likeable personalities, and not machines for uttering perverse opinions.

The discussions on the papers were well developed and would, no doubt, have been lengthy had time permitted. The manner in which Mr. Nichols Moore presided enabled as many as possible of the members who could constructively criticise the papers to take part in the proceedings. From general report, confirmed by the charming tribute paid to Mrs. Nichols Moore by Mr. Chattock at the annual dinner, it may be inferred that the conduct of the E.A.W. meetings was no less able.

It is perhaps fitting to mention here (if only in parenthesis) that the presence of so many members of the Electrical Association for Women at Torquay was one of the most pleasing features of the week—not only as a social asset, but also as an indication of the important part which women are destined to play in the development of electricity. We propose to deal more fully next week with the subject, including the lecture given by Miss Partridge on Thursday last week. Meanwhile, we may note, as a matter of interest, that a new branch of the E.A.W. was subsequently formed at Plymouth with Lady Astor as its first President.

The paper on tariffs provided the fullest, and that on legal problems the most entertaining, discussion. A few of the salient points may be noted here. Alderman Walker's underlying principle with regard to Whitley Council awards is that wages and conditions should be of such a character as to attract the best men to the electricity industry, due regard being paid to wages cost in private plant. During the discussion of legal problems, it was authoritatively stated that while no commercial method at present exists for preventing the emission of sulphurous-acid fumes from power stations, a solution of the difficulties due to grit deposition will certainly be found in the early future. The discussion on heavy-oil engines elicited the fact that in Germany, while the practice is to carry the base load on steam stations, oil engines are often installed to maintain voltage at peak at the end of long overhead feeders. Another view was expressed that as capital charges for peak-load plant are from ten to fifteen times the cost of fuel, the higher capital cost of the oil engine would severely limit its utility, unless super-charged engines could be designed for a much greater number of revolutions.

The paper on tariffs provided an opportunity for emphasising the soundness of the principles enunciated by Dr. John Hopkinson 37 years ago. There was agree-



Figs. 2, 3 and 4.—Mr. J. W. Simpson, the President, Mr. Cramb and Councillor Griffiths.

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ment among those who joined in the discussion, with but one dissentient voice, as to the superiority of the two-part tariff over the flat rate. It was also submitted that the primary charge should be as high as might be necessary to enable a very low secondary charge to be quoted.

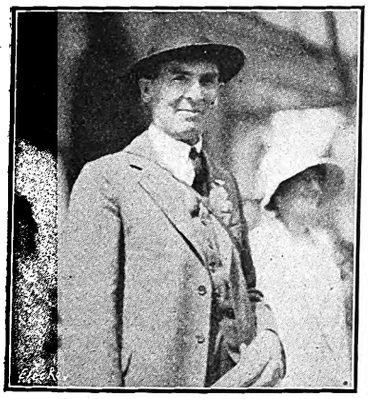
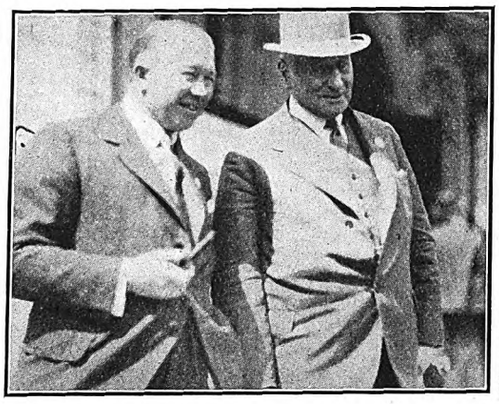
The social festivities reached their climax with the annual dinner on Thursday, at which some 300 persons were present. Sir John Snell, in proposing the toast of the I.M.E.A., congratulated the President on the vision shown in his address. He was in sympathy with his views, and the next big task of the Commissioners would be the co-ordination of distribution. His listeners were disturbed by the doubt he expressed as to his own strength for the purpose, and could only hope that complete restoration to health would negative the implication. He praised the enterprise of Torquay Corporation and its engineer in extending the local network into the hinterland, and referred to the Ayrshire Joint Board as an example of successful co-operative action.

The most striking feature of the speech was a reference to the urgent need for better financial support of the Electrical Research Association by the electricity supply industry. This is dealt with more fully in our leading article. Sir John, in his concluding remarks, referred to the consistent courtesy of the Honorary Secretary of the Association, Mr. A. C. Cramb, upon whom has fallen the brunt of organising so many Conventions. Other speakers were, in chronological order: the President, Ald. E. Huntsman, the Mayors of Newport and Torquay, Mr. R. A. Chattock and Mr. Frank Hodges, to whose speeches a later reference will be made.

During the dinner the sea-front was brilliantly illuminated by the Corporation, the work being carried out under the direction of Mr. H. F. G. Woods, the borough electrical engineer. Many other lighting effects due to the enterprise of well-known electrical firms gave the town a gala appearance at night. Among the most noticeable was the flood-lighting of the ladies' bathing beach from the parapet outside the Vitaglass Room of the Medical Baths. The contrast of the vivid green verdure on the cliffs with the sombre darkness of the sea received much favourable comment from the dancers. Other good flood-lighting schemes included the Town Hall, Pavilion, Royal Terrace Gardens and the Grand Hotel. A particularly good example of shop-window lighting was that displayed by Messrs. Bobby and Co., Ltd. In the harbour a curious craft advertised a well-known piece of electrical apparatus. Outlined with lamps by night and gay with bunting by day it attracted the attention of all comers and added to the gaiety of the scene. These efforts were supplemented by H.M. aircraft-carrier *Furious* lying in Torbay, the outlines of the huge vessel being well defined by lamps on Monday.

The hospitality of Torquay has been manifest in so many ways that her claim to be "the guest-town of the United Kingdom" does not seem too ambitious. The ever-present sense of welcome was heightened by the personal interest shown in the proceedings of the Convention by the Mayor in his dual personality of "engineer and lawyer."

Taken altogether, the I.M.E.A. Secretary, Mr. J. W. Simpson, is to be congratulated on the outcome of his first Convention.

Figs. 5, 6 and 7.—Four well-known Members.

Whitleyism in the Electricity Supply Industry.
Discussion on Ald. W. Walker's Paper.

Mr. A. NICHOLS MOORE, president, in calling upon Councillor W. GRIFFITHS (Mayor of Newport, Mon.) to open the discussion, said he did so, not because he came from Newport, but because for many years he had been on the executive of the National Union of Railwaymen, and had been a member of the negotiating Committee which ultimately settled conditions on the railways on the basis of Whitleyism. The president added that Councillor Griffiths was at present a working railwayman on the footplate of a G.W.R. locomotive, and therefore he would discuss the paper from the employés' point of view.

Councillor GRIFFITHS said there were two outstanding features of the adoption of the Whitley Council system on the railways. One was that it saved a great deal of managerial time which was formerly taken up in dealing with wages and conditions in relation to numerous and separate applications, and the other was that it had been possible, through the medium of the Whitley Councils, to more or less standardise wages and conditions, at any rate so far as the areas were concerned, and that had removed the cause of a very great deal of dissatisfaction. As a result of all that there was a far more satisfied body of workers on the railways, and consequently a more efficient service. Referring to the statement in the paper that very often extravagant and irresponsible applications are made for improved conditions, Councillor Griffiths remarked that the workers could not get out of an industry more than they put into it, nor more than the industry could bear. At the same time, if the management desired to get the utmost out of the employés it was only natural that the employés should expect the management to do its utmost on its part. The point it was necessary to bring home to the workers was that the more they put into the industry the better opportunities there would be for them to share in the results of their activities. One of the best ways to get the utmost out of the employés was to give them a share in the management and control. That might be regarded by some people as a revolutionary proposal, but he claimed it was necessary to take the men into the confidence of the management, and invite them to share the responsibilities. Development along those lines would be productive of much good. On the railways there was a system of local councils, and those local councils met the management periodically and discussed questions affecting the welfare of the industry. If some such machinery could be introduced into the electricity supply industry, so that the practical knowledge of the men could be made use of in developing and controlling the industry, a great deal of good would inevitably follow; there would then not be the extravagant demands that were so often made. He therefore suggested that the electricity supply industry should go a stage farther than the Whitley Council and develop along the lines he had suggested, because that would build up greater confidence between the employés and the management, and would be not only to the benefit of the particular industry, but also for the country as a whole.

Alderman E. HUNTSMAN (chairman, Nottingham Electricity Committee), whilst suggesting that the Whitley Councils in the electricity supply industry had achieved the objects laid down by the author, deprecated the implication in the paper that an expert should be appointed to deal with the case for the employers when negotiations had to be carried on. It was obvious that when matters were discussed between the

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employers and the employés there should be a complete knowledge of all the facts on both sides, but for the case for the management to be dealt with by some expert would inevitably create suspicion, because, speaking as a lawyer, he knew the tendency of such experts was to desire to win their case rather than to discuss the particular matter in the amicable and friendly manner so essential in such negotiations. As to the suggestion in the paper that the areas of Whitley Councils should coincide with the areas set up by the Electricity Commissioners, he rather felt that with the establishment of Whitley Councils, with their present areas, there had grown up a sort of local patriotism, and during the whole of his experience there had not been one discourteous word said on one side or the other. In such circumstances he thought they should hesitate before sacrificing such a state of affairs, and go over to a system of larger areas, as suggested in the paper.

Alderman G. Croot (chairman, West Ham Electricity Committee) said he had been on the No. 10 District Council for 10 years as a representative of the management side, although for 40 years he had been associated with a certain social and political movement which had for its object the improvement of the conditions of the workers. However, he claimed he had been able to do justice to the managerial side without sacrificing anything so far as the workers were concerned, because he had always kept his personal opinions to himself. (Loud laughter.) Speaking, however, from the workers' point of view, he suggested to employers that it was to their interest that their employés should join their trade unions, because it might easily happen that if there were a large number of non-unionists in a works they would not have direct representation on a Whitley Council, and might cause far more dissension than the trade unionists. He agreed it was not the business of the management to insist that all their men should join the union, but it would undoubtedly be to the general advantage if they did. As regarded the ability of an industry to pay higher wages, he contended that employers should not use the argument put forward in the paper that other industries were not paying such high wages as a reason for not improving the conditions of their own men. If an industry could afford to pay higher wages it should do so, irrespective of the conditions in other industries. As to the complaint in the paper that trade unions made repeated applications for better conditions, that was what a trade union was for.

Alderman A. Senington (Bristol) referred to trouble that existed in the No. 6—Bristol—area with regard to the constitution of the District Council and complained that the democratic nature of the District Councils was not being maintained because duly appointed trade union representatives were not being allowed to serve on that particular Council.

Councillor T. Snowden (chairman, Bingley Electricity Committee) said it might seem a little paradoxical that he was an employer and a member of a trade union, but he was practising that spirit of sweet reasonableness which would have to be made manifest very much more than it had been up to now if they were going to solve the problem of the employer and employé. Speaking with regard to the suggestion in the paper that agreements should be made compulsory, he said he was distinctly opposed to that because he believed it was far better to approach employer and employé on the lines of equity and justice. So far as the employés were concerned it was a paying proposition not to treat them as hewers of wood and drawers of water, but as human units in the industry. Only in that way was it possible to remove that atmosphere of suspicion and distrust that had existed for so long and had hindered industrial prosperity in this country. The workmen must be convinced that they had a duty to perform if they were to participate in the results, and that progress would not be made by strikes and lockouts. In the past the employer had been more to blame than the workmen, however, and if an endeavour was made to work on mutual lines there would be no need to talk of making compulsory agreements. He did not believe trade unions would abandon the strike weapon, but at the same time he was convinced that mutual discussions on the lines of Whitley Councils would enable a happy medium to be arrived at and make both sides appreciate that they were members of a general community in the industry.

Alderman W. Walker, replying to the discussion, said the machinery was already available for setting up works councils in the industry, such as were indicated by the Mayor of Newport. There was the constitution to enable that to be done by agreement between employers and the workers, and therefore Newport had its opportunity if it desired to take advantage of it. He had been associated with works councils on the Manchester Corporation which discussed with the management questions relating to the conduct of the undertaking, and they had been exceedingly useful. There was no intention of suggesting in the paper, as Alderman Huntsman had inferred, that an expert should be appointed to argue the case for the employers when matters of dispute arose. What he meant was that there should be someone in a permanent position who would prepare facts and figures for the use of the members of the Whitley Council on the management side, because it was necessary to have all the relevant facts, but it took a great deal of time for individual members of the Council to find them for themselves. The trade unions did this; they had their investigation and research departments which prepared facts and figures for the use of those who had to conduct the negotiations. As to the suggested alteration of areas, he believed that would have to be considered in time. Alderman Croot seemed to be a Dr. Jekyll and Mr. Hyde, and never seemed to know which he was at any particular moment, but there again it was possible to deal with the difficulties he had mentioned of repeated complaints by means of works councils. He was sorry Alderman Senington had brought a local squabble into the discussion. The local constitution of the Whitley Council in the Bristol area was peculiar, and there was a dispute going on which he was hoping would be settled locally. As chairman of the National Joint Committee he was advising his colleagues to keep out of the matter if it were at all possible, and let the dispute be settled locally. Mr. Snowden appeared to have misconceived what was meant by compulsory agreements. The Industrial Councils Bill was an adoptive measure and did not become operative until both sides had adopted it by a majority. Each side on the council must adopt it by a majority, and then if the Bill were adopted it would prevent decisions of importance being rendered inoperative by a small minority on a council which refused to give effect to them. There was always a minority which never wished to do the right thing, and in consequence was a source of trouble to the industry. Therefore if 98 per cent. of a council was in favour of certain action they could, by adopting the Bill, compel the other 2 per cent. to do what the majority thought right.

On the motion of Mr. J. K. Brydges (Eastbourne), seconded by Mr. A. J. Fuller (Fulham), a hearty vote of thanks was accorded Alderman Walker at the conclusion of the discussion.

Recent High Court Cases.

Discussion on Mr. J. H. Rothwell's paper.

In the course of his introductory remarks the author explained that since the paper was prepared, a decision had been given at Leeds which drew a clear distinction between a common-law corporation and a statutory authority. The case at Leeds had to do with the running of 'buses by the Corporation. The particular service was not authorised by an Act of Parliament, but it was not proposed to spend any of the ratepayers' money and, although certain competitors endeavoured to restrain the Corporation, the Court held that Leeds, being a common-law Corporation, could do anything which a private individual could do, provided it did not spend any money which it was not authorised by statute to spend. There were many things which a Corporation could do without calling upon the rates, or any fund, and a common-law corporation could do, in those circumstances, just what an individual could do. It did not apply to urban district councils, or rural councils, or county councils, because they were created by statute; but a municipal corporation was a common-law corporation created by charter, and therefore its powers were wider than those of an authority created by statute. That was a state of affairs that was not appreciated often enough, but the Leeds decision had made the point perfectly clear, and he hoped they would all take advantage of it.

Councillor H. K. Beale (chairman, Birmingham Electricity Committee) said that whilst there had been no complaints from residents in the neighbourhood of the Birmingham power stations as regarded sulphur, there had been complaints with regard to nuisance from grit and dust; although the town had spent £60,000 in trying to remedy that, the effort had only been partially successful and the trouble had not been entirely cured. So far as stoker-fired furnaces were concerned, he believed the trouble had been overcome, but the pulverised fuel plant was still giving trouble from that point of view. He feared that unless the trouble was prevented the size of stations would be curtailed, or the undertakings would be put upon such terms as would seriously retard the supply of cheap electricity. Only the large stations were giving serious trouble, and only by concentrated effort of engineers and chemists would a remedy be found. He did not, of course, know what the result in the Manchester case would be, but even if there were complete immunity as a result of that decision it would not be safe to carry on as at present, because public opinion had been roused and the possibility of further legislation could not be ignored, unless a remedy could be found for what was undoubtedly a very serious nuisance. That had happened before, for instance, in the case of sparks from railway engines, and therefore engineers and chemists must seriously tackle the problem. Referring to contributions to the rates and the limitation set by the Electricity (Supply) Act, 1926, *viz.*, that after March 31st, 1930, no sum shall be paid in aid of rates from profits of a trading undertaking until the reserve fund reached 5 per cent. of the capital outlay, Councillor Beale said that was a very useful piece of legislation; he had always believed that the profits of such undertakings as electricity undertakings should be used for the purpose of giving as cheap a supply as possible. An endeavour, however, was being made by some undertakings to contribute to rates out of profits for the year ending March 31st, 1930, although, as the author had pointed out, the net profits for the year could not be ascertained until after March 31st next, when, of course, under the Act it would be illegal to make such contributions. For unscrupulous authorities, however, it was possible to do that by paying what a company would call an interim dividend. It would be possible, for instance, to make a payment in advance of March 31st next on account, although, of course, it would have to come out of the net profits. He did not suggest that that should be adopted as

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a general policy in order to get round the Act, but merely to show that there was a way of doing so, although he had no doubt the Electricity Commissioners would effectually close that loop-hole.

Mr. O. TREHARNE MORGAN (town clerk, Newport, Mon.) said it was a very serious matter for an undertaking to have an injunction granted against it, as in the Manchester case, and in all such cases the undertakings ought to be allowed to continue, subject to paying for any damage caused by them. As the damage might be continuous, that would ensure that every possible step would be taken to prevent the nuisance, and he believed the difficulties would be surmounted by chemists and engineers. As an instance of what could be done, he mentioned the pumping plant put in by the Newport Electricity Committee, by the advice of the president, to avoid the nuisance caused by cooling towers. Referring to the replacement of apparatus on a change of system, Mr. Morgan suggested that the date after which no compensation could be claimed should be the date when the Council decided to make the application to the Commissioners, and not the date of the Commissioners' consent, because owing to the publicity given to discussions in Councils and also to the notices on the agendas of meetings, some people might be smart enough to put in apparatus as soon as they heard what the Council proposed to do, and in that way the protection suggested by Mr. Rothwell would be of no avail.

Mr. F. W. PURSE (engineer and manager, West Ham) remarked that, as chairman of the Law and Parliamentary Committee of the I.M.E.A. for four years, he had been brought more closely in touch with the legal side of the Association's affairs than the body of the members and, incidentally, he expressed the view that the Association did one of the best things it could possibly have done in securing Mr. Rothwell's services as honorary solicitor. One of the things brought out by the paper was the uncertainty of the law affecting electrical undertakings and the fact that, unless it was very clearly laid down what could and could not be done, there would always be difficulties. Many members had been under the impression that so long as an unauthorised undertaker obtained consent to open the roads it was all right, but it was useful for Mr. Rothwell to point out that if the road authority gave that permission it could be proceeded against. In connection with the replacement of apparatus, he felt that with the great development of automatic rectifiers many undertakings would consider a second time before embarking on the enormous expense involved in changing from d.c. to a.c. He had never seen any justification for contributions to rates out of profits, and had always held the view that the return to the ratepayers for giving security for the loans was the valuable presentation to the ratepayers by the electricity consumers of the undertaking free of debt, or almost so, because in many cases the greater proportion of the loans was repaid and the ratepayers were thus benefited to a very considerable extent. Owing to the manner in which the general legislation relating to the industry had been dealt with, a large number of undertakings had been compelled to promote Bills containing special clauses for their protection. When the 1926 Act was going through Parliament the Association thought it was a good opportunity to insert a number of general clauses, but the Ministry of Transport said that that Bill was promoted for a specific purpose, and not for the purposes of general legislation. Detailing a number of matters upon which individual local authorities had had to protect themselves, Mr. Purse mentioned the question which arose in the St. Pancras case, in which the boundary of the area of supply went through certain premises, and it was not clear in the general legislation whether the supply given by one authority could be used in the whole of such premises; that was a matter which required clear definition. Similarly, a large number of authorities had had to seek special powers authorising them to construct sub-stations and transformer chambers, yet it would have been thought that having been authorised to supply electricity they would necessarily have had the powers to construct sub-stations, &c. Then there were the by-laws relative to apparatus, wires, and fittings: under Section 6 of the Act of 1882, power was given to local authorities to make by-laws for the safety of the public, but it had been held that they did not include by-laws relating to the interior installations of premises supplied. Thus from time to time clauses had been put into private Acts giving powers to make by-laws relating to installations. He believed his own authority was the only one which had by-laws approved by the Electricity Commissioners, and therefore enforceable; unless they were enforceable they were useless. An important point in this connection was that the clause should contain the words "premises supplied or proposed to be supplied," because in the absence of such wording the position was that an installation had to be allowed to be connected and then the supply must be cut off on the ground that it did not comply with the by-laws, the point being that until the supply was actually given the premises were not supplied. Therefore, it was necessary to add the words "or proposed to be supplied." That also emphasised the necessity for arriving at some standardisation of general clauses of that nature. There were also the facts that two-part tariffs could only be arrived at by agreement with the consumer and could not be enforceable on consumers, and again the question of pre-payment meters and responsibility for the money, as pointed out in the paper. He had known slot-meter consumers to tell him that they were hard up and had taken the money out of the meter, but offered to repay it. There again there was the difficult position that if the Corporation agreed to that it would be, in the words of the lawyers, compounding a felony! Yet another matter was the use of a power supply for lighting purposes, concerning which there had been prosecutions, all of which emphasised the need for consolidating the legislation affecting the electricity supply industry and putting it upon a sound and uniform basis.

Mr. W. M. SELVEY, referring to the complicated state of electrical legislation in this country and to further possible legislation and regulations, to say nothing of the expected Factory Act and possible meticulous regulations as to terms which might be offered for the sale of electricity, said there was a striking need for the awakening of the consciousness of the whole industry; one of the principal directions in which reform would be necessary would be in the entire recasting of the whole of the electrical legislation as soon as the country had been allocated to some authority, and when the final policy as regarded distribution could be clearly realised. He therefore suggested that the legal brains connected with the industry should turn their attention to a clear codification of the whole of the Acts in one simple and understandable form. Referring to the Manchester case, he said that the evidence in the Court of First Instance was undoubtedly that the nuisance complained of was especial to those particular works. It had not occurred elsewhere in connection with similar work, and therefore there was absolutely no technique available in order to deal with the nuisance. The evidence was further that such simple steps as had been taken at very considerable expense by the Manchester Corporation had proved wholly ineffective, and had, in fact, shown that the problem was entirely outside current ideas relating to such works. As the Act authorising the construction of the power house did not authorise the supply of electricity "within an area," as defined in Section 1 of the Electric Lighting Clauses Act, 1899, and hence did not come within Clause 81 of the same Act relating to nuisance (provided this view was sound) then the Barton power station was placed on all fours with the railways, and would not be liable to an injunction so long as negligence did not occur. That, he said, was the position which electrical engineers had always desired power stations to be in, and it was the position in which the industry must ultimately put itself as long as the law allowed such a principle to be applied to any other similar public service wholly dependent on the statutes. After pointing to the fact that apparently the increase in the size of power stations was taken seriously into consideration by the Court of Appeal, and mentioning that that fact introduced one of the largest questions which the industry had yet met, Mr. Selvey urged the necessity for the establishment of some body having power to act for, and defend as a whole, the electrical industry. Such a body must obviously deal primarily with harmonising the internal conditions of its own industry. Thereafter it must be able to speak nationally to the Government, and it should be able to formulate such a codified form of legislation as should hold a true balance between itself and those other interests with which it came into contact. That premised a definite contact in their mutual interests between supply, manufacture, transmission, and distribution, which, for the sake of illustration, might be taken as represented by the I.M.E.A. and the power companies, the B.E.A.M.A., the C.M.A., and the E.C.A. That trend of affairs might not be to the liking of everybody, but he believed it was inevitable.

Mr. R. A. REAY-NADIN (town clerk, Sutton Coldfield) said that all local authorities obtained indirect aid for their rates by the intelligent development of the electricity undertaking, because wherever electricity was developed there was also development in the local area which brought with it a substantial indirect contribution to the rates. He, personally, agreed with the principle of the 1926 Act that every undertaking should have a sufficient reserve fund to develop on sound lines. With regard to the point made by the author, arising out of the Leeds case, that a local authority had no power to give permission to a private undertaking to open the roads, as the author had also indicated that a large corporation stood in the same position as a private individual, it would hardly seem that the two points supported each other.

Councillor COUSTON (chairman, Edinburgh Electricity Committee) disagreed with the view expressed in the paper that even by the signing of an agreement to that effect, a slot-meter consumer could be made responsible for the moneys in the meter. As a magistrate in a police court, he had had to deal with cases of stealing from both gas and electricity slot meters, and he doubted whether in a High Court it would be held that the tenant, once having placed his money in the meter, was any longer responsible for it, because it was placed there at the request of the electricity undertaking in order to avoid the inconvenience and expense of daily collections. That seemed to him the common-sense point of view of the matter, and police courts only used common-sense, not law! Once the money was in the meter it was the property of the electricity undertaking, and he believed the High Court would take the view that the local corporation was responsible for it then, because it took the responsibility of leaving the money in the box, the consumer having paid for what he received, or was about to receive. Therefore he suggested that that point should be looked into further.

Mr. J. H. ROTHWELL, replying to the discussion, said that

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a large number of clauses were inserted in private Acts which might now be regarded as model clauses, and the time might well have arrived when they should be reprinted in pamphlet form. Such a step was the more necessary because so many corporations were finding their legislation becoming so enormous, and because a great deal of it had become obsolete, as it had been since incorporated in general Acts. This consolidation of the legislation relating to the industry was a task which would have to be undertaken. If existing clauses could be collected in the manner he had suggested it would be helpful in another way, *viz.*, there would be practical experience of them, whereas very often without that knowledge a large amount of time and expense was involved in obtaining a clause in a Bill, only to find later that it was by no means so useful as it had been supposed to be. Th refore, the clauses mentioned by Mr. Purse would be exceedingly valuable as a supplement to the paper. The whole point of the discussion was to emphasise the question of the consolidation of general legislation with regard to electricity supply, and he hoped that if steps were taken in that direction the Government of the day would find time to consider the matter. He was interested in what Mr. Reay-Nadin had said as to the difficulty of reconciling the decision in the Leeds case, and to the suggestion in the paper that a local authority could not give permission to a private company to open the roads, but the fact remained that no private individual could open the roadway on his own responsibility. Councillor Couston had been very entertaining on the question of prepayment meters, but the whole difficulty could be overcome by insurance.

The President, at the conclusion of the discussion, introduced Sir John Brooke, who was recently appointed an Electricity Commissioner.

Sir John Brooke, in proposing a vote of thanks to Mr. Rothwell, said it was very necessary in any legislation, and especially in legislation relating to an industry such as the electrical industry, that the clauses should be uniform throughout the country. At the same time it was not always possible to get general legislation, and it was therefore necessary from time to time to insert special clauses in private Acts of Parliament. From that point of view, therefore, the work that the Association's Law and Parliamentary Committee was doing in bringing together such special clauses must be of enormous benefit to the industry and to those who had to report on and criticise private Bills.

Alderman H. B. Vorley (Islington) seconded the vote of thanks, which was carried unanimously.

The Heavy-Oil Engine and its Application in Electricity Supply Undertakings.

By Geoffrey Porter, A.M.Inst.C.E.
(*Abstract.*)

THE Diesel engine has languished under the shadow of the remarkable achievements of the designers of the steam turbine and the high-pressure water-tube boiler; moreover, the performance of the few early examples of the engine in England was not impressive, and its reliability was not of the high standard demanded by British engineers.

Apart from its employment in stations of small and medium capacity (up to about 10,000 kW in the United Kingdom and 20,000 kW abroad) and in privately-owned industrial power houses, its use on land for electrical purposes is considered mainly in connection with stand-by and sub-station uses as an adjunct to the main plant.

The chief development has occurred in ship propulsion, in a branch of engineering in which conservatism is of the most deep-rooted order. The success of the engine at sea has revived the earlier interest on land to some extent. The total power of the heavy-oil engine employed at sea, in the form of propelling machinery, exceeds four million horse power in power ratings up to about 10,000 b.h.p. in individual units. The recent interesting decision to equip the new White Star Atlantic liner with some 100,000 b.h.p. of heavy-oil engines, arranged in power station form as a group of 30 engines of about 3,000 b.h.p each to drive generating plant for the electric motor-driven propellors, is a momentous event.

On land in the United States of America there is about two million b.h.p., and in the United Kingdom about one million b.h.p. Adding a reasonable power for the use in other countries throughout the world, an estimate of about six million total b.h.p. in use is probably not excessive.

Side by side with the increasing adoption of the heavy-oil engine has been development of the sources of natural oil. Production is now outstripping demand, and oil producers are endeavouring to consolidate a mutual policy for the restriction of supplies, ostensibly to conserve the resources of nature by the elimination of waste. The relative prices per ton of oil and coal are not entirely decisive in forming a judgment as to the superior advantages of heavy-oil engine or steam equipment in any particular instance, as the efficiency of heat utilisation affects the problem very materially. While at present the general price ratio of the two fuels is about 4.3 to 1, the introduction of the efficiency factor reduces the effective ratio to about 36 to 27, or 1.33 to 1. As in either type of equipment the fuel cost is from 45 to 50 per cent. of the total operating expense per annum, the effective relative prices have a considerable bearing upon the economics of the matter. The author is satisfied that light-grade furnace oil is a perfectly satisfactory engine fuel, subject to "digestion." Knowledge of a recent fuel-oil contract has also satisfied him that a "Diesel" oil can be obtained in large quantities at prices very much below those ordinarily quoted to the user of comparatively small amounts.

Engines.—The principal types of heavy-oil engine designed for power-station purposes are classified very roughly as follows:—

(1) The low-compression, airless-injection, "semi-Diesel" or "surface-combustion" engine; the latter description has been adopted by B.E.S.A. The majority of this class are designed as 2-stroke-cycle single-acting engines, fitted with a "hot-bulb" for storing heat to assist in firing the working fluid and to permit the formation of the mixture of oil and air for combustion.

The main objects of the design are cheapness and simplicity. In general such engines are less efficient than the high-compression types of the Diesel class and its derivatives. The use of the crankcase as one element of a scavenge pump, the low mean effective pressure, not exceeding about 40 lb./sq. in., and the class of materials utilised in construction do not permit of high thermal or commercial efficiency, nor can the class compete in terms of power rating with the designs employing higher compression pressures and brake mean pressure ratings. In general such engines do not exceed a rating of 300 b.h.p. in a 6-cylinder construction. The most recent development of this design, in which the hot bulb has almost disappeared and the cylinder head is entirely water-jacketed, approaches very closely the so-called "cold-starting" type. The retention of the crankcase for scavenging purposes necessarily limits the permissible cylinder power rating.

Engines of this class are widely used in factories and isolated situations where skilled attendance is not available, and also in very small electric power stations where capital cost is of greater importance than efficiency and operating cost. In comparison with small steam plant the efficiency is markedly good; the true "hot-bulb" engine of this class, burning a commercial grade of fuel oil, is not so efficient as the modern fully water-cooled design.

(2) The high-compression, air- or airless-injection, low- or high-speed "Diesel" engine is capable of high-power ratings in a multi-cylinder design. At present the largest engine of the kind, in which fuel is injected by air pressure and the rotational speed is 94 r.p.m., develops 15,000 b.h.p. in nine double-acting cylinders. The engine is directly coupled to a 3-phase, 6,600-volt, 50-cycle alternator. In interesting contrast are a pair of 11,700-b.h.p. 10-cylinder double-acting engines running at 215 r.p.m., each coupled directly to an 8,000-kW alternator.

The tendency to abandon the air compressor and the air-blast system of fuel injection in favour of the high-pressure fuel pump and airless (hydraulic) injection is very decided. The object of the change is to simplify operation and construction, and at the same time to cheapen first cost and improve thermo-dynamic and mechanical efficiencies.

In its modern forms the Diesel engine now includes double-acting and opposed-piston designs in addition to the older single-acting 2- and 4-stroke-cycle designs. The power rating of single-acting engines has probably reached its commercial maximum at about 400 b.h.p. per cylinder in 4-stroke-cycle examples and at about 600 b.h.p. per cylinder in the 2-stroke cycle. In either case the cylinder dimensions will be about 27 in. by 55 in., at a running speed of 100 r.p.m. and a piston speed about 900 f.p.m. The problem of the construction of cylinders above that size becomes difficult in the light of the need for efficient jet penetration, charge mixing, and heat transfer to the cooling medium; larger single-acting cylinders have been made. The double-acting type of engine permits much larger power ratings to be adopted. The problem of designing the lower combustion chamber has been solved in several ways. Most commonly the mean brake pressure below the piston is less than that used above it. Cylinder bores up to 33 in. are in commercial service. A successful, but experimental, 35-in. double-acting cylinder has been built and develops 2,000 b.h.p. on the test bed, and in time larger ratings will become commercially practicable.

The weight of engine per b.h.p. has been gradually reduced to about 1 cwt. in the case of low- and medium-speed engines; in the case of high-speed engines the lowest weight is about 15 lb. for special railway service, and some 30 to 40 lb. in the case of engines designed for driving electric generators. In the case of 4-stroke double-acting designs in service low-speed cylinders are developing 650 b.h.p.; and in that of 2-stroke-cycle engines as much as 1,600 b.h.p. (*vide* the 15,000-b.h.p. engine already mentioned). The 2-stroke-cycle, double-acting, airless-injection engine constructed by the M.A.N. Company, developing 11,700 b.h.p., is rated at 1,170 b.h.p. per cylinder.

In general the mean pressure rating of cylinders remains at a conservative value, from 65 to 70 lb./sq. in. referred to brake horse-power. Mechanical efficiency ranges from 75 to about 80 per cent. One recent double-acting 2-stroke-cycle engine, low-speed and airless injection, has achieved the remarkable mechanical efficiency of 90 per cent. In this instance, as is the case with the majority of the double-acting engines, the average mean brake pressure in 27½-in. by 47½-in. cylinders is somewhat low at 54 lb./sq. in. In this engine the rate of fuel consumption per b.h.p. per hour is 0.38 lb.

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The opposed-piston type of engine, built usually as a 2-stroke cycle machine, has a successful record, and is making good headway in land service. It is, in effect, the equivalent of a double-acting engine. Up to the present the cylinder bore does not exceed 14 inches, in this country at any rate; cylinders of 19 or 20 inches are, however, under construction, and the Doxford type is shortly to be built by a British licencee in England in power ratings up to the largest for land service.

In view of their importance as land marks, particulars of the large engines mentioned in previous paragraphs are given in Table I.

TABLE I.

	15,000 B.H.P.	11,700 B.H.P.
Working cycle	2-str, 2-actg.	2-str. 2-actg
Alternator... ...	10,000 kW	8,000 kW
No. of cylinders	9	10
Cylinder bore	33.85 in.	23.62 in.
Piston stroke	59.05 in.	35.43 in.
Stroke/bore ratio	1.744 : 1	1.50 : 1
Revolutions per min. ...	94	215
Mean piston speed ...	926 f.p.m.	1.270 f p.m.

The 15,000-b.h.p. engine was purchased some two and a half years ago by the City of Hamburg for peak-load service in its Neuhof power station. The duty normally performed is the generating of the demand above that of the primary and secondary base loads. The set runs about 800 hours per annum, and occasionally performs base-load duty when one of the base-load sets is out of commission. The engine will start and take up one-third of the rated full load without the use of the scavenge blowers, which are in duplicate and electrically driven, a valuable feature in the event of an electrical failure in the power station circuits. The set can be run up and paralleled on the bus-bars in three minutes normally; in an emergency, when there is no warning, about six minutes is required. While the economic effect of the set is reported excellent, the reasons for installing it included specifically the great advantages to be gained by the use of a generator able to be started very quickly in any emergency without any standby charge other than the capital charge; nevertheless, the economic effect estimated to accrue in the preliminary calculations was considerable. The investigation of an improved steam plant "time factor" by the provision of a Diesel set as peak-load plant foreshadowed a net saving of the order of £25,000 per annum, and the management states that this estimate has been fully realised.

At the Neuhof station the steam plant capacity is 52,500 kW and the Diesel capacity 10,500 kW, making a total of 63,000 kW; in addition, other stations supply the system. Formerly the time factor was 2,055 hours per annum; it is now 2,430, an improvement of some 18 per cent. The increased use of the steam section of the plant at a higher rate of running plant load factor has improved the overall heat consumption (steam) by 1,000 B.th.u. per kWh. The steam plant is of excellent quality, having a performance of about 16,000 B.th.u. per kWh on test.

The management considers the addition of a further 20-30,000 kW of heavy-oil-engine generating plant would still further improve the performance by permitting better co-operation between the Neuhof and the other power stations, and would, of course, make provision for the growing peak load, bearing in mind that this year's peak tends to merge into last year's base load. In Germany the conditions of service entail the use of 50 per cent. of the installed plant capacity for peak-load purposes of short duration, while the equivalent peak-load output is no more than 5 per cent. of the total.

The thermal results of the engine as stated by Mr. M. Gercke, technical director of the M.A.N. Company, in a paper presented to the Diesel Engine Users' Association in May, 1928, are given in Table II.

TABLE II.

Gross load.	Scavenge blower.	Net load.	Fuel consumption.	Heat consumption.	Thermal efficiency.
kW.	kW.	kW.	Lb. per kWh.	B.th.u. per kWh.	Per cent.
10,405	565	9,840	0.552	9,950	34.3
10,446	572	9,874	0.550	9,940	34.3
7,941	570	7,371	0.556	10,050	33.9
5,417	556	4,861	0.587	10,620	32.1
2,561	570	1,991	0.867	15,700	21.7

The values given in the table are remarkable, even for a Diesel engine, and point to exceedingly good design. The thermal efficiency at about 95 per cent. of the gross loading is some 59 per cent. better than that of a power station steam turbo-alternator equipment with its attendant steam-raising, condensing, and auxiliary arrangements designed to capture the last B.th.u., assuming 10,000-B.th.u. coal is burnt at the overall rate of 1.5 lb. per kWh.

A pair of high-speed Diesel engines is among the first comers of the types which may eventually dominate the heavy-oil engine field. One, designed by Mr. H. F. Ricardo, F.R.S., and manufactured by Messrs. Brotherhood, of Peterborough, is an entirely new departure: it embodies sleeve-valve control of the combustion air and exhaust gases and follows light-oil engine design to some extent. The first engine of this type to be set to work in a public generating station is now in operation in Worthing and has been driving a 3-phase, 50-cycle alternator for several months in parallel with older a.c. generators. The engine is very efficient and, though a small one of 300-b.h.p./200 kW, shows a fuel consumption per kWh in daily service of 0.59 lb., or an average heat consumption of 11,500 B.th.u. per kWh at 83 per cent. (average) of the maximum rated loading. The other engine has been developed by Messrs. Mirrlees, Bickerton & Day, Ltd., of Stockport, and is a logical advance upon the customary arrangement of mechanical detail. One or two of these engines are also in power station service, and give satisfactory performance.

The method of supercharging devised by Mr. A. Büchi, who described its fundamental basis at the World Power Conference in 1928, differed widely from the ordinary system of supercharging at low air pressures occasionally employed in marine Diesel engines. By its means an engine, after undergoing inexpensive alterations of cam and valve settings, may be overloaded safely and continuously by 50 per cent. of the normal maximum rated power and by 100 per cent. for short periods. Manufacturers guarantee successful operation under overload conditions of not more than 10 per cent. for two hours in ordinary Diesel engines. Inversely, Dr. Büchi's system enables a smaller (supercharged) engine to perform the work of a larger (unsupercharged) engine, and thereby effects a reduction in first cost.

The method is to carry the exhaust gases discharged from the cylinders at about 7 or 8 lb. per sq. in. above atmosphere to a gas turbine coupled to a turbo-blower; as the gases leave the turbine at atmospheric pressure there is no loss of energy by the transfer, the inter-connecting pipes being very short. The blower supplies air to the engine cylinders during the "induction" stroke at a pressure about the same as that at which the gases left the cylinders at the end of the expansion period adopted. The quantity of combustion air and fuel oil mixed in the cylinder being larger than in the normal type of engine, a higher power rating is gained, while the maximum pressure and temperature are not increased. The frictional and other losses (expressed as mean pressure) in a Diesel engine are almost a constant proportion of the indicated mean pressure, about 22 lb. per sq. in.; consequently the mechanical efficiency is improved. The efficiency of the process of combustion is the same as that of any ordinary Diesel engine, and the fuel consumption per unit of work is therefore also improved. The scantlings of the crankshaft in normal design are sufficient to support the slightly increased turning moment exerted. A series of independent tests carried out by Dr. Stodola, of Zurich, confirmed the claims made on behalf of Mr. Büchi's system. The non-supercharged engine at normal full load consumed 0.408 lb. of fuel oil per b.h.p. per hour with a mechanical efficiency of 72 per cent. When supercharged and giving the new normal full-load output, the fuel consumption amounted to 0.392 lb. per b.h.p. per hour, with a mechanical efficiency of 80.2 per cent.

(3) The "cold-starting" engine is singularly misnamed. In the opinion of the author (by no means accepted by all) this class of engine is a "Diesel" because the fundamental principle is satisfied by it. The fundamental difference between this class and the original is the nature of the heat cycle employed. The modern Diesel engine operates on a mixed-cycle wherein a slight rise in pressure occurs during the admission and ignition period of the process, such a cycle being thermally more efficient than the constant-pressure cycle; hence an indicator diagram exhibits a rounded top. The "cold-starting" engine, however, is practically, if not entirely, a constant volume machine. The indicator diagram presents a line nearly, if not quite, vertical from the end of the compression curve, and shows an explosive pressure rise up to a maximum of about 650-700 lb./sq. in. The economy of the engine is good; if anything, rather better than that of a Diesel engine of equivalent output, owing to the nature of the design and the absence of an air compressor. In England this engine is extensively manufactured by Messrs. Ruston, Hornsby & Co., Ltd., of Lincoln. At full load a fuel consumption of 0.396 lb. per b.h.p.-hr. is achieved, corresponding closely to a kWh consumption of 0.59 lb.

Drawing a line at about 600 b.h.p. capacity per engine, the "Diesel" engine in its modern form as an "air" or "airless" injection engine holds the whole heavy-oil-engine field above that limit. The tendency of design is markedly towards higher piston and rotational speeds, higher brake mean pressures and lighter construction to reduce first cost. A high-speed engine can be sold at a price about three-fifths of that of a low-speed engine of the same power.

Lay-out.—Engine foundations must be very carefully carried out. A modern heavy-oil engine is so beautifully balanced that earth tremors seldom cause annoyance. A maximum of 7 lb. of cooling water per kWh is an ample provision to make, and steps must be taken to reduce scale formation. Fuel-oil storage may be safely calculated on a basis of 3,500 kWh per ton of oil. The area of floor space required for low- and medium-speed heavy-oil engines is 0.60 sq. ft. per kW of capacity.

Results.—Perhaps the most valuable work accomplished by the Diesel Engine Users' Association is the annual analysis of heavy-oil-engine working costs. Though not representing total generating station results, their effect has been to create a species of ideal for the benefit of engineers and managers, fostering a healthy spirit of friendly rivalry. The returns, derived from a considerable number of members, are a source of authoritative information.

A general conclusion is that the airless injection engine is, in practice, about 2 per cent. more efficient and correspond-

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ingly cheaper in fuel cost than an air injection engine of the same capacity. Official trials suggest a difference in efficiency between the air and airless injection types of about 8 per cent., corresponding closely to the power absorbed by the air compressor. The airless injection engine benefits also by the absence of the cooling effect of the blast air upon the combustion chamber contents at injection.

While it is unwise to draw a conclusion from the evidence afforded by a few stations, it would appear that the preference of the manufacturer and the user alike for running speeds not in excess of 250 r.p.m. has some justification. This remark is not extended to high-speed engines of 750 r.p.m. and upwards specially designed for land service; at present there is too little information available about them applicable to power station conditions.

In analysing heavy-oil-engine station costs the Diesel Engine Users' Association noticed an interesting fact in the position taken by a set of engines about 20 years old, which achieved the lowest average rate of fuel consumption per kWh in a list of 138 engines. That so low a fuel consumption as 0.665 lb. per kWh should be attained in the 20th year of an engine's life is a remarkable commentary upon the sustained efficiency of the heavy-oil engine. Except on account of obsolescence due to insufficient generating capacity, the question of depreciation from the point of view of economy hardly arises. The consumption noted is equivalent to a heat use of 12,967 B.th.u. per kWh. Another definite conclusion may be drawn: the cost of repairs and maintenance is low and shows little tendency to increase with age. One of the popular objections to the heavy-oil engine is its alleged costly repair bill, but actual experience during many years does not confirm this delusion.

Future Prospects.—Operating often under dreadful conditions of load factor, which precluded the hope of an economical use of steam power, and often equipped with a poor type of plant, undertakings did little but struggle under a burden of cost that strangled development. The Diesel engine came as a godsend to them. Thanks to its freedom from standby charges, to the small number of operators required, and to its inherent efficiency, companies began to pay dividends and municipal undertakings were able to reduce the price of energy and, in some cases, ceased to call upon the rates for assistance. The future of undertakings in this country of the "non-selected" type is very uncertain from the financial point of view. The heavy-oil engine has served them so well that their share in the good things to be offered by the Central Electricity Board may well be less than that of their colleagues who have clung to steam generation, perhaps not in its best form. Up to the present the bulk supply prices that have been arranged are not especially attractive when contrasted with local heavy-oil-engine generation, especially in an area where a power company is supreme. With increasing output the standing charges of the "oil" stations tend steadily to fall, so that the position of many of them, good as it may be to-day, contains the prospect of even better results were local generation to continue. Their future depends now upon the level of the bulk-supply charges, even if they remain active for peak-load work. These charges are an unknown quantity: those that have been provisionally agreed during the intermediate period of the construction of the primary and secondary transmission systems are not based upon any definite method of accountancy, and the ultimate charge may be something very different from the temporary charge, especially when it is remembered that the Central Electricity Board has power to suspend contributions to the sinking funds for five years. In general, rates of charge of the order of £3 per kilowatt and 0.25d. or 0.30d. per kilowatt-hour are too high to benefit a well established heavy-oil-engine generating station where extensions of similar plant can be effected. In units up to 1,000 kW capacity an extension can be carried out for an annual capital charge of about 30s. per kW (interest and repayment being calculated at 5 per cent. for the normal periods as a simple annuity). The heavy-oil engine is now regarded abroad not so much as a competitor of steam, but as an ally to be utilised in effective combination to secure the most favourable economic result.

There are numerous fields of application for the heavy-oil engine outside the power stations of statutory undertakers, notably in the private stations of industrial undertakings, and, of course, for all sorts of purposes in other countries where our export trade hopes to profit. Thanks to the somewhat illogical method of conducting the legislation of this country, the large privately-owned power-plant owner has been given unexpected and gratuitous aid in the form of rate reduction that is not extended to the statutory electricity supply undertaker. It is certain that the rate burden upon supply authorities will be increased in the immediate future and some revision of tariffs may be needed to meet the additional charges of the kind. There are instances in which the item "rates and taxes" will exceed in magnitude the fuel cost of undertakings. It cannot be surprising if some of the larger industrial concerns return to "self" generation and look favourably upon the simple, compact, highly efficient, and handy heavy-oil engine as an excellent means of satisfying their requirements. Should this possibility materialise it is not unlikely that the accelerated increase of output and demand upon which the 1926 schemes depend will fail to occur and the Central Electricity Board may be unable, whatever may be its intention, to sell energy at rates low enough to enable the local distributor to retain his best class of business.

Comparison of the capital and operating costs of 20,000-kW capacity generating stations equipped with heavy-oil engines and steam plant of good design, but not with the refinements incorporated in the largest base-load stations, with a maximum demand of 16,000 kW and annual demand load factors of 35, 25, and 20 per cent., shows the steam station to be the more economical to the extent of 4, 4.2 and 5 per cent., the maximum difference being of the order of £3,600 per annum. An increase of 10 per cent. in the price of coal (say 1s. 6d. per ton at 15s. per ton) would place the annual cost of the two equipments on level terms. Thus, the conclusion of engineers abroad that "there is nothing in it" between the two methods of generation when the output to be dealt with is considerable, is borne out. There may, however, be factors other than cost bearing an important influence upon the choice of plant. The oil-engine plant is simpler, requires a smaller staff, needs far less water, and oil storage is much less obnoxious to neighbours than a coal yard. The area of site will be less and it may be practicable to place the oil station nearer the centre of gravity of the supply system.

The use of the heavy-oil engine in the power station side by side with steam generating units, or in distant sub-stations for peak-load duty, has been much discussed, and in Germany combinations of the kind are frequent and are undoubtedly satisfactory. In making any such arrangement cost is not the only consideration to be taken into account; indeed, on a pure cost basis it is not always clear that a definite financial advantage can be obtained. The heavy-oil engine possesses a remarkable advantage over the turbo-generator in its capacity for quick starting from cold without any kind of preparation charge other than the standing charge for attendance and capital. The pulverised-fuel boiler has much improved the flexibility of the steam-raising section, but the turbine lacks flexibility entirely and careful adjustment of temperature is an essential before load can be applied. This consideration, among others, had weight in the decision of those responsible for the purchase of the 10,500-kW heavy-oil-engine set in Hamburg. Other towns in Germany, Bremen, Kottbus, and numerous others, have found this favourable feature of the heavy-oil engine a great convenience. At first sight the cost of a Diesel engine, round about £16 per kW with its foundations and generator, would not appear to be justified for short-hour use. The time factor may vary according to conditions from 200 to 1,000 hours and over; normally 800 hours is not unusual. Those who are accustomed to the non-industrial condition of a high peak load of short duration, combined with minor peaks that must be dealt with by overloading turbo-generators and steam-raising plant, are well aware of the heavy burden of cost imposed by standby and preparation costs. The liability to fog, or storm, and the impossibility of running a turbo-generator on to load very quickly, compel the simultaneous use of a greater number of generators than may be needed to meet the normal demand. The result is reduced efficiency in both the steam-raising and steam-using sections of the power station. While the rate of steam consumption varies but little in large turbines, the numerous sources of constant loss, in the aggregate and applied to large outputs, detract seriously from efficiency and constitute the equivalent of an additional standing charge when the generators are not operated at a high running plant load factor.

Comparison of the cost of 5,000-kW peak-load plant operated at a plant load factor of 85 per cent. shows the oil-engine equipment to be slightly cheaper in use than "good," and more expensive for the purpose than "high efficiency," steam plant. By "good" steam plant it is intended to imply an efficiency of the order of about 21-22,000 B.th.u. per kWh; by "high efficiency" 16,000-20,000 B.th.u. per kWh; that of the oil set is assumed to be about 12,000 B.th.u. per kWh. In the author's opinion the heavy-oil engine either for peak- or base-load duty at the main generating station cannot compete with the "high efficiency" base-load type of generating plant with its large overload capacity and quick steam-raising characteristics until the prevailing relative capital costs and fuel prices are materially altered. Nevertheless, a general conclusion cannot safely be made because of the great variety of local circumstances.

With regard to sub-station duty the position is governed entirely by the capital cost and the annual value of losses in transmission and converting plant, if employed. According to the capital cost of laying e.h.p. cables to a sub-station (and this item may be exceedingly heavy in a large city where the soil below streets and footways is generally congested with the mains of other public services) it may or may not be desirable to provide additional cables, either in the form of radial feeders, or as additions to a ring main system. There are, undoubtedly, cases in which the extension of sub-station plant by oil engines would effect an economical result, quite apart from the freedom from interruptions liable to be caused by cable or generating-station defects. The provision of quick-starting generating plant, entirely independent of the electrical system, on the "incoming" side in a heavily loaded district would add to the safety, continuity, and reliability of supply.

In a minor, but not unimportant, direction there is a strong case to be made out for the use of the heavy-oil engine as the primary source of energy for the internal auxiliary service of a steam generating station. In the interests of safety and in a dire emergency a completely separate system is a necessity when the auxiliary service is as important as that of a large generating station now is.

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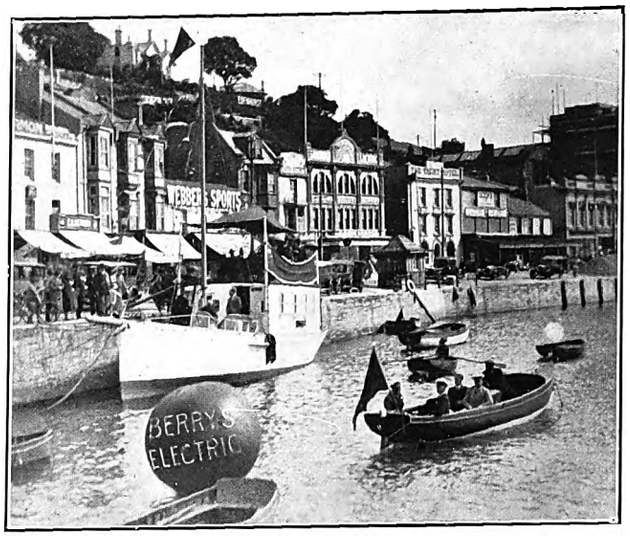
The I.M.E.A. at Torquay.

Members arriving to hear Mr. Jennings' Paper.



A Novel Craft in Torquay Harbour.

Mr. Frank Hodges and Sir John Brooke.

Mr. H. F. G. Woods.

Members arriving at Town Hall on Thursday.

Entrance to Old Torbay Hospital.

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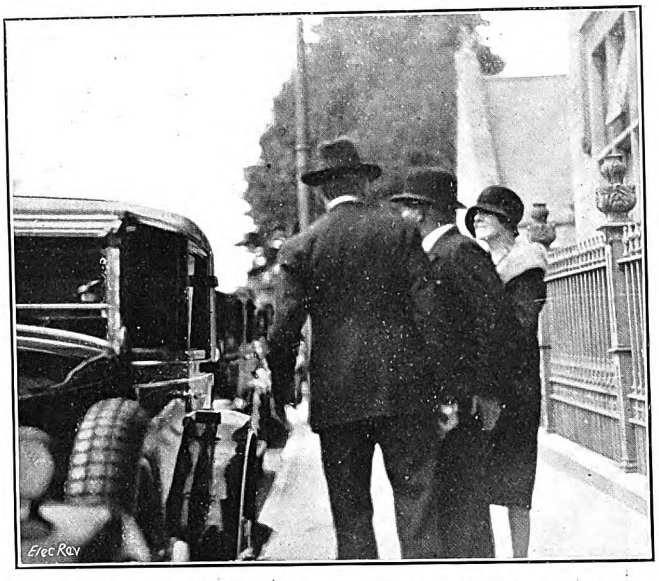
The President, E.D.A., with Mrs. Nichols Moore.

Mr. T. R. Martin and Others.



Dr. Ferranti and Mr. and Mrs. Nichols Moore.

The Town Hall, Torquay.

The Torquay Borough Electrical Engineer under Cover.

Messrs. G. J. and H. H. Berry Enjoying Life on board their "Lugger."

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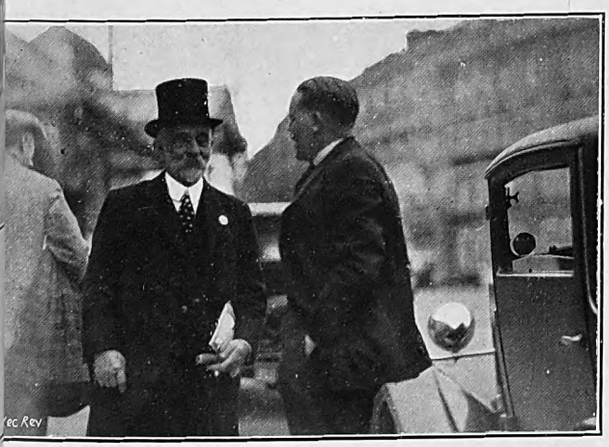
Miss M. Partridge, B.Sc.

Mrs. Ll. B. Atkinson and Mrs. Cramb.

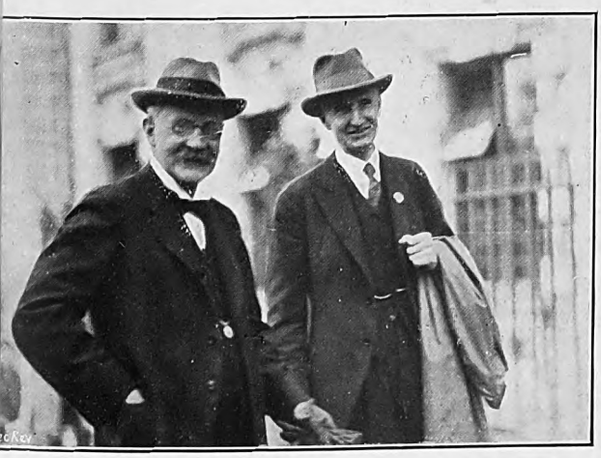
Members Leaving the Town Hall.

A Small Group Outside the Pavilion.

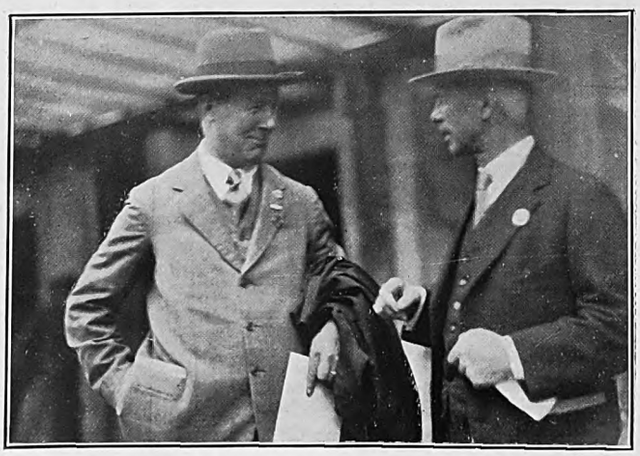


Ald. A. Smith and Mr. N. B. Coop.

Lt.-Col. Vignoles Greeting some Friends.



Dr. S. L. Pearce with Mr. H. C. Lamb.



Mr. F. W. Purse with Mr. J. K. Brydges.

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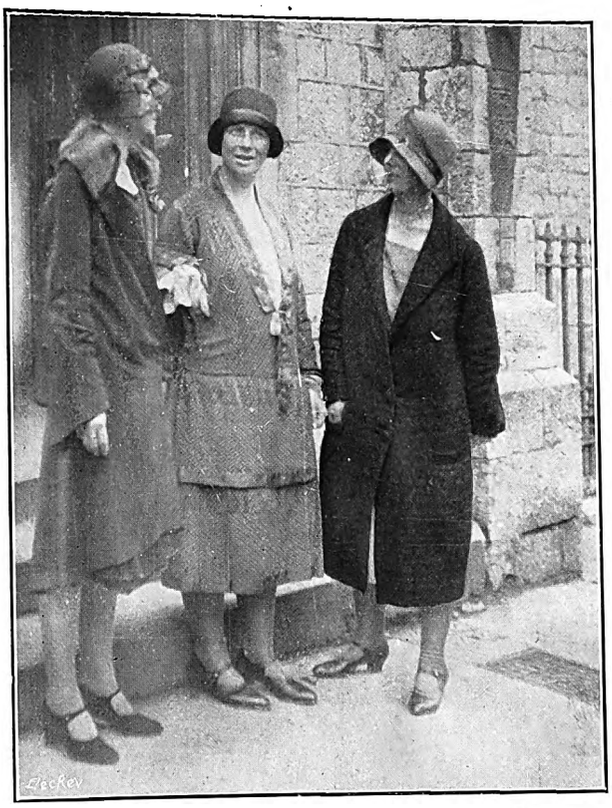
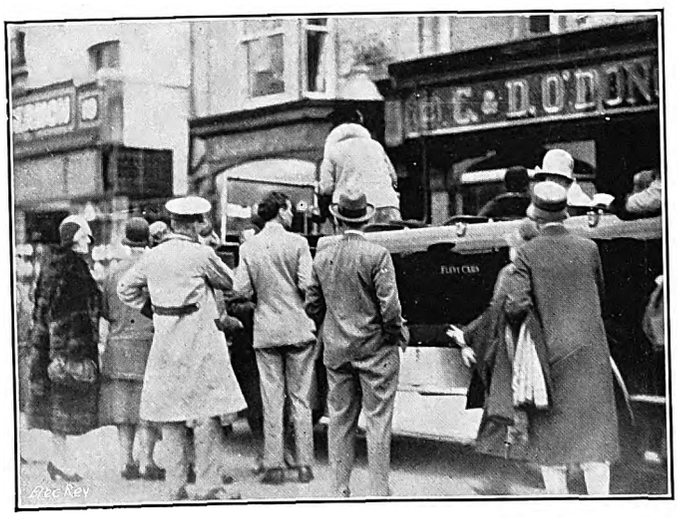
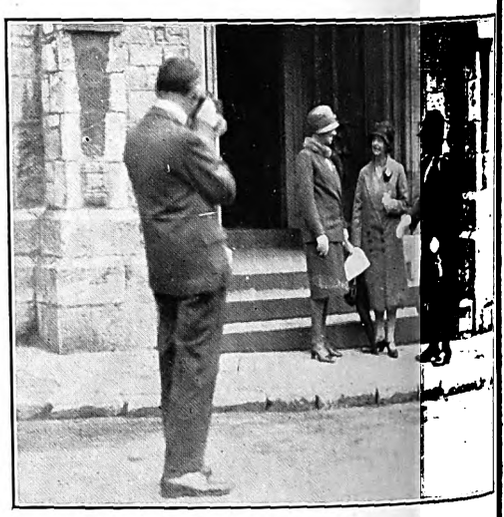


The Director, E.A.W., with two Members.

Members of the Council of the E.A.W.



The E.A.W. leaving for Devon Moors.



Lt.-Col. Vignoles Filming some of the Ladies.

Mrs. Nichols Moore.

E.A.W. Members Outside the Exhibition.

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The I.M.E.A. Exhibition.

(*Continued from page* 1035.)

TUESDAY afternoon of last week saw much attention paid by members of the I.M.E.A. Convention to the exhibits in the Old Torbay Hospital, and the keen appreciation of the show as a whole by the members reflected the excellent work done by the Electrical Development Association in organising the exhibition, and by Mr. V. W. Dale, business manager, E.D.A., who was responsible for the lay-out and general arrangements. Various views of the stands, taken from different parts of the Exhibition, are shown on pages 1082 and 1083, and they depict the general pleasing character of the show as a whole. Throughout the Convention a goodly number of members of the public visited the Exhibition at appropriate times.

The developments of the GENERAL ELECTRIC CO., LTD., in the realm of both domestic and industrial appliances were well represented on the company's stand, and a selected range of modern lighting equipment was shown. The company concentrated upon those features as being of particular interest to station engineers. The new range of "Magnet" cookers, which embraces every type required for domestic purposes, from the "Magnet" minor breakfast cooker to the large table model cooker suitable for a family up to ten persons, was also included. The breakfast cooker has the special features of separate boiling plate, grill, and oven elements, independently controlled by 3-heat reciprocating switches. The "Magnet" automatic cut-out safety kettle, a range of "Magnet" fires in special finishes, and a new type of wash boiler were among the other items displayed. Of industrial appliances, there was a special display of garage equipment, the possibilities of which have been drawn attention to recently by the British Electrical Development Association. An effective demonstration of water heating was given in one of the rooms, a section of which was subdivided into a kitchen and bathroom, the entire water supply for which was furnished from a "Magnet" water heater in the kitchen. The selection of lighting fittings on show included "Perlique" glassware, demi-coupe glassware, wall brackets, enclosed units and industrial reflectors, including the "Wembley" lantern.

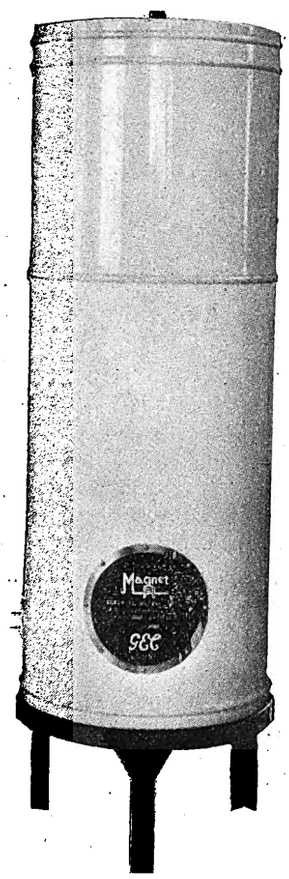

Fig. 6.—New "Magnet" Storage Water Heater.

Special features of the G.E.C. display were a new storage water heater and a new wash boiler. The "Magnet" water heater, fig. 6, incorporates, it is claimed, all the features which long experience has shown to be necessary for high thermal efficiency, combined with robust construction. It is made in sizes from two gallons upwards, and arranged for floor or shelf mounting. Of pleasing appearance, with white-enamel finish, it is of sound mechanical design and capable of simple adjustment within suitable limits of temperature. It is double-cased, and has three inches of efficient lagging between the outer case and inner container. The inner container is of steel or copper, and is tested to withstand a pressure of 25 lb. per sq. in. The heater, which is suitable for all voltages from 200 upwards, is equipped with a thermostat of the quick-make and -break bi-metal type, and can carry up to 5 A a.c. For d.c. and for more than 5 A a.c. a relay switch must be added. The standard "Magnet" withdrawable-type immersion heater is fitted. The wash boiler operates on the thermo-siphon principle, with an internal percolator giving very free circulation, heat loss being reduced to a minimum by ample air spacing between the inner container and the outer casing. This outer casing, which is mounted on three legs, is of galvanised-iron, and the container is of heavily-tinned copper. The boiler is fitted with a heavy-gauge galvanised-iron lid, and when reversed this lid serves the purpose of a table. The elements are of the strip type, each enclosed in a protecting copper sheath clamped to the bottom of the container. Control is effected by means of a 20-A, 3-heat, reciprocating-type, rotary switch mounted in a cast-metal box with an enamelled cover, which is connected to the wash boiler by a 4-ft. length of 4-core c.t.s. cable. Both control box and boiler are fitted with earthing terminals.

The main exhibit on the stand of the HOTPOINT ELECTRIC APPLIANCE CO., LTD., comprised a range of new model "Hotpoint-Falco" electric cookers. The main characteristics of the "Hotpoint-Falco" designs are retained. The prevention of moisture passing from the boiling section to the oven section is attained by the provision of a cast-iron crown plate with a protecting rim. This also provides a non-corroding division plate that will not be readily destroyed under the adverse conditions in which some cookers operate. The oven element assembly is in one unit and can be removed from the oven by undoing two wing nuts and three terminal wires. Similarly, the whole switch assembly is made in one complete unit, and can be readily removed, after detaching the right-hand portion of the hob, by the removal of only three screws and disconnecting the leads from the boiling plates, grill and oven. The wiring of the cookers is simple. Where a relatively long run of conductor is necessary, as under the hob to the boiling plate or plates on the extreme left, the wiring is carried in a channel of cast-iron, vitreous enamelled. This coating of enamel is made to stand a pressure of 1,500 V to "earth." One of the cookers shown is of the latest popular finish, *i.e.*, mottled-grey enamelled. In addition to the cooking apparatus by this company, there were on show the "Hotpoint-Maytag" electric washing machine, the tub of which is constructed of cast-aluminium and operates on the "gyrafoam" principle; the "Premier-Junior" and "Premier-Duplex" electric vacuum cleaners; and a general display of "Hotpoint" electrical appliances.

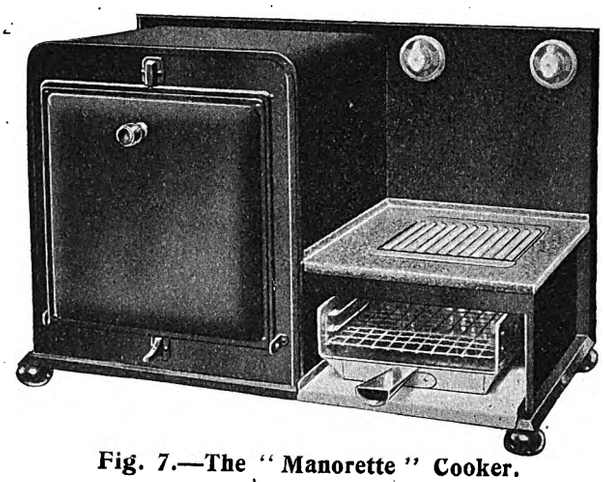

Fig. 7.—The "Manorette" Cooker.

Among an interesting display of cookers on show on the stand of the MANOR ELECTRIC OVEN & FIRE CO. was the "Manorette" cooker, fig. 7. The outside dimensions of the cooker are height 19 in., width 28 in., and depth 15 in. The door and front frame are constructed of fine cast-iron, and the body, base-plate and back of mild-steel. The interior of the oven is of blue planished steel. All the steel parts are treated with rust preventive compound, stoved on, and the exterior is finished in stoved black-enamel. The interior dimensions of the oven are 12 in. by 12 in. by 11 in., the loading being 200 W. The boiling plate and grill is of the standard "plug-in" type, with a loading of 1,800 W. The hob and crown plate are vitreously enamelled. The oven and boiling-plate elements are 3-heat controlled. A six-bar radiator displayed by this company has a total loading of 3,600 W, the overall dimensions being 20 in. high by 15 in. wide. It can be supplied in stoved black-enamel or electro-bronze finishes. Other "Manor" exhibits included a 10-gal. wash boiler with

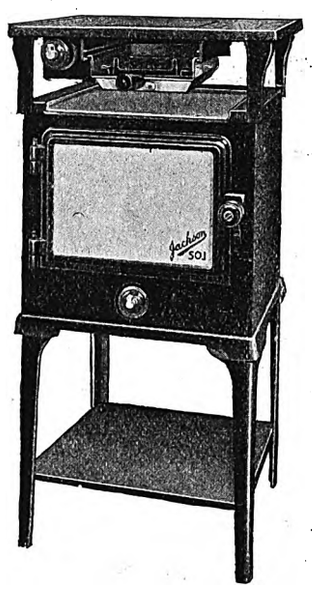

Fig. 8.—The "Jackson" Junior, with Legs.

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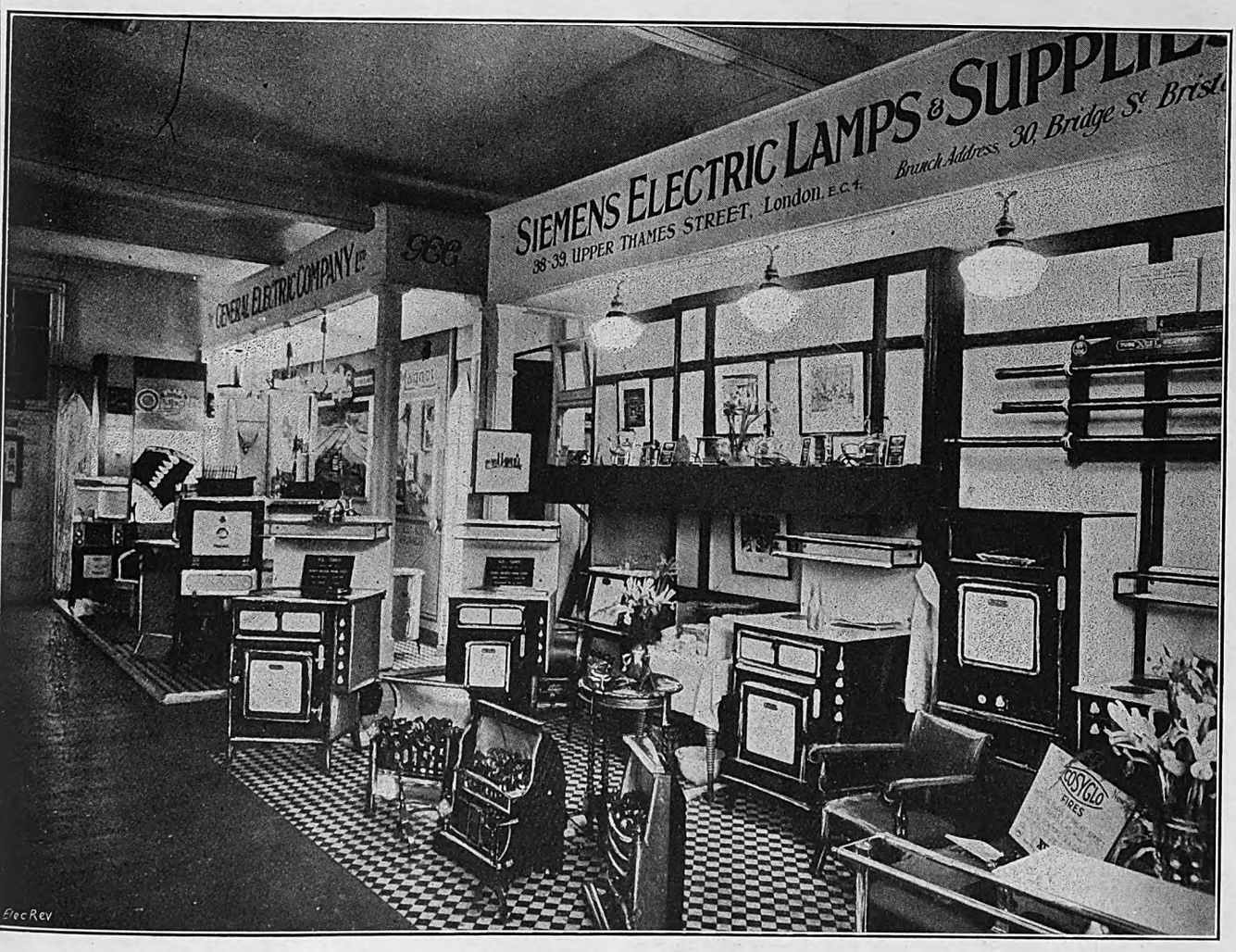
—the Domestic Electrical Apparatus Displayed.



—of the Exhibition, depicting the general pleasing character of the Show.

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overall dimensions of 32 in. high and 20 in. in diameter, and with a loading of 4,000 W; bowl fires; a table heater measuring 3½ in. high by 18 in. wide by 10½ in. deep, having a loading of 200 W; and a special wash boiler and a bath heater as supplied to the Willesden Council. The "Manor" heating elements are protected from damage by "Steatite" tubes.

The JACKSON ELECTRIC STOVE CO., LTD., had on show a range of cooking cabinets in marblon all-enamelled finish, and the "Jackson Junior" cooker, fig. 8, which, it is claimed, is being supplied in thousands to supply authorities for hire and hire-purchase purposes. The Jackson exhibits also included a No. 51 cooker, which is similar to the No. 50 J. model, but has a self-contained boiling plate in addition to a grill-boiler, the latter being slightly smaller than that on the No. 50 J. hob; the oven is the same. Another item on this stand was the No. 48 new table cabinet on the lines of the No. 46 model. Messrs. Jackson also showed a range of fires finished in the new Chinese styles. It is believed that it was the first time these particular finishes have been applied to electric fires. The effect is to dispel the somewhat metallic appearance given by the average electric fire when supplied in brass or copper. A new Jackson wash boiler shown, No. 155, is similar to the No. 154 model, but the bottom of the former has a smooth surface.

In addition to the new design of Berry-McClary cooker, and new models of "Magicoal" electric fires, BERRY'S ELECTRIC (1928), LTD., exhibited a domestic water heater, introducing some new features. It is of the storage-tank type, with low consumption. The interior is built up from a unit system, enabling the heating element and thermostat to be withdrawn without emptying the water from the con-

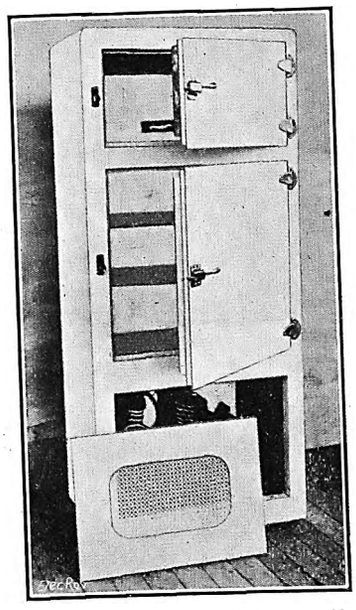

Fig. 9.—The Domestic Model "Marco" Refrigerator.

tainer, and, when necessary, the whole of the internal gear can be removed for cleaning purposes without interfering with the outer case. The heating element is of robust construction, with a single spiral wire, not coiled. The thermostat can be used on d.c. or a.c. In conjunction with the heating element there is a special circulating device which keeps the inner container more or less at equal temperature throughout, ensuring the full capacity of really hot water. It is claimed that the trouble of constant dripping on the hot-water side has been definitely overcome in this cooker.

Among the range of refrigerators displayed by MARCO REFRIGERATORS, LTD., were the small domestic model MC.159, fig. 9, which has an internal capacity of 8 cu. ft., in white-enamel finish; domestic models MC.127-130, with internal capacities varying from 10 to 28 cu. ft.; and commercial models with capacities up to 58 cb. ft. There was also on show on this stand a new standard model, No. 35, which is claimed to be particularly suitable for butchers, provision merchants, &c. This model has an internal capacity of 35 cu. ft., and is fitted, in addition to ceiling hanging rails, with a tier of instantly-removable slatted wooden shelves.

The exhibits by Messrs. MOORWOODS, LTD., included the large, medium, and small models, in addition to the "Moorwood-Junior" cookerette and a selection of electric fires, including a stainless-steel fire and a mantel register suite. The "Moorwood" electric cooker is specially designed to meet the requirements of the average household. The oven is made in one piece, with all corners rounded, and is easily removable for cleaning. The oven elements are placed at each side and one at the bottom; the elements are spread over a wide area, are interchangeable, and are all 3-heat controlled. The oven is provided with a grid shelf, slide shelf, and pudding tin, and is enamelled throughout. Two 8-in. diameter fast boiling plates are fitted to the No. 210 cooker, and one to each of the smaller models. In addition, an efficient covered grill and boiling plate is provided on each model, controlled by an individual three-heat switch.

(*To be continued.*)

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Economic Effects of Monopoly on British Power Stations.

Many of your readers will be disappointed at your brief, but decidedly biased, review of this important book by Mr. A. H. Swain. It is all very well to say that the facts which form the background of the book had better be forgotten. Why should they? Is it of no importance to the public and ratepayers what prices are charged by manufacturers, seeing that the price of electricity is bound up with the cost of heavy machinery and cable?

Your remark that "If manufacturers will *assure themselves* that the prices which they quote are reasonable . . ." is really too humorous. It is quite simple and only natural for manufacturers to assure themselves. What is of greater importance is to assure the public, or the local authorities who represent the ratepayers and consumers, and this is the whole point. Mere rhetoric will not convince them when they are quite aware of the profits, for example, of the members of the C.M.A., their reserves, and the prices of their shares as quoted on the Stock Exchange.

Consider the vital question of rural electrification: a cheap supply of electricity to the rural areas is a matter of life or death to the already desperate agricultural industry. Those who have read your report of Col. Vignoles's paper in last week's issue may have been struck by the remarks of Mr. Turnbull, of Aylesbury, as follows:—

> "He was getting [from the Government] 2½ per cent. of his interest paid, but that was on condition he used unemployed miners and also *British cable*. The latter meant an increase of 50 *per cent.* over the price paid for foreign cable, and therefore it became questionable whether there was any advantage in having Government assistance in the matter."

These remarks need no comment other than that one would think they lend excellent support to Mr. Swain's contentions.

There are chief engineers who find it much more convenient to take the path of least resistance and pay the price demanded. On the other hand, there are others who realise their responsibilities as good citizens and are jealous of the reputation and efficiency of their undertakings. It is bad enough to be at the mercy of rings at home, but seeing that leading members of the B.E.A.M.A. are gradually coming under the influence of cartels dominated from New York, the matter cannot be contemptuously dismissed as of no consequence.

Mr. Swain deserves the gratitude, not only of engineers, but also of the general community, for bringing this serious subject to their notice.

"Blessed are those who eschew the path of least resistance, for they are the salt of the earth."

Citizen.

June 6th, 1929.

X-rays at Sea.

We are very interested to see in your issue of to-day's date, amongst your "Notes," a description of X-ray apparatus for use on board ship. We feel, however, that in justice to ourselves and other British makers of X-ray apparatus, we must correct the impression which is given that hitherto X-ray work afloat has not been possible.

We ourselves have made and supplied many sets to be used in such circumstances, and it is within our knowledge that other firms in the electro-medical industry have done so also.

X-ray apparatus is a standard part of the equipment in the British Navy, and although the type of installation used may not be of the most modern character, this fact is well known to everybody concerned, and a certain policy has been adhered to for special service reasons.

X-Rays, Limited,
CUTHBERT ANDREWS.

London, *June 7th*, 1929.

Tramcar Regenerative Braking.

In your issue of March 22nd, 1929, you publish a letter from Mr. E. H. Croft in which he refers under the above heading to an article of mine in the ASEA *Journal*, Vol. 5, 1928. Mr. Croft criticised my suggestion for obtaining good braking by connecting a small resistance in series with each motor armature, but as his remarks are based upon a misunderstanding I should like to explain matters a little further.

The small resistances referred to are only in circuit during braking. It is to be regretted that the diagram accompanying my article is small and difficult to follow, but the principle of connection for motoring and braking appears moderately clearly from the figures on the right hand side of the diagram. With the controllers shown, no alteration is necessary if the small

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equalising resistances are added. As expounded by Mr. Croft, I do note think that the method would make a more endearing appeal to a foreign than to a British engineer.

Mr. Croft further states that I have missed a point in failing to state that the breaking of one lead prevents braking on both motors with the well-known cross-field connection. Here he has certainly not studied my article very carefully, as I distinctly mention at the conclusion that my suggested arrangement has the advantage over a cross-brake connection that, should a breakdown occur on one motor, the other will still continue to act as a brake.

I may mention that there is a method of making the cross-brake connection function properly when the brake circuit is interrupted by connecting a resistance across the cross connection. I refer here to the American patent No. 1076298 of Mahoney, and the German patent No. 309554 of Krauss.

My article was, I may say, first written in 1921 and was solely intended to convey to interested parties information regarding a method of connection which would enable very good braking to be obtained without involving any alteration to the controllers.

I certainly intended no criticism of the article written by Mr. Croft, and I consequently consider his remarks rather unjustified.

P. Friebel.

June 10th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1927.

28,905. "Means for controlling the intensity of a beam of light for use, for example, in recording sound." A. Whitaker and Gramophone Co., Ltd. July 4th, 1928. (311,520.)

31,489. "Electromagnetic transmitters and receivers for reproducing sound." A. F. Sykes. November 23rd, 1927. (Patent of addition not granted.) (311,826.)

33,689. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. January 13th, 1927. (283,543.)

1928.

965. "Automatic telephone systems." Siemens Bros. & Co., Ltd., C. L. Peters, and D. A. Christian. January 11th, 1928. (311,666.)

1,344. "Sound-reproducing apparatus." C. M. R. Balbi. January 23rd, 1929. (311,835.)

1,543. "Means for the protection of electrical installations." W. Fennell. January 17th, 1928. (311,792.)

1,573. "Electric switchgear." British Thomson-Houston Co., Ltd., M. C. L. Hunter, and W. P. Hamlyn. January 17th, 1928. (311,793.)

1,574. "Draw-out electric switchgear." British Thomson-Houston Co., Ltd., M. C. L. Hunter, and W. P. Hamlyn. January 17th, 1928. (311,794.)

4,377. "Railway signalling apparatus of the double-wire transmission type." A. G. Kershaw and Westinghouse Brake & Saxby Signal Co., Ltd. February 11th, 1928. (311,676.)

4,391. "Composite magnetic materials." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). February 11th, 1928. (311,677.)

4,640. "Measuring and like apparatus for use with high-potential circuits." International General Electric Co., Inc., and C. G. Mayo. February 14th, 1928. (Addition to 224,873.) (311,796.)

4,641. "Vapour-electric rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. February 14th, 1928. (311,681.)

4,650. "Electric heating units." S. Morse. February 14th, 1928. (311,682.)

4,677. "Printing wheels suitable for use in telegraphic receiving and printing apparatus." Creed & Co., Ltd., and F. G. Creed. February 14th, 1928. (311,684.)

4,694. "Electric communication cable." Standard Telephones & Cables, Ltd., and W. K. Weston. February 14th, 1928. (311,685.)

4,695. "Automatic switches for telephone systems." Standard Telephones and Cables, Ltd., and M. S. Snell. February 14th, 1928. (311,686.)

4,787. "Electromagnetic instruments for converting oscillating currents into sound and *vice versa*." British Thomson-Houston Co., Ltd., and L. B. Ault. February 15th, 1928. (311,722.)

4,934. "Vapour-electric rectifiers." British Thomson-Houston Co., Ltd., and J. C. Read. February 16th, 1928. (311,801.)

5,013. "Control of output of variable-speed electric dynamos." F. H. Royce. February 17th, 1928. (311,806.)

5,054. "Interlocking electromagnetic relays." Automatic Telephone Manufacturing Co., Ltd., and C. H. Brizell. February 17th, 1928. (311,807.)

5,067. "Picture-transmission system." W. E. Beatty (Bell Telephone Laboratories, Inc.). February 17th, 1928. (311,810.)

5,893. "Device for producing electric discharges of predetermined duration and constant intensity." L. N. Brillouin. March 8th, 1927. (286,666.)

5,946. "Remote-control arrangements for electric alternating-current distribution systems." C. Lorenz Akt. Ges. March 18th, 1927. (287,161.)

6,004. "High-tension electrical supply for wireless apparatus." H. R. Milnes. February 27th, 1928. (311,849.)

6,264. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. February 28th, 1928. (311,851.)

6,389. "Electric motors." E. D. Feldman. February 29th, 1928. (311,853.)

6,643. "Luminous circuit charts." Siemens & Halske Akt. Ges. July 22nd, 1927. (Addition to 283,893.) (294,225.)

8,400. "Apparatus for locating the direction of sound and sound-signals." D. W. Smith and H. W. Whyte (executor of R. J. W. Whyte (deceased)). March 20th, 1928. (311,869.)

8,592. "Electromagnetic actuating mechanism for the reproduction of sound with radio loud-speakers, telephone receivers, and the like." R. I. Denham. March 21st, 1928. (311,870.)

8,712. "Mechanical trip devices applicable for use with electric switches and for other purposes." English Electric Co., Ltd., and H. Bacon. March 22nd, 1928. (311,871.)

9,464. "Electrical relays and amplifiers." P. Freedman and W. J. Rickets. March 29th, 1928. (311,881.)

9,499. "Electrically-driven floor brushes." A. Giambertoni. March 29th, 1927. (287,914.)

9,561. "Means for the protection of electrical installations." W. Fennell. January 17th, 1928. (Divided application on 311,792.) (311,811.)

10,022. "Means employed for supplying current or potentials from mains to utilisation means." Graham Amplion, Ltd., and P. K. Turner. April 3rd, 1928. (311,893.)

10,113. "Electrical switches and switch fuses." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. April 4th, 1928. (311,895.)

11,140. "Incandescent electric lamp fittings." R. I. Scorer. April 16th, 1928. (311,906.)

11,967. "Electric cables." Siemens Bros. & Co., Ltd. (C. W. Schofield). April 24th, 1928. (311,914.)

11,982. "Electric switch lampholders and the like." R. Nettl. April 24th, 1928. (311,915.)

12,196. "Means for measuring the rate of generation of electrical impulses." Coventry Automatic Telephones, Ltd., and J. E. Collyer. April 26th, 1928. (311,921.)

13,300. "Measuring or indicating instruments." R. Amberton and Electrical Apparatus Co., Ltd. May 5th, 1928. (Cognate application, 3,804/29.) (311,929.)

14,179. "Timing adjustment of magnetos for internal-combustion engines." G. Cattaneo. May 13th, 1927. (290,584.)

14,759. "Multi-part insulators." D. H. Rowland. May 24th, 1927. (291,028.)

16,283. "Apparatus for the inter-conversion of mechanical and electric oscillations." British Thomson-Houston Co., Ltd. June 6th, 1927. (291,734.)

17,109. "Lamps for power-driven vehicles." R. Hansen. June 13th, 1928. (311,959.)

17,394. "Miners' electric safety lamps." J. H. Pease. June 15th, 1928. (311,963.)

20,084. "Gaseous-conduction electrical rectifiers for alternating current." Westinghouse Lamp Co. July 20th, 1927. (294,208.)

20,327. "Trucks or wheeled underframes for tramway, railway, and like vehicles." Electro-Mechanical Brake Co., Ltd., and J. H. Williamson. July 12th, 1928. (311,981.)

21,597. "Remote-control systems." Associated Telephone & Telegraph Co. September 3rd, 1927. (296,664.)

21,605. "Electrically-heated massage appliances." M. Kramer. July 25th, 1928. (311,992.)

23,360. "Circuit arrangements for operating an electric discharge tube with direct current." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 2nd, 1927. (296,432.)

24,269. "Electric resistance furnaces." Hevi Duty Electric Co. May 22nd, 1928. (312,006.)

29,263. "Mercury-vapour rectifiers." Associated Electrical Industries, Ltd. October 11th, 1927. (298,572.)

30,541. "Double-cap insulators." Akt. Ges. Brown, Boveri et Cie. October 21st, 1927. (299,322.)

35,655. "Electric selective arrangements for operating alarm devices." Soc. Française Radio-Electrique. December 2nd, 1927. (301,753.)

36,557. "Electric transmission of pictures." C. Lorenz Akt. Ges. December 23rd, 1927. (302,901.)

1929.

1,791. "Arrangements for eliminating disturbing and secondary waves in wireless circuits." C. Lorenz Akt. Ges. January 31st, 1928. (Addition to 263,825.) (305,131.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 5th :—

Pathfinder (lettering and design). No. 498,136. Class 8. Radio-telephonic apparatus.—Essex Radio Supplies, Ltd., 35, Norton Folgate, E.1.

Movector. No. 500,080. All goods in Class 8.—The I.G. Farbenindustrie Gesellschaft, 28, Mainzerlandstrasse, Frankfort-am-Main. (British representatives: Abel & Imray, 30, Southampton Buildings, Chancery Lane, W.C.2.)

Three Torches (lettering and design). No. 501,981. Class 8. Electric batteries (not for medical purposes).—H. S. Myers, 6, St. Andrew's Buildings, Gallowgate, Newcastle-on-Tyne.

Solink. No. 500,322. Class 13. Electric lighting fittings, junction boxes, fusible cut-outs, switches, and circuit-breakers.—Donovan & Co., Northcote Road, Stechford, Birmingham.

Utilising the Thermal Heat of the Sea.

At a recent meeting of the French Academie des Sciences, M. Georges Claude gave some details of the latest developments in connection with the Claude-Boucherot method of utilising the thermal heat of the sea. In order to demonstrate the system, an experimental plant (ELECTRICAL REVIEW, January 11th, 1929, p. 58) was last year established on the River Meuse at Ougrée, Belgium, with the object of ascertaining whether the system could be successfully applied in connection with agitated sea water. M. Claude recently visited Cuba, and as a result of his cordial welcome it has been decided to transfer the experimental plant from Belgium to Cuba, where it is possible to draw water from a considerable depth. To this end he is having constructed a suction pipe about 6½ ft. in diameter and a mile and a quarter in length, which will allow the necessary water to be obtained from a depth of 1,968 feet and at a point nearly a mile from the coast. The pipe, except at the land end, will be only 2 mm. thick, but in order to obtain strength and to allow it to adapt itself to any sea-bottom irregularities it will be corrugated. To find a suitable locality for the plant, M. Claude engaged a steam yacht equipped with special depth-sounding equipment, and eventually decided on a place known as Matanza, about 60 miles east of Havana. The work is well in hand, and M. Claude is looking forward to making experiments under conditions that will be practically identical with an industrial installation.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BARNES (SURREY).—Girls' secondary schools, East Sheen, for Surrey E.C. (£35,200); W. W. Finny, secretary, Kingston-on-Thames.

BICESTER.—Re-erection of Cottisford House (mansion), residence of J. Bertram.

BILLINGHAM (STOCKTON-ON-TEES).—Hotel, for J. Eadie and Co. Houses (34), Sunnybrow estate, for Harland and Parker.

BIRKENHEAD.—Housing scheme (182), for T.C.; R. W. Johnston, borough engineer (returnable deposit of £2 2s.).

BIRMINGHAM.—Nine schools on housing estates; Education Committee. School, Pipes Hayes (£18,000); Education Committee. Elementary school, Upper Witton (£20,000); four infant welfare centres (£22,000); nurses' home and extensions, Little Bromwich hospital (£72,866); tuberculosis centre and laboratory, Margaret Street (£45,000); isolation hospital, Little Bromwich (£57,000); city engineer. 570 houses on Corporation estates; Henry Boot & Sons, Ltd., and Jones & Spencer, Ltd. Cinema, Grove Lane and Dudley Road, for A. Furze.

BLACKBURN.—Secondary school for girls, Troy estate; director of education.

BRADFORD.—Warehouse, Thornton Road; city engineer.

BRENTFORD.—Hospital extensions (£100,000); Board of Guardians.

BRIGHTON.—Extensions, Brighton College (£12,000); Messrs. Longley, builders, Crawley.

CAMBUSLANG.—Cinema; N. B. Theatres (Cambuslang), Ltd., 163, Hope Street, Glasgow. Cinema, Main Street, for Savoy (Cambuslang), Ltd.

CANTERBURY.—Electric lighting installation, for the Board of Guardians; clerk.

CARLISLE.—Re-erection of premises, Caldewgate, for the Carlisle Bread & Flour Co. (£10,000).

CHADWELL HEATH.—Factory, High Road; J. T. Luton and Sons, Ltd.

CHELTENHAM.—Pump house, Tewkesbury Road; Shell-Mex, Ltd.

CHISLEHURST.—Cinema, Albany Road and Red Hill, for W. Fletcher, 20, Albany Road.

COVENTRY.—Works, Stoke Heath, for the National Cork Industries, Ltd.

COWES (ISLE OF WIGHT).—School centre; Education Committee.

DONCASTER.—Girls' school and extensions, for the borough E.C.; J. B. Richardson, architect, 26, Printing Office Street (returnable deposit of £2 2s.).

DORKING.—Secondary school (£51,520), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

ELLESMERE PORT AND WHITBY.—Municipal buildings and market hall, for the U.D.C.; E. E. Evans, architect, 17, Beresford Road, Oxton, Birkenhead.

FARNHAM.—Girls' secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

FRESHWATER (ISLE OF WIGHT).—Re-erection of Palace Cinema; W. G. Barnard.

FRIMLEY.—Secondary school (£33,382), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

GLASGOW.—Cinema, Possil Road; J. McAllister, 59, Bath Street. Cinema, Amulree Street; G. Singleton, Cambuslang. Workshop and stores, for Corporation Housing Department; the director.

GLOUCESTER.—Hostel, Training College for Domestic Science (£39,000), for Gloucestershire E.C.; director of education, Gloucester.

GRAYS.—School (£28,000), for Essex E.C.; J. Stuart, county architect, Chelmsford.

HANWELL.—Secondary school, Drayton Bridge Road (£40,000); W. S. Try, Uxbridge.

HAREFIELD. — Nursing accommodation at sanatorium (£34,000); Middlesex county architect.

HOVE.—Ice rink (£67,500); Ice Rinks, Ltd.

HULL.—Installation of electric lighting at the central public library; rehousing scheme (£94,200); elementary school, Westcot Street; D. Harvey, city architect, Guildhall.

IRISH FREE STATE (DUBLIN).—434 houses in the Donnycarney area, for City Commissioners; city architect, Exchange Buildings, Lord Edward Street.

(RUSH, CO. DUBLIN).—National school, Loughshinney (deposit £1); R. Donnelly, architect, 14, Lower O'Connell Street, Dublin.

(DALKEY, CO. DUBLIN).—Installation of electric lighting in town hall and offices, for U.D.C.; J. G. Treston, town clerk.

LANCASTER.—43 houses, Corporation estate; F. Moore and Co., Morecambe.

LEEDS.—180 houses, Middleton estate; F. Clough. Extension, 'bus garage; city engineer.

LEICESTER.—Housewifery centre, Knighton Fields House; Education Committee. Four shops, Braunstone estate (£10,000); Leicester Co-operative Society, Ltd.

LEWES.—Boys' secondary school, for East Sussex E.C.; Ringmer Building Works, contractors.

LONDON (ILFORD, E.).—159 houses, Tavistock Gardens, &c.; J. Aldridge.

(LEYTON, E.).—Wash-houses, for T.C. (£14,500); borough surveyor.

MANCHESTER.—Improvement scheme, Mosley Street and Marble Street (£83,000); city engineer. Electricity supply, Cooke Street Centre, Hulme; Education Committee. Extensions, College of Technology (£320,000), for the E.C.; Director of Education.

MILL HILL.—Secondary school; Middlesex Education Committee.

MITCHAM.—Houses (300) and shops, for the U.D.C.; A. A. Moyniham, builder.

MUSSELBURGH.—100 houses, for Corporation; burgh surveyor.

NEWARK.—County Technical College and School of Art, on the Chauntry site, for Notts. E.C. (£24,630).

NORTHALLERTON.—County hall extensions (£9,027), for North Riding C.C.; Armitage & Hodgson, Ltd., builders, Camp Road, Leeds.

NORTHAMPTON.—46 houses and 1 shop, St. David's estate; A. Glenn & Sons, Ltd.

OXFORD.—400 houses at Cowley, 600 at Headington, and 250 at Summerton; Allied Building Corporation. Development of Temple Cowley estate; F. & R. Lewis, Ltd.

PLYMOUTH.—Development, Beaumont Street estate; St. Aubyn Estates, Ltd.

REIGATE.—Refuse destructor and plant (£10,678), and additional 28 houses, for the T.C.; borough surveyor.

RIPON.—Aerodrome, Pateley Bridge Road; Corporation Industrial Committee.

SHEFFIELD.—62 houses, Greystones Grange; W. Malthouse, Ltd. Extension of Lodge Moor Hospital (deposit £2); W. G. Davies, city architect, Town Hall.

SITTINGBOURNE.—Housing scheme (60), for the U.D.C.; W. Lashmar, surveyor (returnable deposit of £2).

SOUTHBOROUGH.—Cinema, High Brooms; High Brooms Brick & Tile Co., Ltd.

SOUTHEND-ON-SEA.—Re-erection of Hamstel Works, Southchurch, electrically equipped; O. Kennedy, 63, Ilfracombe Road.

STRETFORD.—58 houses, Ryebank and other roads; W. P. Rochell.

THORNE (YORKS.).—Housing scheme (64), for the R.D.C.; H. Plewes, surveyor. Schools, for West Riding E.C.; education architect, County Hall, Wakefield.

WALSALL.—50 houses, Bleckenall estate, Bloxwich; A. Smith.

WEYBRIDGE.—Ballroom, &c. (£25,000), Oatlands Park Hotel; proprietor.

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The

Electrical Review

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The E.H.P. Conference at Paris.

INTERNATIONAL E.H.P. Conferences have been held in Paris biennially since their inception in 1921. Last week's conference was, therefore, the fifth of the series. The organising authority is the Union des Syndicats de l'Electricité, acting in conjunction with the national branch of the International Electro-technical Commission. The membership is of a representative character, with the important reservation that German engineers are not invited. The question of their future inclusion was on the agenda this year, and a settlement in favour of the resolution would be beneficial to all concerned, for a conference of this kind falls short of its purpose unless it can draw upon the experience of all who can contribute something of value to the common stock. This consideration is quite apart from the wider significance of science, art, and sport as factors in the promotion of a better international understanding.

Although the E.H.P. Conferences were first intended (as their name implies) to deal with high-voltage transmission, their scope has been widened to include modern large-scale generation also. Nevertheless, transmission matters are still the predominant features of the programme and will, doubtless, continue to be so, since the tendency to concentrate generating plant in fewer and larger stations has increased the relative technical importance of transmission, owing to new problems arising out of the greater distances between sources of supply and loads. Transmission questions will just now be of more than usual interest to British engineers in view of recent devolopments here. It is true that the new schemes and most of the existing ones in this country are, strictly speaking, for interconnecting and not transmitting systems; that is to say, they consist in the linking up of power stations, at moderate distances apart, rather than the sending of large amounts of energy to far-off step-down sub-stations. Most of the papers, however, related to subjects pertinent to either system. Thus, to mention some of the topics covered, overhead-line problems are dealt with in papers on protection against lightning and surges, selective protection, supports, and the effect of atmosphere on insulator performance; underground cables by papers on the laying of single-core cables (66 kV and upwards) and

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dielectric disturbances due to thermal expansion of conductors; and sub-station apparatus and general subjects by papers on the relation between transformer and line insulation, inter-turn insulation in transformers, insulating oil, arc rupture in switchgear, design of large switchgear, load control, and the construction of the British "grid."

As a result of the increase in the number and length of transmission lines, concurrently with the reduction in the number of small generating stations, capital expenditure on mains will form a greater proportion of the total than it has in the past. This variation gives prominence to two factors that have hitherto applied only in particular cases. The first is the decreased importance of obsolescence, as distinct from depreciation; *i.e.*, the economic life of material assets will more nearly coincide with the period allowed for loan repayments. The economic life of plant in small generating stations is often appreciably less than that allowed for the purpose of calculating sinking fund annuities. This may be due either to rapid growth of load requiring the supersession of a small set after a short life by a larger set, or to technical improvements justifying the installation of more efficient plant not necessarily of greater capacity. In transmission and distribution, on the other hand, obsolescence and depreciation may be regarded practically as identical terms. The efficiency of transmission is not susceptible of appreciable improvement, except by the employment of higher voltages, in which case the primary transmission lines become secondary transmission lines or high-voltage distributors.

A similar close relationship between economic and financial life holds good, though to a less extent, in the case of a high-efficiency base load generating station, constructed on a suitable site and containing plant approaching the limits of commercial efficiency. These considerations should give greater security to capital invested in the electricity supply industry.

The second factor referred to is that, as transmission and distribution costs are standing charges, a relative increase in capital expended on these portions of the system increases those charges which must be met irrespective of the amount of energy supplied. It will thus be essential for financial stability to secure a reasonable revenue at an earlier stage of development than might be requisite in the case of individual generation. It is possible that the low prices obtained for electricity in countries dependent upon water-power may be due almost as much to the commercial keenness engendered by a need for meeting heavy standing charges as to the absence of fuel costs. The effect of this should be both to stimulate efforts to acquire new consumers and to enable a low running charge to be made to all consumers with a view to encouraging the use of electricity to the utmost extent.

A Serious Omission.

MR. N. S. REYNTIENS's report upon Belgium, which is reviewed in this issue, contains no reference whatever to the electrical manufacturing industry of the country, although recently-published official statistics showed that over 18 million kg. of electrical machinery and equipment was exported during the year covered by the report (*vide* ELECTRICAL REVIEW, March 29th, p. 581.) In this respect Mr. Reyntiens has inherited the shortcomings of his predecessor, Mr. J. Picton Bagge. It was Mr. Bagge's last report that led us to complain last year of the lack of information in this most important direction in the general run of D.O.T. reports. We may repeat what we said then:—"We feel that far too much attention is devoted to matters of purely national importance to the neglect of those phases of activity which have a direct bearing upon the interests of British manufacturers and traders. The latter want to know what their competitors are doing, and they are of the opinion that it is the job of our accredited official commercial representatives to give them this information."

May we hope that among the improvements which the new administration has promised to introduce, this by no means unimportant matter will receive attention?

Advertising a Public Service.

WE have received from the London office of the Metropolitan Life Insurance Co., of New York, a brochure entitled "Public Utilities Advertising." This presents a reasoned argument in favour of advertising by public service corporations—such as electricity, gas, telephone, &c.—and deals at some length with the nature and construction of utilities' advertisements. In showing the necessity for these concerns to advertise, the opinions of several leaders of the American electrical industry are quoted. Nine reasons are given why a public utility company should advertise; these are as follows:—(1) To sell securities; (2) To sell service; (3) To sell appliances; (4) To interest the stockholders and customers in the activities of the company; (5) To explain policies, business methods, *personnel* problems, and plans for development; (6) To defend itself when unjustly attacked; (7) To promote goodwill, thrift, safety and community development; (8) To explain to its customers why it has applied to the State Utility Commission for permission to raise its rates; and (9) To present arguments for the renewal of its franchise. While some of these objects apply purely to American conditions, there are many which are worthy of the attention of British supply authorities. Municipal electricity departments especially should explain to their "stockholders"—the ratepayers—what they are doing and can do. Too often developments which would arouse public interest and lead to an extension of the service are hidden in a report under the words "The minutes of the Electricity Committee were adopted." There cannot be too much general advertising of electricity, but individual advertising makes the greater appeal.

Engineering and Financial Statistics.

WE have received from the Electricity Commission, too late for more than preliminary comment in this issue, a new volume of the "Return of Engineering and Financial Statistics relating to Authorised Undertakings in Great Britain." This Return relates to the year ended December 31st, 1926, for companies, and (in most cases) March 31st, 1927, for municipalities. Thus the particulars given have reference to conditions obtaining more than two years ago and, in view of the rate of development in the electricity supply industry, they lose much of their practical utility on this account. The amount of work represented in compiling the tables and in preparing the lucid analysis in the first part of the volume must be considerable. Having regard to the other calls on the time of the Commissioners' staff during the past two years, the somewhat belated appearance of these statistics may be assumed to be inevitable. With the passing of the recent exceptional state of affairs, we may, no doubt, expect this flaw in an otherwise admirable compilation to be rectified in the near future.

During the period under review 6,618 million kilowatt-hours were generated (more than 98 per cent. by steam plant) and 5,606 million kilowatt-hours were sold. The aggregated maximum load reached 3,239,585 kW on undertakings and 2,700,594 on generating stations. The load factor for generation was therefore about 30 per cent. The sales of energy in bulk were more than twice those of the previous year. The number of undertakings holding supply powers increased from 593 in 1925-26 to 621 in 1926-27. Twenty-four generating stations were closed down. A.c. plant accounted for nearly 93 per cent. of the total of 4,682,069 kW actually installed, 91.5 per cent. of which consisted of turbo-alternators. Of the a.c. generating plant installed, more than 71 per cent. was three-phase 50-cycle plant.

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The Pooley Hall Electricity Undertaking.

By means of pulverised-fuel firing and modern equipment and methods generally the full advantages of the small power station generating at the pit head are reaped.

THE colliery at Pooley Hall has an output of approximately 7,000 tons of coal per week, and, due to the soft nature of the coal, produces a large percentage of smalls, including smudge, to the extent of 16 per cent. of the total output, and ⅛-in. dust

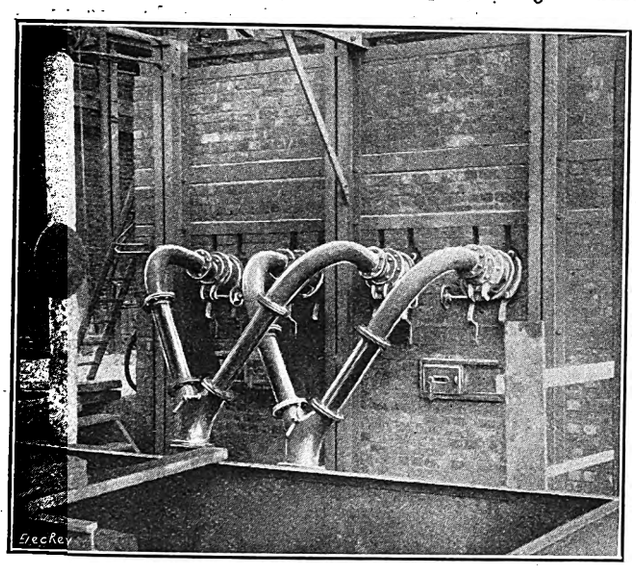

Fig. 1.—Arrangement of Burners on No. 1 Boiler.

to the extent of 12 per cent. The smudge and dust, respectively, have calorific values of about 10,700 B.th.u. and 9,500 B.th.u.

Initially the steam-raising plant at Pooley Hall consisted of four Lancashire boilers, 30 ft. × 8 ft., 100 lb./sq. in., fitted with ordinary fire bars. It is estimated that the cost of steam production at that time was 1s. 6d. per 1,000 lb. of steam, for fuel, wages and stores costs only. Attempts to raise sufficient steam by burning the smudge failed. Later two additional Lancashire boilers were installed, and the whole six were fitted with Bennis mechanical stokers. The result of that alteration was that it became possible to burn the smudge, and the steam production costs were reduced to 10d. per 1,000 lb. of steam. With low-grade fuel the output of the boilers never exceeded 4,000 lb. of steam per hour per boiler.

In order to try to increase the capacity of the boilers, and to burn the lowest-grade fuel (⅛-in. dust), it was decided to experiment with pulverised fuel on two of the boilers. A No. 10 "Atritor," supplied by Messrs. Alfred Herbert, Ltd., was installed for the necessary drying and pulverisation (see ELECTRICAL REVIEW, June 7th, 1929, p. 1002). This machine was capable of dealing with 2,000 lb. of fuel per hour, and was installed so as to serve the two boilers. It was directly coupled to a 40-h.p. motor, and the power demand was approximately 25 h.p. when the "Atritor" was working at its maximum output. In order to provide sufficient combustion space a brick chamber was built in front of each boiler, connected to the flues by tubular connections or necks. Combustion was completed in the chamber and the hot gases passed through the flues. The tubes connecting the boiler to the combustion chamber were of welded sheet-steel, ⅜ in. thick, and had hollow walls through which the feed water passed or circulated at atmospheric pressure, so keeping the temperature of the inside walls of the tubes below the fusing point of the ash and preventing slagging taking place. As a result of the pulverised-fuel firing 6,000 lb. of steam per hour per boiler was obtained. The thermal efficiency of the reconstructed boilers was, of course, not good, but the commercial efficiency was considerably increased.

As a result of the success of the firing with pulverised fuel, when it became necessary to again consider increasing the boiler plant, it was decided to install water-tube boilers and to fire them with powdered coal. Three Babcock & Wilcox boilers were installed, each with a heating surface of 5,346 sq. ft., and designed for an output of 18,000 lb. of steam per hour when fitted with chain-grate stokers. Two No. 10 "Atritors" were installed for each of the first two boilers, each machine being driven by a 25-h.p. motor. Improved design of the machines was responsible for the less power required. The energy consumed for each machine is not more than 18 kWh per ton of coal pulverised. For the third boiler a No. 16 "Atritor" was installed; this machine has double the capacity of each of the No. 10 machines. The pulverising machines are placed directly under the dust hoppers, the fuel falling into each machine through a small conical chute.

The first two boilers are equipped with four burners all near the top of the front wall of the chamber. The fuel-feeding arrangements are such that No. 1 "Atritor" in each case supplies burners one and three, and No. 2 machine supplies burners two and four. Fig. 1 depicts the feeding arrangement of the burners of one boiler. The alternate-burner scheme helps to keep the combustion chamber at a uniform temperature when only one pulverising machine is required. The

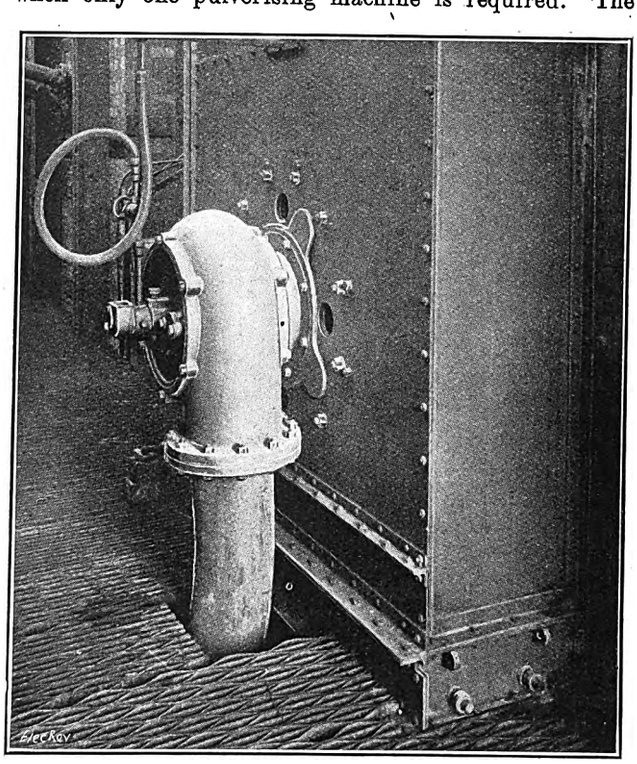

Fig. 2.—The Riley Flare Burner.

amount of fuel supplied to each burner can be regulated by means of a flap-valve placed on the fuel pipe near the burner. Auxiliary air is drawn in through port-

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holes in the sides of the burners, and also through small doors built in the front of the chamber.

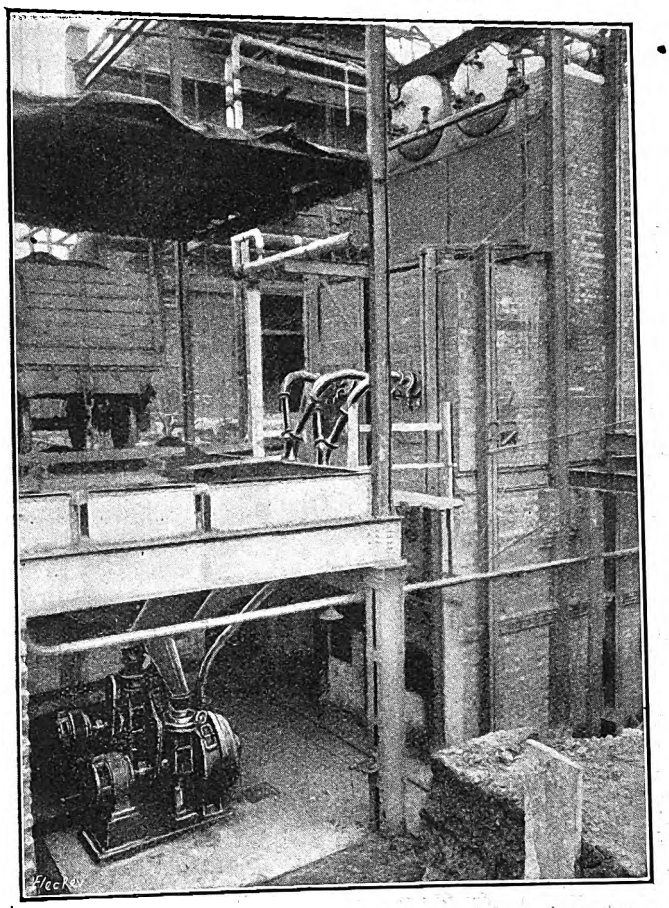

Fig. 3.—No. 1 Boiler During Construction, showing Pulverising Equipment.

On the No. 3 boiler only one burner of the Riley flare type (ELECTRICAL REVIEW, June 7th, 1929, p. 1002) is installed. This burner, fig. 2, is fed with auxiliary air by a small subsidiary fan, the amount of air varying according to the quantity of fuel consumed and to the amount of CO_2 it is desired to obtain. The combustion chambers of the water-tube boilers are of brickwork, with cavity walls on the three outer sides. The cavity walls serve to reduce radiation losses, and also to provide the hot air for drying the fuel during its pulverising stage in the "Atritor." The hot air is drawn from the chamber through a duct to the pulveriser by means of a fan which is an integral part of the machine. Fig. 3 is a view of the first Babcock & Wilcox boiler during erection, and depicts the general arrangement of the pulverising and firing equipment. Fig. 4 is a view in the boiler-house basement, showing the "Atritors" feeding the boilers. Fig. 6 shows more clearly the pair of pulverising machines which serve No. 1 boiler. The result of the working of the modern boilers on pulverised fuel, using the $\frac{1}{8}$-in. dust, has been to reduce the fuel cost to 6d. per 1,000 lb. of steam produced, or 8d. including interest and depreciation on the capital outlay. The coal consumed by the boilers is now about 350 tons per week, or 5 per cent. of the total output of the colliery, which is considered a very satisfactory figure. A test on one of the boilers showed an evaporation figure of 8.4 lb. of steam from water at 212 deg. F., per lb. of fuel, and an efficiency of 81 per cent.—this with fuel of a calorific value of 9,690. B.th.u.

In connection with the boiler equipment there is installed, *inter alia*, a pair of Weir direct-acting steam feed pumps, each capable of delivering 8,000 gallons of water per hour; a Kent Venturi recording water meter; and a Neckar water-softening plant. With the exception of No. 1 boiler, which has a Bailey recorder meter in place of a separate steam-flow meter and CO_2 meter, each boiler is equipped with a CO_2 meter and recorder, remote water-level indicator, Cope feed-water regulator, and so so. The operation of the Cope regulator as fitted to these boilers ensures a continuous feed being maintained during steady-load periods, and by temporarily restricting the flow on a sudden increase in load and increasing the flow on a sudden drop, enables rapid changes to be met without loss of steaming efficiency. The apparatus is thermostat controlled, an expansion tube being so positioned that its expansion or contraction varies with the water level.

As a result of the Pooley Hall concern becoming a public supply undertaking at a comparatively late date in its development, the generating plant is in two portions, a.c. and d.c., in two separate power houses. The d.c. plant consists of a 500-kW B.T.H. m.p. turbine, using steam at 160 lb./sq. in. direct from the boilers, and also the exhaust from the colliery winding engines; a Greenwood & Batley m.p. turbine (300 kW) fed in the same way; and two 150-kW Belliss & Morcom reciprocating sets. In the a.c. power house there are two 400-kW G.E.C. motor-generators, 6,600-V, 3-phase, 50 cycles, and a 625-kVA Belliss & Morcom set, 3-phase, 50 cycles, 440 V. The exhaust from this Belliss

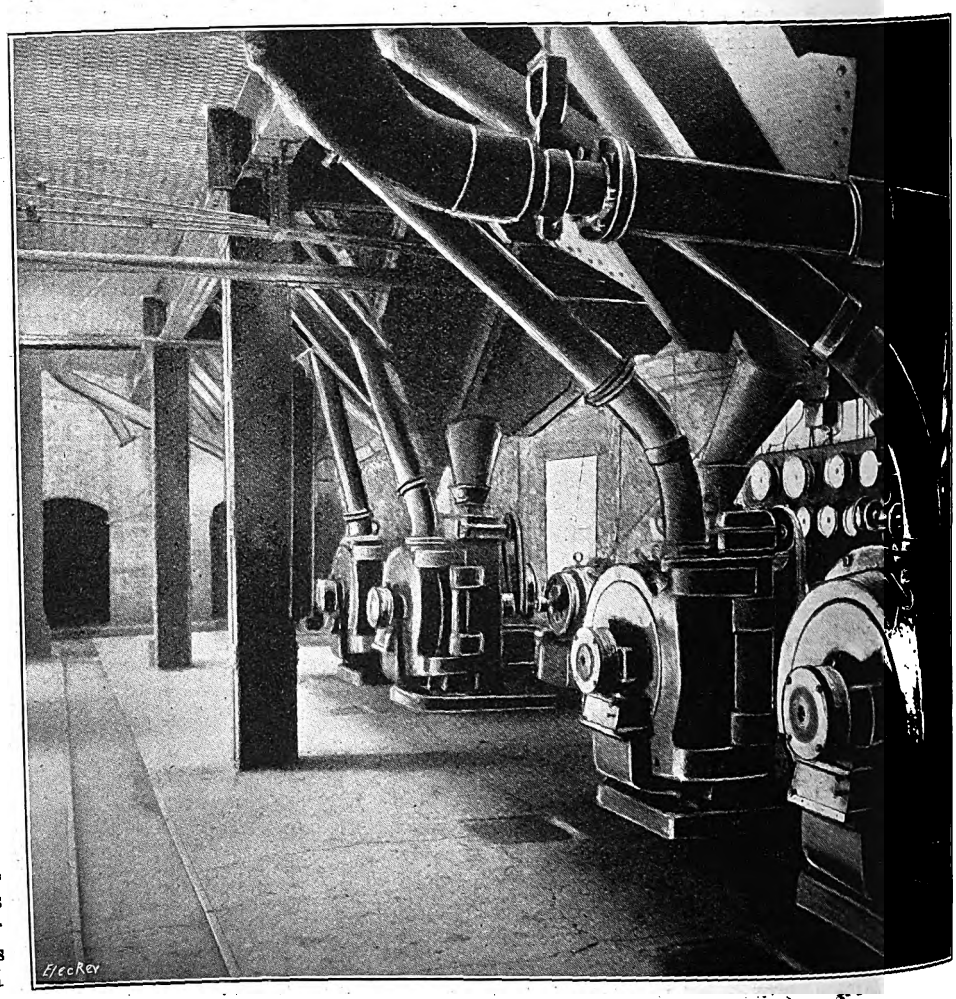

Fig. 4.—"Atritors" in Boiler-house Basement.

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engine is also fed to the m.p. turbines. Part of the 440-V a.c. supply is used at the colliery, and the rest is stepped up to the 6,600-volt transmission pressure for the public supply. Figs. 5 and 7 are views of the interiors of the d.c. and a.c. power houses, respectively.

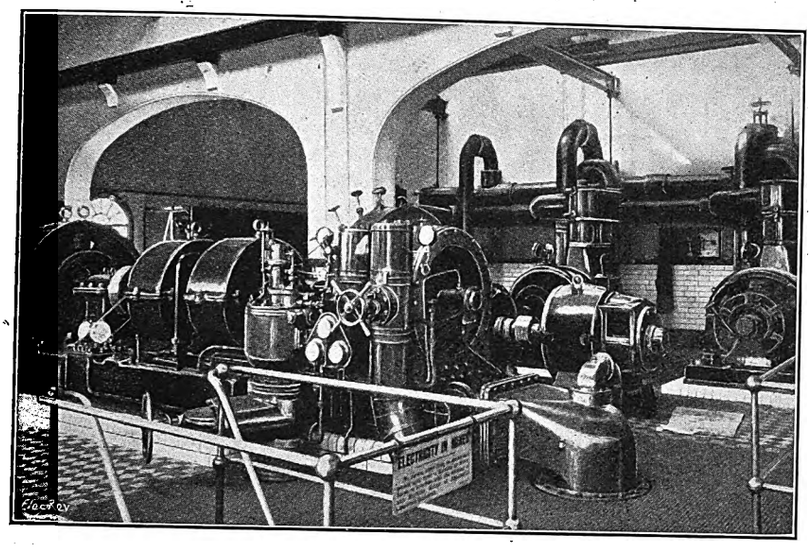

Fig. 5.—The D.C. Power Station.

Public electricity supply by the Pooley Hall undertaking started about 1924 when, "unauthorised," the company ran a pair of wires down the road to give a d.c. supply to a few of its employés and others. Additional consumers were continually asking for and being given supplies, until it became apparent that if the activities of the company in that connection were to continue the concern must be put on a proper working basis. The company accordingly applied for an Order to supply within an area of 100 sq. miles, comprising the whole of the rural district of Tamworth and parts of the districts of Atherstone, Market Bosworth and Ashby-de-la-Zouche. This order has been approved by the Electricity Commissioners and is now awaiting confirmation. Tamworth township has its own supply Order, but an agreement has been entered into between the Pooley Hall Colliery Co. and the Tamworth Corporation for a bulk supply to Tamworth for 15 years, and providing for the supply company to manage the whole of the distribution scheme for the Corporation for the first four years. At the end of 1925 the company was supplying over an area of 25 sq. miles, which has now increased to 35 sq. miles. The undertaking is proud of the fact that it was a pioneer of the free-wiring scheme, as a result of which it was able to obtain as consumers most of the available houses in Tamworth—that against competition with gas—and 85 per cent. of the available houses in the whole area. The tariffs adopted for the supply are 9d. per unit for lighting under the free-wiring scheme, 6d. per unit for ordinary lighting, and 1¼d. for heating and power. The company is developing the domestic supply, and has at present 600 cookers on its mains, half of which are in miners' cottages, where free coal is supplied. The cookers are hired out at 4s. per quarter, including an electric kettle. It is interesting to note that at the time of a visit to the colliery a selling campaign for electric irons was being run, the staff of the undertaking, including jointers, mates, and so on, all being salesmen under a competition scheme. Some five dozen irons were sold in the first two days, and a couple of gross in the week. Showrooms have been established in both Polesworth, where a public electricity supply was first given, and Tamworth.

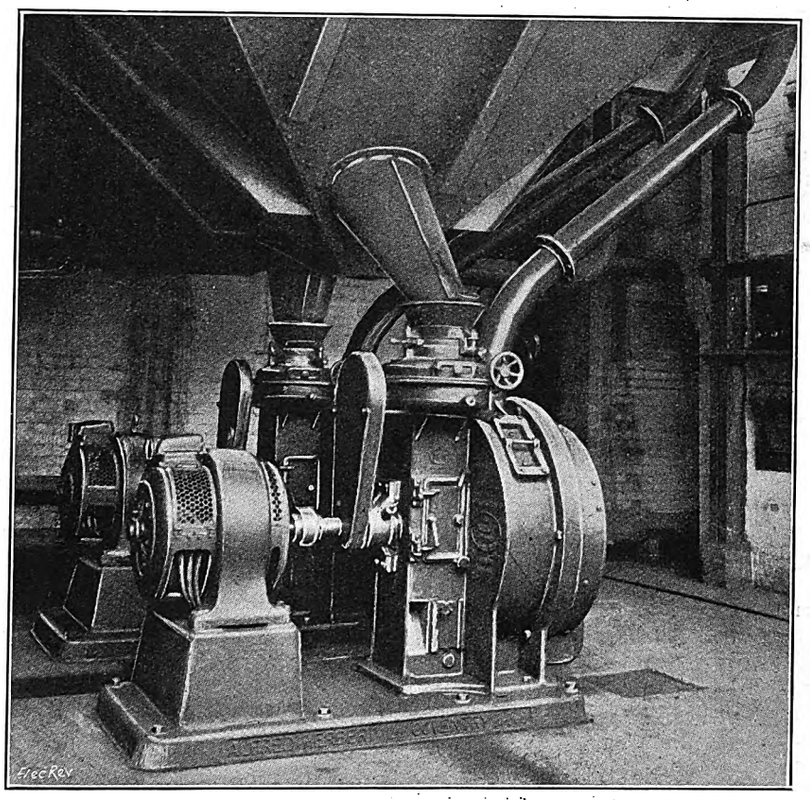

Fig. 6.—Pair of No. 10 "Atritors" serving No. 1 Boiler.

The total number of consumers on the mains is 4,960, including 1,486 in the borough of Tamworth. The load factor of the undertaking is about 40 per cent., including the colliery supply. The peak load of the undertaking last winter was 600 kW. There are 15 transformer sub-stations on the system, and the lengths of e.h.p. underground and overhead lines in service, respectively, are 22,000 yards and 4,700 yards. The original d.c. mains are gradually being changed over to a.c., and the d.c. overhead lines replaced by underground cables.

It is interesting to note that the undertaking is taking a very active part in schemes to endeavour to get new industries into the area, and is

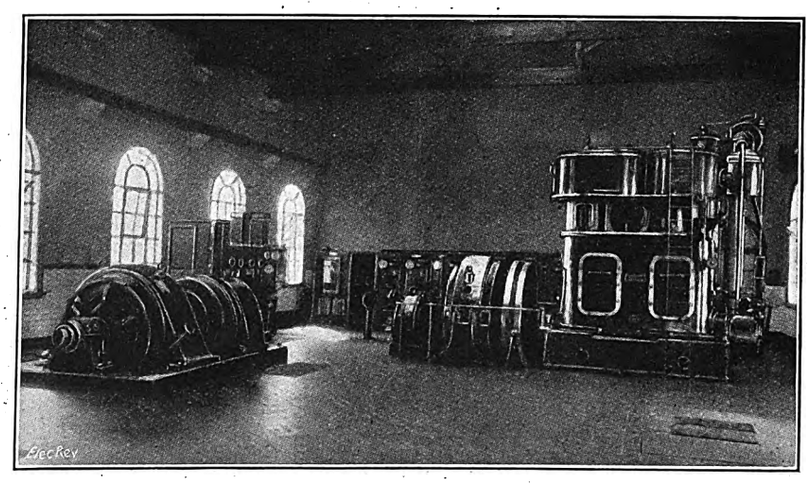

Fig. 7.—The A.C. Power Station.

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prepared to offer very attractive rates for electricity supply to such industries.

It is interesting to note that the Pooley Hall company is actively interested in a joint development committee that has been formed of a number of local influential persons to raise a fund for the purpose of bringing new industries into the area and generally advancing the prosperity of the locality.

The excellent results obtained in the working of the undertaking form a testimony to the foresight of the colliery officials. Their policy has provided an outlet for a considerable quantity of otherwise unusable fine dust coal at the colliery, thus reducing freightage charges to a minimum. Many arguments are put forward in favour of pit-head power stations, but it should be mentioned here that the Pooley Hall undertaking is particularly fortunate by way of its water supply. It is served by the Coventry Canal and also the River Anker, which flows through the Company's property.

In conclusion, we are indebted to Capt. Chaytor, director of the Pooley Hall Colliery Co., Ltd., who has been personally responsible for the development of the public electricity supply, to Mr. W. Fenn, manager and engineer of the colliery, and to Mr. J. Burns, of Messrs. Alfred Herbert, Ltd., for their assistance in the collection of the above information and for the photographs reproduced overleaf.

Ignition Power of Electric Sparks.

This contribution, being of the nature of an official communication from the Mines Department Testing Station, Sheffield, should be of value to designers of signalling and other electrical apparatus for use in explosive atmospheres.

By Capt. C. B. PLATT, M.B.E., and R. A. BAILEY, B.Sc., Ph.D.

THE flash, or spark, produced by breaking an electrical circuit in which is included an iron-cored inductance (*e.g.*, a signalling bell) is capable under certain conditions of igniting inflammable atmospheres of methane and air. If the iron core of the inductance is surrounded by a copper sleeve, or if, alternatively, a non-inductive shunt of suitable value is connected across the inductive coils, the induced voltage can be reduced and the incendivity of the spark eliminated. This principle is employed in the design of many signalling bells and other instruments for use in coal mines, wherein inflammable atmospheres containing methane are likely to be encountered.

During the course of experimental work on this subject it was also necessary to investigate the efficacy of such safety devices in the presence of inflammable atmospheres of hydrogen and air.

In general, atmospheres of hydrogen and air are considerably more sensitive, and require much less energy in the break-flash to cause ignition, than atmospheres of methane and air; apparently anomalous results were observed, however, when the spark-suppressing device consisted of a non-inductive shunt connected across the inductance; in consequence, experiments were made with a view to compare the efficiency of a non-inductive shunt in eliminating ignition of methane-air and hydrogen-air mixtures, respectively.

The circuit consisted of an air-cored inductance of 95 milli-henries connected in series with a non-inductive rheostat, a secondary battery of 26 volts, and a small gas chamber containing the contacts by means of which the circuit was made and broken and between which, therefore, the spark was produced. The contacts in the gas chamber consisted of a stationary platinum rod and a revolving strip of iridio-platinum (10 per cent. iridium) which made contact with the platinum rod once every five seconds: the shape of the revolving strip was such that the circuit was made slowly and broken rapidly.

Before making the experiments the apparatus was so adjusted that a current of from 240 to 250 milliamperes would ignite an 8.5 per cent. methane-air mixture; the air-cored inductance was then connected to the non-inductive shunt under investigation. The gas chamber was filled with the appropriate gas mixture and the current was regulated before the circuit was broken, so that the minimum value at which the gas ignited could be determined.

The minimum igniting currents for the most readily ignited mixtures of methane and air (methane 8.5 per cent.) and hydrogen and air (hydrogen 29.9 per cent.), respectively, are given in Table I. Determinations were also made, for purposes of comparison, with hydrogen-air mixtures containing 20.4 per cent., 10.4 per cent., and 7 per cent. hydrogen, respectively.

TABLE I.

MINIMUM IGNITING CURRENT, MILLIAMPERES.

Shunt ohms.	Methane 8·5%	Hydrogen 29·9%	Hydrogen 20·4%	Hydrogen 10·4%	Hydrogen 7%
None	240	82	82	94	182
10,000	265	142	140	150	230
5,000	297	174	174	180	250
2,500	350	240	240	240	300
1,000	430	380	390	370	420
500	610	550	540	530	600
250	730	670	670	670	750

An examination was then made of the minimum igniting current when a small iron-cored inductance fitted with a detachable copper sleeve was substituted for the air-cored inductance. The results are shown in Table II.

TABLE II.

MINIMUM IGNITING CURRENT, MILLIAMPERES.

Iron-cored inductance	Methane 8·5%	Hydrogen 29·9%
Without copper sleeve ...	410 ...	250
With copper sleeve ...	1,160 ...	450

From the results given in Tables I and II it is evident that the non-inductive shunt is more efficient in preventing the ignition of hydrogen than it is in preventing the ignition of methane. For example, on the one hand, with an 8.5 per cent. methane mixture and a 29.9 per cent. hydrogen mixture the minimum igniting currents without a non-inductive shunt are in the proportion of approximately 3 to 1, while with a non-inductive shunt of 250 ohms they are, approximately, the same. On the other hand, the copper sleeve is considerably less efficient in preventing the ignition of hydrogen than it is in preventing the ignition of methane.

These facts are contributed in the hope that they may be of value to those concerned in the design of signalling and other electrical apparatus for use under conditions in which there may be a risk of a spark igniting inflammable gases.

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The E.H.P. Conference at Paris.

A Review of the Proceedings.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

LAST week the fifth Conférence Internationale des Grands Réseaux Electriques à Haute Tension was held at Paris under the presidency of the French Minister of Public Works, supported by Mr. Ulrich, president of the Conference. There was a remarkably large British attendance, numbering nearly fifty, out of a total of 700 members from 28 countries (Germany is still excluded on account of the feelings of the French, though her admission to the next conference is one of the items on the agenda of the General Council). Undoubtedly the holding of the I.E.E. summer meeting concurrently with the latter part of the Conference contributed to the larger British attendance. Out of the 108 papers contributed, 15 came from Great Britain. It may not be generally known that the I.E.E. has a special committee for dealing with E.H.P. Conference matters.

Under the patronage of the Commission Electrotechnique Internationale, former meetings were held in 1921, 1923, 1925, and 1927, and exceptional and world-wide interest is taken in the proceedings. While this Conference may now claim to be well-established and universally supported, its range of subjects seems almost too wide. However, the width of its scope meets the requirements of most sections of electrical engineering, and undoubtedly encourages a large attendance. It is a convenience for each visitor, who may have travelled a considerable distance, to have several matters under review in which he is particularly interested.

Three new vice-presidents were elected this year, *viz.*, Messrs. C. E. Montanès (Spain), E. Wilczek (Hungary), and F. Brock (Austria). Mr. W. B. Woodhouse, who unfortunately could not attend this year, has been a vice-president from the commencement.

This year, only three British delegates were appointed by the I.E.E., instead of the eight to which the country was entitled. They were Messrs. P. V. Hunter, J. R. Beard, and Johnstone Wright. Unfortunately they were unable to attend during the opening two days and the concluding days, which points to the moral that the British delegates should be large enough in number to permit of official representation during the whole conference.

Year by year the organisation of this Conference continues to improve under the capable guidance of the director, Mr. J. Tribot-Laspière. He is to be congratulated upon the very excellent *vade mecum* that he provided, which, though only a detail, greatly added to the convenience of members. The official languages of the Conference were French and English, the former predominating. In this connection Mr. R. A. MacMahon rendered most valuable assistance by acting as the official interpreter. He has the happy knack of being able to give very concisely the gist of a speech in either language with a complete grasp of the finer technical points, which the average translator seems to miss in the effort to be precisely literal. Naturally it is Mr. MacMahon's type of version that is of most value to the listener.

Three of the British delegates and 18 other delegates were presented to President Doumergue, namely (from left to right in fig. 1): Messrs. C. Budeanu (Rumania), Norberg Schulz (Norway), V. del Buono (Italy), I. S. Gheorghin (Rumania), T. B. Thrige (Denmark), H. W. Young (U.S.A.), R. Borlase Matthews (Gt. Britain), J. Tribot-Laspière (secretary), K. Drewnowski (Poland), C. O. Mailloux (U.S.A.), Ronvaux, M. Ulrich (president), P. V. Hunter (Gt. Britain), J. R. Beard (Gt. Britain), E. Gevaert (Belgium), J. Tomanek (Czecho-Slovakia), S. Malmfors (Sweden), E. Wilczek (Hungary), S. Murata (Japan), Abd-el-Aziz Ahmed (Egypt), F. Brock (Austria) and K. Stromberg (Finland).

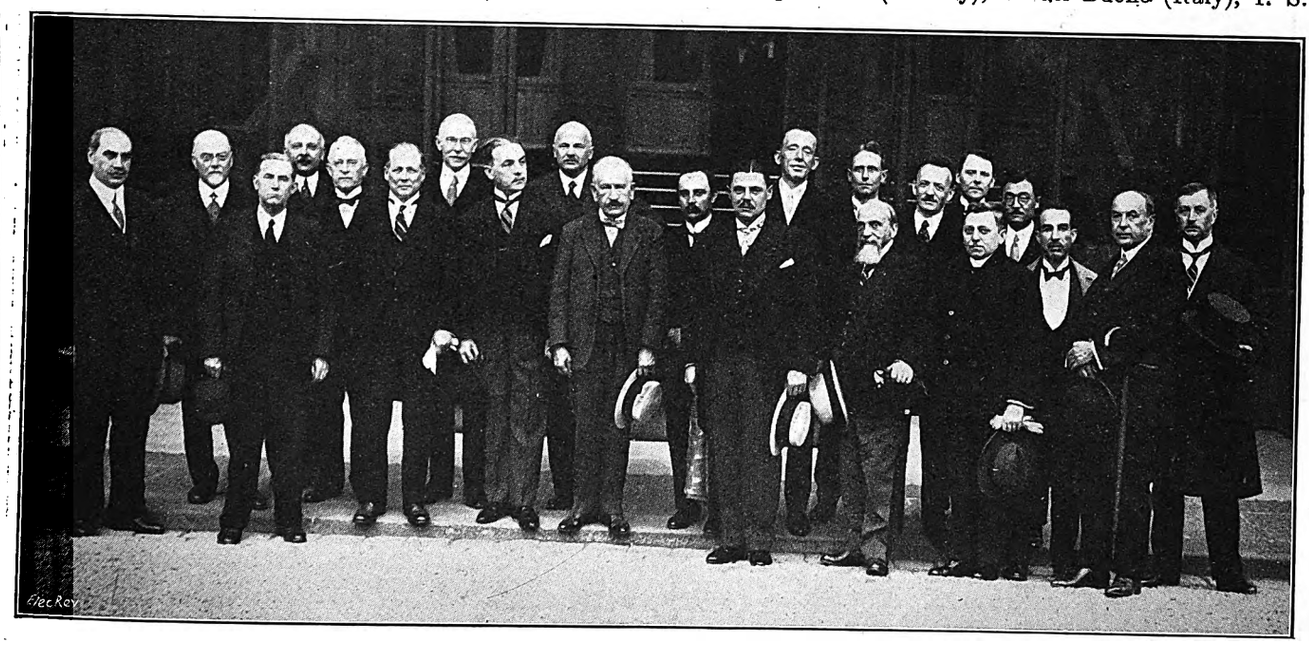

Fig. 1.—Conference Delegates who were Presented to the President of France.

Some of the leading Continental engineers will be recognised in fig. 2, amongst the British representatives being Mr. R. A. MacMahon, Mr. J. R. Beard, Mr. Johnstone Wright, Mr. G. H. Nash, Mr. P. V. Hunter, Mr. E. T. Painton, Mr. R. O. Kapp, and others in the centre; while in the doorway Mr. H. W. Clothier, Mr. R. B. Matthews, and Mr. J. Tribot-Laspière can be seen. The modern form of decoration and lighting in the meeting hall may be pointed out.

This year's session gave those who attended it a valuable opportunity of making themselves acquainted with the technical progress that has taken place during the last few years, and of getting into personal touch with engineers working in other countries who have solved problems, or who have them to solve, of a similar

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character to those that many members have to face in their own countries. The proceedings of the Conference and the papers presented were of such a character as would unite in general common interest producers and distributors of electricity and everybody connected with the construction and operation of high-voltage networks, including also many matters relating to the economics of such affairs.

As at the last conference, the French Government gave its whole-hearted support to the deliberations by sending representatives from those Ministries which are materially interested in electric power, and the number of the reports sent in shows that many engineers in different countries are willing to reserve for the Conference the exposition of the results of their labours, and to give to their technical *confréres* the benefit of the fruits of their researches. A number of new constructions and methods were dealt with at the Conference.

The date chosen for the Conference, June 6th to 15th, is at the most pleasant time of the year for a stay in Paris, and arrangements were made after the Conference for visits to be paid to installations of technical interest in the Pyrenees, the Alps, and on the Riviera.

In his opening speech Mr. Ulrich, the president, referred to the principal characteristics of the Conference. By the way, Mr. C. Le Maistre was one of the three delegates appointed by the C.E.I., the other two being Dr. C. O. Mailloux (U.S.A.) and Professor C. Feldman (Netherlands) who is also President of the C.E.I.

The programme of the Conference showed that, as usual, the papers to be discussed were divided into three sections, dealing with (i) power production and transformation; (ii) the construction and insulation of lines; and (iii) the operation of networks. The Institution of Electrical Engineers' summer meeting commenced on the fifth day of this Conference, and facilities were afforded for English members to attend the Conference sessions on the last two days. During this week the members of the E.H.P. Conference had an opportunity of taking part in a similar extension to that of the I.E.E. party, by visiting the Pyrenees. This year of the 108 papers submitted, 15 came from this country, the authors and titles of British papers are as follows:—

Messrs. E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce, "An Introduction to Researches on Circuit Breaking."

Mr. J. E. T. Cogle, "The Effect of Impurities on the Electrical Strength of Insulating Oil."

Mr. S. A. Stigant, "Transformer Inter-Turn Insulation."

Mr. H. S. Holbrook, "The Co-relation of Line and Transformer Insulation."

Messrs. B. D. Goodlet and J. B. Mitford, "The Influence of Atmospheric Conditions on the Performance of Insulators."

Messrs. H. W. Clothier and C. A. Stephens, "High-Tension Switchgear Developments."

Mr. J. R. Beard, "The British 132,000-Volt 'Grid.'"

Mr. R. Borlase Matthews, "Sawn-Timber Supports for Rural Overhead Lines."

Messrs. W. B. Woodhouse and E. B. Wedmore, "Overhead Electric Lines: An Account of the Work of the British Electrical and Allied Industries Research Association."

Messrs. P. D. Morgan and S. Whitehead, "A Study of Methods of Laying a Three-phase System of Single-Conductor Cables."

Fig. 2.—A View of the E.H.P. Conference Hall at Paris.

Mr. L. C. Grant, "Lightning and Surge Propagation in High-Tension Transmission Lines."

Mr. Reginald O. Kapp, "The Selective Protection of Transmission Lines."

Messrs. P. V. Hunter and J. Francis Watson, "Certain Aspects of the High-Tension Distributing Problem."

Mr. W. Fennell, "Supplying Large Areas from the 'Grid System.'"

Mr. G. R. Falkiner-Nuttal, "Load Dispatching on Large Electric Systems in the United States."

The proceedings of the Conference will be printed in the French language, though if there is sufficient demand an English edition will be obtainable. The proofs of the papers already exist in both languages.

The numerous papers were well classified into subdivisions under the usual three groups, the first of which dealt with the equipment and operation of generating stations and of transformer sub-stations, the second section covered the construction and insulation of transmission lines, and the third division was reserved for matters pertaining to the operation and arrangement of distribution networks. In a continuation of these notes a brief analysis of the various papers will be made, so that the main points may be brought out.

(To be continued.)

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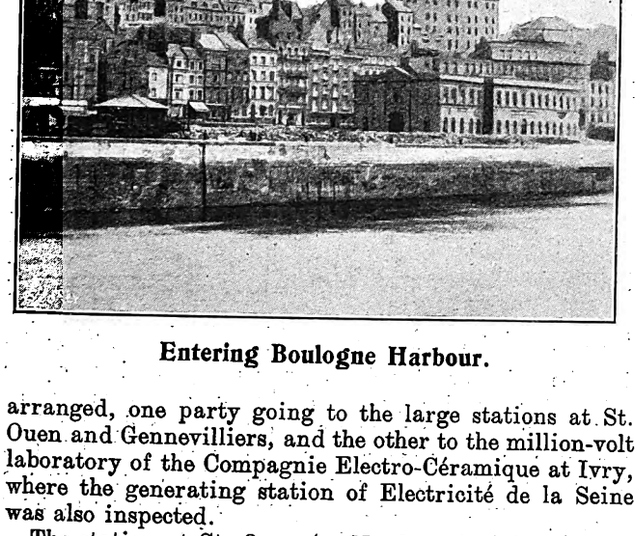
The I.E.E. in France.—I.

An Account of the Summer Meeting.

THE summer meeting of the Institution of Electrical Engineers opened in Paris on Wednesday, June 12th, in brilliant weather. As the E.H.P. Conference was still in session, the arrangement offered an opportunity to those attending the conference to take part in the I.E.E. programme also.

On the Wednesday morning alternative visits were



Entering Boulogne Harbour.

arranged, one party going to the large stations at St. Ouen and Gennevilliers, and the other to the million-volt laboratory of the Compagnie Electro-Céramique at Ivry, where the generating station of Electricité de la Seine was also inspected.

The station at St. Ouen (or Nord station) is operated by the Compagnie Parisienne de Distribution d'Electricité and serves practically the whole of the centre portion of Paris. The load is mainly a lighting one and varies within the unusually wide limits of 19,000 kW in the morning and 300,000 kW at some periods in the evening. This station is interesting in that a number of the machines were made originally for 42 cycles and were subsequently altered for the present standard of 50 cycles. One very long engine room contains eight sets of 15,000-kW capacity running at 3,000 r.p.m., and eight sets of 35,000 kW running at 1,500 r.p.m. The generators are constructed for 12,300 volts, and are in the main supplied by the Ste. Generale de Constructions Electriques et Mécaniques of Belfort.

The main boilers supplying the larger turbines are of the "Stirling" type, constructed by the Cie de Fives-Lille.

The coal-handling plant is of considerable interest. Trucks of approximately 40 tons capacity arrive in a siding, the rails of which are slightly inclined so as to tilt the trucks sideways. The coal is washed out completely into a ditch by means of a powerful hosepipe, and is then lifted by large grabs to the top of a mound, where it slowly dries before being used. The whole unloading process is entirely dustless and would appear to be very economical.

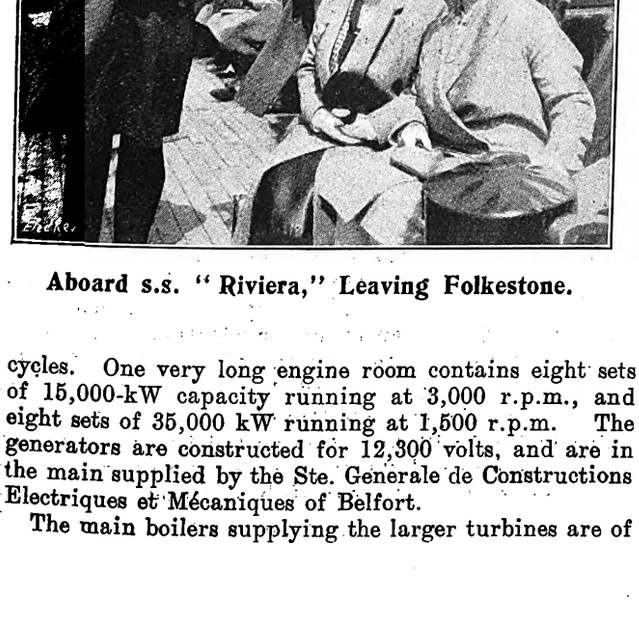
From St. Ouen the party motored a few miles to the large Gennevilliers station (which was decribed in detail in our issues of July 21st, 1922, p. 89, and October 20th, 1922, p. 544 *et seq.*). Additions have been made since that date and the two latest machines are of 50,000-kW each. These sets, with the existing six 40,000-kW sets, give the station a total capacity of 340,000 kW. An entirely new boiler house has been found necessary to supply these later machines. The Union d'Electricité, which operates this station, supplies power to the whole of the suburbs of Paris, together with a certain amount to the Metro railways.

Nearly 200 miles of 60,000-V cable are in use and practically no trouble is now experienced, though a few years ago it was found necessary to replace some 3,000 joint boxes, an undertaking the magnitude of which will at once be apparent. Dr. Mercier, the engineer-in-chief, personally conducted the party round the station.

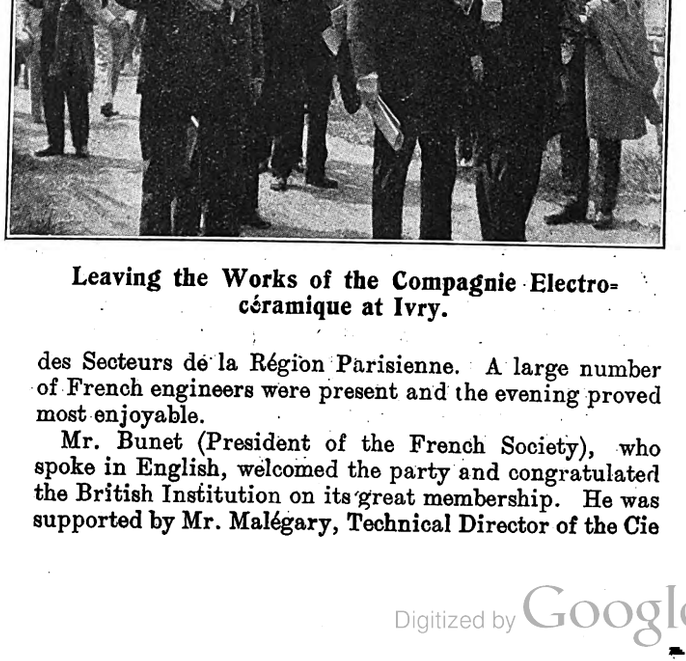
During the morning the ladies of the party were received by the French ladies committee and conducted to the famous establishments of Worth, where a mannequin parade was staged, and to Boucheron, where magnificent jewellery was displayed.

On Wednesday afternoon a number of members visited the Ecole Supérieure d'Electricité, where they were received and entertained to tea by Mr. Paul Janet, Director of the School. In the evening the members of the British Institution were entertained at a banquet given by la Société Française des Électriciens, la Compagnie Parisienne de Distribution d'Électricité, le Groupement des Secteurs de la Région Parisienne. A large number of French engineers were present and the evening proved most enjoyable.

Mr. Bunet (President of the French Society), who spoke in English, welcomed the party and congratulated the British Institution on its great membership. He was supported by Mr. Malégary, Technical Director of the Cie



Aboard s.s. "Riviera," Leaving Folkestone.



Leaving the Works of the Compagnie Electro-céramique at Ivry.

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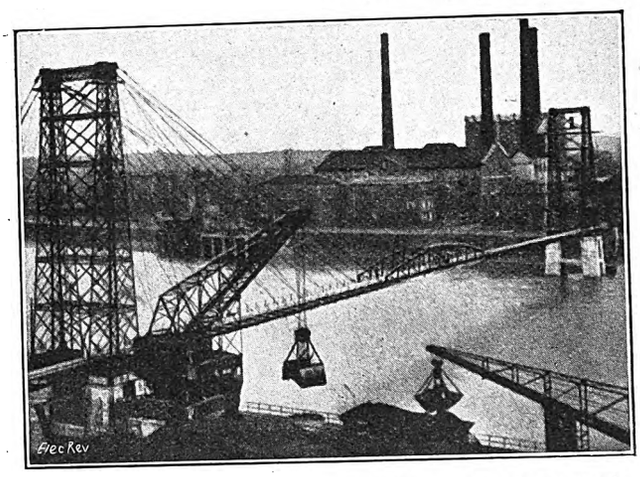
Parisienne de Distribution d'Electricite. Lt.-Col. Edgcumbe then replied in a witty speech, mainly in French, in the course of which he expressed the pleasure which it gave the Institution to be in France once more and the thanks which all the British members felt for the kindness and hospitality extended to them.

The Million-volt Testing Laboratory of the Compagnie Generale d'Electro-Ceramique.

Much interest was shown in the Ampere Laboratory of the Compagnie Generale d'Electro-Ceramique at Ivry-Port, which was established in 1923, and in which electrical tests at pressures up to 1,000,000 volts can be carried out. The Company, which is the largest manufacturer of porcelain insulators in France, and the first in that country to produce insulators for 220,000 V, has found the installation of great value in turning out material capable of standing up to very high pressures under all conditions. The laboratory is housed in a separate brick and iron building 118 ft. in length by 65½ ft. in width and 59 ft. high; the building is well "earthed," so that the laboratory practically forms a Faraday "cage." Internally it is divided into two sections, one being allocated to the transformers, while in the other are located the control gear, and on an upper floor is the actual test bed. Above the latter is a screened balcony from which the progress of the tests can be readily followed and the necessary records made.



Bridge for Cables between Vitry and Alfortville.

The installation comprises a convertor set and three step-up transformers. Power is received from the local distribution service at 5,000 V, 50-periods, three-phase; part is reduced to 200 V for ordinary use. To provide against any irregularities in the amplitude of the local supply, a special convertor set is employed to give a constant frequency at all loads The 190-h.p. motor (200 V) is of the synchronised asynchronous type, while the 8-pole alternator to which it is coupled is so constructed that the output voltage never varies more than 2 per cent. of the sinusoidal-curve voltage. The ends of the stator windings are brought outside the machine, so that either single-phase can be used, or all three phases can be connected up in star or delta fashion. The 15-kW, 115-V exciter is common to both machines.

One million volts is obtained by means of three identical Haefely 500/375,000-V, 50-period, air-insulated transformers, each having a capacity of 125 kVA. The machines are furnished with compensating windings, the insulation between them being provided for by means of an air mattress contained in two Haefelyte concentric cylinders. The centre of the h.p. winding being connected to earth, the active parts of the apparatus are insulated from earth by large-diameter Haefelyte cylinders, the number of which is proportionate to the arithmetical average of the maximum input and output voltages. Thus, although the three transformers are alike, as mounted on their insulating cylinders they reach to different heights, *viz.*, 18 ft., 21¼ ft., and 27¾ ft. From the floor the height is actually 6½ ft. more in each case as, owing to the site of the laboratory being subject to flooding from the River Seine, it was found necessary to mount them on cement foundation blocks.

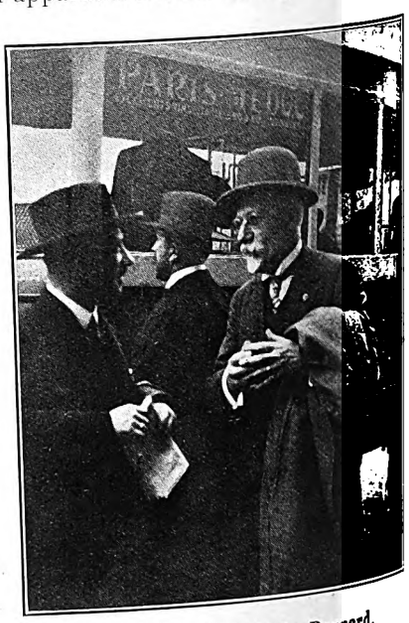
The transformers are so arranged that they can be used either singly, each to develop 125 kVA at 365,000 V between terminal and earth, or connected in parallel if that output is insufficient. One million volts between one terminal and earth is obtained by the cascade grouping of the transformers. In this case the first transformer is fed with power at 500 V; the second is excited by connecting together a similar number of turns of the secondary circuits of the first and second transformers, while the third is excited by directly connecting the primary circuit with the primary of the second transformer; that is to say, while there is a difference of only 500 V, the absolute voltage to earth is 625,000 V.

The transformers can be three-phase coupled by exciting the primary of each apparatus by one phase of the alternator, which enables three-phase current at 375,000 V between phases and earth to be delivered at the three ends of the secondaries, or practically 650,000 V between phases. In practice, the changes in the various connections are easily made by means of long sectionisers.

Within the laboratory the h.p. conductors consist of Haefelyte tubes lined internally with Dutch metal, the diameters for the respective voltages being 100, 200 and 300 mm. The conductors which are connected by brass spheres, 150, 300 and 500 mm. in diameter, are hung from the roof by tubular porcelain insulators, 19 ft. 7 in. in length.

The control apparatus and measuring instruments are grouped on a desk so located that the operator can see both the material under test and the transformers. Not being satisfied with the usual method of measuring the voltage by experimentally determining the ratio of the secondary to the primary voltages as shown by a volt-

Lt.-Col. Edgcumbe and Friends.



Mr. Bunet and Mr. Barnard.

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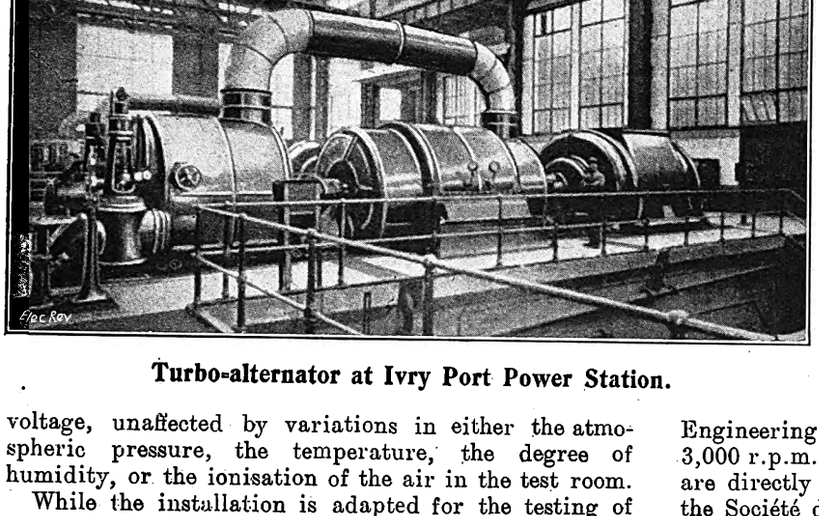
meter, the Electro-Ceramique Co. measures the absolute voltage by determining the charging current of a condenser of known capacity connected up between the h.p. terminal and earth. The condenser employed consists of an upper sphere and, at the lower end of the gap, of a half-ball. The intensity of the current, rectified by an incandescent cathode lamp, is measured by a milliammeter graduated to give a simple reading of the voltage, unaffected by variations in either the atmospheric pressure, the temperature, the degree of humidity, or the ionisation of the air in the test room.



Turbo-alternator at Ivry Port Power Station.

While the installation is adapted for the testing of all kinds of h.p. apparatus, it is mainly employed for testing porcelain insulators under dry and rainy weather conditions and breakdown in oil. The dry tests are carried out within the laboratory, the chain of insulators under test being suspended from the roof trusses, and its lower end connected to a h.p. conductor. The tests under rain are conducted in the open air, where a short power transmission line has been erected; the line is of the normal 220,000-V type, but can withstand 650,000 V between phases, so that chains of insulators can be tested up to three times the present highest standard capacity. The oil breakdown tests up to 600,000 V are effected by plunging the insulators into a tank 16½ ft. in diameter and containing about 25 tons of oil. A low-pressure steam coil is provided in the tank, so that the oil may be heated up to a temperature of 90 deg. C.

Another interesting feature of the laboratory is a machine of the Company's own design and construction for the combined mechanical and electrical testing of insulators, it being so arranged that four chains at a time can be subjected to prolonged tests at a high voltage.

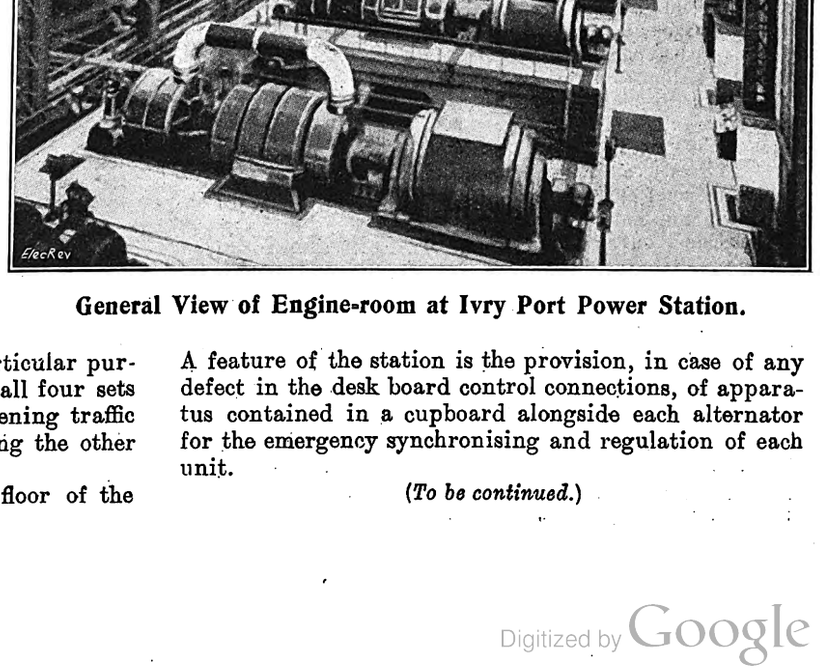
The Ivry Port Power Station.

The power station at Ivry Port, of the Société d'Electricité de la Seine, is the latest addition to the electricity-generating installations in the Paris district, and is mainly intended for the supply of power to the Paris underground electric railways, the requirements of which have outgrown the capacity of the original plant. The new station is located on the banks of the River Seine which, being subject to flooding, has necessitated the location of the main operating floors at a high level. Designed for an ultimate capacity of 130,000 kW, four turbo-generator sets, each of 15,000-kW capacity, have so far been installed, this size of set having been decided upon as being the most suitable for the particular purpose, the conditions being such that whilst all four sets are required for the busy morning and evening traffic periods, one is sufficient for the load during the other parts of the day.

Owing to the risks of floods the firing floor of the boiler house is approximately 35 ft. above ground level. The installation comprises eight Babcock and Wilcox boilers, six having automatic chain-grate stokers, while two are arranged for pulverised-fuel firing. The chain-grate boilers have a heating surface of 6,835 sq. ft., with 3,853 sq. ft. superheaters; they are capable of each supplying 41,900 lb. of steam per hour at a pressure of 313 lb. per sq. in.; the final temperature after superheating being 707 deg. F. The two pulverised-fuel boilers have each an output capacity of 61,730 lb. of steam per hour; the heating surface of the boiler proper is 6,942 sq. ft., and of the combustion chamber 1,345 sq. ft. Both types of boiler were supplied under a guaranteed efficiency of 85 per cent.

Coal for the boilers is received both by barge on the river and by rail, the wharf being of sufficient length to enable two 800-ton barges and two 200- to 250-ton trains or wagons to be simultaneously unloaded. Coal bunkers are available for the storage of between 11,000 and 12,000 tons. A feature of the station is a water de-aerating, distilling, and feed-heating apparatus which was constructed under the patents of the (English) Contraflo Engineering Co., Ltd. The turbines, which run at 3,000 r.p.m., are of the Escher Wyss compound type and are directly coupled to 21,400-kVA generators built by the Société des Ateliers de Constructions Electriques de Jeumont, 50-cycle current being generated at 10,500 V. Each alternator is provided with a 74-kW exciter and with closed-circuit air circulation. Two Breguet 650-kW auxiliary turbines running at 1,000 r.p.m. are also installed, these being coupled through gearing with a ratio of 1 : 6.9 to 250-V three-phase generators.

The h.p. switchgear is housed in a four-storey building and comprises the apparatus for controlling the four alternators and two groups of feeders, each of the latter consisting of six cables of 5,000 kW capacity at 10,500 V. The first floor houses the cable end boxes and apparatus for putting the cables under load; on the second floor are the bus-bars connected to the external feeders and the synchronising voltage transformers, while the alternator oil-circuit breakers and the transformers for auxiliary service supply are on the third floor. The upper storey is devoted to the main bus-bars, the potential transformers and the synchronising gear.



General View of Engine-room at Ivry Port Power Station.

A feature of the station is the provision, in case of any defect in the desk board control connections, of apparatus contained in a cupboard alongside each alternator for the emergency synchronising and regulation of each unit.

(To be continued.)

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Spot- and Flood-light.

The accompanying illustration, fig. 1, depicts a standard model of the new "Stella-Ray" spot- and flood-light which is being marketed by the NEWMAN ELECTRICAL CO., 5 and 6, Eden Street, Hampstead Road, N.W.1. The essential characteristic of this unit lies in the unique effects achieved by the projection of an intense beam of light in a given direction by a scientifically-designed reflector, which can be of silvered glass, or, alternatively, of heavily-nickel-plated copper. The "Angle" type of fitting has three movements and an adjustable holder

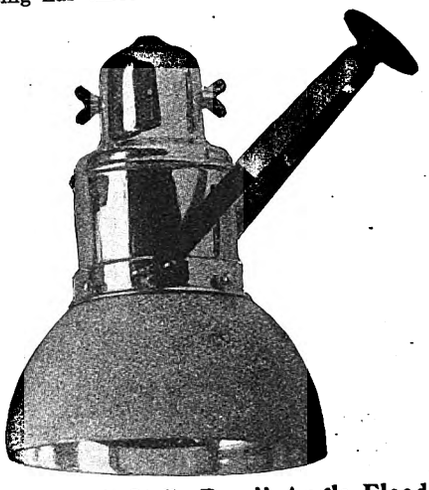

Fig. 1.—The "Stella-Ray" Angle Flood-light.

support with locking nuts. The design of the "Stella-Ray" fittings is such as to enable the light rays to be projected in any direction desired. In the case of shop-window displays, the use of the "Stella-Ray" units affords, it is claimed, a unique method of "spotting" any particular article of merchandise. It is claimed that a light equivalent to 1,000 c.p. is concentrated in a given direction for a loading of 150 W. "Daylight Blue" lamps used in conjunction with the "Stella-Ray" units ensure an ideal medium for colour-matching purposes. Perhaps one of the most fruitful fields for the introduction of this new spot- and flood-light lies in the realm of colour effects. Beautiful multi-colour effects have been achieved by the use of ordinary 100-W colour-sprayed bulbs, without the interposition of artificial colour screens.

Small Repulsion-Induction Motors.

It is encouraging to note the increasing number of British firms which are now developing the smaller classes of electric motors, fig. 2. Among the latest contributors to this class of manufacture are Messrs. HIGGS MOTORS, Witton, Birmingham, who are producing a new range of small repulsion-induction motors with capacities varying from 0.1 to 1.5 h.p. They are claimed to be particularly suitable for driving line shafting,

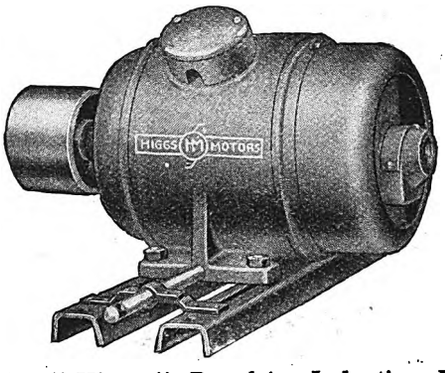

Fig. 2.—"Higgs" Repulsion-Induction Motor.

air compressors, pumps, and so on. These machines are constructed with double-wound rotors. On the periphery of each there is a winding somewhat similar to that of a d.c. armature connected to a commutator in the usual manner; below this there is a squirrel-cage winding. The windings work in conjunction with one another and develop a high starting torque with a reasonably low starting current. The brushes are permanently on the commutator. The smaller motors are provided with chilled cast-phosphor-bronze bearings and lubricated by the wool-yarn system. They are well protected from falling dirt, as there are no openings in the shell or on the top of the end covers to admit foreign matter. The frames are arranged to run in the horizontal position; should they be required to operate on a wall or ceiling, the position must be specified when ordering, so that the end cover can be correctly fitted. The larger motors can be run on the floor, wall, or ceiling, without alteration, as they are fitted with ball bearings. The standard rotation is clockwise when viewed from the pulley end, but the rotation can be reversed by a movement of the brush rocker. It is claimed that the makers' test complies with B.S.S. Nos. 168 and 170—1926. At starting the machines develop approximately twice full-load torque with approximately three times full-load current. The machines can be thrown directly on to the line. When a starter is used, the motors develop 35-40 per cent. full-load torque with full-load current. The starters are designed to pass full-load current on the first stud, but the torque increases as the starter handle is moved over.

A New Pocket Lamp.

Messrs. BATTERIES, LTD., Hunt End Works, Redditch, have just marketed a small pocket lamp, fig. 3, fitted with a "Nife" accumulator. The particularly interesting feature of this apparatus is that owing to there being no gases given off during discharge the cell is fitted with solid plugs, thus making

Fig. 3.—The "Nife" Pocket Lamp.

the battery, it is claimed, absolutely leak tight. One charge of the battery will give, it is claimed, the same output as 10 dry batteries suitable for the lamp. The output should prove useful for meter reading and other purposes for which it is desirable to avoid constantly changing the batteries.

A Meter-testing Load Outfit.

To provide a means of reducing the consumption of electricity during meter testing, the A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, Westminster, S.W.1, has introduced the "Phantom" load transformer. The principle employed is that of loading the current coils of the meters under test at reduced voltage, the pressure coils being fed directly from line. The apparatus consists of a transformer and a resistance, the latter being connected to the secondary winding of the transformer. The whole is housed in a small oak box similar to that of the calibrating meter. The primary of the transformer is connected to the voltage terminals of the meter to be calibrated, and the supply pressure is thereby transformed to a few volts. The secondary of the transformer is connected in series with the current coils of the meter to be calibrated and the test meter. The current can then be regulated by means of the resistance between 0.1 and 10 A. The load is adjusted through a regulating rod, which is provided with graduations, so that the adjustment may be read. In order to increase the range of regulation, the secondary winding consists of two coils which may be connected in series or in parallel by inserting one or two plugs. There is a further winding on the secondary side of the transformer, which supplies an incandescent lamp for indicating whether the transformer is under load; it also serves to light the scales and counters. The primary coils are protected by a fuse against overload resulting from connection to a wrong terminal. The current leads are secured by strong wing nuts to the terminals.

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Legal.

A Trade Union Libel Action.

ON June 13th at the Liverpool Assizes an action for damages for libel was brought by the Electric Supply Workers' National Association and its secretary, Mr. G. Gorton, against Messrs. C. Dukes, M.P., J. T. Watkins, and J. H. Hampson, of the Union of General Workers.

It was stated by Mr. J. E. SINGLETON that the plaintiff union was recently formed in view of the necessity for a special body to look after the interests of workers in the electricity supply industry. It met with opposition from the established trade unions who considered that the new body intended to undermine their position. The association was "turned down" by the employés' side of the Whitley Council and a pamphlet was issued stating that the employers' side had decided not to recognise or negotiate with Mr. Gorton while his association remained unrepresented on the Council. It was also stated that anybody who joined the Association would be deprived of the benefits and protection which were afforded by representation on the Whitley Council. This statement, said Counsel, was untrue and there were no grounds for saying that the Association was disruptive. The Union of General Workers, in 1925, had offered Mr. Gorton a position if the Association amalgamated with the Union, but he declined it.

Evidence was given by Mr. Gorton, who was cross-examined by Mr. Cyril Atkinson, K.C., for the defendants, and the hearing was adjourned.

When the case was resumed on June 14th evidence was given by members of the Association, who said that they had read the circular in question. One witness stated that he was present at a meeting at which the defendant Hampson said that Mr. Gorton had offered to hand over the Association to the General Workers' Union provided that he and two others were given positions. Hampson had stated that the Union could not take the Association over owing to its financial position.

The treasurer of the Association stated that the circular had caused some decrease in membership.

For the defence, Mr. ATKINSON, K.C., said that the plaintiffs had violated one of the cardinal principles of trade unionism by endeavouring to induce men who were already members of a union to join the Association. Mr. Gorton's real grievance was his exclusion from the Whitley Council.

At the conclusion of the action on June 15th the jury was unable to agree. The parties consented to a majority verdict and the jury awarded the plaintiffs £250 damages. Judgment, with costs, was entered accordingly.

Ferranti, Ltd., v. Measurement, Ltd.

A SETTLEMET was mentioned in the King's Bench Division on June 13th in connection with litigation between Ferranti, Ltd., and Measurement, Ltd.

Mr. G. O. Slade appeared for Messrs. Ferranti, the plaintiffs, and Mr. W. T. Monckton for the defendants. The settlement was announced to Mr. Justice Avory.

Mr. SLADE said that the litigation, which was between two well-known companies of electrical meter manufacturers, would not be continued. The matter was an action for libel and the plaintiffs complained of advertisements inserted by the defendants in issues of electrical trade papers in June and July, 1927. For the plaintiffs he was instructed to say that they admitted that the words of which they complained were not defamatory and they desired to withdraw the action. It had been agreed between the parties that each should pay its own costs. That being so, his friend, Mr. Monckton, for the defendants, agreed that there was no need for any order of the Court to be drawn up.

Mr. MONCKTON consented to the withdrawal of the action on these terms.

Venture Trust, Ltd., v. The Marconi Company.

BEFORE Mr. Justice Clauson in the Chancery Division on June 14th, Mr. Jenkins, K.C., on behalf of the Venture Trust, Ltd., moved for an injunction against Marconi's Wireless Telegraph Co., Ltd., and Senatore Marconi and the other directors to restrain the defendants from carrying into effect the scheme for the merger of interests by the sale of the communications assets of the defendant company and certain other companies to Imperial and International Communications, Ltd., and the exchange of the stock and shares of the defendant company and such other companies for shares of Cables & Wireless, Ltd., or taking any other steps for the purpose of carrying the scheme into effect until judgment in this action or further order.

Mr. JENKINS stated that in 1922 the defendant company made an issue of 6½ per cent. debenture stock and on December 31st, 1927, there was outstanding of that debenture stock £1,207,186. The holders of that stock were given an option which they might exercise at any time within ten years to exchange their stock for £1 ordinary shares. If the option were exercised the stockholder would obtain a premium of 200 per cent. At the beginning of 1927 the company had suffered heavy losses and the capital was reduced to £4,000,000. Ten shillings was struck off the ordinary shares, and a certain number of ordinary shares remained unissued to satisfy the debenture stockholders in case they should exercise their option. Shortly after the reduction of capital the shares of the company began to rise in price very rapidly. Plaintiffs attributed that to the "Beam" system, but the defendants attributed it partly to the reduction of capital and to the fact that dividends were in sight. The directors urged the debenture stockholders to exercise their option to convert. Some months before this the plaintiffs had bought £10,000 of debenture stock at a large premium, the option appearing at that time a valuable one that might be exercised. The directors stated that each £3 nominal value debenture stock entitled the holder to convert such stock into one fully paid ordinary share of £1 with dividend rights equivalent to those of two 10s. ordinary shares. In the meantime the "beam" system had become valuable and had created difficulties for the cable companies. The plaintiffs had exercised their option and received 3,333 £1 shares, in addition to which they bought others at a premium of 68s. a share to bring their holding up to 4,000 shares. The debenture stock was virtually disposed of by conversion. When the offer for the exchange of shares was first mooted there was a rumour that the directors proposed to restore the 10s. which had been written off the old £1 shares. This was, however, not done, but the Marconi directors wanted to treat the 10s. shares on the same basis as the £1 shares. They had treated the £1 shares as if they were divided into two moieties, and said that with regard to one moiety of 10s. they would give £50 preference shares in a new company, thus getting rid of that moiety, and the plaintiffs would then have only one moiety of 10s.

An affidavit by Mr. F. G. Kellaway, managing director of the Marconi Company, was read by Mr. LIONEL COHEN, K.C., counsel for the company. He stated that it was not the fact that the rise in the quotation of the ordinary shares began to take place on the success of the "Beam" system, which had been demonstrated at least a year before. The primary cause of the rise was the writing off of accumulated losses by the reduction of capital, which paved the way for the resumption of dividends. Only £1,185,537 of the debenture stock of the Marconi Company was converted into shares. It was untrue to say that only 500,000 shares in the Marconi Company were issued otherwise than for their par value, and that those 500,000 shares were issued at a small premium. The holders of the 10s. shares had borne the whole of the loss under the reduction scheme for the benefit of the shareholders as a whole, and the directors thought it right that their loss should be considered. Any holder of £1 shares who considered himself aggrieved had only to refuse the offer, in which case he would remain as a shareholder in the Marconi Company with all the rights incidental to his holding of £1 shares.

His LORDSHIP said he did not understand what Mr. Jenkins was asking him to stop the Marconi Company from doing.

Mr. JENKINS said that, technically, the offer was by the Merger Company, but the directors of the Marconi Company were nearly one-half of the Merger Company, and they were putting forward the scheme to the detriment of the Marconi shareholders.

His LORDSHIP considered that counsel had not brought anything to his mind which entitled him to stop them.

Mr. JENKINS said that they were acting contrary to the rules which the Court had laid down to be followed by directors of companies, and they were doing an injustice to the plaintiffs.

The hearing was concluded on Monday last. Mr. Jenkins, resuming his argument for the plaintiffs, said that if the scheme as a whole was wrong the defendants ought to be restrained from taking any part in it.

The JUDGE pointed out that the Marconi Company was not making the offer of the exchange of shares. It was being made by Cables & Wireless, Ltd., which was not a party to these proceedings.

Mr. JENKINS contended it was really the Marconi Company which had brought about the offer of exchange of shares, and that this was a breach of duty.

The JUDGE said that if Cables & Wireless, Ltd., was doing something wrong it might be restrained, but Mr. Jenkins was not asking that.

Mr. JENKINS said that the Marconi Co. could be restrained from carrying out the scheme as a whole by selling assets as part of the scheme.

The JUDGE said that the company was not selling its assets as part of the plan if accurate language was used.

Mr. JENKINS said that the directors of the Marconi Company were unfairly using their powers to induce the Merger Company, the board of whch they formed nearly one-half, to make an offer for an exchange of shares on a footing that was unjust to plaintiffs.

Mr. GAVIN SIMONDS, K.C., also addressed his Lordship on behalf of defendants.

Without calling on Mr. COHEN, K.C., for the defendants, Mr. Justice CLAUSON, in dismissing the motion, said that he had nothing to do with the question of whether the offer made to the £1 shareholders was not a fair and proper one. The £1 shareholder could accept it if he liked, and if he did not accept it he would remain a shareholder in the Marconi Company. The Merger Company was not a party to these proceedings, although the directors of the Marconi Company were also directors of the Merger Company. The Merger

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Company not being before him, it was impossible for him to interfere with it in offering its shares to the shareholders of the Marconi Company in exchange for their shares. The terms of the sale of the Marconi Company's assets to the Imperial Communication Company were not yet fixed, and he could not stop the directors of the Marconi Company from negotiating the terms of such a sale unless he was satisfied that they were about to commit a breach of duty towards their shareholders and were selling the assets at an insufficient price or in circumstances in which they were sacrificing the interest of their company, but at present nobody knew what the terms were going to be.

Mr. JENKINS asked for leave to appeal.

His LORDSHIP said that the plaintiffs had a right to appeal without asking for leave.

Thefts from Meters.

AT Morecambe Police Court, last week, two apprentice plumbers, Lawrence Taylor and Hubert Bowden, were found guilty of thefts from electricity and gas meters. There were reported to have been thefts amounting in total to about £50, and numbering nearly 60. The youths had obtained access to houses by their plumbing work, and used keys to open meter locks, sharing the proceeds equally. The relatives of the lads undertook to reimburse the money, and their employer said he was willing to take the youths back into his employ if his customers were prepared to trust them. The magistrates bound Bowden (the younger) over for two years on condition that the money was repaid. Taylor, who had been in trouble before, was sent to prison for three months with hard labour. Mr. ROBERT WALSH, Deputy Town Clerk, stated that for the past 18 months there had been a great amount of suspicion against officials of the Electricity and Gas Departments on account of these thefts.

Breach of Electricity Regulations.

AT Gateshead Police Court, on June 12th, Messrs. Clarke, Chapman & Co., Ltd., electrical engineers, were fined £50 for a breach of the Electricity Regulations under the Factories and Workshops Act. The prosecution was the sequel to a fatal accident in which an apprentice moulder named Wilfred Hughes was killed on March 22nd at the company's Gateshead works. Mr. R. H. ROGERS, H.M. Inspector, said that Hughes was carrying a ladle which came in contact with some live copper wires. A fellow worker ran to help him, but when he touched Hughes he received a shock. The current was cut off and the youth fell to the ground and died shortly afterwards. Mr. Rogers said that there was negligence in that the wires were not properly safeguarded. Mr. J. L. TAYLOR, who defended, said that this was the first instance of lack of thorough inspection at these works over a period of 60 years. Steps had been taken to prevent the occurrence of any similar accident.

Marconi Royalties Appeals Succeed.

IN the Chancery Division on Tuesday last, Mr. Justice Luxmoore delivered his reserved judgment allowing the appeals by Marconi's Wireless Telegraph Co., Ltd., against the decisions of the Comptroller-General of Patents in favour of the applications of the Brownie Wireless Co. of Great Britain, Ltd., and the Loewe Radio Co., Ltd., for compulsory details, in the case of the Brownie Co. to manufacture receiving sets at a lower royalty than that demanded from other manufacturers, and in the case of the Loewe Co. to manufacture in this country triple and double valves in respect of which the royalties payable to the Marconi Co. should also be substantially lower.

Mr. Justice Luxmoore allowed both appeals and directed that the orders of the Comptroller-General should be discharged. He held that it was not in the public interest as the Brownie Co. claimed that such a licence should be granted to it, that the terms of the licence offered by the Marconi Co. were not unreasonable, and there was no evidence to support the Brownie Co.'s contention that reduction of the royalty would have the result of bringing into existence a new class of purchasers who were now prevented from buying valve sets by the prevailing prices. In the case of the Loewe Co. the Judge held that there had been no refusal to grant a licence by the Marconi Co., as terms were never defined, and therefore the time had not arrived when the Loewe Co. was in a position to apply for a compulsory licence. He thought the establishment of a factory by the Loewe Co. in this country would be in the public interest, and he hoped that the parties would come to terms.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Electrical Review Index.

The Index to Vol. CIV (for the half-year ending June 30th, 1929) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes, or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.4.

The Co-ordination of London Passenger Transport.

At last week's meeting of the London County Council, Mr. Silkin, a Labour member, put forward a motion that the Parliamentary Committee should be instructed not to proceed further with the London County Council (Co-ordination of Passenger Traffic) Bill. He said that the sponsors of the Bill had been defeated in the General Election, which showed the trend of public opinion in the matter. Sir John Gatti refused to accept this construction, and stated that the result was a national and Imperial matter and did not upset the mandate which the Council had previously received. The onus of rejecting the Bill must be borne by the new Government; the Municipal Reform Party would not relieve the Government of that responsibility. After further debate the motion was rejected by 60 votes to 45.

Telephone Development Work.

In a recent issue we urged the General Post Office to make greater efforts to acquaint the public with the nature, scope, and convenience of its telephone service. We are consequently pleased to see an attractive folder that has been issued by the G.P.O. containing some particulars of telephone facilities and charges. On the outside of this publication there are two coloured maps. One depicts the British Isles divided into zones by concentric circles with their origin in London. In each belt there are smaller circles divided into three sectors which give the rates for a three-minute call between 7 a.m. and 2 p.m., 2 p.m. and 7 p.m., and 7 p.m. to 7 a.m. The other map shows the Continental telephone links. The principal cities are shown and the day and night rates are given in each case. The remainder of the folder is devoted mainly to an extension of this information in table form, one page giving the three rates for calls from London to about 130 provincial towns, and another giving the day and night rates for calls to the principal Continental cities. Elsewhere it is stated that Anglo-Continental telephony now reaches Ceuta (Morocco) on the south, Warsaw on the east and the Arctic Circle on the north.

Another Large American Merger.

The *Financial Times* reports that Messrs. J. P. Morgan and Co., of New York, are effecting a merger of electrical utility companies in Upper New York State representing a total capital of $500,000,000. The principal concern involved is the Buffalo, Niagara & Eastern Power Co., operating at Niagara Falls and the western part of New York State, with assets valued at $221,000,000. There are three other large companies and several smaller concerns.

Contractors Visit G.E.C. Works.

A visit was paid to the works of the General Electric Co., Ltd., at Coventry on June 12th, by about 150 members of the Western Section of the Electrical Contractors' Association. The visitors were received by Sir William Noble, a director and chairman of the Coventry Chamber of Commerce, and were entertained to luncheon in the pavilion on the works sports ground. They were subsequently conducted round the factory and shown the processes in the production of modern telephone and radio equipment.

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The "Exide" Convention.

As we reported in our last issue, this year's convention of "Exide" service agents, arranged by the CHLORIDE ELECTRICAL STORAGE CO., LTD., was held at Brighton. In the accompanying picture the Mayor of Brighton (Ald. H. J. Galliers) is seen chatting with Mr. D. P. Dunne, sales manager and director of the Chloride Co. It was most appropriate that Brighton should have been chosen as the *venue* for the convention, for Ald. Galliers is a leading electrical contractor of the county borough, and the local "Exide" service agent.

Mayoral Welcome to "Exide" Agents.

Among the 400 or more delegates to the Convention were several from the Dominions. The idea behind these annual gatherings is the co-ordination of selling and service principles and the evolution of a policy for the ensuing year. This year's meetings were held in the Royal Pavilion, and the banquet, which is a feature of the event, took place in the Dome. Mr. D. P. Dunne presided, and proposed the health of the Mayor and Corporation of Brighton, thanking them for the excellent reception accorded to the delegates. Ald. Galliers responded to the toast.

Bankruptcy Proceedings.

S. E. HUNT, 8a, Torwood Street, Torquay, electrical engineer and contractor.—The first meeting of creditors was held on June 7th, at the Official Receiver's offices, Exeter. The statement of affairs showed liabilities of £2,312, against net assets of £499, leaving a deficiency of £1,813. Debtor attributed his failure to heavy overhead charges, interest and rent, bank charges, &c., preventing him earning sufficient to meet living and personal expenses; the inconvenient situation of his shop; a loss of £100 on a large contract; and legal costs. Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, London, E.C., was appointed trustee of the estate. The following are creditors:—

	£		£
Bates, A.	195	Fulford, T. R.	30
Bune, J.	52	Falk, Stadelmann & Co.	112
Brearley, H.	25	General Cable Manufacturing Co., Ltd. ...	50
Berry's Electric (1928), Ltd.	32	Johnson, Miss	105
Castellina Co., Ltd. ...	24	General Electric Co., Ltd.	23
Cleave, H. R., & Co. ...	62	Lighting Trades, Ltd. ...	23
Driver, F.	212	Newcombe, F. D., & Co.	40
Ever-Ready Co. (G.B.), Ltd.	30	Philips Lamps, Ltd. ...	39
Emanuel & Sons, Ltd. ...	65	Richardson, W. E. ...	50
Edison Swan Electric Co., Ltd.	36	Roe, E. A.	66
Foster Engineering Co., Ltd.	80	Santon, Ltd.	31
		Underwood, Mrs.	100
		Universal Lamps, Ltd. ...	33

J. A. HENDERSON, trading as "Hendersons," electrical contractors, 28a, Basinghall Street, E.C., and "St. Olaves," Hall Lane, Walton-on-the-Naze.—The first meeting of creditors was held on June 12th, at the London Bankruptcy Court, before Mr. E. Parke, Official Receiver. The debtor filed his petition on May 30th, and was adjudicated bankrupt the same day. He states that he has always been engaged in the electrical trade, and during the war was employed in cable making. After the Armistice he acted as managing director of Henderson & Thornton, Ltd., and subsequently, for a short time, of Osbornes, Ltd., which absorbed the former company. In June, 1925, he started on his own account as an electrical contractor, under the registered name of "Hendersons." Contract work was obtained in London and the provinces, and he did very well for a time, but business had fallen away during the past two years, with the result that the profits were not sufficient to cover the overhead expenses, and, being pressed by creditors, he filed his petition. The labour troubles of 1926 had an adverse effect on the business. The liabilities were estimated at about £2,500, against assets estimated to produce £315. The failure was attributed to the industrial unrest and to general slackness in the electrical trade. Mr. D. C. Evans, 18, Ironmonger Lane, E.C., was appointed trustee.

H. PEOVER, Market Lane, Newcastle-upon-Tyne, electrical apparatus and tool merchant.—The public examination was held on June 6th, at the Court House, Newcastle-upon-Tyne. The statement of affairs showed liabilities of £1,868 and assets of £236, leaving a deficiency of £1,632. Debtor stated that he commenced business on his own account in October, 1925, without capital. His father, to whom he owed £225, guaranteed a bank overdraft up to £500. In October, 1927, he began the manufacture of wireless sundries; this was successful until October, 1928, when creditors began to press. He attributed his failure to want of capital, losses on manufacture of wireless apparatus, owing to a smaller demand than was anticipated; loss by forced realisation of stock, and bad debts. The examination was adjourned.

G. A. NORMAN, electrical engineer, 44, Lancaster Street, Barnsley.—First and final dividend of 5s. 2d. in the £, payable at the Official Receiver's office, County Chambers, King Street, Wakefield.

H. SAVORY, electrical engineer, 7a, Hill Street, Shaw.—First and final dividend of 6s. 6¾d. in the £, payable at the Official Receiver's office, Byrom Street, Manchester.

J. DEAN, electrician, 4, Gogerddau Place, Aberystwyth.—Receiving order made June 6th, on a creditor's petition.

W. H. LAURENS, radio engineer, 492, Prescot Road, Old Swan, Liverpool.—Receiving order made June 12th, on debtor's own petition.

E. A. WARNES, electrical and radio engineer, 10, Crescent Gate, Wilmslow Road, Rusholme, Manchester.—Receiving order made June 10th, on debtor's own petition.

G. WILMINGTON, electrical and radio engineer, 75, Railway Street, Nelson.—Receiving order made June 6th on debtor's own petition. First meeting June 21st, at the Official Receiver's office, District Bank Chambers, Blackburn. Public examination July 23rd, at the County Court House, Burnley.

W. T. JACOB, wireless engineer, 14, Meyrick Street, Pembroke Dock.—Last day for proofs for dividend, June 28th. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen.

Company Liquidations.

SOUND STORES, LTD., 29a, Charing Cross Road, W.C.—Under a compulsory winding-up order made against this company last January, accounts have been lodged showing total liabilities of £7,088, and a deficiency of £4,995 with regard to contributories. The Official Receiver, who is liquidator, reports that the company was incorporated as a private company in March, 1928, to carry on business as dealers in wireless sets, gramophones and records. The issued capital of £2 only is held by Nathan Gordon and his wife, who have been the only directors. Gordon was appointed chairman of the company at a salary of £80 a month, and Mrs. Gordon acted as saleswoman, receiving £2 10s. a week. Together, therefore, although the company had no capital, they were taking money out of the business at the rate of £1,090 per annum. The company appears to have obtained goods on credit without much difficulty from a wide circle of traders. The company started business at 9, Great Newport Street, W.C., with the aid of £500 shown by the books to have been advanced by Mrs. Gordon, who subsequently made further advances on the security of debentures, the validity of some of which will have to be carefully considered. As early as August, 1928, the company was unable to meet its liabilities, and creditors began to press for payment. On November 13th, 1928, Mrs. Gordon appointed Mr. F. E. Branstone, receiver and manager under powers on her debentures for £1,200; a resolution for voluntary liquidation was passed eight days later, and a petition for compulsory liquidation was presented on December 18th, 1928. The receiver has paid £1,077 to the debenture holder, and has paid over a balance of £155 to the Official Receiver. The Official Receiver observes that Gordon's explanations of many matters are far from satisfactory, and it is clear that the company's trading and accounts will require close investigation.

VERDON CUTTS & CO., LTD., 87, Fargate, Sheffield, electric furnace manufacturers.—A meeting of creditors was held on June 13th at the Institute of Chartered Accountants, E.C., when Mr. C. L. Widlake, Sheffield, the liquidator, presided. He reported that the liabilities amounted to £7,739, all due to unsecured creditors, and the net assets to £490, leaving a deficiency of £7,249. The company was incorporated in 1922, and took over a business which had been established in 1909 by Mr. Verdon Cutts, who had traded as Verdon Cutts and Co. Certain assets were purchased, including goodwill £500, and drawings and designs £6,000, and office furniture. The capital of the company was £10,000, and was later increased to £19,500. From the commencement of the trading of the company down to the date of the liquidation, continuous losses had been sustained, and the total loss to date was £19,427. When the company was established it was considered that there was a good market for electric furnaces, and it was hoped to get large orders from abroad. The orders were not sufficient, however, to place the company on a sound financial basis, and throughout the period of trading the overhead charges and the expenses had generally been too heavy for the turnover. The matter remains in the hands of the present liquidator.

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H. & S. Scott, Ltd., wireless manufacturers, &c., Barbican, E.C.—The statutory meeting of creditors was held on June 12th at the Institute of Chartered Accountants, E.C. The liquidator reported that the liabilities were £2,362, and the net assets £2,333, leaving a deficiency of £29. The business had been in existence for a number of years, and the company was registered in 1919, the issued capital being £1,002, all of which was fully paid. For a number of years the company traded successfully, but losses had been sustained on the wireless department. That department was developed with a view to a separate company being floated, but trading losses had been incurred. The stock consisted very largely of wireless parts, but it was in good condition, and negotiations were proceeding for the sale of those assets as a whole. A resolution was passed confirming the voluntary liquidation of the company, and an advisory committee of three of the creditors was appointed.

Brightlingsea Electricity Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. C. Lucas, 167, Strand, W.C. A meeting of creditors is called for June 25th, at 167, Strand, W.C. Particulars of claims to the liquidator by July 25th. (The above meeting is purely formal, as all creditors have been or will be paid in full.)

Sheffield Wireless Depôt (1926), Ltd.—Winding up voluntarily. Liquidator, Mr. H. Cunningham, Angel Street, Sheffield. A meeting of creditors was held at the Law Society's Rooms, Bank Street, Sheffield, on June 18th. Particulars of claims by July 19th.

Gas & Electric Securities, Ltd.—Liquidator, Mr. E. T. A. Phillips, Official Receiver, Carey Street, W.C., released June 6th.

Private Arrangements.

L. E. Jones, 193, Fawcett Road, Southsea, Portsmouth, electrical engineer.—A meeting of creditors was held on June 12th at the offices of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., when Mr. E. H. Hawkins stated that the liabilities amounted to approximately £396, and the net assets to £162. The debtor commenced business in 1922, with his brother, who took over a business which had been previously carried on. In 1927 the brother withdrew, and the business was continued by the debtor. The turnover last year was approximately £1,400. There had been several summonses issued, and one creditor was in a position to sign judgment, and the debtor had executed a deed of assignment to Mr. Hawkins in order to protect the estate. The creditors decided that, provided the debtor deposited £100 with Mr. Hawkins within the next 14 days, they would accept that amount, to be distributed *pro rata* in settlement of their debts. Meantime, the estate would be protected under the deed of assignment with Mr. Hawkins as trustee. The following are creditors:—

	£		
Compton Technique	... 35	Electric Cables, Ltd.	... 22
Eaton & Sons ...	... 21	Shaw, J., & Sons ...	... 37

G. N. Jenkins, 195a, Earl's Court Road, S.W.5, electrical engineer, &c.—A meeting of creditors was held recently, when a statement of affairs was submitted showing liabilities of £963 and net assets of £710, leaving a deficiency of £253. The debtor commenced business in 1918, taking over an existing concern. He had traded mainly at a loss. He had no private assets, but in addition to the items in the statement of affairs, it was reported that there was work in hand from which some balance might accrue. A deed of assignment had already been executed in favour of Mr. A. H. Partridge, 3, Warwick Court, Gray's Inn, W.C., and this was confirmed.

C. L. F. Jones, electrical and wireless engineer, Colwyn Avenue, Rhos-on-Sea, and 14, Mostyn Street, Llandudno.—At a recent meeting of creditors it was stated that a deed of assignment was executed on May 13th last in favour of Mr. A. Sandford, Rhos Road, Rhos-on-Sea. The unsecured liabilities were returned at £708, against net assets of £235. It was believed, however, that the deficiency would only amount to £422. The creditors passed a resolution confirming the deed, subject to cash creditors for £180 withdrawing their claims. A committee was also nominated consisting of the representatives of Metro-Vick Supplies and the B.N.B. Wireless Co., Ltd. It was stated that the cash creditors were willing to withdraw their claims, with the result that the deficiency would be reduced to £242.

United States Radio Prices.

The *Manchester Guardian* says that a general reduction in the price of radio sets in America should follow the statement of an official of the Radio Manufacturers' Association at the annual trade show in Chicago. He predicts that in a few days the Radio Corporation of America will require royalties on only the radio "chassis," and not on the complete set, from its licensees. The plan will be retrospective as from April this year, and will mean a reduction of about 50 per cent. in some cases. The royalty hitherto has been 7½ per cent. on the complete receiver. According to advices from sales managers from all parts of the country this year's demand for sets will be greatly increased. Already orders exceeding £19,000,000 have been received. Last year about 2,000,000 new receiving sets were manufactured. The estimate for the 1929-30 season is 2,800,000.

Our Foreign Electrical Trade.

The following table shows the values of exports and imports of electrical goods and machinery during May, 1929:—

	May, 1929.	Inc. or dec. as compared with May, 1928.	5 months 1929. Inc. or dec.
Exports—	£	£	£
Electrical goods and apparatus	1,288,888	+296,207	+281,634
Machinery	5,527,880	+871,500	+528,611
(Inc. electrical machinery)	561,356	− 45,213	−110,357
Imports—			
Electrical goods and apparatus	434,557	+113,672	+334,412
Machinery	1,802,323	+429,869	+754,060
(Inc. electrical machinery)	184,128	+ 37,000	+ 15,645
Re-exports—			
Electrical goods and apparatus	22,779	+ 10,386	+ 9,003
Machinery	168,969	+ 14,385	+ 21,132
(Inc. electrical machinery)	13,928	+ 1,107	− 7,712

Social Events.

The third annual outing of the staff of Messrs. Robert Hornby & Co., Ltd., took place on June 15th. Some 60 members of the staff and friends travelled to Brighton by special saloon coaches. On arrival a visit was made to the recently re-opened Aquarium. After luncheon, Mr. A. O. Rixon proposed the toast of the chairman of the company, Mr. Hornby, in responding, referred to the co-operation which existed between the indoor and outdoor staffs and believed that this had a great deal to do with the success of the company. The toast of "The Representatives" was proposed by Mr. J. W. Brooks and responded to by Mr. Kilpatrick, the Scottish representative. Mr. Greaves proposed the health of the Visitors, and Mr. H. Porter Cox replied. The afternoon was spent in a series of bowls contests, which were thoroughly enjoyed. Altogether it was a very successful and enjoyable reunion, well carried out by the organiser, Mr. E. G. Meadows.

The seventh annual sports and gala of Messrs. Siemens Bros. and Co., Ltd., were held on June 15th at the company's sports ground, Park Lane, Charlton. Although the weather clerk was not so considerate as in previous years, heavy clouds threatening rain, the weather remained dry, and a large gathering of employés and friends were present to witness the events and to give vocal encouragement to the competitors. The friendly rivalry between the various departments was very keen, and exciting finishes were the order of the day. The programme was a large one, numbering 52 events, and the strict adherence to the time table reflected credit on the organisers. To those who desired a change from the excitement of the arena, side-shows offered many diversions and were well patronised. Sir William Bull, Bart., accompanied by Lady Bull, presented the prizes, which included many cups and medals, and they received a warm welcome. Music was provided during the afternoon by the Greenwich Royal Hospital School Band, and the proceedings were brought to a conclusion with an excellent concert given by "The Escalators" concert party.

The staff of Siemens Lamp Works, Preston, recently held an 18-hole medal play competition on the links of the Dick, Kerr Club at Ashton Park. The competition was for the "Dr. Wright Prize," and the successful competitors were Messrs. S. Facer (75), W. Higginson (77) and J. W. Laurence (82).

The Midland Electric Manufacturing Co., Ltd., attained its majority during the current year, the company having been incorporated in 1908. The occasion was celebrated by several functions. There was a dinner at the Midland Hotel, at which all the executive staff and outside representatives were present, followed by a musical evening, at which there were present five of the small band who helped to found the company and are still with it. There were also present about 50 who had been employed by the firm for 10 years and over, to whom commemorative presentations were made. On the following day, by invitation of Mr. W. L. Barber, the founder of the firm and managing director, a visit was paid to his country house in Wyre Forest, one of the beauty spots of the Midlands.

Proposed German Tariff Reductions.

Under an arrangement additional to the German-Swiss commercial treaty, it is proposed to reduce the duties of a number of articles upon importation into Germany. The duty on automobile headlights is to be 120 Reichsmarks per 100 kg.; and that on "dynamos and magneto dynamos for motor vehicles and stating motors for combustion engines," is to be reduced to 110 Rmk. per 100 kg. The duties on electric cooking apparatus are to be as follows:—Appliances weighing more than 100 kg. and up to 500 kg.: 50 Rmk. per 100 kg.; weighing more than 500 kg.: 40 Rmk. per 100 kg. The duty on "magnetic ignition apparatus" is fixed at 160 Rmk. per 100 kg. In the list of reciprocal reductions in the Swiss tariff there is a new one providing that dynamos and electric starters and combinations of these are not to pay more than 110 fr. per 100 kg.; and "dynamo-magnets and magnetos for sparking" are not to pay more than 170 fr. per 100 kg.

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New Catalogues and Lists.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Leaflet No. 1701 drawing attention to "RM" type solenoid operated brakes for a.c. and d.c. service.

D.P. BATTERY CO., LTD., Bakewell, Derbyshire.—A well-produced and illustrated booklet dealing with "Kathanode" traction cells and indicating the many purposes for which the batteries are employed.

MESSRS. ROBEY & CO., LTD., Globe Works, Lincoln.—Pamphlet No. 513, containing illustrations of the company's products, including steam and oil engines, boilers, water heaters, &c.

MESSRS. D. H. BONNELLA & SONS, LTD., 46 and 48, Osnaburgh Street, N.W.1.—A catalogue of motor-car accessories, including roof lamps of many designs, dashboard lamps, inspection lamps, switches, &c. Illustrated and priced.

MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Denmark Street, W.C.2.—Leaflet No. VT. 13/1a, illustrating silica transmitting valve type RO/2.5 kW, and Leaflet No. W.A. 22, dealing with Mansbridge condensers.

HARLAND ENGINEERING CO., LTD., 196, Greengate, Manchester.—List No. X. 64/283, illustrated and priced, giving particulars of ironclad distribution fuseboards.

MICA MANUFACTURING CO., LTD., Bromley, Kent.—A catalogue of mica, micanite and bakelite insulating material, describing the uses to which this insulation can be applied. A price list is included.

MESSRS. J. STONE & CO., LTD., Deptford, S.E.14.—An illustrated card giving particulars of copper furnace pans or washing coppers.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—List No. 213 of Philips automobile lamps giving reduced prices.

LONDON ELECTRICAL CO., 1, Sherborne Lane, King William Street, E.C.4.—Four pamphlets dealing with "Ritsema" and "Goblin" vacuum cleaners, "Con-venient" lamp fittings, electric fans, and "Rayflect" daylight signs. Illustrated and priced.

AGRICULTURAL & GENERAL ENGINEERS, LTD., Aldwych House, Aldwych, W.C.—A booklet entitled "Plucking by Machine," published by the associated company, Messrs. E. H. Bentall and Co., Ltd., and dealing with the Bentall-Kingdon method of plucking poultry.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet F 4977, illustrating G.E.C. Bakelite pendants. Priced.

DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, Middlesex.—Two descriptive pamphlets dealing with the "Union" recording calorimeter, and the M.S. time-temperature regulator.

WHOLESALE ELECTRIC LAMP CO., LTD., 37, Vauxhall Bridge Road, S.W.1.—Illustrated leaflet giving particulars of the revised prices of "Royalstone" fittings.

XETAL PRODUCTS, LTD., King Street, Long Eaton, Nottingham.—A pamphlet drawing attention to Xetal impregnated transmission and conveyor belting, and including a price list.

DRAKE & GORHAM, LTD., Rockingham Works, Newington Causeway, S.E.1.—Descriptive List No. 102, dealing in an interesting manner with e.h.p. ring main controllers and "Metesco" oil switch fuses.

FERRANTI, LTD., Hollinwood, Lancs.—A well-produced catalogue illustrating the company's fires, and including a new price list.

MESSRS. GEO. BRAY & CO., LTD., Leeds.—Catalogues Nos. C.3A, C.4, and C.5, drawing attention respectively to Chromalox immersion heaters, radiators, and heating units. Illustrated and priced.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Leaflet 35f, illustrating and describing "Pul-syn-etic" electric impulse clocks and "time discipline" apparatus. Priced.

P.O. Employés and the Merger.

The *Daily Herald* reports that the opposition of the Post Office Engineering Union to the transfer of beam and wireless employés from the State to the Imperial Communications Company was referred to in a report submitted to the conference of the union at Glasgow on June 12th. It was stated that very few of these employés had taken advantage of the option to transfer. The terms offered by the company were not so good as those recognised by the State and were condemned as inadequate by the union. The Union of Post Office Workers and the Post Office engineers were still negotiating with the company in the hope of getting more satisfactory terms.

The F.B.I. and Australian Trade.

Following upon a study of the report of the recent Economic Mission to Australia, led by Sir Arthur Duckham, K.B.E., the Executive Committee of the Federation of British Industries has made a number of recommendations with regard to Anglo-Australian trade. In the first place the Economic Mission is requested to convey to the proper quarters in Australia an expression of the hope that representatives of primary producers and industrialists from Australia will visit Great Britain in the near future, for the purpose of investigating the possibility of increasing the sale of Australian primary products in the United Kingdom, and the capacity of Great Britain to supply Australia with those goods which she is not in a position to manufacture herself. The F.B.I. places its organisation at the disposal of such visitors. It is also suggested that individual trades should consider the desirability of sending representatives to Australia, with the object of examining the question of what types of goods can, with economic advantage, be manufactured in Australia, and of exploring the possibility of British initiative and capital co-operating in this direction. In the case of goods which Australia would not be capable of manufacturing economically and would consequently have to import, these representatives, it is hoped, would be able to prove that Great Britain was fully capable of supplying them and that it was to the interest of both countries that on these goods a substantial and effective preference should be granted to British manufacturers. Finally, the Federation expresses the hope that no opportunity will be lost by His Majesty's Government of following up the valuable work performed by Sir Arthur Duckham's Mission, with special reference to the question of facilitating trade between the two countries and of endeavouring in collaboration with the Australian authorities to reconcile any divergence of interest.

Trade Announcements.

Messrs. ROUCH & PENNY, electrical engineers and contractors, have removed to larger premises at 8, Old King Street, Broadmead, Bristol. They ask for up-to-date catalogues.

The ELECTRIC HOMES CO., dealers in electric lighting fittings and domestic appliances, have opened premises at 73, Park Street, Bristol.

The CLEAN COAL CO., LTD., has removed to Medway House, Horseferry Road, S.W.1.

New offices and works are being erected for the PYRENE CO., LTD., on the Great West Road, Brentford.

The Nottingham branch of PHILIPS LAMPS, LTD., is being removed to larger premises, on June 24th, at Trivetts Square, Short Hill, Nottingham. (Telephone: 40581, as before.)

It is announced that the business of EDWARDS & ARMSTRONG, LTD., electrical engineers and contractors, has been merged as from May 31st with the Western Electricity Supply Co., Ltd., whose head office is at Cainscross, Stroud.

Messrs. DRAKE & GORHAM, LTD., state that Messrs. Pooley and Austin, 34, Broadway, Westminster, S.W.1, are their agents for the sale of e.h.p. and l.p. switchgear in London and the South-Eastern Counties.

Messrs. GEORGE ELLISON'S Manchester branch office is now at No. 1, Dickinson Street. The telephone number (City 5964) and telegraphic address ("Starters Manchester") are not altered. A representative selection of Ellison switchgear has been arranged for inspection in these new offices.

Book Notices.

"*Journal* of the Institution of Electrical Engineers," Vol. LXVII., No. 390. June, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Blue Print Reading," by W. W. Sturtevant. Pp. xi+135; 64 figs. Price 9s. 6d. net; "Direct-Current Electricity," by L. Raymond Smith. Pp. xi+262; figs. 272. Price 10s. net. London: McGraw-Hill Publishing Co., Ltd.

"Memoirs of the College of Engineering, Kyoto Imperial University." Vol. VI, No. 1, March, 1929: "Theoretical and Experimental Researches on Electric Resistance Welding."

Australian-American Trade.

The May *Journal* of the British Empire Chamber of Commerce in the United States of America reports that the Australian Government has submitted to the State Department at Washington, through the British Embassy, a memorandum setting forth certain existing inequalities in the commercial dealings of the two countries, and to the strong disinclination of the Australian people to submit quietly to an aggravation of this condition by the imposition of higher American duties. The memorandum, which is quite definite and precise, points out that trade between the Commonwealth and the United States is already excessively one-sided, that the adverse balance —now in excess of $111,000,000—is increasing, and that changes in the American tariff, calculated to still further reduce imports from Australia, will mean the diversion of Australian trade from the United States to other countries.

Local Exhibition.

WELLINGBOROUGH.—The Northampton Electric Light and Power Co., Ltd., and its two associated companies, the Wellingborough Electric Supply Co., Ltd., and the Rushden and District Electric Supply Co., Ltd., provided an admirable exhibition at the recent Northamptonshire County Agricultural Show, Wellingborough. The show occupied a very suitable site by the side of the main Wellingborough-Northampton road. The arrangements were carried out by Mr. W. E. Watson, A.M.I.E.E., who was in charge. The stand demonstrated the uses of electricity for agriculture, farming, and in the home. Apparatus was loaned by the Wolseley Sheep Shearing Machine Co., Ltd., Messrs. Drake & Gorham (electrical pumps), the British Thomson-Houston Co., Ltd. (portable farm motor), and Young, Osmond & Young (greenhouse and tubular heaters). Chaffcutters, milk separators, &c., were supplied by Messrs. Ennals & Cooper, Northampton. Electric cookers, hot-water apparatus, cleaners, ironing and washing machines and other domestic apparatus were well displayed. Use was made of E.D.A. and other posters.

Marconi House to be Sold.

Consequent upon the cable-wireless merger, Marconi House, Strand, is being offered for sale.

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Recent Contracts.

An order has been placed by the Racecourse Betting Control Board with the D.P. BATTERY CO., LTD., for six 100-V, 500-ampere-hour "Kathanode" batteries for operating Totalisators, which will be mounted on lorries for transport to and from different racecourses.

Park Royal Hospital has just been equipped with a specially designed "Marconiphone" radio installation. Seventy loud speakers and 400 headphones are provided, and in addition to radio programmes, gramophone record recitals are possible by means of a pick-up.

Trade with Belgium.

The British Consul at Liége (Mr. F. O'Meara) has furnished the Department of Overseas Trade with a confidential memorandum on some aspects of trade and industry in Eastern Belgium, with particular reference to the appointment of agents in this market. Copies of the memorandum may be obtained by any United Kingdom firms interested, on application to the Department.

South African Mines' Imports.

According to the *South African Mining and Engineering Journal*, last year the South African mines purchased imported goods valued at £6,473,922 (in addition to local products valued at £11,268,061). Of this total, electrical machinery accounted for £483,081, and electrical machinery, spares and fittings for £156,347. The value of the electrical energy purchased during 1928 is given as £1,816,971.

Cables at the Newcastle Exhibition.

BRITISH INSULATED CABLES, LTD., states that it supplied, laid and jointed the whole of the cables for power and lighting at the North-East Coast Exhibition, Newcastle.

Unemployment.

A decrease of 32,181 in the number of registered unemployed was recorded for the week ended June 3rd. The total at that date was 1,100,100, as compared with 1,132,281 on May 27th, and 1,160,049 on June 4th, 1928.

Deed of Assignment.

F. THORNTON (T. Thornton & Co.), electrical engineer, 8, Croft Street, Burnley.—Particulars of claims by June 22nd to the trustee, Mr. F. Clarkson, Bank Chambers, 7, Hargreaves Street, Burnley.

An E.T.B.I. Competition.

A competition of a somewhat novel character is being organised by the Electrical Trades Benevolent Institution. We hope to give some particulars of the competition, and of the many prizes which are being awarded, in an early issue.

An Illumination Design Course.

The 19th Illumination Design Course which was held in London last week proved to be the most successful of the series. Representatives of the electrical contracting industry predominated, there being 50 of them. There were 46 manufacturers' representatives and 24 from supply authorities.

Wireless Apparatus for Italy.

It is reported from Genoa that owing to certain developments in connection with broadcasting an active demand has arisen for wireless sets, and that Italian manufacturers have been unable to cope with it. While German and American firms have been busy in endeavouring to supply this demand, it is said that the British wireless apparatus industry is not as widely represented in that part of Italy as the situation at present warrants. Alternating current sets should be supplied. Condensers and loud speakers are imported separately, as also are valves and headphones.—*The Times Trade and Engineering Supplement.*

Glasgow Rate Increases

The Glasgow valuation roll shows, *inter alia*, that as a result of the recent reassessments of property the ratable value of the electricity undertaking has been increased by £49,276 to £268,642; that of the tramways by £10,973 to £200,983; and that of the Clyde Valley Electrical Power Co. by £1,956 to £42,174.

New French Company.

A company has been formed at Douai, with a capital of two million francs and the title La Société des Secteurs Electriques du Nord et du Pas de Calais, to extend the electricity distribution systems in those Departments.

German Foreign Electrical Trade.

The imports of electrical machinery, apparatus and fittings into Germany during the first three months of this year attained a value of £587,700, as compared with £584,100 in the corresponding quarter of 1928. The exports of similar material of German manufacture advanced during the same periods from £5,888,250 to £6,581,950.

For Sale.

Messrs. Flick & Son will sell by auction at the power station, Orford, on June 28th, electrical plant and equipment consequent upon the dismantling of the station. (See our advertisement pages to-day.)

Prices of Materials.

Messrs. James Forster & Co., reporting on June 15th, stated that the lead market last week was very quiet, transactions being mainly professional. Demand from consumers has not been active, though a fair consumption is taking place, most of the buying being of a hand-to-mouth character. Arrivals have not been quite so plentiful recently, so that early lead is in demand, but it is anticipated that considerable quantities will arrive during the next six weeks. There seems nothing in the position to anticipate any great movement either way in the near future. The Board of Trade returns for May show:—Imports, 26,483 tons; exports, 3,912 tons; leaving for home consumption, 22,571 tons.

Messrs. F. Smith & Co. report, June 18th: Copper (electrolytic) bars, £84 10s., 5s. dec.; do. do. sheets, no change; do. do. wire rods, £94 10s., 5s. dec.; do. do. h.c. wire, 11⅝d., 1/16d. dec.

Messrs. James & Shakespeare report, June 18th: No change in copper bar, sheet and rod, or English pig lead.

Messrs. Edward Till & Co. report, June 18th: India-rubber, Para fine, 11d., ¼d. dec.

Lighting and Power Notes.

Bradford.—LOAN.—The Corporation Electricity Committee is seeking sanction to a loan of £5,000 for the erection and equipment of a transformer chamber at Harrogate Road.

Blackpool.—LOANS.—The Corporation has received sanction to a loan of £8,000 for the purchase of cookers, &c., to be let out on hire. Application is to be made for sanction to a loan of £25,000 for a change in the frequency of supply.

Birkenhead.—LOAN.—Application is to be made by the Corporation Electricity Committee for sanction to a loan of £5,966 for the supply of electricity to Puddington and Burton.

Burton-on-Trent.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. T. Hall) for the year ended March 31st last show a total income of £110,839, as compared with £97,173 in the preceding year. Working expenses amounted to £56,359, as against £48,703, leaving a gross profit of £54,530 (£48,470). After providing for loan charges, &c., and capital expenditure charged to revenue, there was a net surplus of £3,374, as compared with £6,152 in 1927-28. A contribution of £3,175 was made to the borough fund. The electrical energy sold increased from 17,334,309 to 21,062,528 kWh, and the maximum supply demanded from 6,100 to 7,750 kW. The average price obtained per kWh fell from 1.31d. to 1.22d. The additional load connected during the year amounted to 3,011 kW, of which the domestic load accounted for 2,303 kW.

Clayton.—COOKER HIRING AGREEMENT.—The Urban District Council recently approved a recommendation that the Electricity Committee should enter into an agreement with Bradford Corporation Electricity Department—subject to confirmation by Bradford City Council—for hiring electric cookers at Clayton on a yearly instalment system. The agreement is subject to reconsideration in two years if Clayton is not by that time incorporated with Bradford.

Continental.—RUSSIA.—The Expert Committee of the Central Electrotechnical Council has approved a scheme for the construction of a power station in the vicinity of the Mt. Visheri, which will include four turbo-generators, each of 70,000 kW. It is proposed to use peat as fuel, the resources of which are stated to be sufficient to last for 40 years. The energy from the new station will be transmitted to Leningrad along a line about 84 miles in length, at a pressure of 220,000 V. It is intended to convey the peat a distance of approximately 28 miles to the site of the generating station by means of an electric railway. Work on the station will be begun this year, and is expected to be completed in six years, the total expenditure being estimated at 101,000,000 roubles. Next to the Dnieper station, now in course of construction, the new station will be the largest in the country.

ITALY.—A concession has recently been granted for the establishment of a station near Terni to utilise the water power of the River Velino. It is estimated that 146,000 h.p. is available.

AUSTRIA.—In a recent issue of *Electrotechnik und Maschinenbau*, of Vienna, the subject of utilising the power for electricity generating purposes of that portion of the River Danube in Austrian territory is dealt with. A scheme is suggested for the construction of 13 hydro-electric stations which would be capable of supplying 5,450 million kWh per annum.

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It is estimated that a minimum of 626,000 h.p. would be available throughout the year.

FRANCE.—Work has recently been commenced by the Société des Forces Motrices du Vercors and the Société Générale de Force et Lumière on the establishment of a new hydro-electric station on the River Isère at Pizancon. The plant will have an output of 150 million kWh per annum.

Croydon.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £1,367.

PURCHASE OF APPARATUS.—The Corporation Electricity Committee has authorised the expenditure of £11,000 for the purchase of apparatus for hire.

POWER STATION SITE EXTENSION.—The Corporation has made application to the Electricity Commissioners for sanction to extend the site of its generating station by the addition of various adjacent lands.

Darlington.—REVISION OF CHARGES.—The Corporation Electricity Department has introduced the following new scale of electricity charges:—Lighting: ½d. per kWh during the lighter eight months, and 3d. per kWh during the darker four months, as against the former charge of 1½d. per kWh for the lighter months, and 1¾d. per kWh during the darker months for half the electricity consumed during the lighter months and 3½d. per kWh for the remainder. Heating and power: 1¼d. per kWh during the darker four months and ½d. per kWh for the lighter eight months. Power: (A) £2 12s. 0d. per kW of maximum demand and ¼d. per kWh for electricity consumed; (B) 1d. per kWh for 2,000 kWh per quarter and 11/16d. per kWh for the remainder. Lighting, heating or power between 11 p.m. and 7 a.m.: Time switch charge plus ⅜d. per kWh. Outside electric signs from dusk to 10.30 p.m.: 2d. per kWh during the darker months and ½d. per kWh during the lighter months. Late shop window lighting: 1½d. per kWh during the darker months, and ½d. per kWh during the lighter months. Where the supply is d.c. the above power charges are increased by 5 per cent., and where the power factor is less than 0.8 an additional charge of 30s. per annum is made for each kVA by which the demand in kVA multiplied by 0.8 exceeds the demand in kW. There are also special charges for unconverted e.h.p. supply and for lighting where the latter demand does not exceed 20 per cent. of the maximum power demand.

Dewsbury.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £7,164 in connection with the new Infirmary and district electricity scheme.

Grange-over-Sands.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £5,000 for electricity extensions, which will enable the Council to complete the mains to all parts of the district.

Hastings.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has arranged to provide a supply of electricity to Staplecross Village and Cripps Corner at a cost of £5,362.

LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £2,500 for services and £1,500 for transformers.

Kendal.—LOANS.—The Town Council has received sanction to a loan of £5,000 on account of the sum required for feeder and distributing mains, and a further loan of £10,000 for a similar purpose has been applied for.

ELECTRICITY SUPPLY SCHEME.—The Council has appointed Mr. J. E. Storr to prepare a scheme for the transmission and distribution of electricity over the area covered by the South Westmorland Rural District Council, with the exception of the district covered by the Order of the Windermere and District Electricity Supply Co., Ltd.

Liverpool.—YEAR'S WORKING.—We have received a copy of the accounts of the city electricity undertaking (engineer: Mr. P. J. Robinson) for the year ended March 31st last. The total revenue amounted to £1,350,688, as compared with £1,288,038 in the preceding year. Working expenses and special charges against revenue totalled £754,021, as against £814,155, and there was a gross profit of £596,667 (£473,883), to which was added a contribution of £3,290 to the sinking fund by the Housing Committee, making a total of £599,957 available. This was disposed of as follows: Interest, £248,825; repayment of loans, £533; contribution to Bootle Corporation stock redemption fund, £1,485; sinking fund contribution, £188,286; contribution to city rate, £50,000; renewal fund, £110,827. The capital expenditure during the year amounted to £833,529, and included £340,927 for lands, £252,534 for machinery, and £243,959 for mains. The total spent on the undertaking is now £7,482,866.

London.—ST. PANCRAS.—The Electricity and Public Lighting Committee has recommended the extension and replacement of mains at an estimated cost of £11,480, and that application be made to the Electricity Commissioners for sanction to a loan for this work.

Northern Ireland.—HOLYWOOD, CO. DOWN.—The Town Council has decided to apply for sanction to a loan of £10,000 for electricity services.

CLONES (CO. MONAGHAN).—At a meeting of the Clones Electric Light & Power Co., Ltd., held recently, it was announced that the company had come to terms with the Electricity Supply Board, and as a result the shareholders would receive £1 11s. for each £1 share. The Electricity Supply Board has taken over control of the undertaking as from June 1st.

Norton.—OBJECTION TO ORDER.—The Rural District Council Council has decided to make formal objection to the application of the Holderness Trust, Ltd., for a Special Order to supply electricity within the Council's area on the grounds that there is only a small number of villages which could be supplied, and that the time allowed for consideration of the Order was not sufficient. The Council has also decided to call a conference of local authorities concerned, with a view to concerted action. The clerk states that the Northern Counties Electricity Supply Co., Ltd., which had been granted powers for the supply of electricity within the Norton urban and rural districts and was preparing a scheme, also intended to object to the application.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

CORWEN.—*Corwen Electric Light Co.*—Power: From 4d. to 1½d. per kWh.

STAMFORD.—*Urban Electric Supply Co.*—Lighting: To 9d. per kWh. Power: 3d. per kWh. Domestic heating: 2d. per kWh. The reductions are subject to the Town Council accepting the suggestions of the company to grant it a monopoly for 40 years.

WINCHESTER.—Lighting: Flat rate, from 7d. to 6½d. per kWh. Prepayment meters, from 7½d. to 7d. per kWh. Business lighting: From 9d., 5d., and 2d. per kWh to 9d., 4d., and 2d. Ratable value and maximum demand tariffs to be discontinued, and instead the following two-part tariff to be adopted: Living rooms assessed at a fixed charge of 3s. per room per quarter for the summer quarters, and 6s. per room per quarter for the winter quarters, plus a flat rate of 1½d. per kWh.

GLASGOW.—Two-rate tariff: Primary rate 6d. per kWh, secondary rate ¾d. per kWh. Commercial lighting: Primary rate 6d. per kWh, secondary rate 1d. per kWh, the primary rate to be based on 600 hours' use per annum of the maximum demand for lighting, with a minimum of 60 kWh. Industrial power:—Small power rate: Primary rate 2d., secondary rate 1d. per kWh. Large power rate: 1½d. for first 100,000 kWh, 1d. for second 100,000 kWh, and ¾d. per kWh above. A new domestic tariff has also been introduced.

BURY ST. EDMUNDS.—Domestic lighting: From 6½d. to 6d. per kWh, less ½d. per kWh discount, making 5½d. net. Power: Consumption up to 2,500 kWh per quarter 3¾d. per kWh, less 20 per cent., instead of 5½d. per kWh up to 500 kWh per quarter. Business premises (alternative tariff): £15 per annum per kW, plus 1½d. per kWh.

CARSHALTON.—*Correction.*—In our note under this heading in our issue of June 7th, we gave the name of the supply authority as the South Metropolitan Electric Light & Power Co., Ltd. This, of course, was incorrect, as the South Metropolitan Electric Tramways and Lighting Co., Ltd., is the supply authority for the Carshalton area.

South Africa.—CAPETOWN.—According to Mr. Geo. H. Swingler, the city electrical engineer, the electricity undertaking was inaugurated in 1895, and the present Dock Road power station was opened in 1904 with an installed capacity of 2,000 kW. To-day the total capacity of the plant is 28,500 kW, including two 3,000-kW and three 7,500-kW turbo-alternator sets. In 1928 the electrical energy generated was 53,727,896 kWh more than in 1917. Apart from transformer pillars and similar distribution points, there are 55 sub-stations in operation, and the 7,900 street lamps in use have a combined candle power of 770,000. The number of meters in service exceeds 30,700.

Special Orders.—The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Electrical Distribution of Yorkshire, Ltd., to supply electricity in the urban district of Cudworth and the township of Billingley; Bristol Corporation to supply electricity in parts of the rural districts of Chipping Sodbury, Thornbury and Keynsham; and the Power Development Co. to supply electricity in the urban districts of Crewkerne and Ilminster and parts of the rural districts of Chard, Yeovil and Beaminster.

St. Helens.—NEW ELECTRICITY CHARGES.—The Electricity Committee has adopted the following new scale of domestic charges:—Premises having a ratable value of £40 and under, a fixed charge of 10 per cent. per annum on the ratable value, plus 0.9d. per kWh; premises having a ratable value of over £40, a fixed charge of 12½ per cent. per annum on the ratable value, plus 0.9d. per kWh, with a minimum annual payment of £2 10s.; as an alternative, a fixed charge of 20 per cent. per annum on the ratable value, plus ½d. per kWh, with a minimum payment of £4 per annum.

Stokesley.—ELECTRICITY SUPPLY.—At a recent meeting of the Rural District Council it was stated with regard to the proposed electricity supply to the Cleveland area of Great Ayton and Stokesley by the Cleveland and Durham Electric Power, Ltd., that the Corporation of Thornaby was insisting that a portion of the trunk line to Stokesley running through the

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outskirts of the borough should be laid underground where it crossed roads, while Great Ayton Parish Council demanded that all-metal standards instead of wooden posts should be used in the village. The clerk expressed the fear that the objections would hold up the supply of electricity to the area proposed, and stated that the company was not prepared to place the cables underground in the Thornaby area as it was complying with Government regulations in taking the cables over highways not much used. It was decided to defer the consideration of the plans presented by the power company, pending a reply from the Electricity Commissioners, to whom a protest had been sent.

Winslow.—ELECTRICITY SUPPLY.—The Rural District Council has approved a scheme submitted by the Northampton Electric Light and Power Co., Ltd., for a supply of electricity. It is hoped to obtain a supply by next winter.

Worksop.—SPECIAL ORDER.—The Urban District Council has applied for a Special Order to include Whitwell in its area of supply. There are about 40 prospective consumers, and the cost of the scheme will be £8,689.

LOAN.—The Council has applied for sanction to a loan of £13,652, part of which is for a main transmission line linking Manton Colliery with Rhodesia, which will pass close to Whitwell.

Tramway and Railway Notes.

Birmingham.—CAR RENOVATION.—It is proposed shortly to recondition a further 500 of the Corporation's tramcars. The renovations include the use of chromium-plated fittings and attractive upholstery. Special lighting arrangements will be installed.

Burton.—TRAMWAY ABANDONMENT.—At a meeting of the Town Council held on June 13th, it was decided to discontinue the tramway services and replace them as soon as possible by 'buses. It was stated that since the tramways were inaugurated 25 years ago the ratepayers had had to make good losses amounting to £66,000. Furthermore, had the tramway services been continued, a further sum of £28,000 would have had to be spent on renewals, with no hope of meeting expenses.

Cardiff.—EXTENSION OF TIME.—The Corporation is to make application to the Ministry of Transport for a prolongation of time to July 29th, 1930, within which to construct Tramway No. 4.

Continental.—FRANCE.—It is reported by the Paris correspondent of *The Times* that a proposal to abolish four further lines of Paris tramways and to substitute for them motor-omnibus services was adopted by the Permanent Traffic Committee on June 13th. The lines which are thus to disappear are those which connect La Muette, Boulogne, Neuilly-Saint-James, and Charlebourg with the Madeleine; all cross the section of the city where the traffic is at its heaviest. Their abolition is part of a general programme to abolish tramways on the main routes and to remove the tramway termini from the centre of the city. The Director of Traffic at the Prefecture of the Seine, explains that wherever it is possible to substitute a service of motor-omnibuses for tramways this is being done, and every effort is being made gradually to restrict the latter to the areas outside the outer Boulevards. Whereas in 1923 the tramways and motor-omnibuses carried more passengers than the "Metro" or Underground railway, the latter now carries in the year 140,000,000 passengers more than the two together. Schemes for the reorganisation of Parisian traffic as part of a scheme for the rearrangement of the administration of the city are now being prepared, and the whole question of the tramways in their relation to traffic is being reviewed.

HOLLAND.—The authorities of the Dutch Railways recently decided to proceed with the electrification of the railway between Amsterdam, Uitgeest, and Alkmaar in North Holland and with the branch line between Uitgeest and Velsen.

Doncaster.—RAILLESS CARS.—The Town Council has decided to convert three tramway routes to the railless-car system, with an extension along Carr House Road to connect with the Racecourse route.

Glasgow.—PINKSTON STATION.—The Corporation Tramways Sub-Committee on Works and Stores on June 12th decided to recommend that tenders should be invited for the reconditioning of the plant at Pinkston power station at an estimated cost of £200,000. Recently the Electricity Commissioners refused permission to the Tramways Committee to extend the plant, the cost of that scheme being £237,000. The view was expressed at the sub-committee meeting that the Commissioners had no powers to prevent the Department from reconditioning existing plant so long as no actual extensions were made.

Greenock.—TRAMWAY ABANDONMENT.—The Minister of Transport has authorised the abandonment of the tramway system of the Greenock and Port Glasgow Tramways Co., and the substitution of 'bus services as from July 16th, 1929.

Haslingden.—PROPOSED TRAMWAY ABANDONMENT.—At a meeting of the Town Council, held recently, the Town Clerk reported on a conference of the joint representatives of Haslingden, Accrington, and Rawtenstall Corporations regarding the joint tramway undertaking and the substitution of omnibuses. The urgency of the question had been impressed on the representatives of Accrington and Rawtenstall, who said that their Councils had not yet considered the matter. The Town Clerk was instructed to obtain consent for the running of omnibuses by Haslingden Corporation between Accrington and Bacup.

Northern Ireland.—BELFAST.—At a meeting of the City Council held recently, reference was made to the accounts of the tramway undertaking for the year ended March 31st last. In spite of a heavy loss of revenue due to competition of privately-owned 'buses, the undertaking was able to end the year with a profit. When the private 'buses were taken over on December 5th last the actual deficit on the trading of the undertaking up to that date amounted to £18,140, and the trams were being run at a loss of £2,000 a week. Had the Tramways Committee been unable to check this weekly loss there would have been at the end of the financial year a loss of £48,000, instead of which the final accounts showed a profit of £10,404.

Southport.—YEAR'S WORKING.—We have received from Mr. T. J. Kendrew, general manager of the Corporation tramway undertaking, a copy of his report, together with a statement of accounts for the year ended March 31st last. The total revenue was £71,172, as compared with £75,057 in the previous year. Working expenses totalled £54,562, as against £57,556, leaving a gross profit of £16,610 (£17,300). After providing for capital charges there was a net surplus of £5,709, as compared with £3,544 the previous year. The number of passengers carried decreased from 13,489,878 to 12,896,830, but the car miles run increased from 1,186,337 to 1,197,326. The total revenue per car mile fell from 15.184d. to 14.266d.

Telegraph and Telephone Notes.

Bolivia.—COMMUNICATION SERVICES.—It is estimated that there are now 6,986 miles of telegraph wire in operation in Bolivia, or only 2.7 miles per 1,000 inhabitants. Of telephones, only 1,824 instruments are in use, or only 0.7 per 1,000 of the population.

International Telephony.—SWEDISH-ITALIAN CONNECTION.—The Swedish State Telephone and Telegraph Department has added a new link to its net of international connections by opening telephone communication with Italy, one of the longest telephone lines in Europe, about 3,000 kilometres (about 1,865 miles) in length. The Swedes can now telephone to all countries in Europe, except the Soviet Republic and the Balkan States, besides the United States, Canada, Cuba, Mexico, Buenos Aires, and Ceuta, Morocco. Sweden now has 490,000 telephones, or 80 per 1,000 persons, while the metallic telephone lines have a total length of 860,000 kilometres (about 534,493 miles). Even little villages in the most remote districts have telephones. Stockholm, with 297 telephones per 1,000 inhabitants, is surpassed only by one city in the world, *viz.*, San Francisco.

Jugo-Slavia.—TELEPHONE SYSTEM.—It is reported that the Swedish American Match Trust, which recently obtained a match monopoly in Jugo-Slavia by making a loan to the Government of 30,000,000 dollars, has now offered an additional loan for an exclusive contract to rehabilitate the country's telephone and telegraph systems. If the offer is accepted, Jugo-Slavia will join the growing list of European countries that have entrusted their State telephone and telegraph services to private, or semi-private, bodies to be run on business lines, with a responsibility to the Government to provide an efficient and ample service.

Northern Ireland.—TELEPHONE CABLE.—Ballyhornan Bay, midway between Ardglass and Strangford, Co. Down, was the scene of activity on June 11th, when the cableship *Faraday* commenced to unload the last of the 60 miles of cable which is to be used for telephone communication between England and Northern Ireland. The new line will be connected with England *via* the Isle of Man, the other section having already been laid by the *Faraday* between Norbeck, near Blackpool, and Greenaugh, I.O.M.

On June 13th the second of the two new cables which are being laid to connect Northern Ireland with England *via* the Isle of Man was put on shore at Ballyhornan, on the South Down coast.

AUTOMATIC TELEPHONY.—A new rural telephone exchange has been opened for service at Aughnacloy in the Clogher Valley, County Armagh. It is the first automatic exchange to be completed in Northern Ireland.

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United States.—RADIO COMMUNICATION.—An extension of the operations of the Radio Corporation of America is forecast in an announcement by General J. G. Harbord, president of the Corporation, who has stated that plans have been made for the immediate establishment by the Corporation of a domestic wireless system to serve the United States through stations in 14 strategic cities, the number of which will be increased later. They will compete with leading telegraph companies; the recent grant of ten exclusive wireless channels, with five jointly shared channels, will be operated by the Radio Corporation's subsidiary concern, Radio Corporation American Communications, Inc., which is expected to act as a United States connection for the Radio Corporation's service to Europe, South America, and the Orient.

CENSUS OF TELEGRAPHS AND TELEPHONES.—According to data collected at the quinquennial census of electrical industries in 1928 by the Department of Commerce, the total number of messages transmitted in the United States by land and ocean telegraphy (excluding wireless) amounted to 229,511,278 in 1927, an increase of 20.1 per cent., as compared with 191,121,333 reported for 1922. The mileage of single wire in use in 1927 was 2,152,230, exceeding by 16.1 per cent. the mileage reported for 1922, which was 1,853,250. The increase in mileage of ocean cable was 36.3 per cent., from 76,711 nautical miles in 1922 to 104,541 nautical miles in 1927. The total number of telephones in use at the end of 1927 was 18,522,767, an increase of 29.1 per cent., as compared with 14,347,395 reported for 1922. The total number of calls made in 1927 was 31,614,172,621, representing an increase of 28.3 per cent. over the 24,647,560,860 made in 1922. The wire mileage, aggregating 63,836,182 in 1927, exceeded by 71.3 per cent. the corresponding mileage of 37,265,958 reported for 1922.

Radio Notes.

Australia.—PLANT CONTRACT.—The Commonwealth Government has accepted the tender of Standard Telephones and Cables, Ltd., for supplying and installing British-made plant at two subsidiary stations under the new national broadcasting scheme, capable of covering almost the whole of Australia. The decision is surprising because Amalgamated Wireless, Ltd., in which the Federal Government holds a controlling interest, which is associated with the Marconi interests, submitted a tender. Before making a final decision the Government took legal advice as to its obligations under the wireless agreement. It is proposed shortly to place a contract for two more stations.

Holland.—NEW COMPANY?—A new Dutch programme company, the H.I.R.O., which seeks to propagate the "humanitarian and idealistic," has been formed. The members of its committee have applied to all the existing radio companies for a proportion of their transmitting time, and, should their request be refused, hope to erect their own station.

WIRELESS CONFERENCE.—The Dutch Government has invited the United States to send representatives to a meeting of the International Technical Consulting Committee on wireless communication to be held at The Hague on September 19th. The State Department, U.S.A., has announced that if Congress approves of the expenses of participation, Government experts will be sent.—*Reuter's* (Washington).

SHORT-WAVE STATION.—Messrs. Philips Lamps, Ltd., inform us that recently tests have been made at Huizen (Holland) with a new short-wave transmitting station (PHI) working on a wave-length of 16.88 m. which is intended for working with the Dutch Indies, the service being under the control of the "Philips Omroep Holland Indie," abbreviated to "Phohi." The transmitter, by reason of its maximum anode output of sixty kilowatts, is claimed to be the world's most powerful short-wave station, and it is the second broadcasting station to be erected by Messrs. Philips, the first being their well-known station PCJ.

United States.—RADIO CENSUS.—Characterising the action of the House in opposing the Dill measure calling for a census of radio sets as a "flagrant disregard for the industry's most vital need," Mr. Edgar H. Felix, radio consultant to the National Electrical Manufacturers' Association, urges the passage of the amendment. "Radio legislation has imposed senseless restrictions on broadcast allocation and, in turn, obstructed progress in the development of the art," said Mr. Felix. "Although Congress demonstrated its lack of knowledge of broadcasting problems in passing the law calling for the 'equalisation' of station facilities in broadcast zones, a law which has been anything but helpful, it is now opposed to a measure that would give the industry an accurate picture of the number of sets in use and the extent of the radio audience. Not only would that information solve many of the major problems of the manufacturing and distribution branches of the radio industry, but it would also establish a sound economic foundation for broadcasting station charges, thus making possible a much higher standard of programmes and curbing the tendency toward direct advertising. The latter trend, which is becoming increasingly dangerous to the welfare of broadcasting, has its origin in the fact that advertisers are insisting on more and more direct propaganda in their radio programmes, failing to appreciate the enormous audience reached and its instinctive distaste of advertisement."

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 15th. State Electricity Commission of Victoria. Two 750-kVA transformers and spares. (B.X. 5325.)*

July 23rd. Posts and Telegraphs Department. Telegraph instruments. (B.X. 5323.)*

July 24th. Victorian Railway Commissioners. Electric overhead travelling cranes, spare motors, and trolley wires. (A.X. 8092.)*

SYDNEY.—August 12th. Department of Public Works. Auxiliary hydro-electric generating plant for Burrinjuck. (B.X. 5365.)*

Belgium.—IXELLES, BRUSSELS. July 5th. Supply of 887, 220 and 444 d.c. ampere-hour and watt-hour meters. Particulars for 6¾ fr. from Service de l'Electricité, 22, Rue d'Alsace-Lorraine, Ixelles.

Carlisle.—July 12th. Electricity Department. Supply, delivery, and erection of switchgear for use in an 11,000-V, 3-phase, 50-cycle sub-station. (See this issue.)

Chile.—VALPARAISO.—July 1st. Port Administration. Sixteen electric travelling cranes. (A. 8122.)*

Croydon.—July 4th. Electricity Department. Supply of 25,000 tons of coal suitable for use in chain grate mechanical stokers. (See this issue.)

Dundee.—July 10th. Electricity Department. One seven-panel e.h.p. compound-filled sub-station switchboard for a 6,600-V, 3-phase, 50-cycle system. (See this issue.)

Egypt.—CAIRO.—July 15th. Ministry of Interior. One 250-kVA Diesel engine-driven a.c. generating set, with switch and control gear. (B.X. 5331.)*

August 13th. Supply of an electric power station, with underground and overhead network, for the town of Maghagha. (B.X. 5318.)*

July 13th. Egyptian State Railways. Supply of underground unarmoured, lead-covered, paper-core telephone cable, approximately £E25,000 to £E26,000.—*Reuter's Trade Service* (Cairo).

Glasgow.—July 4th. Electricity Department. Extension of the overhead charging feeder system, and charging plant at the Govan refuse destructor station garage. Specifications, &c., from the general manager, 75, Waterloo Street, Glasgow, C.2.

Holywood.—July 2nd. Urban District Council. Laying and erection of l.p. underground and overhead mains and h.p. cable, erection of l.p. switchboard, h.p. armour-clad and truck-type switchgear, and 3-phase transformers. (June 14th.)

India.—SIMLA.—July 8th. Indian Stores Department. 30-kW oil engine-driven generating set for the Military Engineering Services, St. Thomas Mount, Madras. (B.X. 5364.)*

July 12th. Three continuous wave wireless transmitting sets, 580 to 3,000 meters. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—July 22nd. Supply, delivery and erection of central indicators and telephones for the Central Scotland Electricity Scheme, 1927. (June 7th.)

July 27th. Supply, delivery, and erection of 132,000-V overhead transmission lines for the Mid-East England Electricity Scheme, 1929. (See this issue.)

LONDON COUNTY COUNCIL.—July 8th. 150 complete bodies for tramcars, 150 sets of swing bolster bogie trucks, 150 electrical equipments for tramcars, &c., and 150 magnetic track and wheel brake equipments. (June 7th.)

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STEPNEY.—July 4th. Parish Guardians. Installation of two electric lifts, &c., at the South Grove Lodge, and one electric lift at the St. George-in-the-East Hospital. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—July 10th. Supply and fixing of a complete wireless installation at Princess Mary's Hospital, Cliftonville, Margate. (See this issue.)

Newport (Mon.).—June 22nd. Electricity Department. One 1,250-kW motor convertor and switchgear. (June 7th.)

New Zealand.—WELLINGTON.—August 7th. Posts and Telegraph Department. Enamelled and silk-covered resistance wire. (B.X. 5322.)*

July 3rd. Black adhesive insulating tape. (B.X. 5378.)*

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

September 4th. Government Railways. Motor generator. (B.X. 5308.)*

AUCKLAND.—August 19th. Auckland Electric Power Board. Single-phase transformers. (B.X. 5324.)*

Nottingham.—June 28th. Electricity Department. Supply of general stores for the electricity undertaking for 12 months from July 1st, 1929. (June 7th.)

South Africa.—PRETORIA.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. (B.X. 5273.)*

August 1st. Telephone cable. (B.X. 5345.)*

August 8th. Posts Telegraphs Department. Telegraph materials including iron tubular sidearms, porcelain insulators, paper sleeves, solder and insulating spindles. (A.X. 8112.)*

PIETERSBURG, TRANSVAAL.—August 13th. Municipal Council. Steam-raising plant, engine alternator and switchgear. (A.X. 7983.)* H. and l.p. cable, lamps and sundries. (B.X. 5312.)*

JOHANNESBURG.—June 27th. South African Railways and Harbours. 2,200- and 600-V cables and accessories. (B.X. 5343.)* Two 2-ton electrically-driven hoist blocks. (A.X. 8072.)*

August 1st. 10-ton electrically-driven overhead travelling crane for Maritzburg workshops. (A.X. 8105.)*

PORT ELIZABETH.—July 11th. Municipal Council. Electrical material, transformers, &c. (B.X. 5375.)*

Stafford.—July 2nd. Staffordshire Education Committee. Installation of electric lighting at Kingswinford Brockmoor Council school. (June 7th.)

Sunderland.—July 8th. Electricity Department. Paper-insulated, lead-sheathed cable, rubber-insulated wire, meters, gasfilled and vacuum lamps. (June 7th.)

Turkey.—CONSTANTINOPLE.—July 4th. Administration Générale des Chemins de fer et Ports d'Etat. Wires, cables and general lighting accessories. (B.X. 5368.)*

Uruguay.—PORT AUTHORITIES.—July 22nd. 300-kilo electro-pneumatic drop-hammer. (A.X. 7974.)*

Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Three 225,000-h.p. boilers with economisers, air heaters, fans, &c. (June 7th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aberdeen.—Accepted :—
Electrical work in connection with the new MacRobert Hall at Robert Gordon's College.—Bell & Robertson, Ltd.

Bradford.—Electricity Committee. Accepted :—
Circulating-water pipes for turbines at Valley Road power station.—Stanton Ironworks Co., Ltd.
Steam piping for Valley Road power station.—Stewarts and Lloyds, Ltd.
Housing Committee. Accepted :—
Electric light installations at Council houses :—
180 houses, Class A (£625).—Armitage & Longbottom.
36 houses, Class A2 (£108).—Taylor & Ashworth.
24 single-room dwellings (£49).—H. Taylor & Co., Ltd.

Bradford-on-Avon.—Accepted :—
Installing electric light at the parish church (£220).—W. H. Rossiter & Co.

Bury.—Town Council. Accepted :—
Sub-station kiosk for electricity department.—Metropolitan-Vickers Electrical Co., Ltd.
Circulating-water screen for Chamber Hall power station.—F. W. Brackett & Co., Ltd.

Burton-on-Trent.—Watch Committee. Accepted :—
Electric traffic signals at Station Street (£105).—Forest City Electrical Co.
Electricity Committee. Accepted :—
Portable silt and sludge pump (£107).—Drysdale & Co., Ltd.

Cheadle and Gatley.—Urban District Council. Accepted :—
Electric lamps.—Edison Swan Electric Co., Ltd.

Dewsbury.—Town Council. Acepted :—
Cables (£1,028).—Greenwich Cable Co., Ltd.

East Ham.—Electricity Committee. Accepted :—
Two 1,000-kW convertors at Church Road sub-station (£5,499).—English Electric Co., Ltd. (revised tender).
Pilot cable (£256 9s. 6d. per 1,000 yards).—Enfield Cable Works, Ltd.
Crane for Manor Park sub-station (£131).—Herbert Morris, Ltd.

Glasgow.—Tramways Committee. Recommended :—
Armature coils.—P. R. Jackson & Co., Ltd.
Points and crossings.—Edgar Allen & Co., Ltd.

London.—ST. PANCRAS.—Contracts and Stores Committee. Recommended :—
One 1,000-kW motor convertor (£2,740).—Metropolitan-Vickers Electrical Co., Ltd.
Additions and alterations to pump house (£2,682).—Victoria Construction Co., Ltd.
Condensing water circulation pump (1,500,000 gallons per hour) (£2,050).—W. H. Allen, Sons & Co., Ltd.
Alterations and additions to engine room at King's Road (£1,371).—Industrial Constructions, Ltd.
L.p. cable (£4,359).—Hackbridge Cable Co., Ltd.
Tenders for wiring work under the small dwellings scheme :—
At Drummond Crescent (£245).—City Electrical Co.
At Thanet, Rasleigh, Sinclair, and Sandwich Houses (£652).—F. & E. Pickering.
At Hastings House (£228).—E. S. Russell & Co.
Electric kettles (3 pint) (19s. 10d. each).—General Electric Co., Ltd.
Electric irons (8s. 3d. each).—Revo Electric Co., Ltd.
GENERAL POST OFFICE.—Accepted :—
Cells.—Edison Swan Electric Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended :—
Cable for Muizenberg pavilion (£335).—Peel Electrical and Engineering Co., Ltd.
Brackets, fittings, and globes (£1,103).—S.A. General Electric Co., Ltd.
Slate panels, circuit breakers, and knife switches (£166).—Switchgear & Cowans, Ltd.

Stafford.—Staffordshire Education Committee. Accepted :—
Installation of electric light and power at Bilston new high school for girls (£1,033); and at Stafford girls' high school (£539).—W. G. France.

Forthcoming Events.

Institution of Mechanical Engineers.—June 25th-28th. Summer meeting.

Electrical Contractors' Association.—June 26th to 28th. Bournemouth. Annual Conference.

Royal Society of Arts.—Wednesday, June 26th. Annual general meeting.

Physical Society.—Friday, June 28th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Institution of Electrical Engineers (South Midland Centre). July 2nd. Summer meeting. Visit to the Avonmouth Docks.

North-East Coast Institution of Engineers and Shipbuilders. July 2nd-4th. Summer meeting. Newcastle-on-Tyne.

Tramways and Light Railways Association.—July 3rd-5th. Sheffield. Annual Congress.

Overhead Lines Association.—Friday, July 5th. Summer meeting. Charabanc tour in the Mid-Cheshire area.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of suppliers of the following :—

POLLOPAS moulding powder.
Electric hedge clipper.
Importers of K.D.A. cables.
Makers of CELLINOID lanterns.
Makers of BOMB type fuses.
"ACORN" electric water heaters (geysers).

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Notes.

Extensible Conductors for Mines.

In a recent issue of "*E.T.Z.*" Herr. H. W. Birnbaum gives some particulars of the extensible electric cables for use in mines which are being manufactured by the Duisburg Cable Works, of Duisburg, Germany. The special cables have all the qualities of ordinary cables and only differ from them by the use of special packing layers between the conductors. The method of construction is such that as the cables are stretched the conductors approach more closely to each other, the reverse action taking place when the tension on the cable is relaxed, no strain, however, being imposed on the conductors themselves. Tests with the extensible cable show that without interfering in any way with their electrical conducting qualities they may be stretched to the extent of 4 per cent. of their length.

Electricity Supply in North Ireland.

At the recent annual Conference at Ballymena of the General Council of Municipal Authorities of Northern Ireland, Mr. Boyd, according to the *Irish Independent*, read a paper on "Electricity in Northern Ireland." Mr. Boyd said that nothing had been done in Northern Ireland in regard to the co-ordination of an electricity supply. He urged that the recommendation of the Commission set up by the Northern Government in 1923, that expert advice should be obtained as soon as possible on the problems involved in the development of electrical supply in Northern Ireland, should be acted on immediately. There was no doubt that the Northern Government had side-tracked electricity supply. The units consumed per head of the population of the Free State were about 25 to 30, and about half that in Northern Ireland. The average density of population in the Free State was about 90 to 100 persons per square mile, against about 200 in Northern Ireland. That was to say, that on a basis of 30 units per head of the population about 300 units per square mile would be got in the Free State, against, on a basis of 50 units per head, 1,000 per square mile in Northern Ireland. To give an idea of the capital involved in a Northern Ireland scheme for generation, compared with that in the Free State, the cost of the water-power station at Limerick would be £40 to £50 per kilowatt installed, and the cost of extending the Belfast Harbour Station, sufficient as a primary station for generation for many years, would be from £8 to £13 per kW. It had been estimated that the extra capital charges on the water scheme would wipe out any saving due to the absence of any fuel costs, and other incidental costs in running steam plant. It was not generally realised that a modern steam station, at the load factors obtaining to-day, could easily beat the average water-power station in cost per unit delivered.

The Electrical Association for Women.

Reference was made in our issue of June 14th to a meeting which was held in Plymouth in connection with the formation of a local branch of the Electrical Association for Women. Councillor Mrs. Daymond presided and introduced Miss Haslett, director, who addressed the meeting. Miss Haslett explained that the Association worked with a two-fold aim, to educate the housewife in the best modern uses of electricity by means of lectures and visits to places of electrical interest, and to give means for the expression of women's point of view in the electrical industry. Although the Association was formed only four years ago, several good pieces of work had been already accomplished. These included the National Woman's Specification, arising from the Outlet Campaign, and the securing of a promise from the Board of Education to consider the universal teaching of electricity in conjunction with domestic science in schools. A committee has been formed to develop the proposed E.A.W. in Plymouth, and has been fortunate in securing the support of Lady Astor as president. It is hoped that the inauguration will take place in October.

Battersea Power Station.

The Public Health Committee of the L.C.C. has received communications from the Chelsea Borough Council and the Westminster City Council raising the question of nuisance and injury to public health and property likely to be caused by the emission of sulphur fumes from the chimneys of the new power station to be erected at Battersea, and has recommended that, on the understanding that the Council is in no way committed as to policy in the matter, the invitation of the Westminster Council to appoint representatives to a proposed conference of local authorities concerned on steps necessary to safeguard the health of the community and property in the neighbourhood of the proposed station be accepted.

Prevention of Fumes, &c., from Power Station Chimneys.

The Electricity and Public Lighting Committee of the St. Pancras Borough Council has received a report from the electrical engineer, suggesting a method for effectively dealing with the dust and grit which at times emanates from the King's Road power station, in which he states that he has designed and installed a system of water-spraying apparatus in the chimney of two boilers which produces a fine mist, and by saturation and gravity substantially assist, in preventing the finer kinds of dust, which escape the arrestors, from being expelled from the chimney. To test the efficiency of the water-spraying methods, the chief chemist of one of the principal electrical power companies has made special analytical tests of the water effluent after treating the gases for dust which has been retained in the chimney, and the efficiency of this method in absorbing the sulphurous and sulphuric acids is very definitely confirmed by the results of the analysis. The method has also been tested by the chemist of Messrs. Babcock & Wilcox, Ltd., and its efficacy confirmed. It has been found that the design of the outlets to the boiler chimneys does not allow sufficient expansion for the gases to reduce their velocity and so permit of the particles of dust being deposited before entering the chimney. To rectify this and restrict the emission of dust into the chimneys, he has devised a scheme whereby large chambers can be inserted between the outlets of the boilers and their respective chimneys, which will permit of the speed of the travelling gases being reduced from 27 ft. per sec. to 7 ft. per sec., and if necessary, treated with water sprays. The chambers will be composed of mild-steel plates coated with sheet-lead inside to restrict the destructive action of sulphurous acid. The dust or sludge collected would then, by mechanical means, be carried away to suitable tanks for disposal. The Committee has recommended that, subject to the consent of the Electricity Commissioners, the electrical engineer be authorised to apply the method outlined in his report to two of the pulverised-fuel boilers at an estimated cost of £3,250, and that Messrs. Babcock & Wilcox, Ltd., be instructed to carry out the work.

An Institution Installation.

An interesting installation has recently been completed at the London Road Institution for the supply of electricity for lighting, &c., using the exhaust for the heating and hot-water services. The generating plant consists of a 90-kW, 60-kW and 40-kW "Belliss-Crompton" sets, a 70-kW set by Alley and McLellan, and also a 15-kW "Blackstone" oil engine and dynamo. The present cost of electricity generated at London Road Institution, including interest and sinking fund on all outstanding loans on the station equipment, is 1.7d. per unit, as against the best offer of the supply undertaking in 1926 of 2.54d. per unit.

During both winter and summer, day and night, the whole of the exhaust steam from the engines and pumps is absorbed in supplying heat and hot water to the Institution. This is accomplished by installing thermal-storage units of suitable capacity on the hot-water service systems, to conserve the heat from the engines when the peak load on the electricity demand does not synchronise with the maximum demand for heat in the Institution. There are three Lancashire boilers, 30-ft. long and 8-ft. 3-in. diameter, made by Messrs. H. & T. Danks, and built for 160 lb. working pressure. Two boilers are fitted with furnaces by Messrs. J. & J. Neil, equipped with rocking bars, and there is a bridge at the back designed for the purpose of preventing smoke. The other boiler is fitted with a Crosthwaite forced-draught furnace. A Goodbrand Economiser fitted at the back of the boilers is capable of raising the feed water to 280 deg. F. on its way to the boilers. All the steam used in every department, including the engines, calorifiers, pumps, laundry, kitchen, operating theatre and disinfector, is measured by Kent's steam meters. In actual practice the total of these steam meters balances very closely with the feed water to the boilers. It will be interesting to note the live steam used in the various departments per week in summer and winter, respectively: kitchen, 113,000 lb. and 131,000 lb.; heating and hot-water service, 423,000 lb. and 850,000 lb.; laundry, 110,000 lb. and 122,000 lb.; disinfector and operating theatre, &c., 55,000 lb. and 126,500 lb.; engines, 244,000 lb. and 411,000 lb.; turbines, 101,000 lb. and 232,000 lb.

The exhaust steam from the engines and turbines is, of course, used in the calorifier house, in addition to the live steam given above.

There are two hot-water storage cylinders, each of 4,000 gallons capacity, made by Wright's Forge & Engineering Co. In each cylinder are two batteries of copper tubes. The lower one is supplied with exhaust steam from the engines and pumps, and is the only battery in use except at time of heavy draw off. An automatic temperature regulator made by the British Arca Regulator Co. admits steam to the upper or live-steam battery, and continues to do so until the temperature of the water in the cylinder reaches normal, when the live steam is automatically cut off. The hot water is pumped round the whole Institution to every draw-off point by means of Mather and Platt's centrifugal pumps driven by turbines made by Hayward's Engineering Co. There are also stand-by turbines and pumps. A somewhat unusual feature in connection with the hot-water service is that some of the draw-off taps and baths are at a higher level than the service tank.

Three heating calorifiers are responsible for the heat required in all buildings. These are also fitted with exhaust steam and live-steam batteries, the exhaust being in the back end of the cylinder, and the live steam in the front end. All the water condensed in the calorifiers has to pass through steam traps. The clean exhaust goes into a hot well in the pit adjoining the Weir pump, and is then pumped automatically by means of a controlled pump made by Messrs. G. & J. Weir into an overhead tank at the left end of the calorifier house, which tank forms the boiler feed reserve. The more or less greasy exhaust

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from the engines is not considered sufficiently safe for boiler feed, so it is pumped up into the tank over the boiler house yard, and is used in the hot-water service. About 80 per cent. of the steam generated in the boilers is condensed and used again in this way. The remainder goes into the laundry washing machinery, to the operating theatre and to the disinfector and elsewhere.

In the laundry there are four belt-driven 84-in. by 42-in. Braithwaite washing machines and three underdriven electric hydro-extractors, made by Messrs. Broadbents. The output of the laundry is 30,000 articles per week, and the cost of washing, including steam, water, soap, consumable materials, labour, &c., is 6s. 3d. per 100 articles.

The hospital, which has on the average 529 occupied beds, is equipped with an X-ray plant, ultra-violet-ray lamps and various electro-medical appliances.

Appointments Vacant.

Civilian education officer at the R.A.F. electrical and wireless school. Two draughtsmen required by the Royal Aircraft Establishment, South Farnborough, Hants. Lady demonstrator for Worksop Urban District Council. Assistant engineer for Basingstoke Corporation. Meter mechanician for Middleton Corporation. Electrical engineer for Tobermory Town Council. (See our advertisement pages to-day.)

Marine Lighthouse Administration.

The Corporation of Trinity House is to hold an informal International Conference at Caxton Hall, Westminster, next month to discuss technical matters relating to lighthouse illuminating apparatus, fog signals, wireless-beacon fog signals, and other cognate subjects concerning lighthouse administration. Representatives of the lighthouse services of some 20 foreign countries will be present, and, in addition to representatives of the principal lighthouse authorities in this country delegates are expected from Canada, India, New Zealand, and South Africa. The Conference will be opened on Monday, July 8th, by the Duke of Connaught, Master of Trinity House.

Fatalities.

An inquest was held at Bootle on June 11th on Owen Jones (28), a tester employed by the Liverpool Electric Cable Co., who received a fatal electric shock at 10,000 V through coming into contact with an electric cable. It was stated a cable weighing 9 tons was being tested with a pressure of 10,000 V in the testing department, and warning lights were illuminated outside the building. Jones must have entered the building before his time for testing the contact. A verdict of "Death by misadventure" was returned.

An inquest was held on June 12th at Newport (Mon.) on Charles Barnes (19), who received a fatal electric shock whilst employed at the works of the British Mannesmann Tube Co. William John Fisher, an electric crane driver, said that after ineffective operation of the hoist motion he brought his crane to a standstill. Barnes, after directing that the cab switch should be switched off, tested the cross-travel wires and entered the cab where he received a shock. Mr. H. G. Townsend, chief electrical engineer at the works, expressed the opinion that Barnes had slipped on a resistance box and had accidentally knocked in the switch. A verdict of "accidental death" was returned.

Educational.

MANCHESTER UNIVERSITY.—The Municipal College of Technology offers a limited number of research scholarships, of a value not exceeding £100, tenable during the 1929-30 session for research undertaken in the Departments of Electrical Engineering and Electrochemistry, amongst others. Applications must be lodged not later than July 6th, 1929.

British Empire Scholarships at Loughborough.

The entrance examinations for the award of British Empire Scholarships in the Faculty of Engineering, Loughborough College, have now been completed and awards made. The scholarships are tenable at Loughborough for the full period of the diploma course, and the Governors of the College have approved the following awards for 1929:—L. M. G. F. Cabral, Queen's College, Georgetown, British Guiana; S. W. Millward, Grammar School, Cheltenham; F. G. McDonald, Technical High School, Johannesburg; T. D. Walshaw, Hurstpierpoint College, Sussex; P. Finucane, Lawrence Royal Military School, Sanawar, India; and H. I. Price, County School, Abertillery. These scholarships are open to all British subjects resident in any part of the Empire, and are of the value of £75 per annum. Applications were received from a large number of the public and secondary schools in England, South Africa, Rhodesia, Australia, British Guiana, India, and the Federated Malay States.

I.M.E.A. Convention Golf Competition.

In the golf competition held during the Incorporated Municipal Electrical Association Convention at Torquay, the "Dennis" trophy in aid of the Institution of Electrical Engineers' Benevolent Fund was won by Mr. Crinks, of Metropolitan-Vick Supplies, with a net score of 76, the runner up being Mrs. D. Antliff, with a score of 77.

The Institution of Production Engineers.

The Institution, one of the younger scientific institutions which devotes itself mainly to the study of practical problems in modern engineering production, has acquired new headquarters in London at 48, Rupert Street, W.1, within two minutes' walk of the Engineers' Club. Mr. Richard Hazleton has been appointed general secretary.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Bridport Town Council has appointed Mr. H. F. CASTLE electrical engineer and manager as from August 1st. Mr. Castle is chief assistant engineer at Basingstoke and was formerly with the Leatherhead and District Electricity Co., Ltd.

The employés of the Sheffield Corporation Electric Supply Department have presented to Mr. S. E. FEDDEN, the retiring general manager and engineer, an antique table and sportsman's field glasses. The presentation was made by Mr. A. Doxey, the oldest employé. As a parting gift Mr. Fedden presented the Department's sports and social club with a pair of solid silver cups for competition in the tennis section.

Mr. F. G. ARNOTT, who for the past five years has represented Messrs. J. H. Tucker & Co., Ltd., in London, has joined Simplex Conduits, Ltd. (London office) as a sales representative.

Mr. E. T. PRICE, of Cardigan, has been appointed electrical engineer to the Newcastle Emlyn and District Electric Supply Co., Ltd.

Mr. W. M. BROWN has been appointed general manager by the Gramophone Co. Mr. Brown was responsible for taking over and working the Marconiphone business.

Mr. A. H. DARKER, A.M.I.E.E., A.M.I.Mech.E., chief electrical engineer of Messrs. J. Stone & Co., Ltd., who has been on a world tour, has now returned to London.

The marriage took place at Holy Trinity Church, Blackburn, on June 4th, of Mr. DONALD P. SAYERS, B.Sc., A.M.I.E.E., of Cheam, Surrey, and Miss HILDA LOMAX, of Blackburn. Mr Sayers, who was formerly connected with the Blackburn electricity undertaking, is now on the staff of a London firm of consulting engineers.

Mr. W. H. PEAK, O.B.E., has resigned his appointments as managing director of the Marconiphone Co., Ltd., the Sterling Telephone and Electric Co., Ltd., and the Relay Automatic Telephone Co., Ltd. Private communications should be addressed to 17, Holland Park, W.11.

Mr. T. J. FRANCIS, B.Sc., A.M.I.E.E., who has been engaged at the Bolton Corporation Electricity Works for the past four and a-half years and for six years has been part-time lecturer at the Bolton Technical College and the Manchester High School of Commerce, has been appointed lecturer in mechanical and electrical engineering at the Plymouth and Devonport Technical College.

It was announced last week end that Mr. HOWARD C. LEVIS had resigned from the boards of the British Thomson-Houston Co., Ltd., and the Associated Electrical Industries, Ltd., of both of which he was chairman. It is stated in some of the Press reports that it was Mr. Levis's intention to retire from active business last year, but he decided upon the acquisition by the Associated Company of the ordinary shares of the B.T.H. Co. to become chairman of the Associated Company to assist. This statement was followed on Monday last by an announcement that Sir Felix Pole, general manager of the Great Western Railway Co., had accepted the post of chairman of Associated Electrical Industries in place of Mr. Levis. Sir Felix Pole, whose photograph we present accompanying these notes, is 52 years of age. At the age of 14 years he became a clerk in the telegraph department of the G.W.R. at Swindon. It is his intention to remain with the company, though not

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in a managerial capacity. From his entry into the service of the company he advanced from department to department, including the electrical department, until in 1919 he became assistant to the general manager, and was further

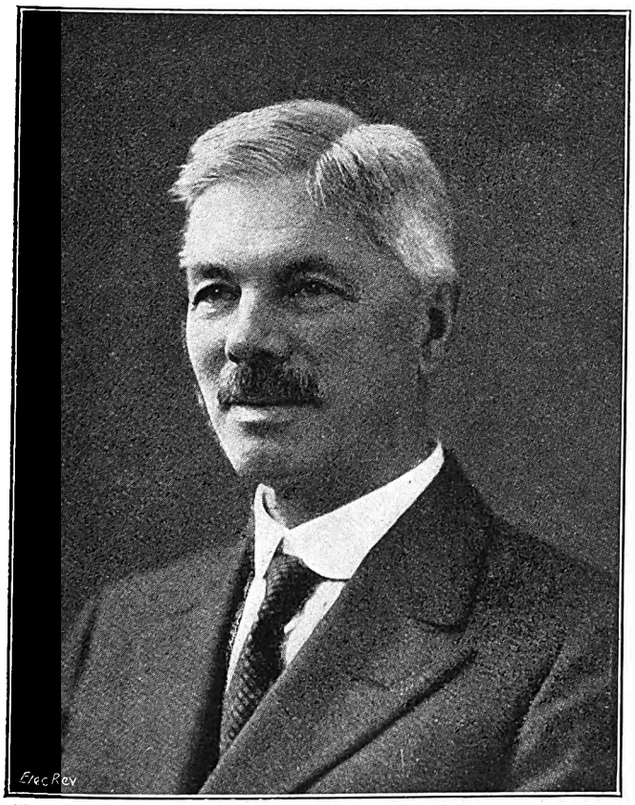
Elliott & Fry] *[London.*

Sir Felix Pole.

Chairman of Associated Electrical Industries, Ltd.

promoted two years later to be manager. The railway company will still have a call on his services in a consultative capacity.

Mr. JOHN KEMPE BRYDGES, M.I.E.E., as stated elsewhere in this issue, was on the 7th instant elected president for the



J. Weston & Son] *[Eastbourne.*

Mr. J. K. Brydges,

President of the I.M.E.A., 1929-30.

coming session of the Incorporated Municipal Electrical Association. Mr. Brydges has held the position of electrical engineer to the county borough of Eastbourne ever since the borough started to supply electricity. Like his predecessor in the office of president (Mr. A. Nichols Moore), Mr. Brydges is a Cheltonian, having been born in Cheltenham in 1867. He was educated at Cheltenham College and received his technical training at King's College, London, and the City and Guilds Central Technical College, South Kensington. His workshop experience was gained with the General Electric Co. of America, by whom he was also engaged in the erection of plants at Andover and Weymouth, Mass., and at Augusta, Ga., and afterwards as manager. After some six years spent in this manner, Mr. Brydges returned to England and joined the staff of the late Robert Hammond. In 1896 he became electrical engineer to the City of Wakefield. In 1899 Eastbourne Corporation took out a Provisional Order for its area (subsequently extended) and appointed Mr. Brydges electrical engineer. Early in the following year the Corporation acquired the undertaking of the Eastbourne Electric Light Co. Mr. Brydges became Associate of the Institution of Electrical Engineers in 1890, Associate Member in 1899, and Member in 1902.

As we reported in our last issue, the appointment of Mr. E. MORGAN as chief engineer and general manager of the Sheffield Electricity Department, has been confirmed. Mr. Morgan is 43 years of age. He was educated at Liverpool University, and received his early training with the British Westinghouse Co. After serving with the Yorkshire Electric Power Co., he went to Wolverhampton in 1920 as technical engineering assistant, becoming chief assistant in 1925. In the following

Lafayette.] *[Manchester.*

Mr. E. Morgan,

The New City Electrical Engineer, Sheffield.

year Mr. S. T. Allen, the borough electrical engineer, was appointed engineer to the West Midlands Joint Electricity Authority, and Mr. Morgan took his place. During his occupancy of the post, Mr. Morgan has been responsible for a great deal of rural development and for the changing-over of the system from d.c. to a.c. He has represented Wolverhampton on the area Joint Board and District Council for the Supply Industry, the West Midlands J.E.A., and the Incorporated Municipal Electrical Association. He is a member of the Institution of Electrical Engineers and an associate member of the Institutions of Civil and Mechanical Engineers. A portrait of Mr. Morgan is reproduced herewith.

Mr. C. W. CHARLESWORTH, manager of the Marconi Works at Chelmsford, has accepted an appointment with the Gramophone Co., Ltd. He is a director of the Sterling Telephone and Electric Co., Ltd., and of the Marconiphone Co., Ltd.

Sir JOSIAH STAMP, G.B.E., D.Sc., has accepted the office of President of the Institute of Transport in succession to Air Vice-Marshal Sir Sefton Brancker, K.C.B., A.F.C., whose year of office expires on September 30th next.

Mr. ARTHUR CROTCH, who recently retired from the Post Office service, commenced his career as a telegraphist in 1883. In 1900 he came to London, being placed on the staff of the engineer-in-chief. He is the author of a number of works on telegraphy and telephony.

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Obituary.—MR. R. W. PENNINGTON.—The death has taken place, after an operation, of Mr. Robert Wilson Pennington, director of Gilbert Gilkes, Ltd., turbine makers, Kendal. He was 55 years of age, and had been associated with the firm for many years.

Mr. C. F. BRUSH.—The death occurred recently at Cleveland, Ohio, of Mr. Charles Francis Brush, whose name is famous as that of a pioneer investigator of electric lighting. He was born in March, 1849, so was 80 years of age. Mr. Brush was experimenting with magnets and batteries when he was 13 years old. He graduated at Cleveland High School and studied later at the University of Michigan, graduating as a mining engineer in 1869. He carried on other occupations for a time and during this period resumed his electrical studies which led to the completion of his first dynamo in 1876. He then directed his attention wholly to electrical matters, made a contract with a company for the production and sale of his patented apparatus, and in 1881 that company was renamed the Brush Electric Co. It was in 1877 that he invented his first commercial arc lamp which carried all honours at the Franklin Institute. Other work included inventions connected with storage batteries; these led to many years' litigation which ended successfully for Brush. In 1880 he sold a number of patents to the Anglo-American Brush Electric Light Corporation in London. He received what was then regarded as a very high price for his patents. He must have been the pioneer in the use of windmills for electircal installations. The full story of Mr. Brush's life is too long to tell here. He began as a self-taught mechanic; later in life was known as the father of the electric lighting industry; and subsequently was accorded honours by the University of Michigan and the Western Reserve University, was decorated a Chevalier of the Legion of Honour by the French Government, and elected a Fellow of the American Association for the Advancement of Science—these and many more things combined to make up the fine record of one who so long ago was constantly before us as a pioneer but has latterly not been quite so prominently engaged before the public view. From him we of the electrical industry derive the household name of "Brush."

MR. A. MEISTER.—We regret to record that Mr. A. Meister, vice-president and treasurer of the Garfield Manufacturing Co. in New York—a company of moulding products for the electrical tarde—was among those lost in the Channel air disaster of Monday last. Mr. Meister was born in Switzerland, and he emigrated to the U.S.A. fifty years ago. He was on a pleasure trip to Europe, and up to the end of last week was searching out old friends in the electrical industry here. He left in the Imperial air liner *City of Ottawa* on Monday morning, and was one of the seven passengers drowned in the disaster.

MR. W. W. SMITH.—Mr. William Wild Smith, A.M.I.E.E., late P.O. engineer at St. Albans, died suddenly at 21, Lancaster Road, N.W.3, on June 10th.

MR. F. MAKEPEACE.—Mr. Francis Makepeace, chief engineer to the S.W. District, G.P.O., died at the age of 60 years on June 11th.

DR. T. BLACKWOOD-MURRAY.—The death occurred on June 11th, in Switzerland, of Mr. Thomas Blackwood-Murray, D.Sc., M.I.E.E., late chairman and managing director of the Albion Motor Car Co., Ltd., at the age of 58 years.

Wills.—Major-General R. H. MAHON, C.B., who was deputy-chairman of the Calcutta Electric Supply Corporation, left £19,796 net, and £20,755 gross, personalty.

Dame MARY FANNY ALEXANDER LODGE, wife of Sir Oliver Lodge, left £3,816 gross and £3,777 net.

Mr. C. A. MEYJES, formerly editor of the *Ironmonger*, left £23,780 gross personalty, and £21,069 net personalty.

Mr. A. C. DORMAN, a director of Dorman, Long and Co., who died in February at the age of 54 years, and was the eldest son of Sir Arthur Dorman, left £60,680 gross and £55,514 net personality.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Fenchurch Radio, Ltd.—Private company. Registered June 10th. Capital, £500 in £1 shares. Objects:—To carry on the business of makers of, and dealers in wireless apparatus, components and accessories, electric lighting and heating fittings, &c. The subscribers (each with one share) are:—G. Lane, 15, Gordon Street, Gordon Square, W.C.1, wireless dealer; D. F. Cubitt, 5, Windmill Road, Wandsworth Common, S.W.18, cashier. The first directors are to be appointed by the subscribers.

Coalisland and District Electric Supply Co., Ltd.—Private company. Registered June 5th in Dublin. Capital, £2,000 in £1 shares. Objects:—To carry on at Coalisland, Co. Tyrone, and elsewhere the business of an electric light and power company, &c. The directors are:—J. K. Stewart, millowner; Annie McKeown, bookkeeper; Mrs. Ida L. Stewart, all of Coalisland. Secretary: Annie McKeown. Registered office: Coalisland, Co. Tyrone.

Mersey Electrics, Ltd.—Private company. Registered June 11th. Capital, £3,000 in £1 shares. Objects:—To acquire the goodwill and all other assets of the business of electrical and mechanical engineers carried on by James Scott & Co., Knowsley Electrical Works, Brasenose Road, Bootle, to adopt an agreement with J. J. Scott, E. Dudley, and C. A. Braddock, and to carry on the said business and that of boiler makers, founders, shipbuilders, &c. The first directors are:—E. Dudley, 33, Moss Lane, Walton, Liverpool; C. A. Braddock, 41, Galloway Road, Waterloo, Liverpool; J. McGuire, 44, Cambridge Road, Bootle. Registered office: 64, Brasenose Road, Bootle, Lancs.

Radiograph, Ltd.—Private company. Registered June 14th. Capital, £100 in £1 shares. Objects: to carry on the business of wholesalers and retailers of wireless sets and parts, photographic materials, electrical and musical appliances, &c. The directors are: J. R. Jennens, 52, Holyhead Road, Handsworth, Birmingham; Nellie West, 10, Church Hill Road, Handsworth, Birmingham. Registered office: 2a, Station Road, Handsworth, Birmingham.

Official Returns of Electrical Companies.

British Radio Valve Service, Ltd.—S. Cole, Sardinia House, Kingsway, W.C.2, ceased to act as receiver or manager on May 28th, 1929.

Radio Service (London), Ltd.—Satisfaction to the extent of £125 (being balance), on May 15th, 1929, of debenture dated July 25th, 1927, securing £2,750.

North Metropolitan Power Station Co., Ltd.—Capital, £100 in £1 shares. Return dated March 12th, 1929. All shares taken up. £100 paid. Mortgages and charges, £850,000.

H. H. Ridley & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated May 6th, 1928 (filed February 11th, 1929). 1,900 shares taken up. £102 paid. £1,798 considered as paid. Mortgages and charges, nil.

Palmers Green Radio Service, Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1928 (filed February 14th, 1929). 2 shares taken up. £2 paid. Mortgages and charges, nil.

Cattley Accumulator Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 11th, 1929. 2,850 shares taken up. £1,900 paid. £950 considered as paid. Mortgages and charges, nil.

Fullers (Ilford), Ltd.—Capital, £52,500 in 45,000 10 per cent. preferred ordinary shares of £1 each and 150,000 deferred ordinary shares of 1s. each. Return dated December 31st, 1928 (filed May 3rd, 1929). 37 preferred ordinary shares taken up. £37 paid. Mortgages and charges, nil.

El-Be Utilities, Ltd.—Capital, £500 in £1 shares. Return dated October 5th, 1928 (filed March 14th, 1929). All shares taken up. £500 paid. Mortgages and charges, nil.

S. T., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1928 (filed April 8th, 1929). 2 shares taken up. £2 paid. Mortgages and charges, nil.

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Edison Swan Cables, Ltd.—Capital, £150,000 in 100,000 preference shares of £1 each and 200,000 ordinary shares of 5s. each. Return dated January 11th, 1929. 900 preference and 200,000 ordinary shares taken up. £50,900 paid. Mortgages and charges, £123,000.

Bel Canto Radio Reproducer Co., Ltd.—Capital, £600 in 500 preference and 100 ordinary shares of £1 each. Return dated January 14th, 1929. All shares taken up. £600 paid. Mortgages and charges, nil.

Wholesale Electrical Supplies (Salford), Ltd.—Capital, £1,000 in £1 shares. Return dated October 27th, 1928 (filed February 15th, 1929). 500 shares taken up. £500 paid. Mortgages and charges, nil.

Wortex Manufacturing Co., Ltd.—Satisfaction in full on June 5th, 1929, of mortgage debenture dated July 15th, 1927, securing £2,000.

Attaix, Ltd.—H. C. Merrett, 32, Finsbury Square, E.C.2, ceased to act as receiver or manager on June 3rd, 1929.

E. K. Cole, Ltd.—Satisfaction in full on February 15th, 1929, of mortgage dated May 8th, 1928, securing all moneys due or to become due, not exceeding £3,000. (Notice filed June 10th.)

Watford Electric & Manufacturing Co., Ltd.—Satisfaction to the extent of £500 on May 31st, 1929, of debenture dated May 31st, 1923, securing £3,000. (Previously satisfied £2,500.)

Mills English Engineering Co., Ltd.—W. R. Thomas, 59, Wind Street, Swansea, was appointed receiver and manager on June 6th, under powers contained in debenture dated January 8th, 1929.

Alpha Electric & Oxy-Acetylene Welding Co., Ltd. (Old company).—F. Reed, Westgate Chambers, Newport, Mon., ceased to act as receiver or manager on May 31st, 1929.

City Notes.

Siemens Bros. & Co., Ltd.

At an extraordinary meeting last week resolutions altering the company's articles of association were confirmed. In the course of his explanation the chairman, Lord Queenborough, G.B.E., said that the company had founded its early success on research and development. Research was more essential to-day than ever before and the company found it hard to keep pace with the large American and Continental concerns which had very much more money to spend in this direction. Moreover, in recent years, the tendency of some of their competitors no longer to confine themselves to methods of direct sale, but to obtain business by acquiring concessions or giving long-term credits on large schemes, necessitated their interesting themselves in that class of business, and that involved entering into very heavy financial obligations and the locking up of big sums of money for long periods. It was natural, therefore, that they should examine carefully the various possibilities of obtaining the advantages of the research and technical development undertaken by some of these powerful groups in concessions and any necessary long-term credit business rather than undertake the obligations in whole upon themselves in competition with those groups. They had been able to make satisfactory arrangements, without in any way affecting the British control of the company, with Siemens and Halske, of Berlin, the largest telephone manufacturers on the Continent and with a very powerful international group. The two groups had associated with them a large number of important companies which together practically covered most countries in the world. The agreement provided for a complete exchange of technical information and for cross-licensing under all telephone patents all over the world in which the parties were jointly interested, while leaving each party a free hand in the matter of prices quoted to customers. They had also arranged with Siemens & Halske for a complete exchange of research, development work, and factory experience in all other fields which were common to both companies. The value of this arrangement was considerable as Siemens and Halske spent more upon research and development work in a year than the whole of their company's profits. They had arranged to issue to Siemens & Halske 450,000 ordinary shares and would receive in exchange 6,557 700-mark shares in the German company. The directors were satisfied that this would be advantageous to the company. The arrangement would give 15 per cent. of the voting power to Siemens and Halske and would therefore not jeopardise the British control of the company. The articles of association provided that not more than 25 per cent. of the total voting power should be in foreign hands.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

In their report on the first half of the current financial year the directors regret that although there is a small aggregate improvement on the corresponding period of last year, the actual results are still far from satisfactory. The output has been fairly well maintained, but only at reduced selling prices in several important sections. The resultant loss of profit can only be met by considerably increased sales and reduced expenses, and everything possible is being done in this direction. The position at the French works is decidedly better. The serious losses of recent years have been stopped, and the directors are confident that the factory will very soon contribute to the company's profits. A reorganisation of the steam and power plant at Silvertown is in progress, and this is expected to yield further substantial economies. There has been some improvement in the results of the Burton factory, and a small increase in the profits from the foreign branches.

The submarine cable department and the c.s. *Silvergray* have had little employment during recent months. The directors are unable to recommend the payment of a dividend on the ordinary shares, but the preference dividend due on July 1st will be paid on that date. The attention of the directors has been called to rumours appearing in the Press as to impending combines or amalgamations affecting the company; they state that there is no foundation for these reports.

Anglo-Argentine Tramways Co., Ltd.

The report for the year ended December 31st, 1928, shows that the gross receipts rose from £4,658,618 to £4,719,180, and the net revenue from £1,011,640 to £1,026,132. After adding interest received, &c., and providing for debenture service, &c., there remains £383,712, to which is added £61,216 brought forward, making £444,928. After meeting the dividends on the first and second preference shares, £85,928 is carried forward. The number of passengers carried increased from 560,747,554 to 570,079,027. Reference is again made in the report to the difficulties engendered by the congested state of central Buenos Aires. This has been mitigated, but the cause has not been removed. Although the company's omnibuses have run at a loss, they have proved a valuable auxiliary to the other services. The company's *ad referendum* agreement on the subject of tariffs has not yet been ratified by the Municipal Council. The need of underground line extensions renders this matter one of ever-increasing urgency, and it is hoped that it will be definitely dealt with by the Council at an early date. The death of Mr. C. H. Sanford and the retirement of Sir Frederick Sykes from the board are recorded, and it is stated that the vacancies have been filled by the appointment of Sir Edmund Wyldbore-Smith and Mr. G. C. Touche. Meeting: June 25th.

Rangoon Electric Tramway and Supply Co., Ltd.

The annual meeting of this company was held on June 11th. Mr. W. A. W. Dawn (chairman), who presided, said that considerable difficulty had been and was still being encountered in maintaining a regulated headway of the tramway services during the busiest traffic periods of the year, due to the replacement of sleeper construction by concrete construction demanded by the Corporation. Since 1920 the expenditure on track construction had been 27 lakhs, and now further expenditure on the concrete foundations was called for by the Corporation. The onus of road maintenance on electric tramways was admittedly an anomaly under present conditions, and in common with other tramway undertakings, the company found that conditions were becoming intolerable and that some relief should be afforded. The power plant had worked satisfactorily and the new boiler was nearing completion. The new pumping plant and 30-in. pipe line for the supply of condensing water was now available and would meet the demands for this purpose for some years ahead. In addition to extensions in Rangoon, the lighting of the streets in Kemayut and Thamaing was completed. Good progress had been made with the work of increasing the l.p. single-phase distribution voltage from 115 to 230 V, and the 3-phase supply from 200 to 400 V. The report and accounts were adopted and Mr. J. Watson and Khan Bahadur Haji A. Chandoo were elected to the board.

Madras Electricity Supply Corporation, Ltd.

The annual meeting was held on June 11th, Mr. J. G. B. Stone (chairman) presiding. In presenting the report and accounts (*vide* ELEC. REV., June 14th, p. 1066), the chairman said that the electrical energy sold during 1928 exceeded the previous year by 24.5 per cent., and the average price per kWh obtained fell from As. 2.7 to As. 2.44. Domestic supply improved by 6.2 per cent. only, but the stage had now been reached when more strenuous efforts might be adopted to increase the demand by catering for small consumers. Supplies for power increased by 38.4 per cent., and a marked increase in this direction might be expected. The demand for street lighting had increased by 8.4 per cent., but as most of the principal streets were now lighted by electricity, future development would be more in the use of lamps of greater candle-power than additions to the number of lamps. Good progress had been made with the erection of the new plant. The second 6,000-kW set was now running, one of the 60,000-lb. Babcock boilers had been completed, and the erection of the second was proceeding. A large storage pond some 10 acres in extent, for the circulating water for the turbines, had also been practically completed, and this would assure an ample water supply during the dry seasons. The report and accounts were adopted.

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United River Plate Telephone Co., Ltd.

The revenue for the year ended December 31st, 1928, totalled £2,764,625, as compared with £2,550,523 in 1927, and the net profit (after meeting debenture interest) amounted to £489,617 (against £464,016). After paying the preference and interim ordinary dividends, and adding £165,002 brought forward, the available balance is £462,219. A final dividend of 5 per cent. is to be paid on the ordinary shares, again making 8 per cent. for the year, free of tax, and £158,219 is to be carried forward. The inability of the company to maintain the dividend without drawing on the amount brought forward is due to a reduction of tariffs forced upon it in the last quarter of 1928. No settlement of the rate question has yet been arrived at. Further progress has been made with the conversion of the Buenos Aires system to automatic working, and it is hoped that the work will soon be completed. Considerable attention has also been paid to other centres. In December last an offer was made by the International Telephone and Telegraph Corporation of New York to purchase the ordinary shares of the company upon certain terms, which offer was accepted by a majority of the shareholders. Mr. P. Cross, Major E. Quilter, and Mr. P. B. Lawson retired from the board, and their places were taken by Messrs. F. Gill, H. M. Pease, and K. E. Stockton. Mr. Gill was appointed chairman and Mr. Pease deputy-chairman. Mr. G. H. Nash was elected an additional director. The meeting was held on Tuesday last.

Calcutta Tramways Co., Ltd.

The annual meeting was held on June 13th, Mr. J. G. B. Stone (chairman) presiding. In moving the adoption of the report and accounts, the chairman said that nearly 90 per cent. of the total traffic receipts, amounting to £503,055, was taken by the tramways, the actual tramway earnings for the year showing an increase of £37,000. The monthly ticket issue continued to be very popular, and in order to induce greater use of the tramways during slack periods of the day, a system of cheap mid-day fares was inaugurated on March 1st last. The operation of the motor-omnibus system showed a working loss of nearly £13,000, but the reduction in mileage where possible on non-paying routes should effect economies. The board felt that the time would come when the system of transportation in Calcutta would be controlled by one authority, but in the meantime the company would give the additional facilities of travel which the 'bus service provided, even though this service in itself was unremunerative. The report and accounts were adopted.

Sphere Investment Trust, Ltd.

Presiding at the annual meeting on June 11th, Sir George A. Touche (chairman) said that the broadening of the company's interests was, in a great measure, accomplished, and the capital was well distributed over different countries and industries. The year under review showed a continuance of the advances in the quotations of securities, especially in equities as apart from prior charges. Towards the end of the year, however, values had to sustain the shock of a rise in the bank rate, as a result of the financial situation in America, coupled with the fear attaching to the outcome of the General Election and the Reparations Conference. Political events had made the outlook a little more uncertain. There would probably be a slackening of interest in British industrial securities and a discrimination in the number and character of new issues applying for public support. A diminution of financial activity appeared to be inevitable. The report and accounts were adopted.

Venezuela Telephone & Electrical Appliances Co., Ltd.

An extraordinary meeting of this company was held on June 10th, and Sir Alexander Roger (chairman), who presided, said that during the past two years the company had introduced the automatic system into the Caracas area. The conversion to automatic operation had been well received and it had been decided to introduce the system into other areas. Further telephone expansion was also suggested. It was therefore proposed to increase the capital by £320,000, which sum would meet requirements for two or three years ahead. The new capital would take the form of non-voting "A" ordinary shares of £1 each and arrangements had been made to offer immediately 140,000 on a *pro rata* basis to preference and ordinary shareholders. The issue would be made at par. The resolutions were adopted.

Rees-Roturbo Manufacturing Co., Ltd.

The gross trading profit for the year ended December 31st, 1928, was £11,068. After meeting debenture interest, the net deficit is £1,533, as compared with a net loss of £8,599 in 1927. As values of plant and machinery were written down under the capital reconstruction scheme, no provision has been made in this year's account for depreciation. The directors' report states that Rees-Stevens electrical equipment for railless-cars during the past two years has proved itself equal to most severe tests, and two of the largest railless-car fleets in Europe are now equipped with this system. During the latter part of the year under review severity of competition became more marked and extended to the company's general products, increasing the difficulty of obtaining work at remunerative prices, and these conditions still prevail.

Whitehall Electric Investments, Ltd.

The report for the year ended March 31st last reports that the profit of £2,738,793 realised upon the sale of the company's properties in Chile and Mexico to the American and Foreign Power Co. has been transferred to capital reserve. Against this reserve £625,000 has been charged in respect of a proposed premium of 5s. per preference share, and £729,313 has been written off debenture issue discount. The sale of the company's properties mentioned above resulted in the reduction of the gross income from £721,951 to £517,105. The net income is £292,193, and to it is added £80,000 brought forward, making £372,193. After meeting the preference dividend and adding profits previously applied in writing off discounts, &c., the available balance is £1,100,400. It is proposed to pay a dividend of 2 per cent. (against 4 per cent. last year) together with a bonus of 18 per cent., on the ordinary shares, leaving £100,400 to be carried forward.

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Beaver Accumulator Co., Ltd.
Blackadda Radio Co., Ltd.
Gold Bow Enamel Wire Co., Ltd.
Pagets Radio Components, Ltd.
Radio and Electro-Technical Industries, Ltd.
Radiophones (1925), Ltd.
Telephos (1925), Ltd.
Wireless League Gazette Publishing Co., Ltd.

Globe Telegraph and Trust Co., Ltd.

The report for the year ended May 31st records a net profit of £347,390, to which is added £52,322 brought forward, making £399,712. A final dividend of 5s. per ordinary share is to be paid on June 30th, making 10 per cent., free of tax, for the year, leaving £77,371 to be carried forward. The report contains a list of investments, the principal being the Eastern Telegraph Co., Ltd. ordinary (nominal value £1,258,915), Eastern Extension, &c. (£973,200), and the Western Telegraph Co., Ltd. (£679,000). The directors propose the widening of the company's present restricted powers of investment to enable it to participate in the further development of communications and electrical enterprises.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Brompton and Kensington Electricity Supply Co.—21,439 ordinary shares of £1 each, fully paid, Nos. 351,017 to 372,448.

Oriental Telephone and Electric Co.—140,833 ordinary shares of £1 each, fully paid, Nos. 428,992 to 569,824.

Underground Electric Railways Company of London.—4,702 ordinary shares of £1 each, fully paid, Nos. 7,159,907 to 7,164,608.

Dealings in the following have been allowed by the Committee under Rule 159:—

Chelsea Electricity Supply Company.—8,969 ordinary shares of £1 each, fully paid, Nos. 425,489 to 434,477.

Underground Electric Railways Company of London.—285 ordinary shares of £1 each, fully paid, Nos. 7,164,609 to 7,164,893.

Mirrlees, Bickerton & Day, Ltd.

The net profit for the year ended March 31st last was £31,896 (against £20,162 in 1927-28). A balance of £5,829 brought forward is added, making £37,725. The dividend on the ordinary shares is raised from 6 to 7 per cent., and £8,504 remains to be carried forward.

James Keith & Blackman Co., Ltd.

After providing for debenture interest and preference dividend, the available balance for the year ended March 31st last is £49,740. It is proposed to place £12,000 to reserve, to pay a dividend of 15 per cent., less tax, on the ordinary shares (last year, 12½ per cent.), and to carry forward £13,740.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

The directors have decided to pay an interim dividend of 3 per cent. on the 6 per cent. cumulative preference shares.

Guest, Keen & Nettlefolds, Ltd.

The profit for the year ended March 31st was £956,071, to which is added £232,490, brought forward. After payment of the dividend on the preference shares and 10 per cent. for the year, free of tax, on the ordinary shares, £243,855 is carried forward.

Lisbon Electric Tramways, Ltd.

The directors recommend a final dividend of 4 per cent., free of tax, on the ordinary shares, making 7 per cent., tax free, for the year, against 6 per cent.

Electric and General Investment Co., Ltd.

The first dividends since 1913-14 have been announced. These are 2s. per share on the ordinary shares (10 per cent. on the amount paid up) and 1s. per share on the deferred shares.

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Ransomes, Sims & Jefferies, Ltd.

The accounts for the year ended March 31st last show a profit of £21,112 (after meeting depreciation, debenture interest, &c.), as compared with £19,835 in 1927-28. The addition of £52,822 brought forward makes available £73,934. An ordinary dividend of 2½ per cent. (as last year) is recommended, leaving £50,434 to be carried forward.

Hick, Hargreaves & Co., Ltd.

The report for the year ended March 31st last shows a net profit of £11,446, to which is added £474 brought forward, making £11,920. A dividend at the rate of 2½ per cent., less tax, is recommended, leaving £7,120 carried forward. The report states that although severe competition and low prices continue to prevail in all branches of the company's business, the turnover for the year has been considerably increased, and by exercising the most rigid economy a substantial increase in profit on trading has been earned. Whilst the value of contracts secured during the year shows an appreciable increase, the value of uncompleted work on the books is rather less than at the commencement of the year.

Cork Electric Supply Co., Ltd.

An interim dividend of 5 per cent., less tax, at 4s. on the ordinary shares, payable on July 31st, has been declared.

Quebec Power Co.

A dividend of $0.5 per share has been declared on the common shares for the quarter ending June 30th.

Northern Mexico Power and Development Co.

A dividend of 1 per cent. has been declared on the common stock.

Edison Bell, Ltd.

An interim dividend of 5 per cent. has been declared on the ordinary shares.

International Telephone and Telegraph Co.

A quarterly dividend of $0.50 per share has been declared on the no-par-value stock.

Austrian Companies.

The *Austrian Siemens-Schuckert Co.*, Vienna, which has declared a dividend of 6 per cent. for 1928, as in the previous year, reports having received important orders last year, both from the Austrian Federal Railways and the Vienna City Council, while the cable factory was well employed. The turnover in the early months of the new financial year was prejudiced by the unusually cold weather and the heavy snowfall, but there has since been an improvement.

The "*Elin*" *Co. for Electrical Industry*, Vienna, whose business is electrical manufacturing, the carrying on of power stations and participation in various other undertakings, states that the lack of orders from the Austrian railways was balanced by successes in the export business. The inland sales organisation was well occupied, and the report for 1928 mentions a series of large orders for power stations, electrical equipment and for railways. The accounts show net profits of 1,060,000 schillings, as compared with 700,000 sch. in the previous year, and the dividend remains at 10 per cent. on a larger capital.

German Companies.

The *Ferd. Schuchhardt (Berlin Telephone and Telegraph Works) Co.*, Berlin, in which the International Telephone and Telegraph Corporation recently became interested, is paying a dividend of 5 per cent. for 1928 as for the previous year. The report states that the orders received from the German authorities did not come up to expectations, but new branches were embarked upon, which led to a further extension of the export trade.

The *Accumulator Co.*, Berlin and Hagen, reports that in 1928 it suffered considerably from foreign competition. The export trade was handicapped by the high import duties of almost all countries, and, on the other hand, foreign rivals utilised the high profits obtained in their home markets for the purpose of disposing of their surplus output at exceedingly low prices in Germany and the export markets of the company. The company was compelled in March, 1928, to lower sale prices in spite of increasing wages and advancing prices of lead. The orders booked in the early months of 1928 slackened off, and this condition has prevailed down to the present time. Nevertheless, the dividend is to remain at 9 per cent.

The *C. Lorenz Co.*, Berlin, states that the lack of Reich orders in 1928 was compensated for by increased activity in the radio-telegraphy, broadcasting, and machine construction branches, the telegraph department in particular showing good results. The keen competition in the telephone branch greatly depressed prices, but the profits increased through the modernisation of manufacturing methods. As mentioned in a previous issue, the dividend remains at the rate of 6 per cent. on the old shares (6,270,000 marks). Shares for about 2,000,000 marks were recently taken over by the Philips Lamp Co., Eindhoven, Holland. Loud speakers, rectifiers, &c., which the Dutch company has hitherto exported to Germany are now to be made by the Lorenz Company.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets begin to give a little indication of the direction in which public speculation in stocks and shares may be expected to move, in the light of the changed situation induced by the accession of the Labour Party to power. From the investment point of view, it may be said that no particular trend or disposition of markets has manifested itself. The prices of securities, *qua* securities, have undergone but slight alteration as a sequel to the General Election Investment capital continues to flow steadily into the best-class stocks, and, although there is a complaint in the Stock Exchange about paucity of business, this is due to the seasonal conditions, the continuance of the high Bank Rate of 5½ per cent., and the uncertainty that still pervades the atmosphere in regard to American money matters.

Marconis Improve.

Marconis strengthened to 3⅞ on the news that the application of the Venture Trust for an injunction against the Marconi Company had been dismissed with costs. The price had been down to 76s., and rose to 78s. 9d. The £1 shares are quoted at 87s. 6d., their value being reckoned as about 10s. above that of Marconi 10s. shares. Marines hardened to 3¼. The Eastern Cable group was scarcely affected, though Eastern ordinary came into demand at 266. The Globe Telegraph and Trust Company has declared its final dividend, making 10 per cent. free of tax for the year, and proposes to take powers for the widening of its business scope, this step being no doubt due to the merger.

Venezuela Telephone.

Dealings have now started in the new "A" non-voting shares of the Venezuela Telephone Company, issued at £1 apiece to proprietors of the existing ordinary and preference shares. The price of the new shares started at 3s. premium. This served to bring in a few sellers willing to take the premium as an extra dividend. Consequently the price eased off to 2s. 6d. premium. The old shares are quoted ex rights, and stand at 25s. 9d. for the ordinary and preference alike. The difference between the old and the new shares is that the former carry voting rights, which the others do not. Some people in the market contend that there should be no more than a shilling or 1s. 6d. difference between the prices of the two issues. It is impossible to state with precision what the extra value of the voting rights is, but to anyone who is taking an interest in the company's shares for the first time, it would certainly appear that the new at 22s. 6d. are cheaper than the old. Other telephone issues are quiet; International common stock remains at 250, and American Telephone and Telegraph at 217½ is 2½ points better on the week. Burndept Wireless are dull at 4s. 6d. International Automatic Telephones at 38s. 9d. show a small gain.

Radio and Gramophone.

The H.M.V. Gramophone Company has announced a new issue of shares to be offered to proprietors at £1 each, this showing an extremely handsome bonus, as the old shares are quoted at 17¼. The H.M.V. Company is controlled, of course, by the Radio Corporation of America, one of the most go-ahead and progressive industrial corporations of the day. The intention of the R.C.A. board is said to fall nothing short of obtaining a controlling interest, or at all events a large slice, in the business of supplying Great Britain and Europe with entertainments connected with the kinema and wireless industry. The day is coming, according to American experts, when there will be such developments in radio as are, at present, hardly conceived by people on this side of the Atlantic, and who do not realise the field which wireless offers for communication between ordinary private persons.

The R.C.A. and Western Electric.

The developments which are taking place to-day in the kinema trade, and in which the Western Electric Company is taking a lead, are plain pointers to what may be expected. These will bring in their train such an accession of orders to commercial firms as is likely to create something like a new branch of industry. The trouble is that developments follow so fast upon each other that the novelty of to-day is liable to be superseded by something else to-morrow, and companies are, therefore, in a quandary as to whether it is worth while laying down expensive plant and embarking upon large plans of capital expenditure, when scientific requirements may require something of a different character in the course of a few weeks. The Radio Corporation of America has announced a comprehensive policy for serving the United States through stations in 13 strategic cities to compete with the leading telegraph companies, this having been made possible by recent grants of ten exclusive wireless channels. Two of the principal American companies in the business are the Western Electric and the R.C.A. Communications—the latter being owned by the Radio Corporation of America.

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Electricity Supply.

A feature amongst electricity supply shares is a spurt in Northamptons, which were 47s. this time last week, and are now 52s. 6d. The story goes that the Greater London and Counties Trust is angling for control of the company, and may be expected to make a substantial bid for the shares. The report is accepted in the Stock Exchange with reserve, for it has been noticed on previous occasions that such gossip is wont to fix upon the wrong company, and that when an offer is made for shares it comes, as a rule, from some unexpected direction. The Northampton Electric Light Company occupies, however, such a geographical position as to render its possible acquisition by the American interests a reasonable proposition, and this no doubt has lent colour to the rumour just mentioned.

Clyde Valley shares have moved up 1s. 3d., following upon their florin rise of last week, and now stand at 37s. The new have risen 9d. to 16s. 3d. premium. Richmonds at 46s. 3d. are a few pence lower; while, on the other hand, Lancashire Electric new ordinary at 28s. 6d. are slightly firmer.

Electrical Equipment.

There has been considerable activity in the shares of the companies dealing with electrical equipment, and amongst these, Callenders at 73s. 9d., now ex dividend and ex bonus, show a substantial rise on the week. The shares have been closely followed, as regards interest, by General Electrics, for which there was renewed demand from America, raising the price 1s. 3d. to 53s. 9d. The 7 per cent. debenture is better at 104½. Associated Electrical Industries, at 52s., have fallen behind General Electrics, with which, of course, they have been recently racing neck and neck. India-Rubber, Gutta-Percha shares came up from 13s. 9d. to 17s. before reverting to the previous price on the issue of a report which was regarded as disappointing. Expectations had been raised of a very good showing being made by the figures, but the directors frankly state that the actual results are still far from satisfactory. Economies are expected to follow the reorganisation of steam and power plant at Silvertown, and an increase in profits is reported from the foreign branches. Henleys are again better at 6½. Siemens ordinary have gone back to 31s. 3d., the preference holding their improvement to 32s. 6d. Telephone Manufacturing shares are steady at 5s. 9d. British Insulated Cables are 1/16 up at 73s. 9d.

Undergrounds Lower.

Underground Electric Railways of London income bonds are flat, the price having given way to 108, the shares going back to 22s. 6d. This is because of the opposition raised to the London Traffic Bills—opposition that apparently caused uneasiness in the minds of shareholders, and led to selling of the bonds. The price of the shares automatically follows, owing to the conversion rights of the bonds into shares. The market is dull and heavy, selling having been accelerated by an unfortunately-worded newspaper paragraph which suggested that the bonds are a shrinking investment, whereas the fact is that they can be converted into shares up to June 30th, 1930. The other Underground stocks show no particular change. The Southern Railway announces a further important extension of its electrification system, but this has had no effect upon the prices of the company's securities.

"Dollar" Stocks Strong.

Brazilian Tractions at 58 are 2 dollars better, and the preferred at 190 are 15 up. Dollar stocks as a whole show improvements. A gain of 10 points in Consolidated Gas, Electric Light and Power of Baltimore common lifted the price to 110½. Power Securities Corporation 7 per cent. preference improved to 25s. 9d. Pennsylvania Water and Power rose 5 to 91½; Shawinigan at 83½ is also 5 up. The East African Light and Power Company declares a dividend making 6½ per cent., which goes against 6 per cent. in the previous twelve months, and the price is a little better at 31s. 6d. Southern Brazilian Electric 6½ per cent. mortgage debentures hardened to 82½, and Southern Electric Railways of Buenos Ayres 6½ per cent. bonds at 96½ show a gain of £1. Anglo-Argentine Tramways first preference shares are 1/16 lower at 3 9/16, which leaves the second preferences higher than the first, the dividends being 6 and 5½ per cent. respectively. Mexican industrials are distinctly harder. There is a general impression that Mexico is once more settling down into something like peacefulness. Rio Tramways firsts strengthened to 97½.

British Traction.

British Electric Traction deferred ordinary stock has gained no more than 50 points this week, as against the 300 which the stock secured in the preceding fortnight. The present price is 1,400, and around this figure a fair amount of business has been done. London and Suburban Traction preferences are weak for the same reason as that which has affected Underground Electric Railways, and the London transport section as a whole has been disposed to dullness. The iron and steel shares also are disposed to ease off, Vickers being 9s. 10½d. Rubber shares have hardly stirred.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Approx. Dividend. 1927.	1928.	Price June 17 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	+6d.	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/6	—	5 5 8
City of London	1		10	38/3	—	4 4 6
do. do. 6% Pref.... ...	1		6	23/-	—	5 4 4
Clyde Valley	1		8	36/3	+6d.	... ...
County of London	1	7½	10	55/6	—	3 13 9
do. do. 6% Pref.... ...	1	6	6	28/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	56/3	—	3 18
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-xd	+1/16	5 3 5
London Electric	1	8½	9	28/-	—	5 0 0
Metropolitan	1	9	9	47/6	—	3 16 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	34/-	—	3 16 6
Mid. Elec. Power	1	15	8	37/6	—	4 5 4
Newcastle on-Tyne Ordinary ...	1	6	6	27/-	—	4 9 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	+1/-	4 17 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	3	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	—	6 1 9
Yorkshire Elec.	1	8	8	36/6	—	4 7 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	73	—	5 9 7
Metropolitan	"	3	3½	60½	—	5 15 8
do. District	"	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	22/6	—6d.	8 4 5
do. do. Income ...	Bonds	6	6	108	—3	5 11 1

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24½	—	6 2 6
Automatic Telephone	1	10	12½	2 1/16	—	6 1 1
Eastern Extension	10	10	10	26½	—½	*3 15 6
Eastern Tel. Ord.	Stock	10	10	265	—5	*3 15 6
Globe Tel. and T. Ord.	10	10	10	27¾	—¾	*3 12 0
do. do. Pref.	10	6	6	11⅛	—	5 5 6
Great Northern Tel.	10	20	—	8½	—	... ...
Indo-European	25	10	10	50½	—	*4 13 0
Marconi	10/-	10	20	3⅞	+1/16	... ...
Marconi-Marine	1	12½	15	3 3/16	+1/16	4 13 4
Oriental Telephone Ord.	1	12	12	3 1/16	+1/16	... ...
Western Telegraph	10	10	10	26½	—½	3 15 6

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3 9/16	—1/16	7 14 4
do. do. 2nd Pref. ...	5	6	6	8⅝	—	3 5 6
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	"	5	5	1400	+50	... ...
do. do. Pref. Ord.	"	8	8	130½	—	6 3 7
Brazil Traction	100	7	8	56½	+½	3 10 10
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	94	—	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/6	—6d.	... ...
London United Tram Deb. ...	Stock	4	4	64	—	6 9 1
Mexico Trams. 5% Bonds	—	5	5	75½	+1	6 13 9
Mexican Light Common	100	Nil	Nil	74½	+2	... ...
do. 7% Pref.	100	7	7	74½	—	9 8 0
do. 1st Bonds	—	5	5	77½	+2	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	52/-	—	9 6 3
Babcock & Wilcox	1	13	15	68/9	—	*4 14 4
British Aluminium Ord.	1	10	10	51/3	—	*3 13 9
British Elec. Transformer Pref. ...	1	7	7	18/9	—	9 8 6
British Insulated Ord.	1	15	15	3 1/16	+1/16	4 1 8
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	3 1/16xr	—	... ...
do. 6½% Pref.	1	6½	6½	1½	—	6 4 6
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 3
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	5½	18/9	—	5 17 1
Enfield Cable Ord.	1	20	20	4½	—	4 14 1
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	8	Nil	8/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/-xd	+1/16	5 13 1
do. Ord.	1	7½	10	2 1/16	+1/16	3 11 1
Henley...	1	25	25	6½	—	9 17 1
do. 4½% Pref.	5	4½	4½	4½	—	6 6 0
India-Rubber	1	Nil	Nil	16/3	+½	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 1
Siemens Ord.	1	7½	7½	31/3	—1/16	4 16 1
Telegraph Construction	12	10	10	24½	—	*4 10 1

* Dividends paid free of Income Tax.

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Economic Conditions in Belgium.

Considerable Electrical Progress Reported.

WE have received from the Department of Overseas Trade a report on economic and trade conditions in Belgium during 1928 by Mr. N. S. Reyntiens, O.B.E.,* who recently succeeded Mr. J. Picton Bagge as Commercial Secretary at the Brussels Embassy.

In his introductory remarks, Mr. Reyntiens states that the note of optimism struck by Mr. Picton Bagge in his last report has been more than justified. Practically all industries are flourishing (with the possible exception of the linen industry), and unemployment is practically non-existent. The country's financial position is strong, and the National Bank reduced its discount rate from 4½ to 4 per cent. during the year. The metallurgical industry enjoyed prosperity; the production of steel, pig iron, and zinc is continually increasing, and order books are well filled. The electrical industry has developed considerably, and this is in no small measure due to the extended use not only of electric light, but also of electric power even in the remotest villages. The marked movement towards the re-establishment of home industries has also contributed to this prosperity.

The future of Belgium is distinctly bright. Public and private finance are sound, industry and commerce are in a flourishing condition, vast improvements in water and road communications may be expected, the port of Antwerp has been greatly improved, and the railways, in spite of low tariffs, are worked at a profit. Although British export trade to Belgium still suffers from high prices, it is satisfactory to note that British exports have increased in quantity and value. The general increase in wages has increased individual purchasing power, and remissions of taxation are anticipated; British trade should eventually benefit from these facts.

Electrical Development.

The use of electricity made further progress during 1928. The effects of the stabilisation of the currency again induced consumers to use electrical energy for power purposes, while largely as the result of propaganda there was an increased domestic consumption. The distribution network continues to spread, and the construction of a h.p. line between Louvain and Liège has completed the linking up of the eastern and western parts of the country. A line connecting the new central station at Schelle with the stations of the Charleroi basin is in process of construction; this will effect a junction between northern and southern Belgium. Other important interconnections are being made. There are now 25,000 km. of high- and low-pressure lines; of 2,700 communes no fewer than 2,150 are now supplied with electricity, placing it at the disposal of about 92 per cent. of the population. Precise figures of the production of electricity are not available, but that from public stations is put at 1,300 million kWh, and industrial stations are credited with 2 million kWh, the total representing 415 kWh per head of the population.

Public authorities are taking a lively interest in the use of electricity, either by means of subsidies for the construction of lines, as in the case of Eastern Flanders and the provinces of Luxemburg and Namur, or by participating in the formation of associations of communes for the purpose of exploiting a system, as has happened in the Provinces of Antwerp, Limburg, Liège, Hainaut, and Western Flanders. The province of Brabant, co-operating with about 80 communes, has just formed an association which will serve nearly all the communes hitherto unprovided with electricity. Financial stabilisation has necessitated an increase in the prices charged for electricity, the mean of which was 50 centimes per kWh in 1914, and 1.90 fr. before stabilisation. The index figure now shows a multiple of 8.5, and negotiations have been entered into by distributors and communes which will probably tend to fix the average price at 2.70 fr. per kWh. Centralisation in this industry is again noticeable, and the union of Liège power stations has been joined by the power stations of Namur and Luxemburg with the title of "Linalux." Distributing companies have founded the Union Belge des Producteurs d'Electricité, whose aim is to group all producers without infringing the unacquired rights. Further mergers will probably take place in 1929 with a view to a community of interest and consequent further development of the industry.

Rural Electrification.

In small farming the use of electricity has not made up for the shortage of farm hands to the same extent as in large-scale farming. The installation of public and private electric lighting and electrically-driven dairy, pumping, grinding, laundry, root cutting and threshing machinery has had considerable extension, especially in villages. The demand keeps pace with the installation facilities and modern improvements of apparatus. An instance is given in Southern Belgium, where 27 villages were connected up in 1928. Out of 2,385 potential clients 1,974, or 82.5 per cent. made use of the new facilities. In the Limburg province this work, which was begun in 1921, will be finished by the end of 1929. By then 722 km. of line will have been installed. At the date of the report 595 km. of line was in use, furnishing 85 per cent. of the population of the province with electricity. Lectures on elementary electricity and the installation of appliances, organised under official auspices, have been well attended since 1925.

Communications and Broadcasting.

The telegraph system comprised 43,704 km. of lines on December 31st, 1928; of these submarine cables between the United Kingdom and Belgium represented 502 km. It is intended to replace the overhead lines between Antwerp and Charleroi and Liège by underground cables. A Bill has been placed before the Senate providing for the formation of a "Régie," placing the telegraph and telephone systems on an industrial basis, as has been done with the railways.

On October 31st, 1928, the number of telephone subscribers was 167,998, and the number of exchanges was 407. This presents an increase in one year of 22,673 subscribers and 8 exchanges. New overhead lines for inland traffic with a length of 2,346 km, and with a length of 300 km. for international traffic, were erected during the period January 1st-October 31st, 1928. There are now seven automatic exchanges in the Brussels area, which has been entirely served by this system since October 15th, 1928. Other exchanges will be built in the capital to satisfy the ever-increasing demand. Telephonic communication has now been opened without restrictions with Cuba, Spain, the United States, the Irish Free State, Norway, Portugal, and the principal towns of Canada and Mexico. The partial service with Germany and Sweden has now been extended to the whole system of those countries.

As the local broadcasting programmes are generally considered inadequate, there is only a limited demand for single-valve receiving sets. The bulk of the country's requirements of radio apparatus are met by one of the large concerns which employs about 350 workers and makes receiving and transmitting sets and parts and apparatus of all descriptions. French and German competition is intense, but American importers have found it difficult to obtain a footing in the market owing to the fact that their sets are not suitable. Expensive first-class sets with not fewer than four valves (including portable types) of British origin sell very well. There is scope for highly-decorative British furniture cabinet sets. There is usually a good demand for accessories such as loud speakers, batteries, and novelties of United Kingdom origin. Several prominent British firms are well represented, and in these lines do good business in Belgium.

Miscellaneous.

Considerable improvements are being made in the ports of Antwerp, Brussels, and Ghent. At the first port additions were made during the year to the hoisting apparatus, including 12 three-ton electric cranes. This year 58 similar cranes are being installed, as well as 5 five-ton cranes. The Port Arthur dock at Ghent was equipped with 12 three-ton cranes, and this year a further 20 are being added, as well as a 30-ton floating electric crane. Tenders were to be invited this year for the construction of a sub-station, &c., and the installation of cranes in the Avant-Port, Brussels.

As most industries now have wage agreements based on the cost of living, wages showed a steady increase during 1928. The percentage of unemployment in a representative group fell from 2.2 per cent. in January to 0.6 per cent. in October, 1928. The "family allowance" system continues to progress, and a Bill compelling successful tenderers for public contracts to pay these allowances became law in April last year. There is no doubt that the movement will expand still further when the effects of the new law are fully felt.

Special attention has been paid by the coal industry to the use of pulverised coal and the extraction of valuable by-products and their sale to industry for power, lighting, agricultural, and industrial purposes. Close co-operation of banking, chemical and electrical interests has been effected for this purpose.

In an appendix to the report dealing with Luxemburg it is stated that a law of January 4th, 1928, approved the agreement entered into by the Government with a French company on November 11th, 1927, whereby a concession was granted to the latter for the construction and operation of lines for the distribution of electric power and light. The law authorised the Government to issue a loan for 25 million fr. in connection therewith. The duration of the concession is 30 years, and is renewable by tacit consent for further periods of 10 years, unless one of the parties notifies to the other its intention of abandoning it. Such notification must be given at least three years before the expiry of each period. The concession constitutes practically a monopoly.

Statistics of Belgium's foreign electrical trade during 1928 appeared in our issue of March 29th (p. 581).

* Stationery Office, 4s. 6d. net.

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The I.M.E.A. Convention—IV.

A Report of the Proceedings and Social Functions at the Annual Convention at Torquay.

It was a happy idea of the I.M.E.A. Council to introduce into its programme at Bath last year a "Women's Day." This new feature was continued at Torquay. It must not be regarded merely as a graceful gesture—due to women for the interest they have always taken in I.M.E.A. Conventions—but rather as official recognition of the important part they must play in promoting the use of electricity in the home. The outlook of women in this sphere is bound to be more practical than that of men, since women alone possess training for and experience of housekeeping. Moreover they have the right to decide what kind of household appliances they shall use.

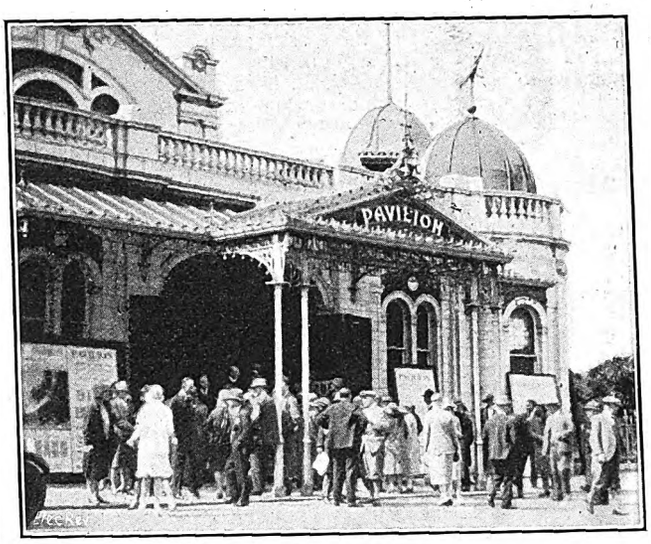

Fig. 1.—The Scene of Many Meetings.

It is, we think, now generally accepted that domestic uses of electricity offer great opportunities for increasing both output and load factor, but it is not so fully realised that, in the opinion of many leading engineers, the potentialities in this direction are greater than in any other. This view is ascribed to Dr. S. Z. de Ferranti, President of the British Electrical Development Association, among others, as well as its corollary that women's help to this end is essential. As an illustration, it is said by experienced show-room managers that they prefer not to sell or hire electrical apparatus to men unless their wives have first approved of the actual article. Dr. Ferranti's name is mentioned, not only because his interest in the subject—based on practical experience—is well known, but because, throughout a period of some forty years, his views as to the future trend of electricity supply generally have proved so consistently correct that his opinion in this particular may be regarded as a fortunate omen for the future of the Electrical Association for Women. Attention may here be suitably directed to two points in his contribution to the discussion on Mr. Jennings' paper on tariffs. One was the necessity for a two-part tariff with the primary charge as high as might be necessary to allow the running charge to be as low as possible; the other was the importance of good service to consumers.

"Women's Day" at Torquay opened with a lecture by Miss M. Partridge, B.Sc., on "Women's Work in connection with Rural Electrification in Devonshire," at which Mrs. Nichols Moore presided. To illustrate her remarks Miss Partridge showed a map of Devon, indicating the villages to be linked up to receive supplies in bulk from Torquay, Exeter and Plymouth. Miss Partridge referred to the developments that have taken place within the last two years and expressed the view that many of the villages referred to would be electrified within another two years. The former industrial prosperity of Devon depended on water-power and faded away with the coming of steam. It could be revived when electricity became available, but in that case there would be no need for unhealthy factories in congested areas. Electricity would enable small home industries, such as weaving, to come once more into their own amid healthy rural surroundings.

The possibility of obtaining a supply of electricity would depend upon the magnitude of the demand and women could, by educating the public, help to create such a demand. For electricity to be cheap, overhead lines must be used. Those who did not like the appearance of the poles could train roses to grow up them or else get used to them.

We are disposed to agree with Miss Partridge's implication that it is only a question of time before overhead electric lines are accepted as part of the natural order of things and perhaps even more than that. There is, we believe, a society in Holland for the preservation of old windmills, which, no doubt, when erected were considered disfigurements of the rural landscape. Turner showed us the beauty of steam-trains and modern Pennellesque art indicates that even iron-works have their splendid aspects.

Miss Partridge related how she had trained a number of girl apprentices and had found them not only very apt at their work, but also of great help in overcoming the fear of electricity in the rustic mind. The argument was that if a girl could carry out wiring and replace a fuse anybody could do so. Many women have

Fig. 2.—Mr. E. A. Edwards at a Short Hole.

Fig. 3.—Mr. and Mrs. Ayton, of Winchester, with Miss Edwards.

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keepers preferred girls to wire their houses as they did not make so much mess as men with dirty boots.

Miss C. Haslett, Director of the E.A.W., referred to the new field of work for women opened up by Miss Partridge, who had done so much for the electrical development of rural Devon.

The vote of thanks to Miss Partridge was proposed by Mrs. Beale, President of the Birmingham Branch of the E.A.W., and seconded by Lady Snell.

The lecture was followed by a private view of the Exhibition at Old Torbay Hospital and later by a luncheon party at Addison's Café. In the afternoon eleven motor coaches, kindly placed at the disposal of the E.A.W. by the Torquay Corporation, conveyed the party to Widecombe-in-the-Moor, where tea was taken, once more as the guests of the Torquay Corporation.

The visit to the Longpark Pottery made a break in the journey that was full of interest to those who took part in it. Suitable mementos of the occasion were kindly presented by the proprietors of the pottery.

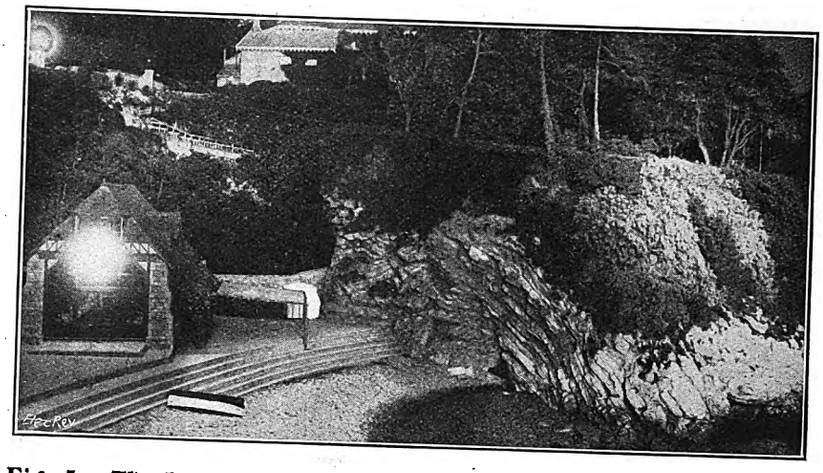

Fig. 5.—The Ladies' Bathing Beach as seen from the Medical Baths.

The Heavy Oil Engine.

Discussion on Mr. G. Porter's Paper.

Mr. Mellor (Messrs. Fraser & Chalmers, Ltd.) did not agree with the author (an abstract of whose paper was published last week) that the oil engine in this

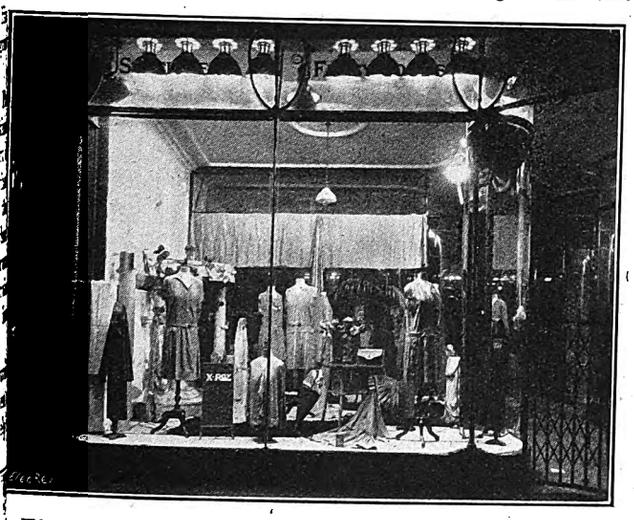

Fig. 4.—A Window of Messrs. Bobby & Co., Ltd.

ountry had languished under the shadow of the progress f steam turbines. On the contrary, he claimed that steam-rbine designers had been spurred to valiant efforts to main-ain relative progress in overall thermal efficiency and gene-ating cost per kWh produced with those which the modern l engine could give. To-day oil engines 25 years old were ving high thermal efficiency and good mechanical behaviour. rogress in metallurgy had reduced the cost of maintenance onsiderably, and to-day it was possible to give a definite surance that thermal and mechanical efficiencies would re-ain at higher levels than with any other prime mover over a ven number of years, which could not be said of a steam-rbine installation, the efficiency of which decreased as wear nd tear of nozzles and blades took place. It had always uzzled him why large electrical undertakings had not been e foremost users of heavy-oil engines, which had proved be the most economical heat prime movers known to in-stry. It might be a surprise to many to know that in London er 10,000 b.h.p. of oil-engine plant was used specially to deal th peak loads and to supply special theatre mains, which ue to the L.C.C. by-laws) were entirely separate from the dinary supply mains. Underground in the West End of ndon was an oil-engine power station capable of dealing present with 5,000 kW, and eventually with 7,000 kW, the special service mentioned above. The room was 120 ft. ng, 36 ft. wide, and 21 ft. high, and yet there was ample om for reconditioning and dismantling. All auxiliaries were the same space, switchboards and controls being on the or above. Fuel storage, filtering, and water-softening plant, ether with a cooling tower and exhaust silencers, had been nd accommodation without even the passer-by having any owledge that such plant was in operation. Could they not visualise similar, but much larger, underground stations placed in similar unobtrusive positions in crowded industrial centres? Dealing with the relative costs of steam and oil plant, Mr. Mellor suggested that the author's figure was very high for cost for oil engines and generators. It was possible to-day to buy oil engines for £7 5s. per b.h.p., and suitable alternators for £2 5s. per kW; for a station of 20,000 kW, 7 oil engines of 4,200 b.h.p. each could be bought for £220,000, and 7 alternators of 3,000 kW each could be bought for £53,000, or a total of £300,000, adding 10 per cent. for contingencies on the engines. Recently he had had to prepare a complete scheme in detail for a 12,500-kW (maximum) oil-engine station with an annual output of 50,000,000 kWh, representing a 57 per cent. load factor with an output of 10,000 kW. The capital cost of five engines and alternators, together with that of the full station equipment, foundations, buildings, cranes and storage tanks, amounted to £239,000, and the total running costs were estimated at 0.301d. per kWh generated. It was very difficult to arrive at a figure for rates, taxes, depreciation, profit, &c., but eventually he computed it at £75,000, which brought the running cost up to 0.65d. per kWh. There were five good steam stations with outputs of approximately 50 million kWh per annum each, whose average cost for the past year was 0.576d. per kWh. One London station had a figure of 1.56d. per kWh for 59 million kWh per annum, but he had not included it in the five he had mentioned. Personally, he regarded his estimate as high, and if fuel could be purchased at £3 per ton, which was not unlikely, the figure would be something below 0.6d. per kWh. Whilst pulverised fuel was lessening the cost of coal for electrical generation, parallel efforts were being made to reduce the cost of fuel oil, and in matters relating to the hydrogenation of coal and low-temperature carbonisation for the production of oil this country was not lagging behind other countries. At the moment it would be nonsensical to suggest that the oil-engine power station would have as low a total working cost per kWh as the high-efficiency base-load station using pulverised fuel, but he looked forward to the time when the production of fuel oil at the pithead would bring about a lower price of fuel oil and render oil-fuel cost per kWh unassailable. Surely the Commissioners could, without lessening their patriotism

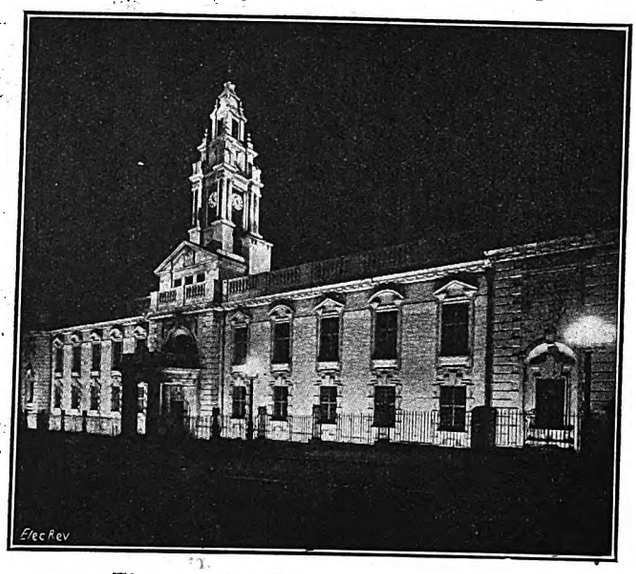

Fig. 6.—The Town Hall by Night.

towards coal, delve more sympathetically into the economical status of the large oil-engine power station for bulk supply,

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peak load, and standby? They would find no engineering reasons to excuse their neglect of the oil engine; furthermore, they would find throughout the country many centres which could be provided with power at a lower cost than that quoted by the author, *viz.*, £3 per kW and 0.25d. per kWh. This country was the pioneer of the internal-combustion engine just as much as it was of the steam turbine; why, then, should not the oil-engine industry receive the same impetus in the development of larger sets for power-station work as the steam turbine? The Electricity Commissioners were the servants of the public, and it was their duty to perform their function by thoroughly investigating whether large oil-engine stations could be efficiently used for public service. There were 25,000 employés in this country (engaged on oil-engine construction) and in a national scheme like the electricity scheme of the Government they deserved similar consideration to that which had automatically fallen to the lot of their steam-turbine colleagues. The Government and the Electricity Commissioners would be doing national service when they asked for the co-operation of oil-engine manufacturers by inviting them to build sets which would never betray the national service to which the Commissioners themselves were committed.

Mr. I. V. Robinson (B.E.A.M.A.) was not an exponent of either the internal-combustion engine or the steam turbine, but wished to call attention to a few facts upon which engineers had to base their opinions when dealing with the relative merits of oil engines and steam plant for particular purposes. Having had to go into the economics of plant for peak-load purposes in connection with a paper for the World Power Conference sectional meeting at Tokio, he had ascertained that the requirements were cheap plant in capital cost and economy in fuel, and it seemed to him that the heavy oil engine failed in both those matters at present. Nobody would suggest that it was possible to put down oil-engine plant of the same capacity as cheaply as steam plant. The efficiency of oil engines was better, and Mr. Porter did not claim as much credit for that as he would have expected him to do, but the great desideratum was the reduction of capital cost, and the paper held out some hope in that direction, because it stated that high-speed oil engines could be sold at about 60 per cent. of the price of low-speed engines. That would bring the working costs to about the same as those of steam plant, and it appeared to him, therefore, that the future of the internal-combustion engine was based upon the high-speed engine and some form of supercharging. At the same time, there was no reason why the ratio of maximum to normal rating of steam turbines should be fixed at 25 per cent., which was the usual; as a matter of fact, at the Hell Gate station in New York there was plant of from 80,000 to 90,000 kW normal rating which had a maximum rating of 160,000 kW for a short period. Both types of plant were equally reliable; as regarded flexibility, he believed steam plant would hold its own, and as regarded cost the internal-combustion engine would be able to make a good show provided a high-speed supercharged engine could be developed.

The President then introduced Mr. Maximilian Gercke, of the M.A.N. Co., of Germany, who had come over specially from Nurnberg to support Mr. G. Porter.

Mr. M. Gercke emphasised the need for close collaboration between oil-burning and coal-burning stations in order to produce electricity as cheaply and efficiently as possible. The proposal to use steam at the base-load stations and to have local Diesel installations as stand-by and phase-rectifying sets had been applied with remarkable success in some Continental districts, especially in Hamburg and Berlin, both of which had been mentioned by the author. The Hamburg station had thus saved some 5,000 tons of coal last winter season, in addition to saving the situation on several occasions when the supply was threatened with interference through ice trouble in the condensers of the steam installation. There were great possibilities of developing the heavy-oil engine in Great Britain by using coal-tar products for Diesel engines. The production of coal tar in this country was very considerable, and would be sufficient to operate large peak-load installations with coal-tar oil, and thus obviate the import of foreign Diesel oils. Referring to the rapid development of the high-powered Diesel engine, he said that in one week recently the M.A.N. Co. booked orders amounting to 36,000 b.h.p., including a tenth repeat order for a 4,000-kW set for the Chilean Nitrate Co.

Mr. J. Christie (engineer and manager, Brighton) said that as a near neighbour of the author for many years he had watched with the greatest interest the gradual development of his old and somewhat inefficient steam station and its ultimate replacement and extension by modern Diesel plant which, for its size, was one of the most completely equipped and efficient Diesel-engine stations in the country, and the results achieved there stood second to none. Mr. Porter, however, would not be allowed to extend that station, and under the "grid" system would take his additional power in bulk from the Southwick station of the Brighton Corporation. The supplementary supply from that source would be a comparatively small, but gradually increasing, quantity, and the demand so taken would be operated as a base load to the highest possible load factor, and the seasonal peaks would be met by running the efficient Diesel plant as and when required. The author had made out a most excellent case for Diesel engines and their more extended use as emergency and peak-load spares, even on a big scale, for use in connection

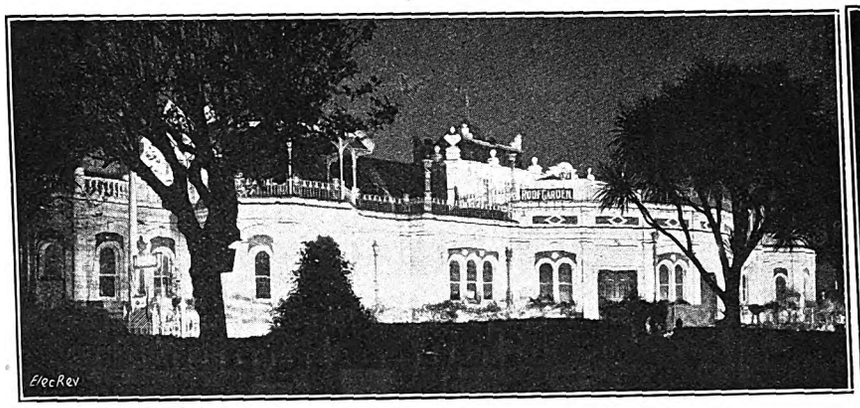


Fig. 7.—The Pavilion under Floodlight.

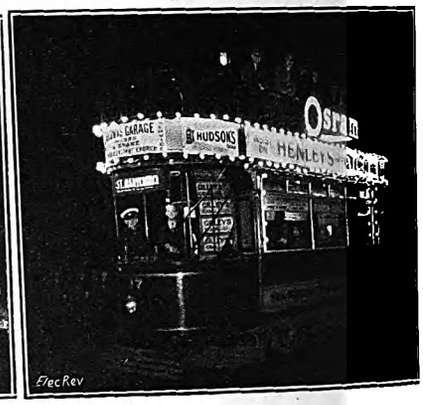
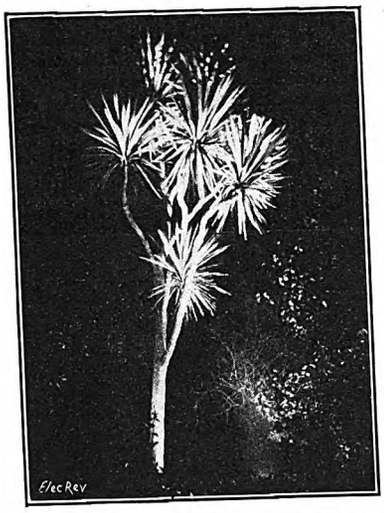


Fig. 8.—A Corporation Tramcar.



Figs. 9, 10 and 11.—Flood-lighting Effects in the Royal Terrace Gardens.

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with super-power stations supplying the national "grid" system. He had recently read in connection with the high-voltage supply system in Palestine and around Jerusalem from the hydro-electric scheme now under construction, that Diesel-engine-driven stations were being used for developing the demand in the outlying areas, pending the construction of the high-voltage transmission lines with static sub-stations in the early stages. When such stations as that of the author were shut down he suggested that the highly efficient plant might be utilised by the Central Electricity Board for developing the demand in the outlying areas in this country until the demand justified the heavy capital expenditure of extending the "grid." Mr. Christie said he could not speak personally with much authority of the operation of Diesel-engine plant, his only experience having been of a comparatively small semi-Diesel equipment put down some three years ago to supply a large institution under the control of the Brighton Corporation, but outside the limits of its area of supply. Three 50-kW sets last year generated approximately 275,000 kWh on a load factor of 30 per cent. at an "all-in" works cost of 1.07d. per kWh, or 2.06d. per kWh, including all capital charges and expenses on a most generous scale for all sorts of equipment and maintenance which were hardly chargeable to the cost of generation. The company supplying in that area charged 10d. per kWh for lighting and from 5½d. to 3¾d. per kWh for power, so that there was still a wide field for isolated plant under favourable conditions.

Mr. H. W. WATTS (engineer, Epsom) said that in his station a Diesel engine was installed in 1912; a new up-to-date engine now being installed, of the double-acting 2-stroke type, was of 150 per cent. greater power, but occupied less space than the older plant, which fact was an indication of the progress made in the construction of that type of prime mover. For power station work the dice had been loaded against the Diesel engine by the very short loan repayment period allowed, and now sanction to extend such plant was withheld altogether. Yet, with its higher thermal efficiency, the Diesel engine was a serious competitor of the best steam plant. It had become a debatable question whether it would prove economical to transmit electrical energy over long distances to meet the peaks, and it became a question of what type of plant would efficiently generate the energy required at a point as close as possible to where it would be required. The Diesel engine, being better in thermal efficiency than up-to-date steam plant, was definitely suitable for that purpose. New plant could be installed for £11 per kW, and at 8 per cent. for interest and depreciation that worked out roughly at £1 per annum, whereas bulk-supply authorities found it necessary to charge often considerably more than £4 per kW of maximum demand; thus there would be a considerable saving with Diesel plant. He had received quotations from British manufacturers of Diesel engines for a 5,000-kW set for £11 per kW, and had been offered a figure of consumption of 0.47 lb. of fuel per kW, which was lower than any given in the paper. After mentioning the poor thermal efficiencies of many of the steam stations in the S.E. England Electricity District, Mr. Watts suggested that the author had been too optimistic as regarded his figures of steam station fuel costs. There was not a steam station in the South of England which could show the costs set out in the paper, not even Barking, with its thermal efficiency of 19.145 per cent. On the other hand, at Epsom he himself was getting the oil-fuel costs mentioned in the paper, and any heavy-oil plant should easily get such results. He asked all station engineers using steam plant, and particularly those who would have the control of selected stations, to consider very carefully the use of oil engines for taking care of the peak loads. The only disadvantage of the Diesel engine at present was that the oil had to come from oversea, but that could be got over in cases of emergency by ample storage, and it should be remembered that, bulk for bulk, it could be stored in far less space than coal, and there were no ashes. One power company had had to acquire 32 acres of land to dispose of its ashes.

Mr. C. M. JOHNSTONE (engineer, Shrewsbury) pointed out that the paper seemed to suggest that above a speed of 250 r.p.m. the author would advise the adoption of very high speeds of rotation and exclude the possibility of the satisfactory performance of engines running at medium speeds and specially designed for central-station work. In 1923 there were installed at Shrewsbury two low-speed engines of 250 h.p. each which had given every satisfaction, and in 1927 and 1928 they were added to by the installation of two 6-cylinder, 600-h.p. sets, which had given excellent results, running at 350 r.p.m. Those two engines were of the four-stroke type with air injection. The bore and stroke were 15 in. and 17 in., respectively, and the mean effective pressure at full load was 93 lb. per sq. in. The compression pressure was 460 lb. per sq. in., and the firing pressure 500 lb. The piston speed was 990 ft. per minute. The compressor was incorporated in the engine and mounted in line with the cylinders at the end remote from the generator. Several sets had been supplied, or were in course of construction. The generating cost at Shrewsbury with an output of 2,322,340 kWh per annum, a load factor of 28.5 per cent., a running plant load factor of 66.07 per cent., and a fuel price of 93s. 3d. per ton, was 0.569d. per kWh, and owing to that low cost the Shrewsbury Corporation was able to sell energy at rates which were among the lowest in the country. The author had not touched upon the advantage of housing Diesel-engine plant without annoyance in the neighbourhood. With well-balanced six-cylinder engines there was no need to fear vibration troubles and, as at Shrewsbury, it was possible to have the power station right alongside public buildings and residences. With previous speakers, he emphasised the advantage of the use of Diesel engines for peak loads, and suggested that the combination of Diesel engines and a partial bulk supply would show a considerable saving.

Mr. BERTRAM KELLY (Douglas, I.O.M.) said that in his power station last year four heavy-oil engines generated 2¼ million kWh at a cost for fuel, oil and water, &c., of 0.39d. per kWh generated. The fuel consumption was 0.92 lb. of furnace oil per kWh generated, at 75s. per ton, and the cost worked out at 0.287d. per kWh generated, which was as good as the very best example quoted in the paper. The Electricity Commissioners and the Central Electricity Board had no jurisdiction in the Isle of Man, but very shortly his station would develop into a capital station in a small way for supplying the whole of the island, an area of about 200 square miles. There would have to be from one to three, or even four, sets of 4,000 kW capacity and, although it was contemplated to put down a steam station, he intended to use Diesel engines in conjunction with the steam plant.

Mr. H. L. HOWARD (Macclesfield Electricity Supply Co.) expressed the view that steam engineers had been trying for many years to catch up the oil engine in the matter of thermal efficiency, and added that they had a long way to go yet. Mr. Gercke had mentioned tar-oil fuel, but many years ago he had had occasion to go very closely into the question of tar oil. In Germany the tar-oil industry was highly developed, and there was a surplus of tar there because they had not the quality of roads there that we had in this country. Here there was no surplus of tar sufficient to warrant the large gas undertakings putting down plant for proper distillation. He had been told by one of the leading London gas companies that it could sell all its tar for road purposes and make a good profit without treating it for the purpose of oil production. He had a large number of Diesel engines, some of them 15 years old, but they were all doing consistently good service, day in and day out, and were as efficient as the day they were put in. The secret was careful and efficient maintenance.

Mr. G. Porter promised to reply later owing to lack of time at the meeting.

Standardisation of Methods of Charge—Some Thoughts and Considerations.

By E. J. JENNINGS, F.C.I.S., Assoc.I.E.E., Secretary, Birmingham Electricity Undertaking.

(*Abstract.*)

A wide diversity of rates, the chief of which are enumerated below, exists throughout the country:

Flate Rate Systems.

(1) Flat rate per unit irrespective of consumption.
(2) Flat rates per unit on sliding scale, according to consumption.
(3) Flat rate, subject to increasing discounts dependent on consumption, also subject to further discounts for load factor and power factor.

Two-Rate Systems.

(4) Flat rate per kilowatt of "registered" maximum demand, plus a secondary charge per unit.
(5) Flat rate per kilowatt of "agreed" maximum demand, plus a secondary charge per unit.
(6) Two-rate charge per unit, varying according to the period of time during which energy is consumed.
(7) For power and heating.—Minimum consumption per quarter per horse power of demand at fixed rate per unit, with excess at secondary rate and sliding scale of discounts.

Two-part Tariffs.

Two-part tariffs, consisting of an annual fixed charge, plus a running charge per unit. Method of calculating fixed charge varying as follows:—

(8) Percentage on ratable value.
(9) On number of rooms.
(10) On floor area.
(11) On hours' use of maximum demand.
(12) On allocated or assessed number of units.
(13) Per lampholder.
(14) On wattage of lamps installed.
(15) On adequate lighting wattage, assessed.
(16) On average lighting consumption for three years, plus x per cent. New connections assessed.
(17) On "active" lighting wattage.

Miscellaneous.

(18) Service charge per quarter, irrespective of number of rooms, plus varying rates per unit under varying conditions.
(19) Fixed charge per wattage of lamps installed irrespective of consumption.
(20) Fixed charge per first kilowatt of lamps installed and lower charge for each additional kW, plus rate per unit.

The desirability of evolving some sort of order for the foregoing state of affairs is apparent, and the fact that within the course of the next few years practically all electricity

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undertakers will cease to be generating authorities and will become purchasers of electricity in bulk from the Central Electricity Board on the basis of a two-part tariff, makes the necessity for undertakers to overhaul the tariffs on which they are retailing the energy still more apparent.

The author was privileged at one time to serve under that veteran tariff builder, Mr. Arthur Wright (first president of the I.M.E.A.), and calls to mind his apt observation to his committee to the effect that the designing of a "scientific" tariff was as difficult and as much a matter for experts as designing a complicated switchboard.

There has been rather too much tendency in some quarters to found tariffs on "scientific" principles, but there is no such thing as "exactitude" in general commercial practice, in the sense that there must be in engineering practice.

No doubt a manufacturer always aims at making a profit on each of his products. The measure of that profit is determined by market conditions, competition, and so forth, but there is such a thing in commerce as "losing on the swings to gain on the roundabouts"; in other words, prices are adjusted according to the character of the demand for his product and the whole of the circumstances in relation thereto.

The late Dr. John Hopkinson, F.R.S., laid down in his Presidential Address to the Junior Engineering Society, November 4th, 1892, the first principles of tariff-making. Briefly, the Hopkinson theory is that the cost of electricity supply depends mainly on the rate at which it is taken rather than on the quantity of energy supplied. The costs are of two distinct categories, *viz.*: (1) those that do not depend on the number of hours of supply, and (2) those that are directly proportional to the hours of supply.

Mr. Arthur Wright was the first to attempt to translate this theory into practice with his maximum-demand system.

The actual time of supply may be of more import than the number of hours of supply. For instance, a consumer with a load factor of 30 per cent., if taking supply wholly during off-peak hours, will be cheaper to supply, relatively, than one with a 100 per cent. l.f. whose demand must of necessity cover the peak load.

Water heating during the night provides an example of this principle, and any margin in price that can be obtained over the actual cost (say 0.25d. per unit) of the extra fuel, &c., required to meet this type of demand will all be profit for the undertaking. In spite of this, how difficult it is sometimes to persuade the powers-that-be that a rate of 0.375d. or even 0.5d. for this type of "valley" supply is good business.

There are wide differences of opinion as to diversity values, but the following appear to be approximately correct on the average:—

Domestic lighting	1.5
Commercial lighting	1.2
Power	2.0
Cooking and heating	8.0

The major portion of the total costs per unit of output is definitely of the order of "fixed" charges; that is to say, all this expenditure must be incurred in preparing to supply before a single unit is sent out from the works. Once this class of expenditure is provided for, any additional cost per unit of output is comparatively small.

Perhaps this can best be illustrated by taking two extreme cases, *viz.*:—

Consumer A demands 10 kW for 1 hour each day per annum.
Consumer B demands 1 kW for 10 hours each day per annum

Assume

(1) Total capital cost at £50 per kW and loan service charges at 8 per cent. per annum.
(2) Fixed costs (other than loan service charges) at £2 per kW per annum.
(3) Running costs at 0.25d. per unit.

The number of units demanded per day in both cases is identical, but the total cost in the first case is more than six times the cost in the second case. If the respective prices charged are 4½d. and 1½d. per unit, in the first case (that of lighting) the profit amounts to £4 12s. 9d., whereas in the second case (power), in spite of the price being less than one-third of that of the former, the profit is practically double.

These figures show that the low-priced supply is contributing to results, not only relatively, but actually far more than the high-priced supply.

The cost components of the order of "fixed" or "standing" charges are:—

(i) Capital charges as a whole (interest and sinking fund, &c.).
(ii) 15 per cent. of the cost of fuel, oil, water, &c. (required in order to be "ready to supply").
(iii) 90 per cent. of wages and salaries at stations.
(iv) 80 per cent. of repairs and maintenance costs (generation and distribution).
(v) Rates, taxes and rents as a whole.
(vi) Management and miscellaneous expenses as a whole,

leaving as "running" charges:—

(i) 85 per cent. of the cost of fuel, oil, water, &c.
(ii) 10 per cent. of wages and salaries at stations.
(iii) 20 per cent. of repairs and maintenance costs (generation and distribution).

Figures relating to the Birmingham undertaking for the year 1927-28 analysed on the above basis are compared with corresponding particulars for six of the largest municipal undertakings for the same year.

"Fixed" Costs.	Per cent. of Total Costs. Aggregate of six large undertakings.	Birmingham undertaking.
(1) Capital charges (whole) ...	39.83	41.26
(2) Fuel, oil, water, &c. (15 per cent.)	2.97	3.08
(3) Wages and salaries at stations (90 per cent.) ...	4.34	4.23
(4) Repairs and maintenance, G. & D. (80 per cent.) ...	13.41	14.25
(5) Rates, taxes and rents (whole)	12.49	10.35
(6) Management and miscellaneous (whole)	6.31	5.37
Total "Fixed" Costs ...	79.35	78.54
"Running" Costs.		
(1) Fuel, oil, water, &c. (85 per cent.)	16.81	17.43
(2) Wages and salaries at stations (10 per cent.) ...	0.48	0.47
(3) Repairs and maintenance, G. & D. (20 per cent.) ...	3.36	3.56
Total "Running" Costs ...	20.65	21.46
	100.00	100.00
Fixed costs per annum per kW of max. demand ...	£8.077	£7.765
Running costs, per unit sold	0.220d.	0.246d.

It must be conceded that both legally and in equity charges *should be related* to costs to a large extent. In any case the true import of costs as defined between those of a "*fixed*" and "*running*" order, respectively, must be understood clearly by all concerned with the framing of tariffs. But slavish adherence in the framing of tariffs to a "scientific" analysis of costs may well be fatal to any real progress in the development of Undertakings.

In the past there has been far too much effort devoted to attempting to get each unit of output to make an equal percentage contribution to the standing charges and profit.

One must be prepared to take ordinary commercial risks if the business awaiting capture is to be secured. A temporary loss of revenue may follow the initiation of a forward policy, but the reward in the shape of increased turnover most assuredly follows in due season.

"Equity" has become something of a fetish. Electricity supply, apart from the element of service to the community, is a business proposition. It is a matter of buying raw materials and producing and selling commodities. Some of the "leaven of commercialism" must be used in with the other ingredients if a "cheap and abundant" supply is to be attained.

It is a sound commercial axiom to find out what you can get for your product and get it, even if it shows a much larger margin of profit than you would expect to get on the average. It will then be possible to sell some other product at a price below that normally aimed out, showing only a small margin of profit, and one will more than balance the other.

This commercial doctrine of "expediency" should be put into practice by Electric Supply Undertakings, subject, of course, to the legal limitations imposed upon them.

The legal limitations are first of all that under the 1882 Act it is laid down that where supply is given in any part of an area every consumer is entitled to a corresponding supply under similar circumstances on the same terms as other consumers in that part of the area. Secondly, that in making agreements undue preference may not be given to any consumer.

The question of "undue preference" has been the subject of much discussion and of litigation on a few occasions. Case law has made it clear that the reason for different charges must be different costs, and that differentiation is justified in relation to cost. In the course of his judgment in the case of the Attorney-General v. Long Eaton Urban District Council, Mr. Justice Sargent said: "It would seem that A. must not be charged less than B. merely to overcome a greater reluctance on the part of A. to become a customer, or to induce A. to become a customer in respect of another supply, although either of those reasons might be a good commercial reason for charging less to A. were the public Undertakers merely carrying on any ordinary commercial business."

Then it is provided that maximum prices per unit specified in each Order may not be exceeded. These maxima are, generally speaking, well on the high side having regard to present-day conditions.

So much for the principal Act. Turning now to the Electric Lighting Clauses Act, 1899, it is laid down that the charges to any ordinary consumer may be (*a*) by the amount of energy supplied, (*b*) by the electrical quantity contained in such supply, or (*c*) by any other method approved by the Minister. Under the 1899 Act, a consumer who did not like any approved method under (*c*) had the option of electing to be charged under either (*a*) or (*b*), but this option was removed by Section 22 of the Electricity (Supply) Act, 1922.

It is thus now competent for Undertakers, provided they can satisfy the Minister of Transport as to the reasonableness and

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equity of the method of charge proposed to be adopted, to get the Minister's sanction to a compulsory multi-part tariff under (c) above. It has to be recorded, however, that no such tariff has yet received official sanction, and thus all existing two-part tariffs are the subject of agreement with consumers, and are not statutory or mandatory in their character.

Electrical energy is only of value as an agent for some definite service, such as lighting, heating, power, cooking, &c. The price obtained should bear *some* relation to actual costs, but not necessarily the same relation to cost in each case, for it must also undoubtedly have regard to the cost of any competitive service. Points to be emphasised here are (1) that electricity supply has not an absolute monopoly in respect of any service it renders, and (2) that the law of supply and demand governs the business to a large extent.

If a large class of supply can be obtained at any margin above running costs, provided it does not call for further capital expenditure, then it is economic and wise to take it on. Prices and costs react on each other, and any contribution to standing charges shown by the margin referred to is all to the good so far as the general body of consumers is concerned.

Further, the small lighting consumers, if the rule referred to of exacting the same percentage of standing costs and profit were rigidly applied, would have to be charged considerably more than their present prices.

While price does not need to be too closely related to actual cost, electricity for water heating calls for what may be termed "cut" prices, for commercial reasons. Its contribution per unit to standing costs can only be very small, but, in view of the potentialities of this demand and its influence in filling up the dips in the load curve, it will make a very valuable contribution in aggregate to those costs.

The great majority of consumers require an electricity service in the first instance for lighting purposes. It is the primary requirement of the consumer, and at the same time is the least desirable type of demand from the supplier's point of view. From its natural characteristics, it inevitably creates a peak over all other types of demand for very short periods of the twenty-four hours; it is seasonal in its incidence and gives in itself the poorest possible load factor. Thus in every way it is the most expensive section of an undertaking's business, and in equity should be made to carry as much of the standing costs as it will stand.

The practice obtaining in some towns of so arranging prices and tariffs as to provide substantial surpluses for rate funds is much to be deprecated.

A deliberate policy of charging more than would otherwise be necessary, in order that the ratepayers' pockets, quâ ratepayers, may be relieved, is contrary to the spirit of the Acts under which it was made possible for public authorities to become authorised undertakers.

It has become too easy to appropriate trading funds that should have gone to (a) improvement of the service, (b) reserve, or (c) reductions of charge, so as to make rate fund requirements balance.

It is well therefore that the Electricity (Supply) Act, 1926, definitely puts a veto on any contributions to rate funds after March, 1930, unless and until there is a sufficient reserve fund accumulated to establish a reasonably secure position, and then only within clearly defined limits.

All the available evidence on the subject seems to indicate that in any scheme of standardisation the ultimate general adoption of a two-part tariff is desirable.

A scale of flat rates, which attempted to cover the whole of the business and at the same time to be equitable in its incidence, would need to be of such a comprehensive character as to be both bewildering to the potential consumer and difficult and expensive of operation.

The general adoption of a two-part tariff has already been advocated by the strong Advisory Committee on General Supplies of Electricity and Methods of Charge, appointed by the Electricity Commissioners in 1925 and presided over by Mr. J. W. Beauchamp.

The undertaking with which the author is connected has adopted a mixture of (b) ratable value and (d) floor area, coupled with actual lighting consumption (if consumer already on books) over a period of two or three years. Regard is had to all three factors in assessing the domestic consumer's fixed charge; in other words, an "electrical" assessment is quoted, and the consumer is not told that it bears any fixed relation to the ratable value of the premises, though it rests mainly on this. This amounts to the "weighting" of the ratable value in an attempt to get rid of the inequalities of a hard and fast percentage of ratable value.

Whilst a "mixed" basis for assessing the fixed charge, such as has been adopted in Birmingham and elsewhere, cannot, in the opinion of the Advisory Committee, become mandatory, and can only be by agreement with the consumer, the experience gained in operating it may provide data on which to base a sliding scale percentage on ratable value that will satisfy the requirements for a statutory method of charge under Section 22 of the 1922 Act.

The author feels that a blend of ratable value and area as a basis, so far as domestic supplies are concerned, presents so many advantages over others that it provides the most likely solution of the problem.

It is wise to divide the annual fixed charge over the four quarters of the year as far as possible proportionately to normal lighting requirements—say, one-sixth for each summer quarter and one-third for each winter quarter—so as to avoid the consumer's natural objection to paying too heavily in summer. These charges should be collected in advance; this will (1) lessen the possibility of bad debts, and (2) provide a substantial amount of working capital.

It is of interest to point out in this connection that our friends of the gas industry, having operated on flat rates of charge for more than three-quarters of a century, are now seeking power to introduce two-part tariffs.

The conclusions reached as the result of a general survey of the incidence of costs, experience of progressive undertakings, and the evolution anticipated under the 1926 Act are therefore:—

(1) Standardisation of methods of charge is desirable in the larger interests of the industry,

(a) because in future practically all electricity supply undertakers will themselves be purchasing bulk supplies on a "common" basis, even though rates themselves may differ owing to differing conditions;

(b) because it will avoid confusing consumers who move from one area to another if a system of charge is universal throughout the country, as in the case of the telephone service.

(2) Equity and experience alike call for the general adoption of a two-part tariff with possibly two-rate meters in certain cases. Any tariff adopted must be sufficiently elastic to permit and encourage freely a policy of filling in the "valleys" in the demand curve.

(3) With regard to the basis for assessing the primary charge to cover standing costs, no universal standard, capable of meeting all requirements, has yet been evolved, but, as nearly as may be, this should be related to the size of the building and the character of its use (*e.g.*, domestic or commercial), and in the case of industrial supplies it should be on the actual maximum demand.

(4) In any tariff or method of charge adopted every unit or output should bear some contribution, but not necessarily the same percentage contribution, towards fixed or standing costs.

(5) The difficulty of dealing with large undertakings developed on the basis of graduated flat rates should be met by the offer of alternative attractive tariffs of a two-part character, and a process of gradual change-over. Consumers should be given the option for a limited period of either two-part tariff or flat-rate system, and reductions of charges should in future be confined to the two-part-tariff rates.

Discussion of Mr. Jennings's Paper.

Mr. C. G. MORLEY NEW (borough electrical engineer, Cardiff) remarked that, although the author did not specifically say so, the greater part of his paper seemed to be directed towards tariffs for domestic supplies. Whilst he personally was in agreement that standardisation of methods of charging was desirable in the larger interests of the industry, he considered the first reason set out by the author why standardisation was necessary, *viz.*, that so much bulk supply would be given, was somewhat weak. He could not see why purchasing in bulk on a two-part tariff should necessitate drastic alterations in the tariffs upon which business had already been built up. As to the ratable value blended with floor area and previous consumption, as adopted in Birmingham, it seemed that the tariff depended very largely upon whether a consumer had, or had not, been supplied previously. The proposal seemed to complicate rather than simplify the tariff, and what was wanted more than anything else was simplification of tariffs. In his opinion the new rating Act had simplified the matter considerably and should assist in enabling a tariff to be devised on that basis, although there still might be anomalies, such as similar houses being assessed differently for various reasons. Some regard, however, must be had for the circumstances of the house and the amentities it enjoyed, because although of equal size some semi-detached and detached houses involved more costs by way of standing charges owing to their being a long way back from the street front, and for other reasons. He suggested that they should aim at a clear-cut ratable-value system, otherwise they might take into account the size of the family and the habits of the occupants of the house. The adoption of such a system as that suggested in the paper would mean that the prospective consumer would be totally ignorant of what electricity was likely to cost him until he made a personal application to the Department for information.

Mr. ARTHUR WRIGHT said the paper was such a complete and fair exposition of the Hopkinson method that there was very little to add to it. A most important point was to get the lay members of the Association to study the Hopkinson principles as laid down in his original paper. Most of the trouble in the electricity supply industry had been due to wrong nomenclature. They had been accustomed, for instance, to speak of electricity as a commodity, whereas it was a service, and they were entitled to charge a rental for that service as well as the cost of using it; if their tariff manufacturers had had less to say about load factor, peak load, &c., and had considered the matter solely on the lines Hopkinson had laid down, from the point of view of a service, it would have been very much simpler. That was the basis of standardisation in this matter. There were just three terms which could

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be adjusted to the local peculiarities of local costs. What could be simpler and a fairer basis than a rental charge, a user charge, and a commercial discount? Hopkinson had said that that was all they required, which was true. The danger of trying to meet a popular cry was very serious; the popular cry was for some average charge, but that was really fatal to further development, and he was convinced that it was only by following Hopkinson closely that the great mass of the public could be induced to use electricity. At present in this country not more than 20 per cent. of the houses used electricity, and of that quantity not 20 per cent. were using electricity to the full extent. Thus the field available was enormous. He had been working in countries where 90 per cent. of the houses were electrified, and in some countries in Europe there was universal adoption of electricity. The city of Amsterdam was a wonderful case of a municipality applying the Hopkinson principles thoroughly and getting the mass of the people to use electricity. In America about 80 per cent. of the houses were electrified, but in this country, owing to the disease of tariffs, which was perfectly horrible in certain towns where there was almost a tariff for every consumer, things were very backward. There must be standardisation, and he submitted that Hopkinson had shown how to get on with standardisation. The duty of every municipality and company was to give a general supply on equitable terms to as many people as possible; he mentioned the companies because there were companies which seemed to think that their sole function was to look after their shareholders, and they were quite content to go along with, say, an 8 per cent. return on their capital and supply quite a small percentage of the inhabitants. What was wanted, however, was universal supply at the lowest possible price for the crowd, and that could only be possible by means of tariffs devised on the principles laid down by Hopkinson so many years ago. He regarded it as quite wrong, in principle, to make up on the swings what was lost on the roundabouts. When buying from the Electricity Board undertakings must be careful to see that the charge to them was not based on their average cost, or the average cost to the Board, but on the true Hopkinson division of the cost. It would be impossible for undertakings taking supplies in bulk from the Board to frame their tariffs until the Board's terms were known, and he had not yet been able to ascertain what were the terms they were likely to get. He therefore urged undertakings to take his advice and scrutinise the terms offered them to see that too high a charge was not made for use, and that a fair rental was charged. If the Hopkinson principle were followed it would be found that, once having started to give a supply, the cost of adding to the output was incredibly small; 1d. per kWh would bring in a good profit, and it was not difficult (although probably neither he nor anybody else who talked of ½d. per kWh would be believed) to sell electricity at well below 1d. per kWh. In order to give a cheap supply throughout the country, however, the charge for bulk supplies to authorised distributors would have to be very much lower than anything he had seen mentioned in any report yet.

Mr. JOHN CHRISTIE (Brighton) said that if they analysed tariffs they would be struck by the complication of the various systems of charging and the bewildering number of alternative tariffs offered by some authorities. Personally, however, he had always held that a simple, easily understood, tariff with flat rates for lighting and power, each at the lowest price it was possible to offer, was the best and most attractive in the long run. If a two-part tariff were to be substituted for an existing flat rate, it would be absolutely essential that the flat rate charged should be raised, so that all consumers at present using it would be compelled to adopt the alternative system; otherwise consumers would simply want to try each system and finally adopt the one which offered the greatest advantage. To base the fixed charge of a two-part tariff on a percentage of the ratable value, number of rooms, or floor area, wattage of lamps connected, &c., meant dealing with a somewhat indefinite factor in the assessment of the charge, which was far too great a responsibility to place in the hands of ordinary inspectors. The only fair way of operating a two-part tariff was the straight maximum-demand system. In the old days when that system was in force in Brighton, consumers used to compare notes, and at the end of the year, if a good consumer got a supply at a low price and boasted about it to his neighbours who did not use the supply in the same way, there were many complaints and the staff had to spend a great deal of time trying to explain what was to the lay mind a very difficult proposition. As the result, it was decided some 21 years ago to abandon the maximum-demand system and flat rates had been charged ever since with the greatest satisfaction to all concerned. The financial results at Brighton were the "proof of the pudding." The accession of new business due to the simple, low, and easily understood flat rates in Brighton had been phenomenal during the past year or two, and he contended that by such a system the consumer in Brighton was getting his supply at a lower rate than he would on any two-part tariff. It might be said that such a system involved duplicate wiring, but in many cases the existing wiring would not permit of 3-kW radiators being installed all over a house, and it was therefore essential that a new system of wiring with suitable outlets should be provided. There might also be the disadvantage of an extra meter, but after all was that a very serious drawback? He would like to see meters supplied free of rental and, when possible, they should be purchased out of revenue. There was no question, continued Mr. Christie, that the maximum-demand system was the only system on which electricity could be purchased from the Central Electricity Board, and for charging consumers to whom it was retailed the same method should apply, charging an increased percentage to cover transformation and distribution losses, plus the margin of profit to which the undertaker was reasonably entitled. Nevertheless, for the large number of ordinary users he saw no reason for retailing on the maximum-demand system, and with carefully considered flat rates, with sliding scales for quantities, the whole thing would level out and provide a reasonable margin of profit.

Alderman W. WALKER (Manchester) said that a number of the systems of charging described in the paper were merely variations of each other, and were quite unnecessary. He was whole-heartedly in favour of the ratable-value system, because any other method of assessment meant that some subordinate must decide, and there was bound to be dissatisfaction between various consumers who regarded themselves as being in similar circumstances. The ratable-value method would be accepted by everybody, because consumers were rated in that way for other purposes, and clearly understood what it meant. The author, having spoken of the need for simplicity in the paper, went on to describe the method adopted in Birmingham, which was a combination of ratable value, floor area, and the actual lighting consumption over a period of two or three years in the case of an existing consumer. That did not seem to conduce to simplicity, and there was, in addition, the nigger that the method could not be applied to new consumers, because they had not any previous consumption, so that their assessment must be based upon some other method. Again, taking the Birmingham method, in the case of a new tenant, was he to be assessed on exactly the same basis as the previous one, notwithstanding that the habits of the new family might be totally different from those of the previous family? Looked at from all points of view, it seemed to him that the ratable-value system was the best. On the other hand, in the case of large, and sometimes special, industrial loads, it was necessary to make variations in the tariff to suit the particular conditions if the business was to be secured. For instance, electro-chemical works next door to the power station taking power at times convenient to the electricity undertaking direct from the station bus-bars and metered on the high-voltage side could not be expected to pay a proportion of the general distribution charges. One danger in connection with the industry was the introduction of politics with regard to supplies to Council estates. Very often candidates for local election promised reductions in charges for electricity as an inducement for ratepayers to vote. That was grossly immoral, and if undertakings were compelled to saddle themselves with losses on such supply and it became known to large industrial users it would be a serious thing, because they would naturally object to bearing those losses.

Dr. S. Z. DE FERRANTI, speaking as president of the Electrical Development Association, said the general public did not understand charging for electricity, and therefore tariffs must be arranged in such a way as to appeal to the general public. In the present stage of development there was no option but to charge on the basis of a two-part tariff. He did not think it very important how the two-part tariff was arrived at, but it must be high enough to cover the standing charges and enable the actual energy to be metered at the lowest possible rate. Only in that way would householders be encouraged to use a great deal of electricity in their houses for small power purposes, instead of confining its use to lighting, as was so often the case at present. The time had arrived when they must go for simplification as far as was possible. Again, the public did not understand, and was greatly troubled by, the variation of tariffs in various parts of the country. There was, of course, justification for different prices, but there was no justification for the immense differences that existed, and he was afraid that they were to a certain extent due to want of commercial efficiency in carrying on the business in certain cases. It was very unfortunate that that should be so, and it was up to the Association to do everything possible to remedy that state of affairs. Many undertakings gave a wonderful service to the community, and if the example set by such undertakings was taken as an ideal by the others it would be most advantageous for the whole industry and very beneficial to the public.

Mr. F. M. LONG (electrical engineer, Norwich), speaking of the criticism that was sometimes levelled at Electricity Committees for selling power at less than its average cost to the undertaking, said he had had occasion to go into that matter in Norwich, and found that, whereas the average cost for the whole undertaking was £10 per kW, plus ½d. per kWh. the cost for power supply was only £7; in the case of lighting it was £12. In Norwich, where there were 24,000 consumers, there were only 250 factories, which were fairly close together, so that the distribution costs were nothing like as heavy as in the case of the lighting consumers who were scattered over a wide area. It was apparent that power could be supplied very much more cheaply than lighting or domestic supplies, and it was also possible to devise a fair flat rate for such supply. For domestic purposes, naturally he did not think there could be anything simpler than the ratable-value system. With regard to heat storage and electricity used during the night, there must be a rate at least as low as ½d. per kWh. which was fully justified because there additional charges were not involved for generation or distribution. They could not go so low as that for cooking because, although some

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engineers said it was off peak load and therefore did not matter, and it could be supplied at practically coal cost, that was not his opinion. His experience had been that very large sums of money had had to be spent on increasing the capacity of the distributing mains, and that amounted to something like ¼d. per kWh on the cooking consumption in order to meet the distribution charges, but that did not apply in the case of water heating at night time.

Mr. S. E. BRITTON (electrical engineer, Chester) said there were undoubtedly too many methods of charging, and the sooner they got down to the absolute minimum the better. There must be a two-part tariff, and the fundamental principles should be the highest possible standing charge and the lowest possible running charge. The ratable value under the 1925 Valuation and Rating Act was on a much fairer basis than had been the case previously, and was an advantage to electrical undertakings, because on the average the assessments had been increased under that Act, and it was a simple matter to get at the figures of the assessments for a very small cost. Mr. Britton, speaking to committee members, suggested the need for a little more courage in developing the rural areas around the large centres, the lack of which, he said, was not carrying out the trust which had been placed in electricity undertakings for the benefit of the public as a whole.

Mr. H. C. LAMB (engineer, Manchester) remarked that the consumer supplied on a two-part tariff quickly appreciated the advantage of it. He agreed whole-heartedly with the principles of equity laid down in the paper, and believed that profit must be obtained where it could be; nobody had attacked that part of the paper. Unless they proceeded on those lines, there would be no progress. It must be remembered that electricity undertakings had to fight against very severe competition, especially in the industrial field. Even many of the contractors who were present at the Convention as friends were serious competitors of public electricity supply in that they carried on extensive propaganda in the industrial field for the installation of private plant; unless public-supply authorities were prepared to counteract that propaganda and quote competitive rates they would make no progress at all. The weakest part of the paper was that relating to standardisation, because the author was unable to make any recommendations on that matter. The subject was an extremely difficult one, and he did not feel that the time had come yet for standardisation to take place. The argument for standardisation was that, although the progressive undertakings might have nothing to gain by it, it would speed up the backward undertakings; but the point was that the progressive undertakings with a variety of more or less complicated tariffs had secured the most business. No doubt in time, when conditions became more unified, it would be easier to introduce standard tariffs.

Mr. E. J. JENNINGS was unable to reply owing to lack of time, and a hearty vote of thanks was accorded him on the motion of Mr. FRANK HODGES.

Annual Dinner.

The annual dinner was held at the Pavilion on June 6th, the president, Mr. A. Nichols Moore, being in the chair.

After the loyal toasts had been honoured, Sir JOHN SNELL, G.B.E. (chairman of the Electricity Commission), proposed "The Incorporated Municipal Electrical Association," mentioning that, owing to pressure of public business and some regard for doctor's orders, he had been prevented from attending the Convention for more than one day. The president's address he had read carefully and, if he might say so without immodesty, a great deal of it might have been written by himself. For ten strenuous years the Electricity Commissioners had been trying to bring some orderly simplicity into the electrical industry, and economic generation was now adequately provided for. When it was remembered that the output of electricity, low as it had been, had doubled in the last five, or five and a half, years, and that the average rate of the increase of growth was one thousand million kWh per annum during the last two years, he had no reason to doubt that the large output of electricity which he had advised the Weir Committee in 1924 would probably be realised within 15 or 16 years was in a fair way of being realised, or even exceeded. If the industry could obtain, as it had done through the Electrical Association for Women, the sympathetic assistance of the ladies, then he believed that the growth of its use for domestic purposes would be of such a nature that the estimate made in 1924 would most likely prove to have been far too much on the conservative side. He agreed with the president that provision for the cheap production of electricity and its main transmission was only half the story, and whether it fell to himself, or to someone with fresher vigour, to head the Commission in the work which lay before it, there could be no doubt that the next task which would obviously fall to the Commissioners would be to co-ordinate the distribution of electricity throughout the country. He did not, however, wish to be misunderstood. For years past the Commissioners had been steadily encouraging (and had been greatly assisted by many of the distributors) the gradual standardisation of distribution systems and the gradual supplanting of d.c. by a.c. distribution, without which the increasing density of load in urban areas, for domestic purposes in particular, could never adequately be met. That quiet preparation was, in the aggregate, going to be quite a substantial contribution to the gradual simplification and improvement of distribution systems, and was quietly paving the way for the larger step yet to be taken. The point which must be borne in mind was that local Government areas, especially the smaller areas, were not necessarily the most economic, and probably did not have the most economic electrical boundaries. He need only point to the development which had taken place in Torquay, where electrical development had not been confined to the town; the Corporation had carried the benefits of electricity at cheap rates into the hinterland and districts surrounding the town. Many other towns were doing the same thing; there were, however, a great many which were not doing that, and to those he appealed and asked, in their own interests and in the general interests of electrical development and of the country, that they should carry electricity supply into the more rural districts, because only by that means could the amenities of life be increased and things made more workable for the poorer people. He was not talking nonsense; indeed, it was sober sense which had been proved in more than one district, and he believed there would have to be some association of municipal interests on the lines that had been adopted with such marked success, for example, by the Ayrshire Joint Board. Something of that kind would have to be done if they were to get the most efficient form of distribution and the most economic distribution in the rural areas.

Addressing himself particularly to the Committee members of the Association on the subject of research in the electrical industry, Sir John said that an income of £16,000 per annum was inadequate to carry out the research necessary in the interests of the electrical supply industry; the expenditure should be something of the order of from £25,000 to £30,000 per annum. Speaking from memory, he believed the contribution to the funds of the Electrical Research Association from the supply industry was about £3,000 a year only. That came from an industry from which local authorities and companies had an annual revenue of something like £50,000,000, and it was growing rapidly. What was wanted was a contribution of 1s. to the Research Association for every £100 of revenue earned. Surely that money could be forthcoming in order to support research work which already had had a most important economic effect upon supply conditions, and he asked Committees of Corporations which were authorised distributors to seriously consider that it was to their own advantage that the contribution of a reasonable amount, in some proportion to their revenues, should be made to the funds of the Research Association.

Mr. A. NICHOLS MOORE, President, in reply, thanked Sir John for the way in which he had proposed the toast. They all wished him a speedy return to that vigorous health which he had so long enjoyed. Undoubtedly the Association was making amazing progress. There were 1,020 delegates and visitors to the Convention this year, and the Association could be proud of the fact that it now had considerable influence and was playing an important part in the development of electricity supply in this country. There had been occasions when the Association had crossed swords with the Commissioners, and when they had sometimes come off worst in discussions with Sir John Snell's colleagues, who, nevertheless, were always open to reasonableness, even if on occasions those who discussed matters with them were kept waiting for decisions. The Association was "all out" with the Commissioners and the Central Electricity Board to make the new scheme a success, and he believed that would be done, but it was necessary to have the help and guidance of the Commissioners to take full advantage of the legislative machinery which Parliament and providence had placed at their disposal.

Alderman E. HUNTSMAN (chairman, Nottingham Electricity Committee) proposed "The County Borough of Newport and the Borough of Torquay," which toast was replied to by the Mayor of Newport (Councillor Walter T. Griffiths) and the Mayor of Torquay (Mr. Harry Geen).

The final toast of "Our Guests and the Ladies" was proposed by Mr. R. A. CHATTOCK (past President).

Mr. FRANK HODGES, in the course of his reply thereto, said that, although the members of the Central Electricity Board dealt with the problems they had to face in a strictly impartial manner, he foresaw the day when private enterprise in matters electrical would offer no more in scope, no more in ambition, and no more in salary than municipal work. He believed the I.M.E.A. membership would increase and the influence of the Association would increase, and he expressed the hope that under prudent and wise guidance the Association would grow.

Annual Meeting.

The annual general meeting was held on June 7th, in the Pavilion, and was, as usual, private.

The result of the election of officers and members of Council for 1929-30 was as follows:—

President: Mr. J. K. Brydges (borough electrical engineer, Eastbourne).

Vice-president: Mr. A. J. Fuller (borough electrical engineer, Fulham).

Hon. solicitor: Mr. J. H. Rothwell (Brighton).

Hon. treasurer: Mr. H. Faraday Proctor (Bristol).

Hon. secretary: Mr. A. C. Cramb (Croydon).

The following gentlemen were elected to fill vacancies on the Council:—*Large undertakings:* Major E. A. Barker

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(Barnsley) and Mr. A. W. Barham (Watford). To fill the vacancy caused by the election of Mr. Fuller as vice-president, Mr. J. W. Burr (Swansea) was elected for one year. *Small undertakings:* Mr. C. J. Wood (Sale). *Local authority representatives:* Alderman E. Huntsman (Nottingham) and Alderman T. Shires (Huddersfield).

The Council's annual report and accounts were adopted.

The meeting closed with a cordial vote of thanks to the retiring president, who, in acknowledging it, spoke of the services of Mr. Cramb as hon. secretary and of the special difficulties which he had to face in organising the Convention this year. The fact that everything in connection with the Convention had passed off with comparative smoothness and had been carried out according to plan was due entirely to Mr. Cramb, and he proposed a hearty vote of thanks to him, which was carried with acclamation.

Mr. CRAMB, in acknowledgment, said it was always a pleasure to do anything he could for the Association. The development in the last ten years, however (during which time he had been hon. secretary), had been such as to render it impossible for him to give the amount of time to the affairs of the Association as he had done in the past. The Association was now getting so big that he sometimes felt a little bit afraid of the future, because it had reached such a position of importance that it was necessary to live up to it. His own duties to his Corporation were increasing rapidly, and the fact that he would not be able to give so much time to the affairs of the Association in the future as he had done in the past was a matter to which the Council would have to give careful consideration.

Cordial votes of thanks were also passed to the Mayors of Newport and Torquay, to the chairmen of the Electricity Committees of those towns, and to the officials of the Torquay Corporation in connection with the arrangements made for the Convention.

The I.M.E.A. Exhibition.

(*Concluded from page* 1084.)

Messrs. GEORGE NOBBS, LTD., made a special display of automatic temperature controls for electric water heaters, ovens, refrigerators, and biological apparatus, as well as the new type "M.B.R." room-temperature control. The room-temperature controls are claimed to be particularly suitable for low-temperature convectors, heating panels, electric hot-water radiators, tubular heaters, and the like. For domestic purposes it is recommended that, where desired, the electric fire may be retained for the cheery aspect, and the automatic control provided for the non-luminous convectors, which

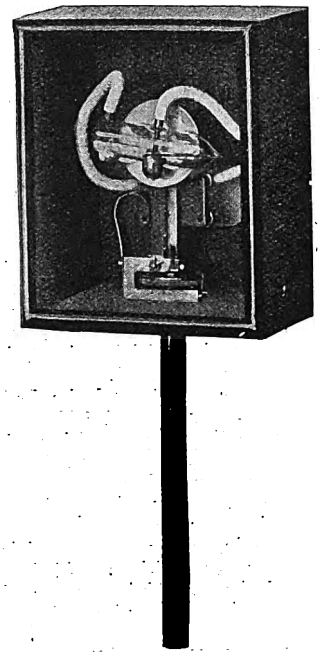

Fig. 10.—"M.B.R." Room-temperature Control.

should be generally situated at the cold parts of the room, *i.e.*, under the windows. For most average conditions it is recommended that 50 per cent. of the maximum heat required in the room be provided by a low-temperature form of heater, and the other 50 per cent. by an electric fire. The adjustable temperature dial of the "M.B.R." instrument is provided for normal conditions for 50-70 deg. These instruments are also made for garages or private lock-ups for preventing attack by frost. Fig. 10 shows the "M.B.R." instrument. The thermostat consists of a sensitive expanded-metal bellows, which operates upon a single-pole tilting mercury switch, and with the dial the whole is mounted in a mahogany box with a hinged glazed door. The standard sizes are from 6 to 20 A up to 250 volts a.c. or d.c. Larger sizes up to 50 A can be supplied, and also for pressures up to 500 volts. Type "M.B.R." room controls work within ± 1 to 2 deg. F. The mercury-tube switch is fitted with a ceramic liner, &c. Electric heater tubes with loadings of 25/70 watts per ft. run were also to be seen on this stand, while new models of hot-water calorifiers formed another feature. The latter are made in seven standard sizes from 5- to 50-gal. capacity, with loadings of from 500 to 3,000 watts, respectively; they are automatically controlled by a thermostatic switch. These

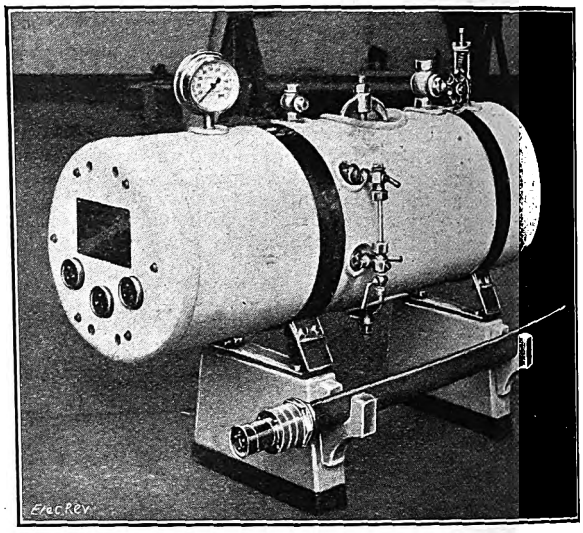

Fig. 11.—"Reyrolle" Steam Raiser.

N.S.G.-type calorifiers, as supplied for hard water, have an internal container divided into two parts, one part being the primary or heating chamber containing the thermostat and immersion heater. This primary chamber is divided from the upper chamber by an inclined deflector plate and a vertical heat-circulation channel, and gives out the heat to the secondary storage chamber by conduction of heat through this deflector plate and channel. As the water in the primary chamber is not changed, and the temperature difference between the primary and secondary storage chamber is small, there is, it is claimed, comparatively very little fur deposit.

REVO ELECTRIC CO., LTD., displayed a comprehensive range of "Revo" electric cookers in standard and "de luxe" finishes. These incorporate the following new features: circular boiling plates, spring-loaded drop doors to the hot-cupboards, improved door catches, improved and simplified switchboxes, and larger ovens. They also incorporate the makers' present standard vitreous-enamelled finish to all sheet-metal portions. The "superspeed" boiling plate, which was first introduced to the public at the Bath Convention last year, was again exhibited. A further item of interest on this stand was a small patented device whereby the low loading of any boiling plate may be reduced still further to meet various culinary needs. This apparatus takes the form of a small subsidiary resistance mounted in conjunction with a tumbler switch; it can be adapted to existing cookers. The remainder of the "Revo" exhibits comprised water heaters, automatic kettles, and a "de luxe" washboiler in mottled finish, together with a sample of the "Maisonette" cooker which is being supplied to the Leicester Corporation.

Messrs. A. REYROLLE & CO., LTD., showed an electric steam raiser, fig. 11, for use where a small quantity of steam is required, and a domestic water heater. The steam raiser has a total capacity of 18 kW, and will raise steam, it is claimed, in 10 to 15 min., the pressure being 80 lb. per sq. in. The heating elements are built up of three 6-kW units, and the required selection is made by means of a standard Reyrolle earthed plug. Three sockets are provided, so arranged that either one, two, or three units are in circuit, giving 6, 12, or 18 kW, respectively. The fittings are nickel-plated and the whole equipment is attractively finished in white enamel. The domestic water-heater is equipped with a 500-watt heating element, which is controlled by means of a thermostatic switch. A representative collection of small metal-clad air-break switches for domestic and other purposes was also to be seen on this stand. All the switches are of the quick-make and -break pattern, and their covers are interlocked, so that it is impossible to open them when the switches are in the "on" position, or to close the switches when the covers are off. The domestic switches include a cooker control board with a red lens and an indicating lamp to show when the switch is on. The switches for industry are suitable for currents up to 60 amperes at pressures of 600 volts, and are weatherproof. A board was also exhibited showing a number of plugs and sockets that have been manufactured by this company to the British Standard Specification No. 196-1927. By kind permission of Messrs. Drury & Chafe, Union Street, Torquay, Messrs. Reyrolle displayed in one

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of their windows some heavier switchgear. A control panel for use with the makers' "centrovisory" control apparatus is capable of controlling six circuit breakers in a remote station, but panels can be manufactured for 12- or 24-way operation. By means of an ingenious and simple diagram on the panel and indication is given of the conditions existing at the switching station, and the meters provided enable the load on each switch to be read and the pressure of the bus-bars to be ascertained.

A variety of apparatus which was to be seen on the stand of SADIA, LTD., included seven wall-type water heaters; a stand-type 66-gal. water heater; a section of a 4½-gal. water heater; a full range of "Sadia" self-winding time switches; a new

Fig. 12.—"Xcel Minor" Cooker.

universal mercury thermostat; full ranges of boiling plates, aluminium utensils, and enamelled table stoves; motor-driven thermostatic controls; and a drying stand. It is claimed that the aluminium cooking utensils, which have been especially designed for electric cooking, result in current saving and increase of speed by about 20 per cent.

The principal items shown by SANTON, LTD., included the "Santon" circulator, geyser, and electric tank belt. The circulator is intended for use with any existing hot-water system, and consists of a double-shell copper tube carrying element tubes down the centre. The double shell forms an air lagging between the hot water rising through the tube and the cold water in the tank. The apparatus is available in two sizes with overall dimensions of 25 in. by 3½ in. and 31 in. by 3½ in., respectively, having a loading of 3 kW in each case. The belt is obtainable with loadings up to 1,500 kW, and the geyser with loadings up to 8 kW single-phase, or 12 kW three-phase.

The exhibits of SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., included standard "Xcel" cookers of various types fitted with "Xcel" totally-enclosed boiling plates. A special feature was a display of "Imperial"-type cookers as supplied to Colonial undertakings. There was also a representative range of "Cosyglo" fires embodying moving-flame and smoke effects, and fitted with an improved rotor. The remainder of the exhibits consisted of "Xcel" safety kettles, together with a large model showing the operation of the cut-out arrangement to prevent element burn-outs; a range of "Xcel" immersion heaters; "Xcel" tube heaters, with a sample of the special high-voltage tube heater as used for tramcar heating; "Xcel" tower rails; and the new "Xcel Minor" cooker, fig. 12, which was on show for the first time. This has a small oven with a new design of dual grill boiling plate. It can be supplied for table use, or with a stand to form a complete cooker.

There was a particularly attractive and interesting display by the Torquay Electricity Department, showing the various types of apparatus let out on hire by the Department, and literature concerning prices, hire rates, and so on.

Messrs. J. H. TUCKER & CO., LTD., had displayed a complete range of control units for electric cookers, water heaters, and the like. These units are all self-contained, and provide for a pilot light, either enclosed in the case itself or showing through a bull's-eye lens, or for a lamp projecting through the lid which, in the case of consumers on a flat rate, can be used as a lighting medium, or for taking off any small apparatus such as toasters. A sub-circuit is provided in the form of a socket point, and is suitably protected by fuses inside the case. In one model this sub-circuit is controlled by an independent tumbler switch. Another model of the cooker control unit is of the open type and specially designed for use with "baby" cookers, embodying all the essentials for efficient control at an attractive price. Included in the appliances for the control of portable heating appliances was a new 15-A d.p. interlocked, foolproof and shockproof switchplug. There are two breaks on each pole of this switch, which are operated simultaneously by the withdrawal of the plug. The withdrawal of the plug not only renders itself dead, but actually disconnects the socket entirely from the source of supply. The withdrawing movement rotates shields of bakelite, which form barriers over the slots into which the plug pins engage with the socket. Other "Tucker" exhibits included insulated lampholders; complete ranges of all types of sockets and plugs to B.E.S.A. specifications; an extensive range of tumbler switches in insulated "Telacite," in white, brown and black; sunk switches with plain or ornamental metal plates; metal-clad lampholders and switch lampholders; and ironclad switch and fuse gear generally. A new product of interest was an ironclad fuseboard consisting of totally-enclosed units made to comply with the test requirements of the I.E.E. and the relative B.E.S.A. specification, and mounted on rustproof detachable battens. The case is fitted top and bottom with malleable detachable ends which can be removed for drilling, even after the board has been erected.

VENNER TIME SWITCHES, LTD., displayed a wide range of time switches for the control of street lighting, electric water heating, and so on. Stop watches, reading to 1/10th of a second, were also a feature, while another exhibit was the new "Venner" thermostat, fig. 16, an improved model easily convertible for use either in horizontal or vertical positions. New models of time switches for poultry farms were also on show. The new solar dial-controlled electrically-wound time switch, as used by the G.P.O. authorities in telephone kiosks, was another interesting exhibit, as was a new type of domestic water-heating control switch giving three "on" and three "off" operations per day. A further item on this stand was a 5-A, 15-day time switch, with selective devices, for controlling earlier-hour and/or Sunday operation.

On the stand of Messrs. YOUNG, OSMOND & YOUNG, LTD., there was an interesting display of "Unity" tubular electric heaters for the heating of schools, churches, offices, &c. Other "Unity" exhibits included a thermostat for constant-temperature control, fig. 15; towel airers for floor or wall mounting; a car-radiator heater for an easy start and protection from frost; a linen-cupboard heater; a 4-bar radiator, with or without 3-heat control; a gas-tight and water-tight heater for petrol depôts; window heaters; and a heater for traction work, available for pressures up to 1,500 volts.

Messrs. BULPITT & SONS, LTD., showed examples of their electric kettles, incorporating some interesting innovations. The latest "Bulpitt" safety device provides for the throwing off of the connector as the result of the softening of a low-melting alloy. When the kettle has cooled down it is only necessary to push on the connector again, and this action resets the safety device, and the kettle is ready again.

A range of immersion heaters for fixing into hot-water tanks is shown for the first time, and a 15-gal. thermal-storage tank is shown fitted with an external thermostat. An efficiency of 96 per cent. is claimed for the immersion elements.

Features of the exhibits by the EDISON SWAN ELECTRIC CO., LTD., were the new wiring systems recently introduced by the company. One is an unearthed system with bakelite junction boxes, and the other an earthed system with the boxes in metal. Figs. 13 and 14 show the bakelite and metal

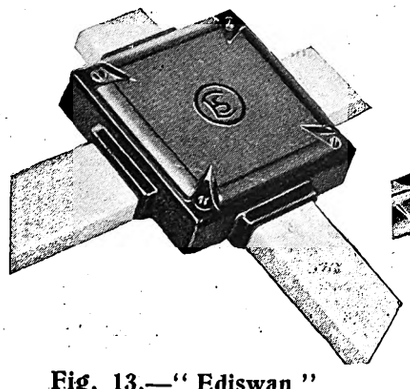

Fig. 13.—"Ediswan" Bakelite Junction Box.

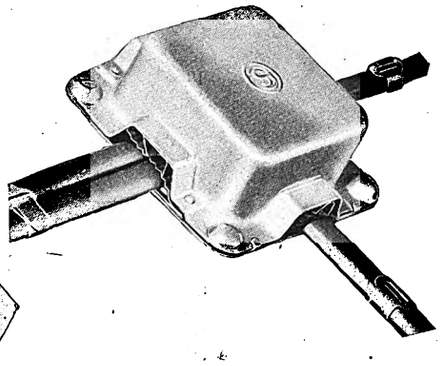

Fig. 14.—Junction Box for "Ediswan" Earthed System.

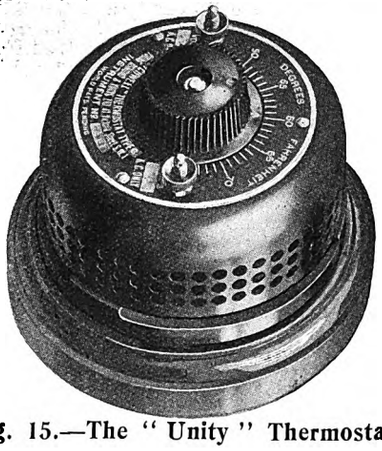

Fig. 15.—The "Unity" Thermostat.

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junction boxes, respectively. The former is attractively designed and finished. The base of the box is quite flat, no chipping or filing is necessary, and there are no loose fillets, loose connectors or unused ways. Connection pillars are cross drilled for easy wiring, and the cord-grip is in one piece. All surface entries are provided with extensions to shroud the ends of the wood channel, thus rendering the box dustproof. Future extension is simple. There is a blanked hole in the base for back entry. The "Ediswan Magnolia" channelling for use with this system is neat, but plain. It is suitable for either clip or screw fixing, the fixing clips fitting internally.

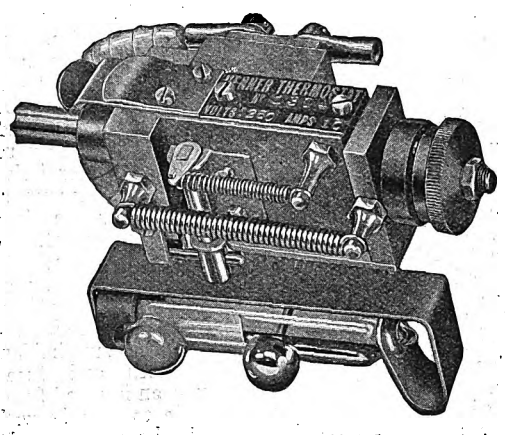

Fig. 16.—The "Venner" Thermostat.

The "Ediswan" junction box used with the earthed system is very simple to fix. The box is stamped from mild-steel, tinned or copper-plated, with a black-bronze finish. The complete box contains only two short screws. The bond is completely automatic and allows for cables of varying diameters. The box will take two twin cables (3/.036) at each entry; back entries are provided. The unused ways are closed. The box can be supplied with a ceiling-rose box cover with a cord-grip. Indented buckle clips provide a rigid base for the cable. Other "Ediswan" exhibits included stationary batteries and "Thor" washing machines and ironing and cleaning appliances.

On the stand of the British Thomson-Houston Co., Ltd., were shown some of the company's latest developments in lighting fittings and equipment, including the new "Hermetica" lantern with double well glass, suitable for industrial use where it is essential to employ a gas-tight and water-tight unit, the "Glassteel" diffuser for higher-class general industrial lighting, and the gas-tight dispersive reflector fitting with guard. Another feature was the B.T.-H. quick detachable ceiling and wall plates with which many municipal and other electrical showrooms have been installed owing to the facility they give for rapid change of display. Also shown was a patented screwless canopy which simplifies the cleaning and re-lamping of fittings employing totally enclosing glassware. In the floodlighting section were shown the B.T.-H. 599 projector in its latest form, and the new spherical projector lantern as installed throughout the North-East Coast Exhibition. Examples of the "Luxor" dining-room pendant and "Eye Restolite" floor standard were also on view. Other lighting equipment shown included street-lighting fittings, such as the "Zona" and the "Rugby" and "Manchester" pole-top units. The "Tungar" rectifiers exhibited proved to be of great interest, particularly the new type 75-V, 6-A model which is shortly to be placed on the market. The overall dimensions of this machine have been reduced, and a new and improved type of main switch and rheostat and new replaceable fuse units have been fitted. Another new type exhibited was the high- and low-tension model. This has been designed especially for the home radio user. By its use both the high- and low-tension batteries of a wireless set can be kept in a thoroughly charged condition with the least possible trouble. On the d.c. side the output is, for low-tension batteries, 0.8 A on 2, 4 or 6 V, and for high-tension batteries 0.1 A at 60, 90 and 120 V. A notable feature in this "Tungar" is the plugging system, whereby the d.c. leads cannot be reversed. Another exhibit which attracted much attention was the B.T.-H. electric refrigerator.

Reviews.

Electric Heating. By Edgar A. Wilcox, B.Sc. Pp. viii+469; figs. 152. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

This work is so comprehensive that its title does not convey anything like the fullness of its contents. It is most exhaustive, and deals with everything pertaining to electric heating, from simple domestic appliances to the largest high-powered furnaces of the nicrome ribbon type, the silica-Carbide type, the granulated carbon type, the graphite plate type, and also arc furnaces for steel and metal smelting, while furnaces for the reduction of iron ores, &c., manufacture of calcium carbide, fixation of nitrogen, and other electrochemical processes are all dealt with in a clear, concise and masterful manner. Chapter XV deals with arc-welding in all its phases, and in such a complete manner that we have frequently seen books devoted to this subject which do not contain as much information on the subject as this chapter alone. It is thoroughly up-to-date, and includes a chapter on high-frequency furnaces of the Ajax Northrupp type and the latest thing in welding, *i.e.*, the atomic hydrogen system as developed by the International General Electric Co., Schenectady, N.Y., is fully described.

The work is suitable as a text-book for students or as a handbook for practical furnace designers and builders, who will find the numerous tables and formulæ, based on practical experience, of the greatest help. We can confidently recommend it to our readers.

A.V.C.

Induction Motor Practice. By A. M. Dudley, B.S. in E.E. Pp. xi+236; illustrated. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

This is essentially a practical book, and is intended to supplement an earlier volume by the author under the title "Connecting Induction Motors," which dealt principally with windings. The present book is intended to bring the author's experience to operating men, students, and those who have to supervise the running and maintenance of induction motors. These machines can present many intricate problems, as can easily be seen from an inspection of the chapter headed "The Question Box." The material for this has been drawn from the pages of the Westinghouse Company's "Electric Journal," in which the author, who is engineering supervisor of development in that company, has for several years contributed answers to questions sent in by readers. "The Question Box" occupies nearly one-half of the present book, and many of the problems dealt with are of interest. No attempt, however, is made to classify the type of problem, only a chronological order being observed. Much might be gained by a proper arrangement of these questions and answers over and above that supplied by the index. The author's practical knowledge can be accepted as authoritative; but the learner will probably prefer some more orthodox type of text-book for studying the action and underlying theory of the induction motor. In this connection there is some lack of consistency, for while considerable space is allotted to explaining alternating currents and the meaning of power factor, peculiar and involved forms of circle diagram are taken almost for granted. Attempts to emasculate essential theory are usually foredoomed to failure; the same principles should be taught to artisan, foreman, manager, student or designer. The treatment may vary in elaboration, but in no case should it be scrappy. For practical matters, especially those concerned with changes made in an existing motor (*e.g.*, change of number of phases, frequency, air-gap, voltage, &c.) the book provides much valuable data, but it may have to be sought. The paragraph sub-headings rather suggest their journalistic origin. "Why Rotor Copper Loss Equals the Per Cent. Slip" is a typical example. Nevertheless, to the class of reader intended, the book should prove useful.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Overhead Lines.

When an electricity supply company or corporation proposed to put up a steel-tower line in the past the Electricity Commissioners used to be satisfied with drawings of the steel towers, showing the sizes of the tower members, the foundations, and giving stress diagrams. They have now started calling for detailed calculations of the towers and foundations, in addition to the other information mentioned above. Seeing that they themselves can check the designs put forward, from the drawings supplied, one would think that the already long list of information and drawings required under Form El.C. 53 B. would have been sufficient without demanding to see the tower contractors' detailed calculations.

It is time a protest was made against this growing tyranny on the part of such bodies in calling for a lot of unreasonable details and information from contractors. It is just the same with a great many of the specifications issued nowadays by consulting engineers, who are continually asking for more and more unreasonable details to be furnished by every tenderer.

Protestant.

June 11th, 1929.

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Tariff Standardisation and Water Heating.

May I draw attention to the following extracts from Mr. E. J. Jennings's I.M.E.A. paper :—

(*a*) "A wider outlook and a bolder policy was suggested as necessary."

(*b*) "We must be prepared to take ordinary commercial risks if the business awaiting capture is to be secured."

(*c*) "The commercial doctrine of expediency was recommended to be put into practice."

(*d*) "Electricity for water heating calls for cut prices for commercial reasons. Its contribution to standing costs can only be very small, but in view of the potentialities of this demand, and its influence in filling up the dips in the load curve, it makes a very valuable contribution in aggregate to those costs."

(*e*) "Equity and experience call for general adoption of a 2-part tariff with 2-rate meters in certain cases, and must encourage freely the policy of filling in the valleys."

In the discussion, Mr. F. M. Long, of Norwich, is reported as follows :—

"With regard to heat storage and current used during the night, there must be a rate at least as low as ¼d. per unit and that was fully justified because there were no additional charges involved for generation and distribution."

To my mind the above extracts form the crux of the whole question of tariff making. Here we have the considered opinion of two men of great experience, commercially and technically, and they both stress the importance of a suitable tariff for heat storage during night hours. "*It calls for cut prices,*" says Mr. Jennings; "*¼d. per unit is fully justified,*" says Mr. Long. Where is water heating done at ¼d.? Has Mr. Long started to do so? Let us hope that this paper will open the eyes of supply engineers (particularly of those with whom the decisions relating to tariffs rest) to the large business in water heating awaiting capture.

Let them take a wider outlook; adopt a bolder policy; and take a commercial risk. *For commercial reasons* a price not exceeding ¼d. is necessary and fully justified where coal costs 0.2d. or less; ½d. per unit is 100 per cent. higher, and is too high to compete effectively with coke, &c.; but at ¼d., combined with a big push, the results would be staggering.

B.

June 15th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1927.

31,660. "Measurement of cross-talk in telephone lines." G. Ward. November 25th, 1926. (281,311.)

32,296. "Television apparatus." J. L. Baird and Television, Ltd. November 30th, 1927. (312,406.)

32,304. "Method of operating an asynchronously constructed generator with a commutator cascade machine, the excitation of which is supplied at least in part through a frequency-changer." Akt. Ges. Brown, Boveri et Cie. December 3rd, 1926. (281,676.)

34,501. "Electric water-heater." L. V. Smith and G. W. Waite. July 18th, 1927. (283,544.)

34,778. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. May 14th, 1927. (290,556.)

1928.

1,678. "Control of output of variable-speed electric dynamos." F. H. Royce and E. F. Clark. January 18th, 1928. (312,099.)

1,698. "Vacuum devices such as electric incandescent lamps, electron-discharge tubes, and the like." British Thomson-Houston Co., Ltd., and L. J. Clark. January 18th, 1928. (312,100.)

1,764. "Ignition mechanism of internal-combustion engines." F. W. Lanchester. January 19th, 1928. (312,103.)

1,921. "Electric time-delay devices." British Thomson-Houston Co., Ltd., H. S. Petch and R. D. Parry. January 20th, 1928. (312,104.)

2,489. "Dynamo-electric lighting systems." R. Bosch Akt. Ges. February 11th, 1927. (285,074.)

5,103. "Electric junction boxes." Sykes & Dyson, Ltd., P. Sykes and W. Cooper. February 18th, 1928. (312,382.)

5,198. "Method of and means for electrical resistance welding." Allgemeine Elektricitäts Ges. February 18th, 1927. (285,513.)

5,213/4. "Mercury-vapour arc lamps and rectifiers." G. J. Blake and G. D. G. Leadbetter. February 20th, 1928. (Addition to 294,288.) (312,116/7.)

5,262. "Insulator for electric live wires." F. Berg. February 20th, 1928. (312,205.)

5,268. "Electric communication cable." Standard Telephones & Cables, Ltd., and E. Kaempf. February 20th, 1928. (Cognate application 33,162/28.) (312,119.)

5,269. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd., J. H. E. Baker and E. P. G. Wright. February 20th, 1928. (312,120.)

5,294. "Signs or other advertising devices." British Thomson-Houston Co., Ltd., and F. E. Smith. February 20th, 1928. (312,121.)

5,356. "Regulators for dynamo-electric machinery and other electrical apparatus." F. Newton. February 20th, 1928. (312,127.)

5,379. "Base for automatic telephone instruments." P. Fitzner. May 16th, 1927. (285,795.)

5,428. "Gramophone electric 'pick-up' devices." J. Copp, F. Tait and A. C. Tait. February 21st, 1928. (312,130.)

5,488. "Method and apparatus for correcting power factor of electric circuits." E. F. Northrup. February 25th, 1927. (285,912.)

5,502. "Cable telegraphy." W. E. Beatty (Bell Telephone Laboratories, Inc.). February 21st, 1928. (312,209.)

5,511. "Electrolytic production of metals, and apparatus therefor." I. G. Farbenindustrie Akt. Ges. February 21st, 1927. (285,824.)

5,621. "Controlling means for sound-reproducing apparatus." W. H. Sayers and Electramonic Co., Ltd. February 22nd, 1928. (312,384.)

5,641. "Dynamo-electric machines." J. A. Kuyser and Associated Electrical Industries, Ltd. February 22nd, 1928. (312,217.)

5,978. "Electrodeposition of metals." Electro Bleach & By-products, Ltd., J. Hollins and D. Jepson. February 25th, 1928. (312,395.)

6,024. "Alternating-current voltage regulators." J. R. P. Lunn. February 27th, 1928. (312,396.)

6,069. "Electric insulators." E. L. Stubbings. February 27th, 1928. (312,398.)

6,108. "Telephone systems." Associated Telephone & Telegraph Co. July 2nd, 1927. (293,294.)

6,528. "Diaphragms for loud-speakers and the like." R. A. Eliot (trading as Neophone Engineering Co.). March 1st, 1928. (312,409.)

6,835. "Loud-speakers of the expanding-horn type." A. J. C. Brooks. March 5th, 1928. (312,413.)

7,001. "Protection of electrical systems." General Electric Co., Ltd., and H. J. Coates. March 6th, 1928. (Cognate applications 8,184/28 and 17,415/28.) (312,416.)

7,012. "Electrical transformers." V. Z. de Ferranti and Ferranti, Ltd. March 6th, 1928. (312,417.)

7,013. "Electrical circuit-breakers." V. Z. de Ferranti and Ferranti, Ltd. March 6th, 1928. (312,418.)

7,882. "Production of electric radiating elements, particularly electron-emitting elements for electric discharge devices." E. Harsanyi. March 14th, 1927. (287,098.)

8,513. "Manufacture of arc-lamp electrodes." Compagnie Lorraine de Charbons pour l'Electricité. April 21st, 1927. (289,042.)

8,531. "Electric connection boxes for cargo clusters, portable lamps, and such like." W. Henderson, and Telford, Grier & Mackay, Ltd. March 21st, 1928. (312,430.)

8,698. "Electrical step-by-step mechanisms." I. H. Parsons and A. E. J. Ball. March 22nd, 1928. (312,432.)

8,979. "Electromagnets." W. Wadsworth & Sons, Ltd., and A. A. G. Jensen. March 24th, 1928. (312,436.)

9,469. "Wireless telegraph and telephone receiving apparatus." A. Shaw, S. H. Long and Siemens Bros. & Co., Ltd. March 29th, 1928. (312,442.)

9,564. "Piezo-electric devices." Gramophone Co., Ltd., A. Whitaker and W. H. Eccles. March 29th, 1928. (312,444.)

9,946. "Sound-amplifying devices." Decca Gramophone Co., Ltd., and G. A. Cozens. April 2nd, 1928. (312,446.)

10,107. "Electrical transformer tanks." T. Freer-Ash. April 4th, 1928. (312,448.)

10,316. "Systems of tuning wireless receiving sets and multi-contact switch therefor." C. T. Nicol. April 5th, 1928. (312,450.)

11,341. "Electric switches." Edison Swan Electric Co., Ltd., and F. Shergold. April 17th, 1928. (312,456.)

11,970. "Electric wall-plugs." T. W. John. April 24th, 1928. (312,461.)

13,943. "Electric submarine cables." Felten & Guilleaume Carlswerk Akt. Ges. October 31st, 1927. (299,761.)

14,026. "Electric couplings." H. Baron (Compagnie Lorraine de Charbons pour l'Electricité). May 12th, 1928. (312,479.)

15,406. "Joints of electric cables." W. T. Henley's Telegraph Works, Co., Ltd., and P. Dunsheath. May 25th, 1928. (312,494.)

15,407. "Joints of electric cables." British Insulated Cables, Ltd., and W. Holttum. May 25th, 1928. (312,495.)

16,843. "High-frequency electrodes." Kelvin, Bottomley & Baird, Ltd., and F. A. King. June 11th, 1928. (312,507.)

17,001. "Apparatus for controlling mechanism by means of light." General Electric Co., Ltd., and E. M. Eden. June 12th, 1928. (312,508.)

18,144. "Wireless communication and remote-control systems." C. Lorenz Akt. Ges. June 25th, 1927. (292,916.)

18,181. "Portable electric lamps." U. F. L. Steindorff. June 22nd, 1928. (312,514.)

18,447. "Index-locking devices for electrical measuring instruments." Evershed & Vignoles, Ltd., and C. Midworth. June 26th, 1928. (312,522.)

20,518. "Cooling of dynamo-electric machines." International General Electric Co., Inc. July 16th, 1927. (294,112.)

20,583. "Apparatus for the inter-conversion of mechanical and electrical oscillations such as loud-speakers." British Thomson-Houston Co., Ltd. July 18th, 1927. (294,147.)

20,725. "Electric insulators." Steatit-Magnesia Akt. Ges. October 20th, 1927. (Addition to 290,262.) (299,032.)

20,889. "Electric motor control systems." G. Somajni. July 19th, 1927. (294,180.)

21,816. "Protective apparatus for electrical distribution systems." Associated Electrical Industries, Ltd. July 27th, 1927. (294,615.)

22,174. "Electrically illuminated manœuvre-indicators for use on road vehicles." J. Baxter. July 31st, 1928. (312,544.)

22,390. "Electric switches." British Thomson-Houston Co., Ltd. August 4th, 1927. (295,037.)

24,021. "Electrical determination of irregularities in the structure of massive metal bodies." International General Electric Co., Ltd. August 27th, 1927. (296,303.)

26,073. "Manufacture of Röntgen ray fluorescent screens." C. Haider. September 12th, 1927. (297,037.)

27,928. "Television apparatus." J. L. Baird and Television, Ltd. November 30th, 1927. (Divided application on 312,406.) (312,560.)

30,939. "Current-collectors for electric vehicles." G. Fischer. October 31st, 1927. (299,778.)

31,316. "Telephone systems." Siemens & Halske Akt. Ges. November 5th, 1927. (300,121.)

35,614. "Electric discharge devices." British Thomson-Houston Co., Ltd. December 2nd, 1927. (301,745.)

36,447. "Radio and the like signalling systems." Marconi's Wireless Telegraph Co., Ltd. December 9th, 1927. (302,181.)

37,256. "Method and apparatus for the measurement of distances by means of electromagnetic waves." A. Koulikoff and C. Chilowsky. December 15th, 1927. (302,602.)

38,290. "Television and like receiving apparatus." L. Thurm. December 30th, 1927. (303,178.)

38,417. "Filter circuit arrangements comprising piezo crystals." Standard Telephones & Cables, Ltd. December 29th, 1927. (303,180.)

1929.

6,132. "Test-sets for locating faults in electric transmission lines." West Manufacturing Co July 5th, 1927. (Divided application on 293,378.) (306,837.)

7,508. "Electromagnets." G. V. Lomonossoff and P. Kapitza. December 20th, 1927. (Divided application on 308,329.) (312,259.)

11,966. "Electrodeposition of metals." Electro Bleach & By-Products, Ltd., J. Hollins and D. Jepson. February 25th, 1928. (Divided application on 312,395.) (312,403.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 12th :—

Vigilus (lettering and design). No. 494,440. Class 8. Radio-telephonic apparatus and parts thereof, &c.—Thompson Manufacturing Co., Ltd., Water Lane Works, Richmond, Surrey.

Lion (lettering and design). No. 498,920. Class 8. Radio-telephonic receiving apparatus, but not including loud speakers sold separately.—L. W. Holt, 196, Shaftesbury Avenue, W.C.2.

Veelix. No. 498,961. Class 8. Exploring disks for television.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Emitta (lettering and design). No. 499,224. Class 8. Electrical accumulators.—W. H. Holbird, 9, Blenheim Grove, Rye Lane, S.E.15.

G.B., Ltd.; the Grosvenor Battery Co., Ltd., Watford (lettering and design). No. 499,417. Class 8. Electric batteries (not for medical purposes).—Grosvenor Battery Co., Ltd., 2-3, White Street, Moorgate, E.C.2.

L.A.W., Lock-Atkinson Wireless (lettering and design). No. 501,128. Class 8. Instruments and apparatus for use in connection with radio-telegraphy and telephony.—S. W. Atkinson. trading as Lock-Atkinson Wireless, 311, Camden Road, N.7.

Voluvernia. No. 501,933. All goods in Class 8.—Gambrell Bros., Ltd., Merton Road, Southfields, S.W.18.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Extension of Corporation fish market (£10,000); city architect.

ALTRINCHAM.—Block of 40 flats and additional houses, for the U.D.C.; surveyor.

ASTLEY.—Senior elementary school (350 places); director of education, County Education Offices, Preston.

AYLESHAM (DOVER).—Houses (50), for Pearson and Dorman Long, Ltd.

BARNSLEY.—Garage workshop at depôt; covered market, New Street; borough engineer. Mining and technical college (£79,660); Charles Smith, builder.

BILSTHORPE (NOTTINGHAM).—Hotel; Stanton Ironworks Co., Ltd.

BOOTLE.—Girls' secondary school (450 places); G. Fraser, architect, Wellington Buildings, Strand, Liverpool. Form of tender from S. Clark, secretary for education (deposit £2 2s.).

BRADFORD.—44 houses, White Abbey estate; city architect. Library, Bierley housing estate; city engineer.

BRIDLINGTON.—Central school (£25,000), for the borough E.C.; director of education.

BRIERLEY HILL.—Houses (84), for the U.D.C.; T. Barker and Sons, builders, Loughborough.

BRISTOL.—Houses, Speedwell estate; E. W. Poole & Son (46); J. Knox (63). Houses (46), Duckmoor Road and Wooton Road; Bristol Housing, Ltd.

BURTON-ON-TRENT. — Extensions, isolation hospital (£8,500); borough engineer.

CARLISLE.—Cinema, Caldewgate, for Workington Hippodrome Co., Ltd.; Mr. Nicholson, architect.

CHESTERFIELD.—New school and alterations old schools, Cross Street; Catholic school governors. Business premises, Church Lane, for Greville & Stuart; Jackson and Fryer, architects. Bazaar premises, for F. W. Woolworth & Co., Ltd., Kingsway, London.

COULSDON.—28 houses, Beverley Road, Whiteleafe; E. O'Sullivan, Ltd.

DERBY.—Wesleyan church, Allen Town; trustees. Premises and institute, for King Street Wesleyans (£9,500); Gee, Walker & Slater, builders.

DONCASTER.—Wesleyan church, Balby; trustees.

DORCHESTER.—Store and workshop, High Street West, for Sir Robert Williams; C. W. Pike.

DOUGLAS (ISLE OF MAN).—Alterations, High School, Park Road; Manx Education Committee. Alterations, West View Lane; Manx Co-operative Society, Ltd. Alterations, South Quay; Corlett, Sons & Cowley, Ltd.

DUNDEE.—216 houses, for Corporation (£85,000); city architect.

EPSOM.—Nurses' home, Long Grove Hospital (£15,890); J. W. Ellingham, Ltd., Dartford.

ESTON.—Secondary school, for North Riding E.C.; director of education, Northallerton.

FARNHAM (SURREY).—Additional 44 houses, for the U.D.C.; surveyor.

FIFESHIRE.—School, Cowdenbeath; clerk, Education Authority, Kirkcaldy.

GLASGOW.—Cinema, Paisley Road; A. E. Pickard. 36 houses, Castlemilk Street, Cathcart; Western Heritable Investment Co., Ltd.

GODALMING.—Church, for the Christian Science Society; particulars from Potter, Crundwell & Bridge.

HAMPTON.—Extensions, soap factory, High Street; Smiths (Hampton), Ltd.

HASTINGS.—Warehouse, 26, Castle Hill Road; P. H. Oxley, architect. Electricity supply, shop and bakery, North Trade Road, Seddlescombe, for Mr. Gregory. Alterations and extensions, Queen's Road, for Timothy White, Ltd., 30, Chandos Street, Portsmouth. Reconstruction, White Rock baths (£34,000); borough engineer.

HORSMONDEN (KENT).—Electric lighting installation, All Saints' Church; rector.

INVERNESS.—Shop and warehouses (£8,000); D. Forbes, 57, High Street.

KEIGHLEY.—Bus depôt, Hard Ings Lane; borough architect.

LEIGH.—School (460 places); S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

LONDON (HACKNEY, E.).—Factory, Shore Road; W. Silk and Son, Ltd. Garage, highways depôt for electric vehicles (£5,000); borough engineer. Factory, Downs Road; A. J. King, Ltd.

(LAMBETH, S.E.).—County Hall extension; E. Stone Collins.

LONGTON (STAFFS.).—Alterations, City Cinema, Market Street; North Wales and Border Cinemas, Ltd.

LUTON.—Factory, Midland Road, for Paul Walser, Ltd.

MAIDSTONE.—Housing scheme (185), Mote site, for the T.C.; T. F. Bunting, borough surveyor.

MALVERN.—Bank and shops, Grange Road and Church Street, for the National Provincial Bank, Ltd., London.

MARPLE.—Cinema and shops, for Walter Stock, Gem Cinema.

NEWCASTLE-ON-TYNE.—R.C. church, Benwell; parish priest.

NEWPORT (ISLE OF WIGHT).—Workshop and stores, for W. Matthews & Son, Trafalgar Road; Stratton & Millgate, architects.

OLDHAM.—Alterations and additions, The Palladium, Union Street; W. B. Baker, general manager.

PLYMOUTH.—Extensions, Dame Hannah Roger's Orthopædic Hospital School, Ivybridge; school trustees.

POULTON-LE-FYLDE.—Grammar school; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

PURFLEET (ESSEX).—Factory; British Carbonite Smokeless Fuel, Ltd. Factory; British Indestructo Glass Co., Ltd.

REDCAR.—Extensions, Sir William Turner's school (£10,000), for governors; clerk.

ROCHDALE.—Girls' high school, Greenhill; secretary to the Education Committee.

ROTHERHAM.—Municipal lodging house; Special Corporation Committee.

RUGBY.—Central post office, North Street, for H.M. Office of Works, King Charles Street, London, S.W.

SALFORD.—School, Tootal Drive, for the borough E.C.; secretary (returnable deposit of £1 1s.).

SANDBACH (CHESHIRE).—Telephone exchange; H.M. Office of Works, King Charles Street, London, S.W.

SANDERSTEAD.—Estate development, Essenden and Beachwood Roads; Whitgift Foundation governors.

SELSDON (SURREY).—34 houses and clubhouse, Addington Park estate; W. G. Lewis. 28 houses, Littlehealth Road; R. Costain & Sons.

STOCKTON-ON-TEES.—Additional 300 houses, for the T.C.; borough surveyor.

STOKE-ON-TRENT.—Municipal aerodrome; city surveyor. Housing scheme, Trent Vale; city engineer.

TILBURY.—Maternity and child welfare centre, for the U.D.C.; surveyor.

TIPTON.—Additional 86 houses and public baths (£18,045), for U.D.C.; surveyor.

TYLDESLEY.—Senior elementary school; director of education, County Education Offices, Preston.

ULVERSTON.—Grammar school; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

UTTOXETER.—Catholic schools; S. S. Proud, architect. Town Hall (returnable deposit of £2 2s.). Additional 70 houses, for the R.D.C.; surveyor.

WHITEHAVEN.—Wesleyan church, Kells (£10,000); trustees.

WIDNES.—Secondary school (deposit £2); S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

WINCHESTER.—Electricity offices and showrooms, Twyford, for the T.C.; Cancellor & Sawyer, architects. Additional 60 houses, for the T.C.; city surveyor.

WORTHING.—Extensions, High School for Girls, for West Sussex E.C.; P. Roberts, "Fernleigh," North Street, Chichester (deposit £2 2s.).

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The

Electrical Review

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Association and Progress.

THE Fourth Annual Conference of the E.C.A. Allied Associations, now being held at Bournemouth, is another milestone in the progress of the electrical contracting trade, and provides an appropriate halting point from which to look back along the road it has travelled, and forward a little to what yet lies before it.

Associations in the electrical industry are to-day so much a commonplace that the other sections of it are apt to overlook the fact that it was the contracting section, its Cinderella, which showed the way to the common weal by organisation. As a matter of history, the E.C.A. was formed in 1901, at a meeting at Anderton's Hotel, presided over by Mr. Henry Alabaster, of the ELECTRICAL REVIEW. Its first activities were applied to negotiation with the manufacturers, who were thus spurred to a similar combination of their forces in what eventually developed into the present B.E.A.M.A. Their example was followed by other sections as each felt the need of a corporate authority which could voice its aspirations; and to-day the whole electrical industry is organised into a number of powerful groups, which arrangement, we hope, is operating to their individual and mutual benefit.

The benefit could be greater if the principle of association were carried further. Trade and professional organisations have a tendency to become insular, and there is certainly scope for closer co-operation between those of our own industry. Their normal attitude to each other is of indifference, occasionally waking to suspicion and active jealousy. The indifference is foolish, and the jealousy a drag on progress. There would be less of it—there need be none—if the several electrical associations would but meet oftener and more readily to discuss in round-table amity the joint problems of the industry. Such a one is the question of the appropriate functions of each in the new and great development offered it by rural electrification. Another is that of preparing an authoritative trading register, defining the terms to which all electrical firms and large users should be entitled, some to factors', and others to trade or quantity discounts: a great and pressing problem, but no more beyond the united efforts of the industry than a similar one has proved to be beyond those of the automobile trade.

The Electrical Contractors' Association, at least, has shown itself wlling, not only to meet the others on

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common ground, but on occasion to take the initiative in suggesting one. Its recent activities are symptomatic of a growing confidence, born of a knowledge of steady progress towards the strength of unity. With few exceptions, all the leading contracting firms are to-day members of it or of its allied associations; but there are a number of the smaller firms who could yet join it, with advantage to themselves and the industry. Many of them, of course, are upon the National Register of Electrical Installation Contractors; and probably a majority of the genuine contractors in the kingdom are accounted for between the two organisations. This assumption is supported by the fact that both are now finding it necessary to scrutinise with the greatest care an increasing number of applications for membership or registration, many of them by undesirables, little men with little training or experience, whose hands have been forced by the insistence of certain supply authorities on one or other of these qualifications. If the remaining authorities would but follow their example, and all consultants and architects could be persuaded to do the same, the present process of elimination of the unfit would be accelerated, and we might hope for a not-too-distant day when every reputable contractor would be within the fold, and to be outside would mean swift extinction by the brand of shoddiness.

That ideal, fraught with so much good to the electrical industry and the public, is appreciably nearer to-day than it was, say, four years ago, when the first E.C.A. conference was held. Ideals attained are not the chance rewards of indifference. This particular ideal is nearer only because it has been defined and insistently demanded; because it is being consciously striven for, with ever increasing strength and confidence; largely, be it said to their credit, by the contractors themselves, without the pressure of public opinion or, until latterly, any practical assistance from the rest of the industry.

Their Association's efforts towards that end would be the sooner rewarded if it had at least the assistance of every reputable contractor. Its membership to-day is about 1,200. How many electrical contractors, genuine and spurious, there are in the kingdom, it is difficult to say—so many spring up over-night in a back room and wither the next day in Carey Street—but after making the fullest allowance for these men of straw, there must still be many hundreds of others who might, but do not, assist, by active membership of the E.C.A., good work of which they accept readily enough the unearned benefits. In this they are like those workmen who refuse subscription to their trade union and yet claim the improved pay and conditions which it secures for its members. Their position is as incomprehensible as it is indefensible. From the narrowest point of view, membership of an association such as the E.C.A. carries with it concrete advantages, such as preferential trading terms, which are outside the possibilities of unsupported action. That is to look upon association as primarily a business matter. But it is more than that. The wider view, the view which must appeal to every man of foresight and public spirit, is that which looks upon association as a means towards the common good of his industry and the community, in which alone his individual stability and prosperity shall find a sure foundation.

Domestic Supply Tariffs.

The proceedings at the recent Convention of the Incorporated Municipal Electrical Association at Torquay once again brought to the forefront the important and much-discussed (perhaps over-discussed) subject of domestic electricity-supply tariffs. It is not our intention to express favour or otherwise for any of the great variety of systems of charging for domestic supply in vogue, except in a general way to repeat our adherence to the principle of the two-part tariff on the simplest possible lines and understandable to the consumer, at the same time looking forward to and hoping for the time when it will be possible to apply universally Dr. Ferranti's ideal flat rate.

We think it worth while, however, to focus attention on the new "Domestic Tariff" adopted by the Newcastle-upon-Tyne Electric Supply Co., Ltd., which we outline in our "Domestic Electrical Developments" columns in this issue. This appears to us, by virtue of the considerable drop in the sliding scale, to provide in substantial measure for the fixed and running charges, without in any way making the necessary complicated calculations of the supply engineer apparent to the consumer. The principle of "buy more—pay less" is one of which the average person has some sort of a conception—at any rate, it is one which he accepts without question as the normal order of things.

It is worth recalling here observations made by the "Advisory Committee on Domestic Supplies of Electricity and Methods of Charge" in its Report to the Electricity Commissioners (Electrical Review, October 29th, 1926, p. 730). "The Committee considers that none of the multi-part tariffs at present in use or suggested are sufficiently perfect for recommendation for exclusive adoption . . .; but that such tariffs of the simplest possible character should be strongly recommended for domestic supplies, and that they are of little use and will not achieve their object unless the alternative method is a relatively high maximum or actual flat rate.

"Most undertakings have the right to impose minimum charges. This has caused trouble with very small consumers, who object to paying for what they say they have not used. It is very essential, however, that the right to make a minimum charge should be retained, and in connection with multi-part tariffs it should be made quite clear that the fixed charge is in the nature of a minimum." We commend this valuable report to further and more frequent use by electricity supply engineers and managers.

Other points worthy of note about the Newcastle tariff are that some provision is made for seasonal load variations, and that the "hidden" fixed charge, which is variable with the number of assessable rooms, is on the lines of the "floor-area" tariff recommended by the above committee.

More Attention to Overseas Trade.

We have frequently referred to the list of members of the Advisory Committee of the Department of Overseas Trade as being unimpressive from the point of view of electrical trade interests. The habit of choosing one or two great men who, because of the variety of their public and other duties and the sizes of their undertakings, can hardly be expected to be able to devote that measure of attention to the real needs of the electrical trade in its desire to succeed abroad, may not have been the best. We are not alluding to the service afforded by members of the more or less permanent staff of the Department, for the limit of their activity is settled in the main by the policy of the Government and the funds that they are in the habit of placing at the Department's disposal. Who could be expected to launch out on new and useful work while Geddes and other "cuts" overhung them? We now learn that the reorganisation of the Advisory Committee is proceeding and that some well-known electrical men who have been in the fore-front of actual trading affairs for many years have been asked to give assistance. We dare hope that the newly-elected Government will see the need for strengthening the D.O.T. as a serious measure for making work for unemployed. There are few more important ways in which a man may serve his industry just now than by zealously endeavouring to encourage more definite and determined effort among

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those, be they committees or firms, who ought to work harder than ever before in this overseas trade connection. It must not be overlooked that so far as this Journal is concerned we have been doing our utmost for years to bring British electrical and allied products before the actual overseas buyer. How far we have succeeded our published statistics show, manufacturers know, and we know too from correspondence received from manufacturers and our own correspondence from overseas. We have long had valuable assistance from the Department of Overseas Trade, and our hopes are high that with the strengthening of the Advisory Committee, things will become still better for ourselves and the trade generally.

Large Three-phase Transformers.

THE use of three-phase transformers, rather than equivalent banks of three single-phase transformers, has many points in its favour, including lower first cost, reduction in space occupied, and superior efficiency. It is therefore gratifying to learn from the paper on "The British 132-Kilovolt Grid," read by Mr. J. R. Beard before the E.H.P. Conference at Paris, that three-phase transformers of as high a capacity as 75,000 kVA are now actually under construction.

Messrs. Johnstone Wright and C. W. Marshall, in their paper read before the Institution of Electrical Engineers on January 24th last, mentioned 30,000 kVA as the maximum output anticipated for three-phase units. The maximum capacity has therefore increased by 150 per cent. in about six months. Difficulties of transport have been the crux of the matter, owing to the restrictions imposed by the loading gauge in this country, as these are very much more severe than those on the Continent or in America. While recognising the helpful co-operation of the railway companies, we think that British transformer designers are deserving of very great credit for the manner in which they have taken the utmost advantage of the difficult conditions.

It should be added that the difficulties were enhanced by the fact that the transformers were designed for natural cooling up to half-load and were fitted with gear for tap-changing on load.

Industry and Commerce in France.

IT is, perhaps, inevitable when business is brisk, and the activity has continued for some time, that some anxiety should be evinced with regard to the continuity of the prosperity. This is the situation at the present moment in French industries, for although in that country everyone is working—capitalist, artisan, and labourer—one learns from all sides that business is calm. This really means that firms who had sufficient orders on their books to keep their works occupied for, say, five or six months are finding that this margin is being reduced. It is needless to say that this margin is never stable. Nevertheless, if one examines the export and import statistics it is evident that since the beginning of this year the balance is less favourable from the French exporter's point of view than it was for the corresponding period of last year. As we have already shown, however, France has been obliged in the past to import largely in order to supply her requirements in the electrical and metallurgical industries. There is every likelihood of this being the case in the future, the current statistics which show an adverse tendency merely proving that French domestic requirements are continuing to absorb the greater part of her own production. The improvement in French commercial conditions which is still in evidence really dates from the legal stabilisation of the franc and the stabilisation effected by the Bank of France before the legal recognition at 124 or thereabouts. Previously with variations in exchange of ten and twenty points per day business was merely and purely a speculation. Whatever opinion one may hold regarding the figure at which this stabilisation was put into effect—for at 124 to the £, France has practically repudiated 80 per cent. of her national debt—there is no doubt that its effect has been beneficial to France and to French industries, and in any case the repudiation of 80 per cent. was preferable to an imitation of the German *débâcle*—which, indeed, was within an ace of taking place. If the figure had been put at 100 the effect would probably have been the same, but as then there would have been a repudiation of only 75 per cent. it would have been more costly. In commerce and industry it was sometimes impossible to induce holders to part with their merchandise against payment in French currency. They preferred to purchase anything, and practically at any price. With the improvement in the franc and subsequent stabilisation these holders, afraid of the inevitable fall in prices, which in many cases did take place, became keen sellers. In many quarters it is now argued that the prosperity of 1928 was largely the result of these artificial conditions, and that the true commercial basis is now being reached. In any case it is obvious that not on the stormy seas of paper inflation and business speculation is it possible to steer the commercial frigate, but that the more prosperous voyages are to be effected rather on the placid waters afforded by stability and solidity. Nevertheless, in spite of more stable financial conditions, another side of economics which is of equal importance from the point of view of everyday life—the cost of living—not only shows no reduction, but has continued to increase steadily until to-day the coefficient is at least 6 as against 1914. There is no doubt that some of the benefits which the Government has been able to effect are being nullified by additional taxation, which certainly accounts for a portion of this increase.

The Marconi Radio Royalties.

LAST week Mr. Justice Luxmoore allowed the appeals of the Marconi Co. against two decisions of the Comptroller-General of Patents directing the company to grant licences to two manufacturers under certain patents which it owns, on special terms. One case, that relating to the Loewe Radio Co., was of a special nature. The method of charging the royalties upon broadcast receiving sets is so much per valveholder. The Loewe Co. has a method of combining two or three valves in one envelope, which renders the valveholder royalty unsuitable. As the Marconi Co., however, has not actually refused a licence, terms not having been properly discussed, the Judge allowed the appeal on this ground.

As regards the Brownie Co., the Judge held that so far from establishing a new industry, the company was endeavouring to enter an existing industry on terms more favourable than existing licences were granted. His Lordship, having regard to the tremendous growth in the number of receiving sets in this country, was also unable to accept the suggestion that the royalties now charged were too high.

The Brownie case was by way of being a test action, and so confident were manufacturers that the Comptroller-General's decision would be upheld that many of them immediately decided to pay only the reduced royalties and lowered the prices of their sets. This has probably had a great deal to do with the increased popularity of portable sets, which, having four, five or more valves, would receive the greatest benefit from a reduction in royalties based on the number of valveholders.

The success of the appeal has thus placed manufacturers in an unenviable position. Not only must they restore their prices to the former level (if they are to make the same profit), but the Marconi Co. is in a position to insist upon the full royalty on all sets sold during the interval. It would appear impossible for manufacturers to claim the difference from their customers and thus they will have to bear the loss themselves if the Marconi Co. stands upon its rights.

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The E.C.A. Convention.—I.

An Account of the Proceedings at Bournemouth.

We remarked last year that the organisers of the annual convention of the E.C.A. Allied Associations had displayed great perspicacity in their choice of meeting places — Brighton, Scarborough and Cheltenham. This year they have sustained their reputation by selecting Bournemouth as the *venue*.

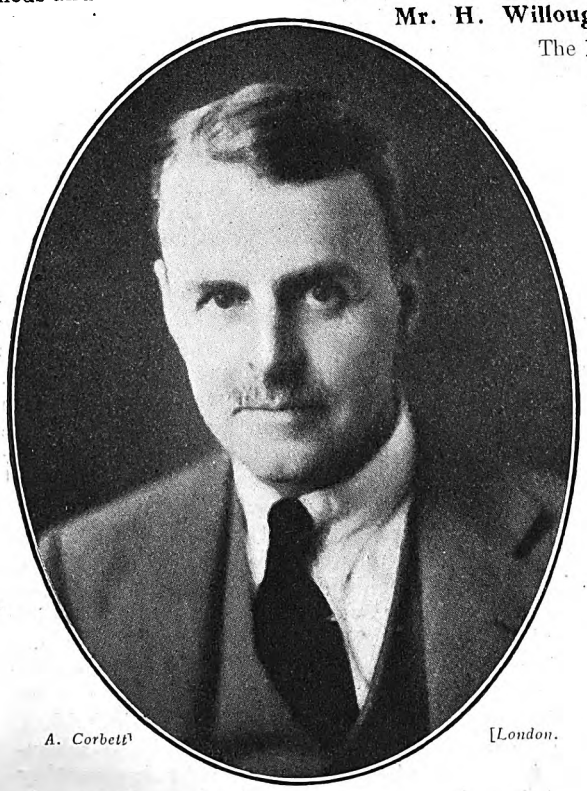
Those who have visited that delectable South Coast town need no commendation of ours to remind them of Bournemouth's innumerable amenities. Readers who have not yet had that pleasure will judge from the views which we reproduce on the next page that the place is well worth seeing. The sea rises on clean firm sand, there are broad promenades and carriage drives and high cliffs. The "chines," wide fissures in the cliffs, clad with trees and plants, are a notable feature of the town. They add to the beauty and health of the locality, acting as watersheds and as entries for the sea breezes which thus reach the higher town. Bournemouth has hundreds of acres of parks and gardens most beautifully laid out, and the reputation of the town as a health resort is dependent to a great extent upon its pine forests. Many places of historical interest are within easy reach of Bournemouth; the ubiquitous motor-'bus will take visitors to such places as Christchurch with its ancient Priory, Castle remains and Constable's House, Winchester, the capital of Saxon England, quiet Wimborne dominated by its Minster's twin towers, and a wide area of typical Hampshire and Dorset countryside, including the New Forest.

One of the town's principal buildings is the new Pavilion which was opened quite recently and is also illustrated herewith. The lighting in this handsome building is particularly well done and should prove of interest to contractors; some notes on the installation appeared in our issue of April 5th (p. 602).

The business meetings of the Convention which commenced yesterday (Thursday) are being held in the Town Hall; this is seen in the centre of the middle picture on the opposite page. The proceedings commenced on Wednesday with a reception in the Pavilion

Lafayette] [London.

Mr. H. Willoughby Ellis, A.M.I.E.E.,
The President-Elect.



A. Corbett] [London.

Mr. H. R. Taunton.

Lafayette] [Dublin.

Mr. A. G. Bruty, M.I.E.E.

The Authors of the Papers which are being read at the Conference.

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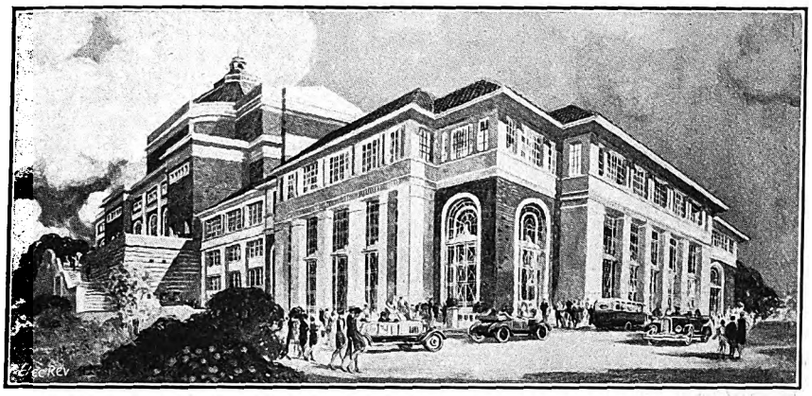
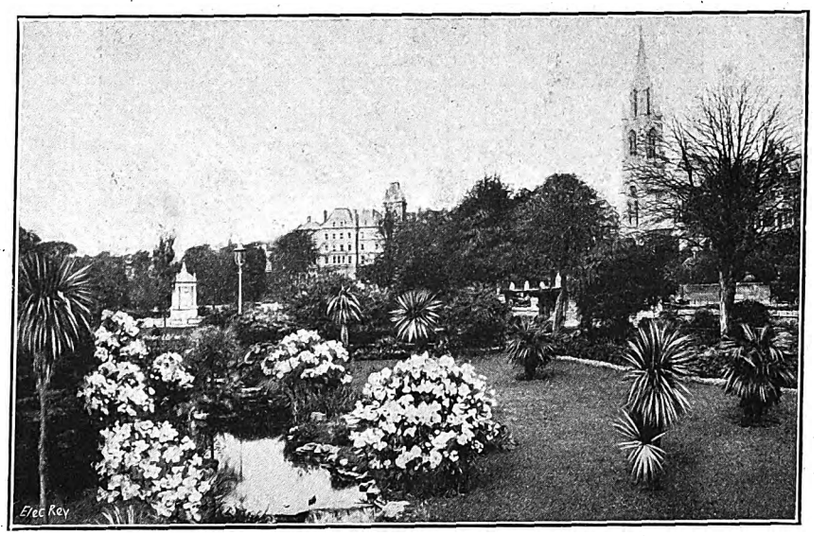
by the President of the Allied Associations, Mr. W. H. Walton. In accordance with precedent this was the preliminary to a dance in which a large gathering took part.



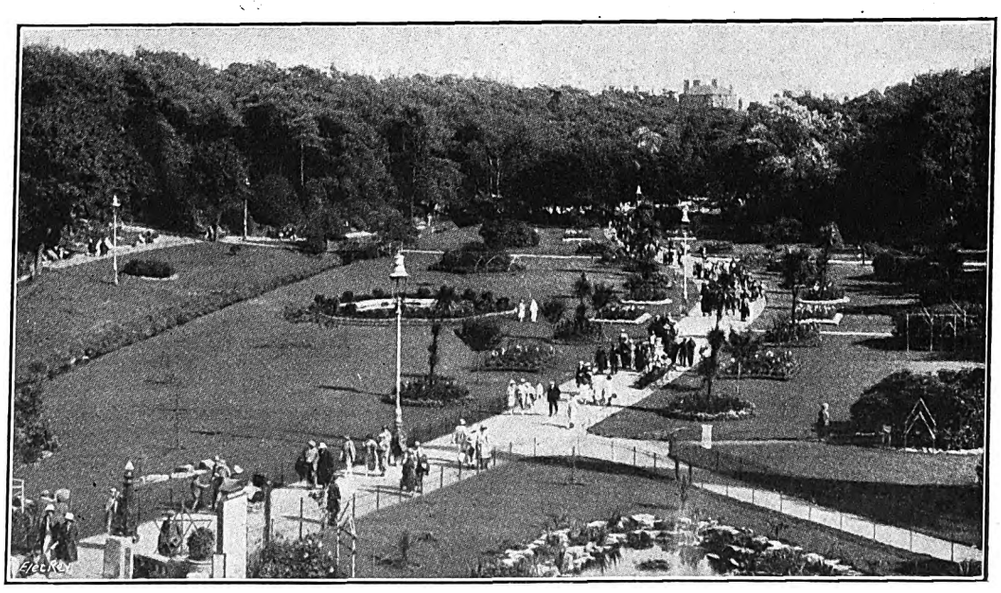
The New Pavilion, Bournemouth.

An early start was made yesterday morning, the first business being the annual general meeting at which the annual report, reviewed later, was presented. The Conference proper opened at 10 o'clock with an address of welcome by the Mayor of Bournemouth (Ald. C. H. Cartwright, J.P.), for which his Worship was thanked by the President on behalf of the Associations. Mr. Walton then delivered his presidential address, an abstract of which follows these notes.



The Central Gardens, showing the Town Hall.

The report was a long and interesting one, and proved, once more, that the E.C.A. works not only to improve the status and conditions of its own members, but for the general well-being of the whole electrical industry. Several perennial matters were dealt with, including the problem of compulsory registration. With this the Association is in entire agreement, although the difficulties are thoroughly appreciated, and the inclusion of operatives in the registration is recognised as a necessity. Headway seems to have been made in connection with the operation of Clause 48 of the 1926 Act. The two greatest problems in this direction are the desire of some supply authorities to run their own appliance businesses, and the failure of some contractors to do all that is necessary to increase the sales of appliances. The report briefly reviewed the Association's educational and other activities. The principal matter, however, was the subject of fair and proper trading. A reasoned argument for a National Trading Register was put forward by Mr. Walton. He truly described the compilation of such a register as a colossal task, but he was convinced that the work would be fully justified by its beneficial reaction upon the state of the industry.



Another View of the Gardens.

In his presidential address Mr. Walton again referred to the need for a National Trading Register. He also dealt with the manner in which the Association is bringing the importance and value of good installation work to the attention of those who have the placing of electrical contracts. This, and the similar work which is being carried out by the National Register, should have a very appreciable effect upon the general standard of wiring installations in this country. Mr. Walton also had something to say regarding those "arm-chair" critics who are content to let others do the work while they "assist" with advice in the form of complaints. We fear that the E.C.A. cannot claim to be unique in this respect.

In his conclusion, the President urged contractors (and others in the industry) to take a wider view of their work. He stressed the fact that electricity was not merely a commodity, but a universal service.

The business of the afternoon session was the reading of a paper on "The Mutual Responsibility of Contractors, Manufacturers, and Supply Undertakings: (*a*) to the Electrical Industry, and (*b*) to the Public," by Mr. A. G. Bruty, M.I.E.E., secretary of the Irish Section of the Association. Broadly, under (*a*) Mr. Bruty placed augmented goodwill, mutual recognition, and increased co-operation; and under (*b*) conscientious

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work and efficient service. He showed that this was not all pious aspiration, but would yield practical and remunerative results. The author had something to say regarding the variety of supply authorities' tariffs and regulations, and made special reference to the action of the Electricity Supply Board, which has been charged with the reorganisation of supply in the Irish Free State, and which Mr. Bruty charged with unfairness towards the Irish electrical contractors in the matters of installation work and the sale of appliances. After dealing with relations between manufacturers and contractors, Mr. Bruty proceeded to point out the way in which the industry could secure the confidence of the public—by providing the kind of appliance needed, by installing safe systems, and by raising the general standard of the trade. We hope to publish in our next issue an abstract of this paper and the one to be read to-day (Friday) by Mr. H. R. Taunton ("The Contractors' Part in Rural Electrification"), and to include reports of the discussions upon them. On Thursday evening there was, as usual, a smoking concert in the Pavilion.

To-day's business comprises the reading and discussion of Mr. Taunton's paper, the installation of Mr. H. Willoughby Ellis as the new President, followed by a short address and the usual vote of thanks. For the afternoon a trip to Southampton has been arranged, for a tour of inspection of the *Aquitania*. In the evening there is to be a ball and supper at the Pavilion at the invitation of the Mayor of Bournemouth. Arrangements have been made for the entertainment of those delegates who propose to stay in Bournemouth over the week-end.

The number of delegates to the Conference exceeds 450, and is 50 more than last year's record attendance.

Elliott & Fry] [*London.*

Mr. W. H. Walton,

President of the E.C.A. Allied Associations.

Presidential Address.

By W. H. Walton.

(*Abstract.*)

Commencing his address, Mr. Walton recalled that at last year's conference he had suggested that the Association's efforts should be directed along three main channels: (1) to the development of the Association itself; (2) to the promotion of better trading understandings with all other sections of the electrical industry; and (3) to securing the closest possible co-operation between members and electricity supply authorities. He proposed to review the progress made during the past twelve months in those important directions.

The Association had always concerned itself very seriously with the technical and business standing of its members; but in view of the hosts of untrained and inexperienced men who were prepared to carry out any electrical work which they could find, it had been necessary to scrutinise the credentials of new applicants for membership with greater care than ever. They were perfectly willing to confer the advantages of membership on sound and dependable men, no matter how small their individual businesses might be, but they were not prepared to recognise the untrained and inexperienced worker who was such a blight on to-day's installation trade. During the past year they had entered into the closest collaboration with the National Register of Electrical Installation Contractors to achieve identical ends. The National Register had published a list of faults which would lead to the removal of any questionable installation engineer from the Register. Electrical contractors had to put their own house in order; nobody would do the work for them. The next move of the Association had been to raise the status of all dependable installation engineers, not only within the industry itself, but also in the eyes of allied and associated professional interests. They had produced a good handbook devoted to really worthy installation work, and they hoped and believed that this would go a very long way to enlighten an important section of the community concerning the short-sighted folly and essential danger of cheap and nasty electrical work. They had been fortunate in obtaining a preface to the booklet from Mr. Walter Tapper, A.R.A., President of the Royal Institute of British Architects, in which he gave a clear lead in favour of sound electrical installation work at a fair price. They had attempted to state the case in favour of good and convenient installations and set forth the arguments against shoddy and inconvenient installations, thereby giving the architect an opportunity of appreciating the prime cause of the widely different tenders which he might receive for the same piece of work. The Association had endeavoured to maintain good relations with organised labour. The Prime Minister, in a recent appeal for industrial peace, had said that the new Government intended to get into touch with representatives of both sides, employers and employed, in essential industries, to confer with them in special work for the good of the people. It had been the consistent policy of their own Federation to confer with their operatives on any and every occasion where the common good of the trade had been concerned. With regard to the promotion of better trading understanding with other sections of the industry, concrete achievements were elaborated in his annual report. There was no doubt that very sound trading progress had been made during the past twelve months. Their delegates to other bodies and their negotiating committees had experienced little difficulty in securing an adequate hearing and thoughtful appreciation of their considered proposals. The buying power of the membership, of course, was a quantity to be reckoned with, but that power had never been applied in any coercive manner. They were criticised from time to time for their "failure" to achieve this, that, or the other thing; but, if their critics would leave their armchairs and take a personal hand in the fight, he was sure that their attitude would undergo some amendment. He knew of no other association which was so faithfully served by its honorary officers. All of them were carrying on their own businesses, and yet found time and energy to put in a great amount of work for the Association. He would say that 75 per cent. of the trading troubles of their section of the electrical industry arose as a direct consequence of discount misunderstandings and misapplications. The electrical industry lacked the close cohesion exhibited by many other trades, and provided a very happy hunting ground for those in search of illicit discounts. A reform calculated to strike at the very root of such troubles would be provided by a National Trading Register clearly defining all firms and individuals entitled to any electrical discount whatever. Recognised wholesalers would be registered as entitled to wholesale terms; recognised retailers would be registered as entitled to ordinary trade terms; while larger buyers would equally be registered as entitled to agreed quantity discounts. Trade terms, as such, would be allowed to nobody save those actually in the electrical trade or carrying on allied trades for the production of semi-electrical goods for re-sale; while all other buyers would be entitled to quantity terms or no special terms at all, depending entirely on the magnitude of their annual electrical requirements. Such a comprehensive register appeared to represent too large a task for practical and effective achievement, but certain sections of the electrical industry were already substantially organised on those lines, while in other national industries the system was in active operation with most beneficial results to the traders concerned and to the public. A National Trading Register represented the first essential step to be taken in the basic reform of any disorganised trade, and, from an electrical point of view, he commended the proposal to the very serious consideration

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of the whole industry. Real progress had been made in securing closer and more businesslike co-operation between electrical installation engineers and their respective electricity supply authorities, particularly in the South of England. Although there were one or two areas in which it seemed impossible for the two sides to get together, in the balance, progress had been overwhelmingly in the right direction.

Far-seeing company and municipal supply authorities realised that a universal electrical service represented far too large, far too complicated and far too much a personal and individual matter, to be concentrated under one management and supplied from one or two central depôts, and as time went on the same view would spread into every area throughout the land. They had all taken far too small and limited a view of their surroundings. They were not engaged in pushing forward an interesting alternative to oil, candles and matches; they were promoting a universal service capable of performing every type of task in a multitude of different ways. At the present moment they had touched no more than the fringe of the comprehensive electrical service which the industry was destined to render to humanity, and such a universal service, designed to meet almost every human requirement, and arranged to suit every pocket and every taste, could not possibly be carried on as a centralised, cast-iron monopoly. Individual enterprise, initiative and personal service were at the very root of electrical progress. The industry required more and better men, more and better displays, more and better individual enterprise, and more and better personal service.

The Annual Report.

In presenting the report for the last year, Mr. Walton said that although there had been no spectacular achievement, the activities of the Association continued to increase, and progress had been made in several important directions. The membership increased during the year; the few old-established contractors in various parts of the country who had held aloof for so many years were now recognising the value of united effort, and were throwing in their lot with the Association. Success could come only by the united efforts of all engaged in the industry, and he asked the whole membership to support the Association on every occasion to the utmost of their ability. Since the last annual general meeting a certificate had been obtained from Messrs. Price. Waterhouse & Co., with regard to the overhead expenses associated with the businesses carried on by members. He could not too strongly emphasise the necessity for every member to pay adequate attention to the figures, and thus do his best to ensure that every job that he carried out bore its proper proportion of overhead expenses. The price-cutting practice of certain firms appeared to go on unchecked; but no association had been able to prevent people pursuing a policy of losing money on contracts if they really wished to do so. It was far better, however, to do a quarter of the work at a reasonable profit than to do a very great deal without sufficient margin for overhead expenses, let alone profit. A committee of the Association had utilised the information supplied by Messrs. Price, Waterhouse & Co. in its negotiations with various Government Departments, &c.; a certain measure of success had already been achieved, and more satisfactory progress would be made in the near future. The new regulations which had been introduced by the National Register of Electrical Installation Contractors should improve the status of all those admitted to the Register. During the past year close co-operation had existed between the Register and the E.C.A. which, to a very large extent, had been responsible for the new regulations now put into force. At the commencement of the year the Association supported the National Chamber of Trade in its resolution for compulsory registration. Although the National Chamber did not see its way at the time to pursue the request for compulsory registration, it had signified its intention of exploring all possible means to secure a national code of wiring rules. Compulsory registration was something which they would all like to see, but it was an extremely involved question; it would be necessary to register operatives as well as contractors. The Council had done its best to increase the usefulness to members of the Electrical Contractors' "Year Book," and had also published a book particularly directed to architects and others who were frequently responsible for giving out electrical work. This contained a preface by Mr. Walter Tapper, the President of the Royal Institute of British Architects, and was designed to emphasise the need for greater care to be exercised in considering tenders for electrical installation work. That effort would go a long way to advance the interests of those in the industry, who were anxious to carry out work of a good and sound nature as against those whose only aspiration seemed to be to carry out work of any description at the lowest possible price.

The Law and Parliamentary Committee, under the guidance of Mr. W. Cross, had been particularly active during the year. A considerable amount of time had been spent with a view to promoting the true spirit of Clause 48 of the Electricity (Supply) Act of 1926. A very large number of negotiations between the contractors and supply engineers had taken place in all parts of the country during the year, and, on the whole, the arrangements which had been arrived at had been extremely satisfactory. The chief function of the supply authority was to sell the energy which it generated, and if supply engineers were satisfied that contractors were rendering the service required to develop the consumption of energy, they would recognise the contractors' efforts in a fair and reasonable way. If contractors failed to pull their weight, and were not absolutely up-to-date in their selling of current-consuming devices, then they could not possibly deny the supply authorities' right to take a hand in the work. Mr. Bruty was reading a paper on "The Mutual Responsibility of Contractors, Manufacturers and Supply Undertakings to the Electrical Industry and to the Public." Electrical contractors had definite obligations to other sections of the industry, in addition to their direct duty to the public. One of these was to equip their public displays so effectively that they were a potent factor in the locality in which they carried on business; then there would be no need for the supply authority to enter into competition with them. The Law and Parliamentary Committee had displayed activity in connection with third-party insurance risks. The Committee had now obtained a policy which would be of the utmost utility to the whole membership. During the year the Apprenticeship Committee had been successful in organising an Advisory Committee representing all interests from the electrical and educational points of view. That Committee had produced syllabuses of a very comprehensive and useful nature, which should have the effect of improving the theoretical and practical training which was available to apprentices. The Council had drawn up "Standard Conditions for Cost plus Percentage Contracts" and "Conditions of Tender and Contract for Electrical Installation Work." Those documents were now in the hands of all members, and the forms and conditions should be utilised in place of the many varying documents which had hitherto been in use in the trade. The Council had also passed certain resolutions referring to electrical installation work for submission to the Electricity Commissioners and to the Institution of Electrical Engineers. The question of "Earthing *versus* Insulation" had been discussed at very considerable length by the Council and branches. In addition, it was considered by many outside bodies, and an informal discussion took place under the auspices of the I.E.E. The introduction of more than one phase of a supply system into one room had also been dealt with, and mainly as a result the Institution had set up a special committee to consider the whole subject, including a representative of the Association. A resolution had been sent to the Electricity Commissioners and to the I.E.E. stressing the necessity for securing the early standardisation of pressure in all areas. The activities of the N.E.C.T.A., Ltd., had been principally devoted to trading matters; the finances of all three Associations were in the hands of the company. The Trading Committee's efforts to secure a National Trade Register for the whole of the electrical industry had continued. Although the Association adhered to its policy that trade discounts should be reserved exclusively for those in the trade, very large buyers of electrical apparatus for their own use must obviously receive considerably better terms than the ordinary private buyer. Unfortunately, however, a system of quantity discounts did not seem to meet the bill. There were a very large number of industrial buyers who demanded and received the full trade discount upon their requirements, and although the efforts of the Association had gone a very long way to get rid of this objectionable practice, if one particular manufacturer or wholesaler withheld the trade discount, ways were usually found to obtain it from another source. That chaotic state of affairs could be satisfactorily corrected only by the introduction of a trade register which would indicate at a glance: Those to whom wholesale terms should be allowed; those contractors and/or retailers to whom the trade discount should be allowed; and those buyers who, for some special reason, were entitled to some discount to be mutually agreed between all sections of the industry. The compilation of such a register was a colossal task, but the utility of it would more than justify the trouble and expenditure. It was the only solution of the chaotic conditions existing in the trade. An informal committee representing the majority of interests in the electrical industry had accepted the suggestion for recommendation to all concerned. The progress made in negotiations with E.L.M.A. was of extreme importance, and would have very far-reaching results in the future. A new register had been introduced, the names upon which would be reserved as the exclusive province of E.L.M.A. retail agreement holders. Heretofore the contractor had complained very bitterly, and to some extent justifiably, that after he had carried out a large installation and supplied the first lamps, he lost any opportunity of retaining the business afterwards. By means of the new register a number of consumers were reserved definitely for the contractor. If the contracting industry satisfied E.L.M.A. that consumers were being adequately served, there was every prospect of further concessions. Relations and negotiations with other sections of the industry continued to be most cordial, and frequent meetings and discussions had taken place during the past year. Manufacturers as a whole were not out to establish retail trading facilities if they could dispose of their goods through the trade. If contractors were in a position to display fittings and current-consuming apparatus really adequately, manufacturers would much prefer the business to go through the trade. It was the duty of contractors to develop every means within their power to increase selling facilities and selling ability. To-day advertising was of the utmost importance, and some eighteen

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months ago the Trading Committee placed a substantial order for illuminated signs for the use of the membership at cost price. Those signs had not secured the wide distribution that was promised; he appealed to members to take them up. So far as the National Federated Electrical Association was concerned, wages had continued to operate in accordance with the national sliding scale agreement of September, 1921, and although an application was put forward by the Electrical Trades Union for a national increase it was not granted; a 5 per cent. rise was given in the London area. The question of wages and working conditions in the industry seemed to have been satisfactorily controlled by the organisation of the Whitley scheme, and except for little outbursts in one or two districts, the relationship between the N.F.E.A. and the E.T.U. continued to be of the most cordial nature. Properly organised employers and properly organised labour were two of the most essential points for peace and progress in any industry. Mr. Walton made particular reference to the activities of the chairmen of the main committees of the Council during his year of office. Mr. Shaw, immediate past-president, had again ably directed the Development Committee in its deliberations; the Trading Committee for another year had had the admirable guidance of Mr. H. Marryat; and Mr. Robson as chairman of the Apprenticeship Committee had conducted business in an able manner during a year of record activity. Mr. Robson, after practically a quarter of a century of service to the Association, had decided to relinquish the chair of the Apprenticeship Committee, and he (the president), on behalf of the members, accorded to him their very best thanks for his services. The Labour Committee's activities, although conducted to a great extent without publicity, were none the less intricate and involved, and the Association owed a debt of gratitude to Mr. Walter Riggs, who had been chairman for the past few years, and had now retired from that office. The report concluded with an expression of thanks to members of the Council and branch officials.

The National Register.

An Authoritative Survey of the Past Three Years' Work of the N.R.E.I.C.

By A. H. DYKES, M.Inst.C.E., M.I.E.E., Vice-Chairman of the Registration Board and Executive Committee.

IN the issue of the ELECTRICAL REVIEW of January 22nd, 1926, Mr. P. V. Hunter, the Chairman, reviewed the progress of the National Register of Electrical Installation Contractors since its inception in 1924. At that time, and subsequently, there were dire forebodings of the impending demise of the Register in its early infancy. The Executive Committee was regularly lectured or abused (according to the individual proclivities of its critics) in one or other of the electrical journals for its incompetence in the management of the affairs of the Register. If I remember rightly one gentleman likened us in the columns of the ELECTRICAL REVIEW to the gods resting on Olympian heights, sublimely indifferent to the demands of their masters (presumably contractor mortals), a description picturesque but utterly untrue of the Executive's attitude at that or any other time.

Now what was, is, and must always be the position of the Executive Committee? The aim and objects of the National Register as laid down by its constitution are: (1) the protection of the public; (2) the raising of the efficiency and status of installation contractors; and (3) the improvement of installation work. It is these dominant objects that we have, and must always have, before us, and I venture to think that in many cases criticism was the outcome of misconception of these objects and the limitations imposed upon us. From some quarters came complaints that the Executive Committee was placing on the Register what are colloquially called "one-man" businesses and that in consequence some of the big contractors were deterred from applying for registration, and those who were registered would retire if the practice were continued. From other quarters came demands that the Register should issue a set of wiring regulations and impose a minimum standard of workmanship to be attained by contractors. With regard to the first, is it not obvious, in view of the three objects above detailed, that registration was never intended to be confined to the large and prosperous firms, but that the small man also should have his chance? When an application for registration is received it is first carefully investigated by headquarters and is then sent down to the appropriate Local Advisory Committee in order that it may from its own knowledge confirm, if possible, the accuracy of the statements contained in the application, and whether the work done by the applicant is satisfactory. These Local Advisory Committees, composed of members representing both the supply and the contracting interests, have now been established all over the country, and are of the utmost assistance to the Executive Committee. To the members of these local committees as also to the Scrutinising Committee (Messrs. F. W. Purse and H. J. Cash), a great debt of thanks is due. The original application with the report of the Local Advisory Committee then goes before the Scrutinising Committee and finally before the Executive Committee. If from the various reports the last is satisfied that the work of a contractor running a "one-man" business is consistently good, and that he complies with the rules and conditions of registration, then, obviously, it is the duty of the Committee to accept his application.

In view of the increasing tendency to restrict work to registered contractors, refusal to register the desirable small man would in effect prevent him from earning a living. There are many small men who are unable to undertake large contracts for the provision and erection of large plant, but are fully competent to carry out the smaller installation work, and the Committee takes the view that to exclude such men would not be in the public interest and would certainly be inconsistent with the objects laid down by the constitution. It must not be assumed, however, that the way has been made too easy. It was found necessary to define the meaning of the expression "suitable business premises" which under the rules every applicant must possess. After long and careful consideration, and bearing in mind the views expressed by the opponents of the registration of the "one-man" business, the Executive Committee has laid down a definition which has been found generally acceptable and has been of great assistance to Local Advisory Committees in making their reports and recommendations on applications for registration.

The question of wiring rules and a minimum standard of workmanship has been a matter of deep concern to the Executive Committee ever since the formation of the Register, and both subjects have been well ventilated at conferences arranged for the purpose with members of Local Advisory Committees, and representatives of the Council of the Electrical Contractors' Association at which frank and free discussion on these and kindred subjects has taken place. It has been proved and admitted that as the standard of workmanship varies in different parts of the country and for different classes of installation, to attempt to impose an arbitrary standard would be impolitic at the moment, and would antagonise many well-wishers and supporters of the Register, and, whilst the I.E.E. Wiring Regulations are regarded as the ultimate stan-

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dard to be aimed at, insistence on strict compliance in every respect with those Regulations is not practicable at the present time. It has, however, been thought advisable to compile a list of examples of faulty wiring work, the commission of which is incompatible with the class of workmanship which is required of registered contractors. This list, with notes on its implications, has been circulated to every registered contractor, and has met with general approval. It is proving of great assistance to Local Advisory Committees when reporting on the work of applicants for registration and making their recommendations, and will be a help and guide to the Executive Committee itself when it is called upon to deal with complaints of bad workmanship. It may be found advisable, as time goes on, to add to this list in order to attain those objectives of the National Register already mentioned. In the past three years there have been several complaints against registered contractors. These have been at once investigated, and, where necessary, members of the Association of Consulting Engineers have been instructed to inspect the work complained of and to report, and the contractors concerned have been called before the Executive Committee to give their explanations. In some cases where there were extenuating circumstances the contractors, as a condition of remaining on the National Register have been required to put right or remedy at their own expense the faults complained of; in others, where the explanations tendered were deemed insufficient, their names were struck off the Register.

During last year we saw our way for the first time to undertake a moderate publicity campaign, limited, of course, by the means at our disposal.

Reverting now to the figures given in Mr. Hunter's article, he stated that at that date 930 contractors had applied for registration and 804 of those applications had been accepted. It will be seen from the figures given below that the progress which he mentioned has been fully maintained. They show the total number of applications received up to the end of the December in each year, from which it will be easy to deduce the number of applications received in respect of each year. They show also the net number of contractors on the Register at the same dates. The difference between the total number of applications for registration and the number of names on the Register is due to applications which were declined, together with those which, at the particular dates, were under investigation and consideration, and also those names which, at one time on the Register, have been deleted for various reasons, such as death, bankruptcy, retirement and other casualties.

	Total applications received	Net number on Register
Up to December 31st, 1926.	1,173	946
December 31st, 1927.	1,348	1,049
December 31st, 1928.	1,584	1,150

Up to the date of this article 1,703 applications in all have been received, and the number of names on the Register is now 1,247. These last figures, assuming the rate to be maintained, show greater progress than in the earlier years, and appear to indicate that the real aims and objects of the National Register are becoming better appreciated by both contractors and those having orders to place. With regard to the latter, the Executive Committee has convincing evidence that local authorities, consultants, architects and others placing electrical work are to an increasing extent confining their inquiries and orders to registered contractors, and advertisements appearing from time to time in the technical Press inviting tenders support this statement.

In view of the foregoing record of facts and figures the Executive Committee feels that it is not unreasonable to claim that the National Register has made, and is making, sure and satisfactory progress towards the attainment of the objects for which it was incorporated.

The I.E.E. in France.—II.

An Account of the Summer Meeting.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

A CONSIDERABLE time has elapsed since last the Institution of Electrical Engineers ventured forth as a body from its native shores. Foreign travel has considerable educational advantages; hence the exceptional opportunity that French engineers offered to their British *confrères* was accepted by a party of I.E.E. members and their ladies numbering about 133, of which over 100 took part in an extension of the visit to the Pyrenees.

Far from being a "joy ride," the trip was more like hard work, for on several days as many as twelve hours were needed to fit in the prescribed inspections of factories and electricity generating stations. During the first stage all went according to plan, and, except for a few showers in Paris, the weather was brilliantly fine.

In Paris the main programme consisted of a survey of all the power stations that provide the city and its suburbs with electricity, as was indicated last week. With the exception of the Ivry station, they are all located on the River Seine as it leaves the city at St. Ouen and St. Denis. The aggregate capacity of the plant is 300,000 kW, while that of Ivry is 60,000 kW (with space for extension to a total of 130,000 kW). The Ivry station has been placed at the junction of the rivers Marne and Seine at the point where they enter the city, on account of the limitations of the Seine in providing adequate condenser-cooling water in the vicinity of the other stations. In fact, one wonders how much longer the Seine will serve for this purpose at the present rapid rate of development of the use of elctricity, more particularly during the dry season. All the stations are fairly modern and are steam-turbine equipped. The chief impression they give is that of an enormous amount of space in the buildings; in fact, extravagantly so. Further, the auxiliaries and steam piping do not seem to be at all compactly and efficiently arranged. The switch-house at Gennevilliers attracted a lot of attention on account of its great size, being virtually out-door plant contained within a building. It will be recalled that this undertaking was a pioneer in laying single-core 60,000-volt cables, and it was ascertained that the pioneer work was not without its troubles, for about two hundred faults had occurred.

One hears a good deal in England of the pros and cons of the standardisation of frequency, so it is of interest to know that some years ago this was taken in hand in Paris and is now practically completed at 50 cycles. The City was systematically tackled section by section, extra temporary bus-bars being provided in the sub-stations to facilitate the changing-over of the feeders, which involved dealing with over 16,000

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electric motors. As the latest example of French central-station practice, the Ivry plant attracted most interest. It supplies the Paris underground railways, which are shortly to be extended beyond the fortifications; the latter are being rapidly removed, since they are no longer of use for military purposes.

Fig. 1.—A Group of Members at Ivry.

A High-voltage Laboratory.

The visit of the I.E.E. to the Ivry station and to the million-volt testing laboratory of the Compagnie Electro-Céramique, also at Ivry, was made jointly with the members of the E.H.P. Conference (this year there were 42 British members at the Conference, who presented 19 papers out of the total of 108). An impressive range of typical tests had been staged to demonstrate the possibilities of the equipment. For testing insulator strings, the pressure was increased in steps of 100,000 volts; at 200,000 volts corona discharge commenced and all the connections could be discerned in the dark, outlined by the brush discharges. The length of the insulator chain was selected so as to break down at a million volts, and it was impressive to see the flash-over in a nearly steady solid stream, which was maintained for a second or so to enable the visitors to appreciate fully the phenomena. It was certainly a very spectacular and most interesting display. The advantage of metal rings on insulator chains was demonstrated. Other experiments were also carried out to demonstrate the various test methods employed. Lt.-Col. K. Edgcumbe, with his excellent knowledge of French, assisted in translation.

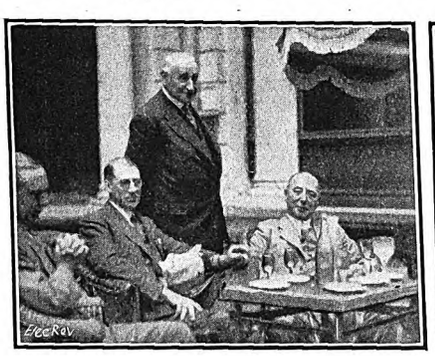

Fig. 2.—Messrs. Young, Chattock and Lt.-Col. Cortez Leigh.

Fig. 3.—Mr. Howard (behind glass) and Mr. and Mrs. Garrard.

Fig. 4.—Lt.-Col. Cortez Leigh, Mr. and Mrs. Lawson, Major Amberton and Mrs. Chattock.

Wireless Station and Factory.

The huge Saint Assise wireless station was the object of one of the visits. The chief items of interest there were the enormous steel masts and the La Cour frequency changers. On leaving the wireless station, a break in work was made to see Versailles, where the party was entertained to tea, after which a visit was paid to the Etablissements Edouard Belin, which are now world famous on account of their successful apparatus for the wire and wireless transmission of photographs, sketches, printed matter, &c. Twelve of their larger machines are in use in England by newspapers.

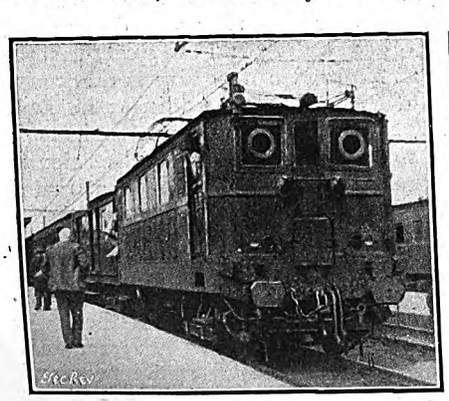

Fig. 5.—Special Locomotive at Vierzon.

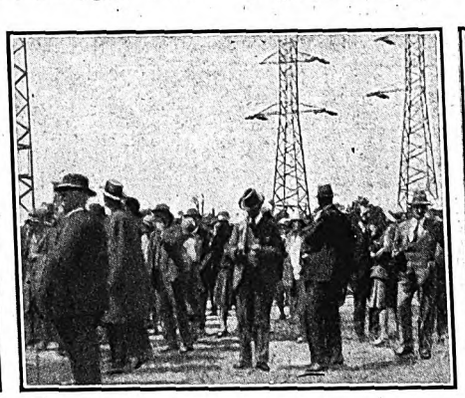

Fig. 6.—Members at Eguzon.

Fig. 7.—A Stop at Limoges.

A very clever piece of apparatus for home reception of pictures was also on view. It is being manufactured in large numbers in readiness for sales to commence next month, when the broadcasting of pictures will take

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place regularly from French radio stations. These amateur receivers are operated by a gramophone clock-work motor, which drives the paper cylinder through a clutch. The latter is operated electrically by means of the signal forwarded by the transmitter, and thus the cylinder is momentarily stopped and re-started at each revolution (it being driven a trifle above synchronous speed) and thus is forced to keep in correct step with the transmitter. Before placing a sheet of paper on the cylinder, it is steeped in potassium ferrocyanide. The varying currents transmitted cause correspondingly greater or less chemical action on the paper. The transmitted picture comes out in blue and white, and is a very satisfactory reproduction. It can be intensified, if so desired, by placing it in a hydrochloric acid bath. Each picture takes five minutes to reproduce.

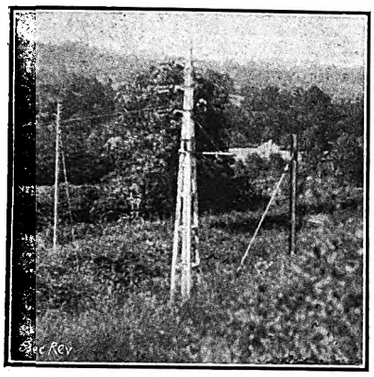

Fig. 8.—Transmission Line in the Midi.

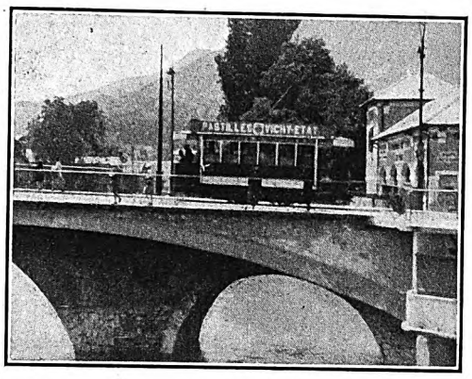

Fig. 9.—The Bridge at Lourdes.

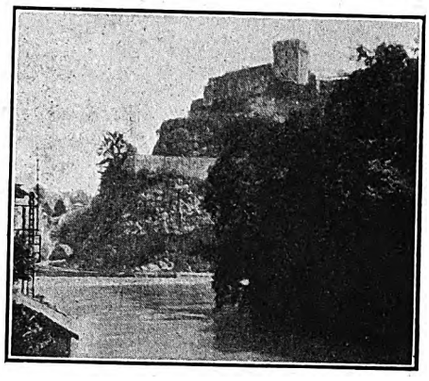

Fig. 10.—The Fort, Lourdes.

A Large Electro-magnet.

On another day the monster 46,000-gauss electro-magnet at Bellevise was inspected. The coils are about ten feet in diameter and six feet long. Their distance apart can be varied. As the inductive effect of the windings is considerable, care has to be taken to switch on and off through resistances. A strong stray field, extending about six feet, drew the visitors cameras and steel objects unexpectedly towards it.

Some interesting experiments were in course of progress on the strength of dams for hydro-electric work —several tons of mercury was employed in place of water to obtain more effective test heads on a small scale.

Out of the five days spent in Paris, one only was allotted for sight-seeing, when the party visited the Chateau de Chantilly. Among other objects seen was the famous large rose-tinted diamond, the theft of which attracted so much attention in the English newspapers a short time ago. Its dramatic recovery will be recalled; the thief hid it in an apple, and his landlady's servant discovered it when peeling the apple.

Social Functions.

The only social function during those strenuous days was a banquet offered to the I.E.E. visitors jointly by the Société Française des Electriciens; la Compagnie Parisienne de Distribution d'Électricité; and le Groupment des Secteurs de la Region Parisienne (the Paris suburban electricity distributors). The president of the Society (Mr. Bunet) presided, supported by the chairman of the Paris Supply Co. (Mr. Malegarie) and the chairman of the suburban distribution authorities (Mr. Girousse). Among the guests present were representatives of the British Ambassador and of the British Consul, Messrs. H. Cahen (president of l'Union des Syndicats d'Électricité), Moutier (president of the French Civil Engineers), Geoffroy, Schwarberg, Mariage, J. Rey, P. Eschwège, and Fabry. Several representative members of the E.H.P. Conference, which was being held in Paris concurrently, were also among the guests, *viz.*, Messrs. Ulrich (the president), C. O. Mailloux,

Fig. 11.—The I.E.E. "Pilgrims" at Lourdes.

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U. del Buono, Parodi, Imbs, and R. Borlase Matthews. Mr. Grosselin was a guest in his double capacity as a member of the Society and as the indefatigable hon. secretary of the I.E.E. in France. Lt.-Col. K. Edgcumbe, president of the I.E.E., received a great ovation, for in returning thanks for the hospitality extended, he spoke most readily and colloquially in the French language, telling a humorous story and even making puns. The Frenchmen greatly appreciated the compliment, and it was a relief after the somewhat ponderous orations that had been delivered in true French style by the hosts. A wonderful *menu* was presented, which might well serve as an example for the I.E.E. annual dinner.

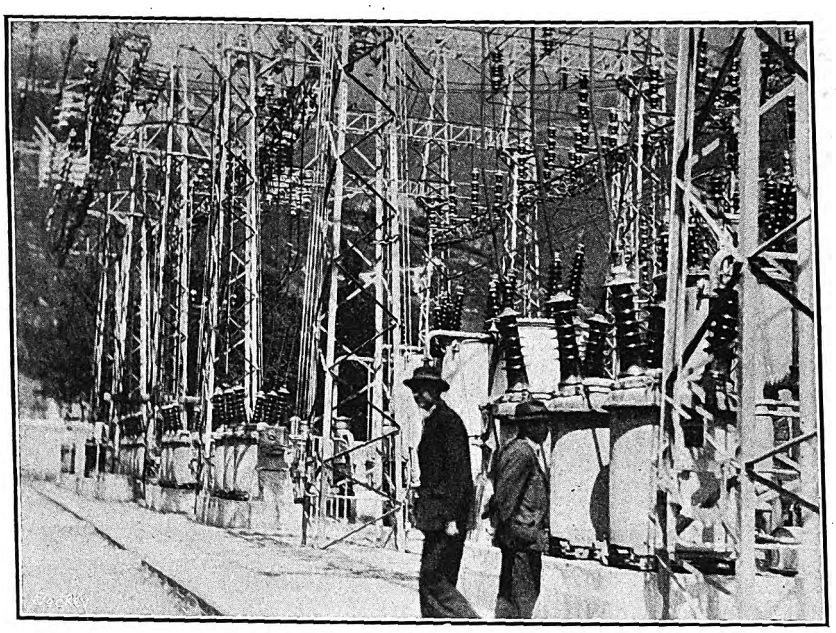

Fig. 12.—Open-air Switchgear at Le Hourat.

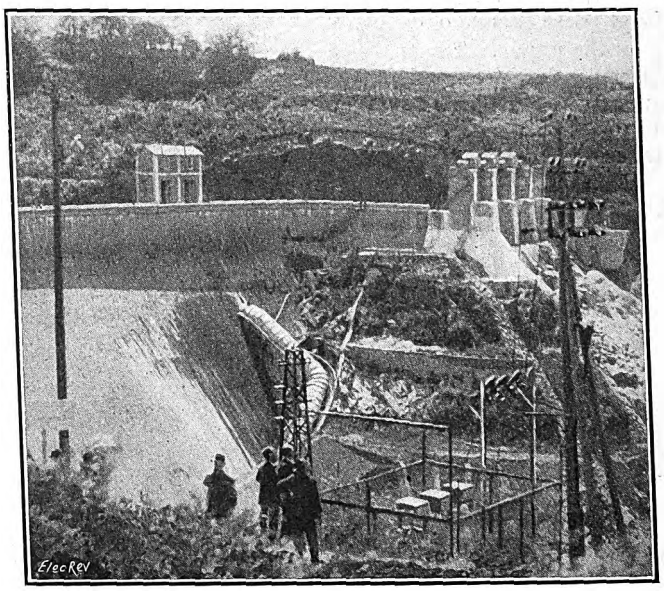

Fig. 13.—Eguzon Water-power Station.

While in Paris, a separate programme was arranged for the ladies, including visits to Messrs. Worth's (the dressmakers) and Boucheron's (the jewellers), tea at the Ecole Supèrieure d'Electricité, and trips to Versailles and Chantilly.

At the end of the week the party divided, some returning and over 100 proceeding to spend a week in the Pyrenees to inspect the railway electrification, hydro-electric stations, electrochemical and electrolytic works, and, incidentally, to see the beautiful country and mountains that France possesses in those parts.

The Pyrenees Trip.

The party for the Pyrenees visit left Paris on Sunday morning, June 16th, in perfect weather. A special train was provided by the courtesy of the Paris-Orleans Railway Co., and for the first 120 miles was drawn by an electric locomotive. At Vierzon, which is the terminus of the electrified portion of the line, a short halt was made before proceeding to Eguzon. The electrified section of the line was of great interest; the locomotives are fed from an overhead line at 1,500 volts direct current, and power is supplied from eleven sub-stations of the rotary-convertor type. The two sub-stations actually in Paris receive current at 13,200 volts, the remainder at 90,000 volts.

At Eguzon the party was transferred to motor coaches for the short journey to the hydro-electric station of the Union Hydro-Electrique, first visiting the large open-air transformer station situated on the hill. This station is the terminal point of the 150,000-volt line coming south from Paris, and it transforms the 10,000-volt power generated by the Eguzon station to 90,000 volts, at which pressure it is fed back along the line from Vierzon, and thence to Chaingy and Chevilly.

The dam at Eguzon is 61 metres in height, providing the water turbines with a fall of 55 metres, fed through a 12-ft. welded pipe. The five generators are rated at 12,500 kVA, the station having a total capacity of 50,000 kW. Rejoining the motor-coaches, a further short journey was made to San Sebastien, where the train was waiting to proceed to Bordeaux, which was reached soon after 9 o'clock.

Monday, June 17th, was largely occupied with travelling, though members had an opportunity of looking round Bordeaux in the morning. On arrival at Pau, some of the party proceeded at once to the rectifier station and afterwards to a chateau, which is said to be the birthplace of Henri IV, a special feature of which was the magnificent collection of Gobelin tapestries.

The British members were then entertained at dinner by the South-Western Centre of the Société Française des Electriciens. A speech of welcome was made by the president of the Centre, who was

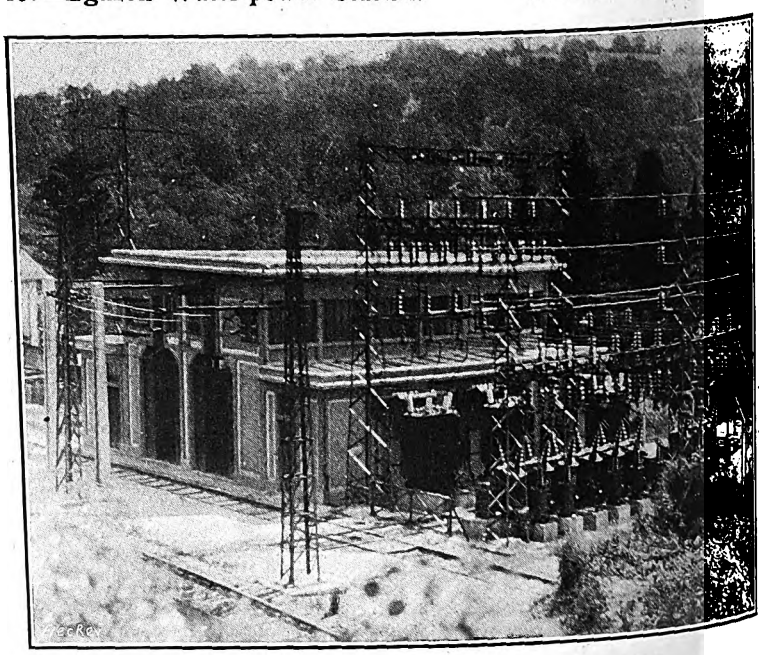

Fig. 14.—A Sub-station of the Cie du Midi.

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supported by Mr. Bunet, president of the Société. Lt.-Col. Edgcumbe replied in a very happy manner, partly in French and partly in English, and took the

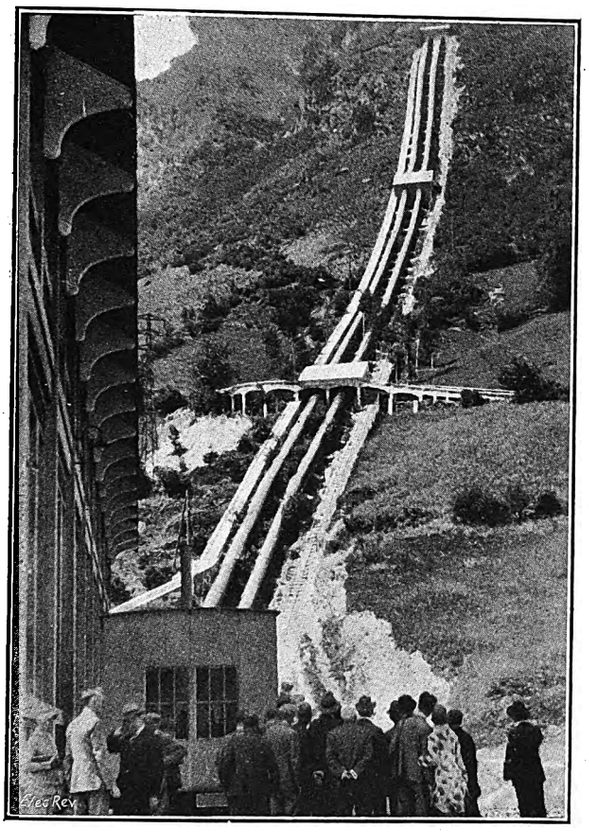

Fig. 15.—Pipe Line at Le Hourat.

opportunity of presenting a silver salver to Mr. Grosselin, secretary of the French Institution.

On Tuesday morning, June 18th, the train was abandoned for motor coaches and a journey made through beautiful country at the foot of the Pyrenees to Eaux-Bonnes, where luncheon was taken. On the way to Eaux-Bonnes, a visit was made to a sub-station of the Cie du Midi and also to the water-power station of Le Hourat, which is equipped with five 8,000-kVA generators running at 500 r.p.m. and generating at 10,000 V.

One feature of great interest to members was the installation in the same station of two rotary convertors, rated at 750 kW, 750 r.p.m., which convert to 1,500 volts on a single commutator. This station is semi-automatic, one machine going into operation when the other becomes overloaded.

The afternoon was devoted to climbing over the Col d'Aubisque, which is one of the highest passes in the Pyrenees, the road at the summit reaching some 5,400 feet. This drive amid wild mountain scenery and the decent to Argelés will remain an unforgetable memory for most of the party.

The Tuesday night was spent in Lourdes. On the Wednesday morning the party drove in motor-coaches to Pierrefitte-Nestlalas and visited the works of the Société des Phosphates Tunisiens at Soulom. Luncheon was served at Gavarnie.

During the afternoon the generating stations at Luz of the Société des Forces Electriques de la vallée de Gavarnie and of the Société Hydro-electrique de la Cère were inspected, returning to Lourdes for dinner.

The Thursday was spent in travelling, except for a short morning visit to the electro-chemical works at Lannemezan of the Société des produits Azotés (nitrogen compounds). Toulouse was reached by special train at about 3 o'clock, and members were then taken for a drive round the town and paid a short visit to the hydraulic laboratory of the Electro-technical Institute at Banlévé.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Electrical Review Index.

The Index to Vol. CIV (for the half-year ending June 30th, 1929) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.4.

Large Power Station Contract.

The West Midlands Joint Electricity Authority has placed an order with the British Thomson-Houston Co., Ltd., for the complete electrical generating plant required for the first section of the new base-load power station being erected at Ironbridge on the River Severn. Included in the contract are a 50,000-kW turbo-alternator, three 21,000-kVA outdoor-type transformers, 33,000-V switchgear, and the necessary auxiliary equipment. The turbo-alternator consists of a 50,000-kW maximum continuous rated two-cylinder double-flow steam turbine with a direct-coupled three-phase 11,000-V 80 per cent. power factor 50-cycle alternator provided with B.T.-H. closed-system air cooler. The turbine is designed for a steam pressure at the stop valve of 375 lb. per sq. in. gauge, 750° F. total temperature. The condensing plant will be manufactured by Hick, Hargreaves & Co., Ltd. Connected solid with the alternator are three B.T.-H. single-phase oil-immersed self-cooled outdoor-type transformers arranged in delta on the primary side and in star on the secondary side, giving 33,000 V between phases. These transformers are stated to be the largest self-cooled units ordered in this country for power-station service. All switching is effected at 33,000 volts. The cooling water for the condensing plant will be taken from the River Severn, a separate pump-house being erected on the river bank for this purpose. Messrs. Drysdale and Co., Ltd., will act as sub-contractors for this part of the contract.

Wages in the Cable-making Industry.

We have received from the Joint Industrial Council for the Electrical Cable-Making Industry a schedule of the rates of wages which will come into operation on the third pay-day in July consequent upon an alteration in the cost-of-living figures.

Conditions in Sweden.

The *Swedish Economic Review* (the official organ of the Swedish Board of Trade) states that during the first quarter of the current year the mechanical workshops and shipyards showed improved employment figures generally. On the other hand, the position in the electrical trade was worse than during the immediately preceding quarter. During the first four months of the year electrical machines valued at 9,475,000 kr. (£526,000) were exported, as compared with 13,351,000 kr. (£740,000) in the corresponding period of 1928. The exports of telegraph and telephone apparatus, however, rose in value from 3,636,000 kr. (£202,000) to 4,285,000 kr. (£238,000).

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Recent Contracts.

Birmingham Electrical Furnaces, Ltd., has received from Morris Commercial Cars, Ltd., an order for an electric box-type carburising furnace complete with a "Birlec" 4-arm charging machine, turntable, loading trolleys, &c. This furnace, which has a usable hearth 9 ft. long by 5 ft. wide and a maximum rating of about 185 kW at 440-V, 3-phase, will be one of the largest electric carburising furnaces in this country.

The Hart Accumulator Co., Ltd., informs us that the following telephone exchanges are among those for which orders for batteries have been received:—Dewsbury, Grimsby, Stanmore, Edinburgh (Granton), Santiago and Malta.

We recently reported that the Metropolitan-Vickers Electrical Co., Ltd., had received an important contract for 21 electric locomotives from the Great Indian Peninsula Railway. The electrical equipment of each of these locomotives includes an "Exide-Ironclad" battery of 24 cells, type LMV.3, manufactured by the Chloride Electrical Storage Co., Ltd.

E.D.A. Activities.

The British Electrical Development Association has produced an attractive little brochure setting forth its constitution, objects and work. The arrangement adopted is to place side by side a description of a certain branch of activity and illustrations relating to that subject. Thus it is mentioned on one page that during the last few years E.D.A. has spent nearly £100,000 on national Press advertising, and on the opposite page there appear reproductions of some of the advertisements which have been employed. Another pair of pages mentions the circulation of booklets and leaflets, and illustrates a number of examples. In giving details of the Association's lecture service, the booklets which are available for the lecturers are also illustrated. Other sections deal with window displays, posters, films, and other familiar features of E.D.A. work. At the end the division of the country between the Area Sub-Committees is depicted, and the personnel of these bodies is given.

The July-August supplementary programme shows that efforts are being directed to the stimulation of "other" uses of electricity (*i.e.*, apart from cooking, heating, &c.). The window display (illustrated herewith, fig. 1) accordingly contains a miscellaneity of appliances such as saucepans, kettles and percolators. The cardboard lady is being made to give good service; this is her third appearance. In fact, the whole display is a regrouping of material already supplied, supplemented by appliances from stock. All the usual assistance is available in the form of posters, booklets, &c. The programme includes an illustration (reproduced herewith, fig. 2) of a special stand bearing six frames in which E.D.A. posters can be mounted. This could be usefully employed in showrooms, and the public part of supply authorities' offices.

Fig. 1.—The July-August Window Display.

Fig. 2.—An E.D.A. Poster Stand.

New Italian Companies.

Among the companies recently formed in Italy are the Società Idroelettrica Venaschese, Venasca (Cuneo), capital 1,200,000 lire; and La Società Elettrica Ploaghese, Ploaghe (Sassari), 600,000 lire.

The German Radio Industry.

According to the annual report of the Verband der Funk Industrie, Berlin, the value of the production in 1928 was more than twice that of the previous year. The number of subscribers increased from 2,009,842 in 1927 to 2,635,567 last year, and a large number changed over from the crystal receiver to the valve receiver, while the technical improvements made induced many people to substitute modern for old apparatus. Mains sets had a good reception, and the loud speaker branch also had a share in the favourable development. The total turnover in valve sets represented a value of 30,000,000 marks, while that of the member firms producing loud speakers was of the value of 10,000,000 marks. A considerable decline took place in the sales of detector apparatus, headphones and components. At the end of 1928 the Association had a membership of 104.

Repair or Small Job Cards.

We have received from Messrs. James McQueen, Ltd., Moat Road, Leicester, specimens of a repair or small job card in which provision is made for details of labour, materials and other expenses to ensure that all charges are accounted for. There is also included a profit and loss account form to be made out upon the completion of the work. A pamphlet containing instructions for filling in the card accompanies the specimens.

The E.C.A. of Scotland.

The annual meeting of the Electrical Contractors' Association of Scotland was held in Glasgow on June 12th, and there was a good assembly of members from the various branches. The accounts submitted showed the funds to be in a satisfactory state. The report of the Central Board dealt in detail with the various activities of the Association, and the hope was expressed that before long a fair trading agreement would be evolved which would be acceptable to all branches of the industry. A year ago a benevolent fund was established for the benefit of members and their families who were in distress. All branches had contributed to this fund, and already it had proved to be of considerable use. A satisfactory increase in the membership during the year was reported. The following office bearers were elected: President, Mr. J. Johnston Foggo, Edinburgh; vice-president, Mr. D. H. Morris (Lowdon Bros. & Co., Ltd., Dundee); and secretary, Mr. Walter Finlay, Edinburgh. The Central Board representatives are:—From Glasgow: Messrs. T. Rigg, D. Bennett, J. Allan, A. S. Nairn, H. Meighan, and R. A. Ure; from Edinburgh: Messrs. A. Pratt, R. E. Douglas, William Mackintosh, and George Lyall; from Dundee: Messrs. J. Smith and R. Kilpatrick; from Aberdeen: Mr. J. L. Anderson. After the annual meeting the members were entertained to lunch by the Glasgow Branch in the Royal Hotel, and in the afternoon the usual golf match, East *v.* West, was held at the Fereneze Golf Course, Barrhead, the West team winning by the narrow margin of one match.

Lithuanian Tariff Amendments.

The *Board of Trade Journal* publishes a list of amendments recently made in the Lithuanian Customs tariff. New rates of duty (minimum tariff) have been fixed, and among the articles affected are dynamos, motors, transformers, &c., and machinery and apparatus of copper and its alloys not specially mentioned (new rate 0.30 lit per kg. gross).

Employment in May.

The June *Ministry of Labour Gazette* says that during May employment in the engineering industry remained quiet on the whole, and showed little general change as compared with the previous month. Electrical engineering showed a slight improvement. The number of unemployed in the engineering industry was 80,090, representing an increase from 8.0 to 8.2 per cent. In the electrical engineering branch the number of unemployed fell to 3,630, and the proportion from 4.9 to 4.6 per cent. The electrical wiring and contracting

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industry reported 1,133 unemployed, indicating a proportional rise from 7.1 to 7.3 per cent. Improvement was shown by the electrical cable, wire and lamp manufacturing group, in which the percentage of unemployed fell from 6.1 to 5.7 per cent., the actual number being 4,879.

Book Notices.

"*Journal* of the Institution of Engineers of Australia," Vol. I, No. 4. April, 1929. Sydney: The Institution. Price 7s. 6d.

"*Journal* of the American Institute of Electrical Engineers," Vol. XLVIII. June, 1929. New York: The Institution. Price $1.

"Speech and Hearing," by H. Fletcher. Pp. xv+331; figs. 154. London: Macmillan & Co., Ltd. Price 21s. net.

"Electrification of Steam Railroads," by K. T. Healy. Pp. x+395; figs. 165. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

"Stores Accounts and Stores Control," by J. H. Burton. Pp. ix+144. London: Sir Isaac Pitman & Sons. Price 5s. net.

"The Wag-Tale." No. 1, 1929.—This is an amusing little magazine produced in aid of the Westminster Hospital. It contains a number of delightfully illustrated articles, and the advertising pages are of a novel character. Copies can be obtained from the Hospital for 6d. (by post 8d.).

Unemployment.

The Ministry of Labour returns show that there was an increase of 12,675 in the number of registered unemployed during the week ended June 10th. The total at that date was 1,112,800 as compared with 1,100,125 on June 3rd, and 1,149,943 on June 11th, 1928.

Prospective Trade with Russia.

The *Daily Telegraph* reports that at last week's Advertising Convention at Newcastle, Mr. Ernest Remnant, the leader of the recent trade delegation to Russia, said that although he had no admiration of the Russian political system he was satisfied that a basis of economic co-operation with Russia could be found to our mutual benefit. In the "quest for markets" Russia must not merely be included, but was entitled to first place. There was no other country which, in the next few years, could absorb such a large quantity of British manufactures. Within a few days a report upon the results of the Mission to Russia would be in the hands of the Government. It would contain a brief outline of the various requirements of Russia during the next five years which might be supplied by British industry, amounting to £200,000,000, prepared for the committee by the Governor of the State Bank. He hoped that it would be judged by purely economic and common-sense considerations, without prejudice, and especially party political prejudice. The problem of providing credit for a period of five years belonged not to industry, but to finance, and the only solution was the provision of capital in the form of a loan and investment in enterprise. Diplomatic relations were indispensable to any considerable development of economic relations, but he had always insisted that they should be conditional upon an undertaking both to compensate British nationals for their claims prior to 1917, and to cease hostile propaganda. They had asked for and obtained assurances in both respects.

The E.T.B.I. Competition.

The competition which the Electrical Trades Benevolent Institution has organised (mentioned in our last issue) is to be launched on July 1st. Books of tickets are obtainable from the Secretary, Capt. J. T. Keeping, M.C., 9, Southampton Street, W.C.1. The tickets are half-a-crown each, and bear particulars and the necessary form relating to this novel and interesting contest. Up to date 66 prizes have been presented by well-known electrical concerns and others, ranging from a box of chocolates up to a 4-valve screen-grid portable receiving set. Among the donors of prizes are the General Electric Co., Ltd., the Arora Co., the A.E.G. Electric Co., Ltd., the Artic Fuse & Electrical Mfg. Co., Ltd., Belling and Lee, Ltd., Benjamin Electric, Ltd., Berry's Electric (1928), Ltd., Berkeley & Young, Ltd., the British Thomson-Houston Co., Ltd., the Brownie Wireless Co., Burne-Jones & Co., Ltd., Cryselco, Ltd., Drake & Gorham Wholesale, Ltd., J. Dyson and Co., Ltd., the Edison Swan Electric Co., Ltd., Mr. Justus Eck, Arthur Preen & Co., Ltd., Mr. J. Fotheringham, Ferranti, Ltd., J. Gledson & Co., Graham Amplion, Ltd., Graham Farish, Ltd., Hart Bros. Electrical Mfg. Co., Ltd., Houghton-Butcher, Ltd., Lectro Linx, Ltd., Marryat & Place, Mullard Wireless Service Co., Ltd., Premier Electric Heaters, Ltd., Philips Lamps, Ltd., Siemens Electric Lamps & Supplies, Ltd., Stuart Turner, Ltd., John Shaw & Sons, Wolverhampton, Ltd., Tungsram Electric Lamp Works (G.B.), Ltd., Oliver Pell Control, Ltd., Ward & Goldstone, Ltd., and Wingrove and Rogers, Ltd. Mr. Justus Eck's prize takes the form of a pewter rose bowl for the seller of the winning ticket.

"Rubite" Automobile Wiring.

All the four winning "Bentley" cars in the Le Mans race, 1929, were wired throughout with "Rubite" cables for ignition, lighting and starting. The insulation of these cables is similar in every respect to that of the "Rubite" cables made by the METROPOLITAN ELECTRIC CABLE & CONSTRUCTION CO., LTD.

Henley's and the Contractors' Conference.

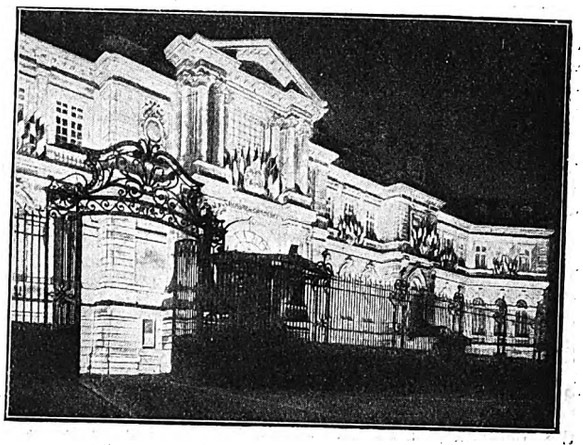
Several functions at the E.C.A. Conference are being held in the new Pavilion, and the proceedings include a tour of inspection of the Cunard liner *Aquitania*. As "Henley" cables have been used extensively in both building and ship, W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., has taken the opportunity of drawing contractors' attention to the fact by producing an illustrated brochure touching upon the subject, and including the provisional programme of the Conference.

Accumulator Manufacture in Australia.

During the past twelve months preparatory work for the establishment of a factory in Sydney, N.S.W., has been going on under the superintendence of Lucas experts from England. Supplies of Australian-made Lucas accumulators are now obtainable. Every part of the batteries is being manufactured in Australia, including plates, containers, cell lids and separators, and the lead will be obtained from Australian sources.

Flood-lighting the Paris Chamber of Commerce.

A flood-lighting scheme has been recently installed at the Paris Chamber of Commerce by Etablissements Faille & Reinhardt. The building is 108 ft. long, the height ranging from 40 ft. to 45 ft. at the highest part. To flood-light this effectively was a little complicated owing to the old and the new parts of the building varying in line of frontage. It was eventually decided to light the new part by means of G.E.C. "FB. 2505" flood-lights equipped with 500-W lamps, and the old part with



The Flood-lighted Paris Chamber of Commerce.

similar floods employing 1,000-W lamps. Most of these were concealed behind shrubs in the foreground at a suitable distance from the front of the building, the spacing being arranged to suit the old and new sections. Supplementary floods from the verandah were also employed with marked effect. The result of this system is illustrated in the accompanying picture.

For Sale.

Mr. H. J. Shaw will sell by auction, on July 3rd, at 13, High Holborn, W.C., a stock of wireless and electrical goods. (See our advertisement pages to-day.)

Catalogues Wanted.

Messrs. WARD & GOLDSTONE, LTD., ask for catalogues and advertising matter for their new depôt at Upton's Yard, 49a, Briggate, Leeds.

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports during the year 1928, comparing them with the year 1927. From these we have compiled the appended table, showing the value of the total imports of electrical machinery and cognate material into the Free State and the amount attributed to the United Kingdom, as country of shipment, but not necessarily of manufacture:—

	Total imports.		U.K. share.	
	1927.	1928.	1927.	1928.
	£	£	£	£
Electric wires and cables	109,989	224,745	47,877	78,855
Telegraph and telephone instruments and apparatus	36,182	10,299	28,428	8,599
Electric lamps and parts	47,187	83,139	40,879	39,155
Batteries and accumulators	34,248	30,710	31,888	27,972
Radio sets and parts ...	74,613	84,431	72,987	82,915
Other electrical goods and apparatus	83,679	119,675	62,560	65,989
Generators	21,830	17,793	13,088	10,991
Motors	17,625	29,979	13,911	21,208
Other electrical machinery	76,084	135,182	62,871	57,986
	£501,437	£735,953	£374,489	£393,670

As will be seen, of the total imports, £393,670, or approximately 53 per cent., as against over 74 per cent. in 1927, came from ports of the United Kingdom, leaving £342,283 for foreign countries, the bulk of which is credited to Germany.

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Bankruptcy Proceedings.

H. PEOVER, electrical apparatus and tool merchant, Market Lane, Newcastle-upon-Tyne. The following are creditors in this recent failure :—

	£		£
Burton, C. F. and H. ...	38	London Elec. Wire Co. and Smiths, Ltd. ...	37
Blombach, Carl	22	Pattersons Accumulator Co.	21
Chorlton Metal Co., Ltd.	116	Peover, H., senr. ...	964
Fielding, Mrs. L. ...	120	Ripaults, Ltd.	28
Graham-Farish, Ltd. ...	33	Spicers, Ltd.	37
Gripso Co.	24	Turner & Co.	34
General Electric Co., Ltd.	75	Alastair McLellan & Co.	30
Kremner, L.	24		

R. BLOOD, 44 & 46, Station Road, Padiham, Lancs., wireless dealer and electrician.—The public examination herein was held on June 18th at the County Court House, Burnley, when the debtor attributed his failure to insufficient turnover and keen competition. A statement of affairs was disclosed showing ranking liabilities of £476, and a deficiency of £309. The debtor commenced trading on his own account as a wireless engineer and electrical dealer in September, 1923, with £80 capital, continuing his employment as an engineer; his wife superintended the business. It was successful for about five years, and in March, 1928, he began to devote his whole time to his business. The examination was adjourned for closing.

K. P. J. JOLIVARD, trading as Jolivard & Co., electrical engineer, 66, Victoria Street, S.W.1.—An application for an order of discharge was made on June 21st at the London Bankruptcy Court by this bankrupt, who failed last February with provable debts of £1,469. Mr. E. Parke, Official Receiver, reported that the assets had realised £74. The applicant started business on his own account in June, 1924, without capital, and carried it on until July, 1924, when he closed down owing to keen competition and pressure by creditors. The failure was further attributed to lack of capital and bad trade. The discharge was suspended for three weeks.

D. B. JOHN, trading as "D. B. John & Brothers," 8, Commercial Place, Pontycymmer, and the Nanthir Stores, Nanthir Road, Blaengarw, Glamorgan, electrical engineer, &c.—The public examination herein was held on June 20th, at the County Court, Wyndham Street, Bridgend. The debtor stated that the real cause of his failure was a loss on a contract for wiring 1,300 houses through quoting 14s. per point, whereas the actual cost proved to be 18s. per point. His father had lent him £485, but that amount had not been included in the deficiency account, which amounted to £1,005. The examination was adjourned in order that the debtor might submit additional accounts.

C. B. MARSDEN, rear of 60, Pisgah Street, Kenfig Hill, Glamorgan, electrical engineer.—The public examination herein was held on June 20th, at the County Court, Bridgend. According to the statement of affairs lodged, there was a deficiency of £141. The debtor attributed his failure to losses on small contracts, and stated that it was his intention to pay all his creditors in full. The examination was closed.

W. H. LAURENS, radio engineer, 492, Prescot Road, Old Swan, Liverpool.—First meeting held June 25th at the Official Receiver's office, Government Buildings, Victoria Street, Liverpool. Public examination, July 9th, at the Court House, Liverpool.

S. E. HUNT, electrical engineer and contractor, 8a, Torwood Street, Torquay.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., appointed June 15th.

R. B. LAWSON, electrical engineer, 66, Seaborn Road, Bare, Morecambe.—Trustee, Mr. H. Parker, Official Receiver, 9, Cannon Street, Preston, released June 7th.

W. R. J. WHITE, electrical agent, late of Golden House, 29, Great Pulteney Street, W.C.—Supplemental dividend of 1s. 9d. in the £ payable at Carey Street, W.C.

E. C. JENKINS, wireless dealer, 124, Cheltenham Road, Bristol.—First and final dividend of 2½d. in the £ payable at the Official Receiver's office 26, Baldwin Street, Bristol.

J. DEAN, electrician, 4, Gogerddan Place, Aberystwyth.—First meeting, July 1st; public examination, July 11th, both at 3, Baker Street, Aberystwyth.

E. A. WARNES (Victoria Radio Co. and E. A. Warnes and Co.), electrical and radio engineer, 10, Crescent Gate, Wilmslow Road, Rusholme, Manchester.—First meeting, July 2nd, at the Official Receiver's offices, Byrom Street, Manchester; public examination, September 13th, at the Court House, Manchester.

J. A. HENDERSON (Hendersons), electrical contractor, 28a, Basinghall Street, E.C.—Trustee, Mr. D. C. Evans, 18, Ironmonger Lane, E.C., appointed June 13th.

Company Liquidations.

A.E.G. ELECTRICAL CO. OF SOUTH AFRICA, LTD.—Last day for proofs for dividend, July 3rd. Liquidator, Mr. E. T. A. Phillips, Official Receiver, Carey Street, W.C.

ASTRA DYNAMO CO., LTD.—Winding-up voluntarily. Liquidator, Mr. H. C. Faulkner, 27, Disraeli Road, Putney, S.W. Meeting of creditors, July 4th, at the Gladstone Club, Goldhawk Road, Shepherd's Bush, W.12.

CARK AND DISTRICT ELECTRIC SUPPLY CO., LTD.—A meeting of members is called for July 24th at 31, Manor Row, Bradford, to hear an account of the winding up from the liquidator, Mr. A. E. Stringer.

RADIO ELECTRIC CO. (BOURNEMOUTH), LTD.—Winding up order made by the High Court on June 18th, 1929.

Private Arrangements.

W. BOUGHEY and G. E. POWELL, manufacturers' agents, trading as Boughey & Powell, 18-24, Baldwin Street, Bristol.—A meeting of creditors was held recently, at the offices of Messrs. E. T. Collins & Son, 28, Baldwin Street, Bristol, when a statement of affairs was submitted which showed liabilities of £754 and assets of £67. It was stated that the debtors had only started trading in October last, with a capital of £50 supplied by Mr. Boughey. Recently creditors had been pressing, and some seven or eight writs had been issued. It was decided that the debtors should be requested to file their petition forthwith. The following are creditors:—

	£		£
British Vacuum Cleaner Co., Ltd.	41	Fennell System, Ltd. ...	24
B.T.-H. Co., Ltd. ...	23	Haskins Bros.	23
Chillcott & Co.	22	Hobart Mfg. Co., Ltd. ...	21
Drake & Gorham	115	Miller, A. H.	24
		Weldrics, Ltd.	125

Dissolution of Partnership.

NELSON & HALEY, plumbers and electrical engineers, 25, Grosvenor Road, Manningham.—Messrs. H. Nelson, P. Haley and S. Lister have dissolved partnership.

Wages in the Engineering Industry.

On Wednesday last week representatives of the engineering trade unions and of the Engineering and Allied Employers' Federation met in London. The trade union delegates put forward their claim for an increase of 8s. per week in the rates of time workers in the industry, with a corresponding rise in the wages of piece workers. In support of the unions' case Mr. J. T. Brownlie pointed out that the wages of engineering workers were only 50 per cent. above the pre-war level, while in a number of "sheltered" industries the increase had been as much as 80 per cent. Sir Allan Smith, for the employers, maintained that the conditions prevailing in the industry were not such as to warrant any increase. The employers did not know what the industry would have to face in the near future. He suggested that further consideration of the matter should be postponed until the end of the year. The union delegates suggested deferment for the shorter period of six weeks, but as this proved unacceptable to the employers they decided that they would report back to their committees with a view to a joint meeting of the executives being held on July 25th.

The British Industries Fair.

Application forms for space in the London section of the British Industries Fair, which is to be held next year in the reconstructed Olympia, were issued by the Department of Overseas Trade last week. A new four-storey building for the Fair is being put up at Olympia. It will not be finished until the 1931 Fair, but two floors will be complete by February next, and by means of bridging the galleries of the existing buildings and other reconstruction work, there will be a vast two-storey exhibition building. In view of the temporary contraction of space, application forms this year are being issued direct only to those manufacturers who exhibited in either 1927, 1928 or 1929, thus giving them a slight start over other manufacturers who, if they wish to exhibit, are invited to apply to the Department of Overseas Trade for the necessary forms. Space can only be guaranteed to firms whose applications are received by July 20th.

Swedish Expenditure in Russia.

In order to stimulate the interest of foreign capitalists in Russian concessions the Moscow newspapers have published statements concerning the capital investments made by foreigners in connection with concessions. It is stated, for instance, that the Allmänna Svenska Elektriska A.B. had invested 11,000,000 roubles in its Russian works up to April this year. This works, which is to begin production in October, is to turn out 30,000 motors of about 10 h.p. per annum. The present temporary works are said to have sold down to May 1st 4,400 motors of Russian manufacture. Since 1927 the concessionnaires are reported to have imported from Sweden generators, transformers, &c., to the value of 9,500,000 roubles.

New Catalogues and Lists.

TRUE SCREWS, LTD., "The Screw House," Clerkenwell Road, E.C.—A new price list of the company's screws, nuts, terminals, &c.

MESSRS. J. H. SANKEY & SON, LTD., Essex Wharf, Canning Town, E.—A folder dealing with "Pyruma" plastic fire cement. Priced.

MOFFATS, LTD., 15, Victoria Street, S.W.1.—Catalogue No. 103, illustrating and describing Moffats' "Gold Medal" electric ranges. Priced.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C. —Leaflet No. 1512 dealing with the "KY" relay.

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WORTHINGTON-SIMPSON, LTD., Queen's House, Kingsway, W.C.2.—A well-produced and illustrated brochure describing the various types of Worthington feed water heaters.

FERRANTI, LTD., Hollinwood, Lancs.—A booklet dealing with multi-range d.c. test sets, and containing notes, illustrated with diagrams and examples, upon some of the many uses of these sets. Also List No. Wb418/1, containing instructions for the use of the company's valve testers.

MESSRS. S. G. LEACH & Co., LTD., 26-30, Artillery Lane, E.1. —Price list No. NS.106, dealing with a.c. motors. Illustrated.

X-RAYS, LTD., 47, Red Lion Street, W.C.1.—A card, illustrated and priced, drawing attention to filing cabinets for storing X-ray films.

BAYER SOOT BLOWER CO., LTD., Lloyds Bank Chambers, 125, Balham High Road, S.W.—An illustrated pamphlet of Bayer mechanical soot blowers for boiler plant.

Messrs. JAMES GORDON & Co., LTD., Windsor House, Kingsway, W.C.—A catalogue giving details of duplex mono CO_2 recorders. Illustrated.

Messrs. HENRY SIMON, LTD., 20, Mount Street, Manchester. —An illustrated leaflet containing accounts of the installation of three pneumatic grain discharging plants at Avonmouth Docks, and the "Alphega-Plansifter" system in use at a Santiago flour mill.

Messrs. S. G. BROWN, LTD., Western Avenue, North Acton, W.—The Brown Budget for June contains a number of interesting articles on the company's activities and products.

Social Events.

On June 15th the staff of Messrs. CHRISTY BROS. & Co., LTD., electrical contractors and electricity suppliers, Chelmsford, proceeded by train to Bristol, leaving at 4.55 a.m. From Bristol they had a long drive through Long Ashton, Wells and Cheddar, lunching at the Cliff Hotel in the last town. After inspecting the gorge and caves they went to Weston-super-Mare, returning thence to their starting points. Speaking at the luncheon, Mr. Frank Christy (director) mentioned that of the company's hundred shareholders about 60 were actually employés, while more than a quarter of the remainder were the wives or children of employés. The rest were close friends of the company.

The employés of the Metropolitan Electric Cable & Construction Co., Ltd., at the directors' invitation, journeyed to Margate on June 15th. The party left the works in a small fleet of charabancs at 8 a.m., and met Mr. James Miller (chairman) and Mr. William Brown (managing director) at Margate, where luncheon was served at 12 noon. A vote of thanks to the directors was accorded musical honours, and the chairman suitably responded. The efforts of the newly-constituted Works Band added considerably to the enjoyment of the return trip.

A party of 50 employés of Messrs. T. H. Wathes & Co., Ltd., Leicester, journeyed to Skegness by train on June 20th last for their annual holiday. A whist drive was arranged *en route* and after lunch a programme of sports was carried through. Prizes were awarded for whist, tennis, bowls and putting. Another whist drive took place on the journey home.

On June 15th the annual sports of the Metropolitan-Vickers Electrical Co., Ltd., took place at Belle Vue Gardens, Manchester. Judging by the large number of entries the sports are as popular as ever, and this year the entries included a strong contingent from the Attercliffe Works at Sheffield.

Trade Announcements.

The central stores of the METROPOLITAN ELECTRIC SUPPLY Co., LTD., has been removed to Ironbridge, Windmill Lane, Southall, Middlesex. (Telephone: Southall 1961-2.)

Messrs. FREDERICK THOMAS & Co., LTD., 189, Drummond Street, N.W.1, have appointed Mr. Thomson Coventry to be their agent in Scotland, with showrooms at 97, Douglas Street, Glasgow.

Messrs. BRUCE PEEBLES & Co., LTD., Edinburgh, have appointed Mr. G. E. Whitehead, 102, St. Mary Street, Cardiff, as their representative for South Wales and the counties of Gloucester, Somerset, Devon and Cornwall; arrangements have been made with regard to service in connection with existing plant, installations, &c.

The TUNGSRAM ELECTRIC LAMP WORKS (GREAT BRITAIN), LTD., has opened new branches at Manchester and Bristol. The Manchester premises are 9, South Street (Telephone: City 9428) and the manager is Mr. E. C. Thurley. The Bristol address is 54-56, Victoria Street (Telephone: Bristol 1620) and the branch is under the management of Mr. W. Weeks.

Polish Foreign Electrical Trade.

During April last Poland imported "apparatus, conductors and other electro-technical materials" valued at 8,550,000 zloty (about £200,000). The exports of the same class of goods were valued at 129,000 zloty (about £3,000).

The Timber Trade.

Our Timber Trade Correspondent reports that the trade in woods from the north of Europe has been very brisk in the Metropolitan district over the past month, which shows that the building trade must be very busy. Unfortunately, however, the coal and shipbuilding areas are still in a depressed state. Stocks of timber are fairly plentiful on the market, although moderate in London and the home counties in face of the good demand, and business is expanding. Arrivals of hardwoods are declining this year, largely owing to the disappointing call, especially for United States logs and lumber. The better classes of mahogany, as well as teak, rosewood, satinwood and ebony are in moderate stock, and prices for these are firm. Plywood is in great request, and fortunately is coming in freely, with manufacturers "booked up" for months ahead.

A Charitable Effort.

The works of Ericsson Telephones, Ltd., Beeston, Notts., were opened to the public on the afternoon of June 22nd by permission of the management, the occasion being an effort on the part of the Ericsson Athletic Club to augment the fund for the endowment of a cot at the Nottingham General Hospital. A nominal charge was made, and parties were conducted round the works by members of the company's staff; over 600 people availed themselves of the opportunity, and great interest was shown in the methods of manufacture and in the general organisation of the works. Particular interest was evinced in the working demonstration of automatic telephone apparatus, the routing through of calls, &c., being demonstrated by attendants. Further attractions were a tennis tournament, a cricket match (Ericsson XI *v.* Ladies XIV), a motor-cycle gymkhana, and a gymnastic display. Musical selections were rendered by the Beeston Town Band.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price June 25th.	Fortnight's inc or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	3¾d. to 4d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£11	...
a ,, Roll ... ... ,,	£11	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	3⅝d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£95 to £100	...
b ,, Wire ... ... per lb.	1/1 to 1/9	...
b ,, Sheet ... ... ,,	1/1 to 2/9	...
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£184	...
Grade II... ... ... ,, ,,	£130	...
Grade III ... ... ,, ,,	£72	...
c Brass (rolled metal 2" to 12" basis) per lb.	10⅝d.	...
c ,, Tubes (solid drawn) ... ,,	1/1 to 1/1¼	...
c ,, Wire, basis ... ... ,,	11⅛d.	...
c Copper Tubes (solid drawn) ... ,,	1/8¼	...
c ,, Bars (best selected) ... per ton	£110	...
c ,, Sheet ... ... ,,	£110	...
c ,, Rod ... ... ,,	£110	...
d ,, (Electrolytic) Bars ... ,,	£84 15s.	...
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£94 15s.	...
d ,, ,, H.C. Wire per lb.	11¼d.	...
f Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	nom.	...
h India-rubber, Para fine ... ... ,,	11d.	¼d. dec.
l Iron, Pig (Cleveland No. 3.) ... per ton	72/6	2s. 6d. inc.
l ,, Wire, galv. No. 8. P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£25 5s.	5s. inc.
g Mercury ... ... per bot.	£23 2s 6d. to £23 5s.	£1 inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up	...
p Phosphor Bronze, plane castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/5	...
p ,, ,, rolled strip & sheet ,,	1/3¾	...
p ,, ,, wire... ... ... ,,	1/6¼	...
o Platinum ... ... per oz.	£13 17s. 6d.	...
d Silicium Bronze Wire ... ... per lb.	1/9¾	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton	£201 to £201 10s.	£2 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

Messrs. James Forster & Co. stated in their letter dated June 22nd that the lead market exhibited a slightly more active tone last week, consequent on a better demand from home consumers, particularly buying by the cable trade. Arrivals continue to be on the short side, but this state of affairs should be remedied before long when larger arrivals are expected. The position of supply and demand seems to be very evenly balanced, so that under present conditions it is not expected that values will alter very much from the present level.

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Lighting and Power

Auchterarder (Perthshire).—STREET LIGHTING.—The Town Council has agreed to proceed with the scheme for lighting the streets by electricity.

Barnard Castle.—OVERHEAD LINES.—Mr. F. Gordon Tucker held a Ministry of Transport inquiry on June 18th into the application of the Cleveland and Durham County Electricity Supply Co. to erect overhead lines through the town. For the company it was stated that it was intended to bring electricity from Fylands Bridge, near Bishop Auckland, to a sub-station at Barnard Castle, and there would be underground cables in some streets and overhead lines in others. The Urban District Council opposed on the ground that overhead wires would be unsightly and that they would possibly be dangerous in the event of their falling. Mr. A. A. Hughes, the company's chief electrical constructional engineer, said that it would be cheaper to carry the lines overhead, and consequently the price of electricity would be lower. Mr. J. M. Heslop, an electrical engineer of Newcastle, engaged by the Council, gave details showing that even with the use of underground cables the scheme could be made profitable.

Bedford.—LOAN.—The Corporation Electricity Committee is to seek sanction to a loan of £10,000 for meters.

Bexhill.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking for the year ending March 31st show a gross profit of £12,327, as against £10,069 for the previous year. The net profit for the year was £3,028, as against £252 for the previous year.

Blackburn.—YEAR'S WORKING.—We have received from Mr. P. P. Wheelwright, borough electrical engineer, a copy of his report together with the statement of accounts on the working of the electricity undertaking for the year ended March 31st. The total revenue amounted to £216,661, and working expenses were £80,863, leaving a gross profit of £135,798. The figures for the preceding year were: Income, £203,034; working expenses, £80,131; gross profit, £122,903. To the gross profit was added an unemployment grant of £2,554, and the proceeds from the sale of old machinery amounting to £50, making a total of £138,402. After payment of capital and other charges there was a net surplus of £4,293, as compared with a net deficit of £3,463 in 1927-28, from which, however, was deducted capital expenditure charged to revenue, &c., leaving a deficiency of £7,888. Capital expenditure during the year amounted to £41,122, of which £32,704 was spent on mains and distributing plant. The sales of electricity increased from 24,471,514 to 27,868,939 kWh, while the average price obtained per kWh fell from 1.945d. to 1.812d. The total connections increased to 46,466 kW.

WHITEBIRK STATION AGREEMENT.—An agreement has now been reached between the Corporation and the Central Electricity Board concerning the terms on which the Whitebirk generating station will be taken over. The Board has decided that, whilst it is unable to take over Whitebirk as a "selected station" owing to legal difficulties, it is prepared to pay 60 per cent. of the capital charges. This will mean an estimated gross saving to the Corporation of £20,500 per annum up to the year 1934-35, as against £16,000 in the terms originally offered. With regard to the main transmission line to Preston, it was stated that the Board had been advised that this line would be required, and it would be prepared to carry the capital costs relating to it from the appropriate date.

Brierfield.—CHANGE-OVER.—Preparations are being made for changing over the supply of electricity in the town from d.c. to a.c. and a start has been made on the construction of a sub-station at the Town Hall.

Canterbury.—NEW ELECTRICITY TARIFF.—The City Council has adopted a tariff for large power consumers who can receive an a.c. e.h.p. supply, and who have 200 h.p. connected, and agree to take a minimum of 50,000 kWh per quarter. The charge is to be £4 per kVA of maximum demand, plus 0.5d. per kWh, electricity for lighting not to be more than 10 per cent. of the total used.

Chinnor.—SUPPLY INAUGURATED.—A supply of electricity provided by the Aylesbury Corporation for the village was inaugurated recently. The supply is by means of overhead lines, and the charge for all domestic purposes is 1½d. per kWh.

Colombia.—HYDRO-ELECTRIC DEVELOPMENT.—Congress has authorised the Executive to engage experts, foreign or Colombian, to prepare plans for several hydro-electric plants, chiefly to utilise the streams and waterfalls of the Sierra Nevada del Magdelena, the Central Cordillera, the falls of Honda, and the Lake of Tota, the total power from which is estimated at over 25,000 h.p. As a preliminary, governors of States in which these streams and waterfalls are situated will make agreements for experts to study schemes for electrification of railways and other uses of electricity. Each administration will prepare separate plans for the inter-municipal and departmental transmission of hydro-electric power, the erection of large central plants for production, transmission and distribution of electricity, and its adaptation to public, industrial, and domestic uses.—*Reuter's Trade Service* (Bogotá).

Dundee.—STATION IMPROVEMENT SCHEME.—At a recent meeting of the Electricity Committee the engineer stated that owing to the increasing capacity of the generating plant connected to the bus-bars at Carolina Port, and especially in view of the prospective connection with the system of the Central Electricity Board, the possible concentration of power during a short circuit was such that the e.h.p. switchgear at some of the older sub-stations was becoming quite inadequate. He therefore recommended the immediate commencement of the work of equipping adequately the main sub-stations at a cost of approximately £8,000.

Featherstone.—STREET LIGHTING.—The Urban District Council has accepted new terms offered by the Electrical Distribution of Yorkshire, Ltd., for public lighting, for 150-W lamps at £4 5s. each per annum, and 100-W lamps at £4 per annum.

Hereford.—NEW CABLE.—The Electricity Committee has obtained permission from the Corporation to proceed with negotiations with the Shropshire, Worcestershire and Staffordshire Electric Power Co., for a h.p. cable from Ledbury to Ross, principally to ensure an additional supply to the works of Edison Swan Cables, Ltd., at Lydbrook.

LOAN SANCTIONED.—Sanction has been received to the borrowing of £3,750 for overhead line extensions to Dewchurch, Dinmore, Goodrich and Peterstow.

OVERHEAD LINES.—The sanction of the Minister of Transport has been received to the erection of overhead lines in the rural districts of Hereford, Ross and Weobley for the transmission of electrical energy at pressures of 11,000, 400 and 220 V.

Hull.—YEAR'S WORKING.—The accounts of the city electricity undertaking (engineer Mr. J. N. Waite) for the year ended March 31st last show a total revenue of £360,950, as compared with £380,695 in the preceding year. Working expenses amounted to £173,631, as against £195,598, leaving a gross profit of £187,318 (£185,097), to which were added unemployment grants and excess of sinking fund investments, making a total of £191,281. After payment of capital charges there was a net surplus of £68,553, as compared with £86,249 in 1927-28. Capital expenditure during the year amounted to £299,298, the chief items being £85,523 for buildings, £127,978 for machinery, and £71,468 for mains and services. The sales of electricity increased from 70,289,545 to 74,601,164 kWh, and the maximum supply demanded from 27,700 to 29,900 kW. Developments have been made during the year in the rural districts of Sutton, Anlaby, Willerby, Melton and Welton. Supplies to Kirkella, Westella and Swanland have been inaugurated recently. Negotiations have been completed with the South Yorkshire Electric Light & Power Co. for bulk supplies at Hedon for Withernsea, and at Skirlaugh for Hornsea, and the preliminaries in connection with these supplies are now proceeding.

Irlam.—LIGHTING SCHEME ADOPTED.—As the result of a canvass of local ratepayers, the Town Council has decided to undertake an electric lighting scheme for the town. It is hoped that a supply of electricity will be available by the end of this year.

Kettering.—YEAR'S WORKING.—The report on the working of the Urban District Council's electricity undertaking (engineer: Mr. W. A. Walker) for the year ended March 31st last shows a total revenue of £70,193, and working expenses of £35,041, leaving a gross profit of £35,152. The figures for the previous year were: income, £66,525; working expenses, £36,091; gross profit, £30,434. To the gross profit was added an unemployment grant of £1,867, and bank interest of £102, making a total of £37,121 available. Loan charges absorbed £31,355, and there was a net surplus of £5,766, as against £3,480 in 1927-28. The sales of electricity increased from 7,202,836 to 7,962,776 kWh. The average price obtained fell from 2.05d. to 1.92d. per kWh.

Leeds.—YEAR'S WORKING.—We have received from Mr. C. Nelson Hefford, general manager and engineer of the city electricity department, a copy of his report together with a statement of accounts on the working of the electricity undertaking for the year ended March 31st. The total revenue amounted to £672,004, and working expenses were £250,859, leaving a gross profit of £421,146. The figures for the preceding year were: Income, £681,265; working expenses, £242,156; gross profit, £439,109. To the gross profit was added a sum of £2,942, profit on the showroom and installation department, and £2,514 from rentals of electrical appliances, making the total available £426,602. Showroom expenses and capital charges absorbed £301,153, including a contribution to the consolidated loan fund of £117,259, and from the balance £86,103 has been spent on works of a capital nature, leaving a net surplus of £39,346 as compared with a surplus of £137,186 in 1927-28. The capital expenditure during the year amounted to £568,874, making the total now spent on the undertaking £5,271,754. The sales of electricity increased from 120,385,212 to 135,498,359 kWh, and the maximum supply demanded from 54,500 to 58,000 kW. The average price obtained per kWh fell from 1.36d. to 1.18d. During the year sanction was granted to the borrowing of a further £200,000 for the construction of the new power station at Kirkstall, which, with the amount sanctioned during the previous year (£500,000) makes a total sum of £700,000, which has now been granted towards the sum of £865,000, which is the estimate for the first portion of the works. Considerable extensions of mains have been carried out during the year, the total length being 208 miles and fifteen sub-stations and kiosks were constructed and equipped.

Leigh.—LOAN.—The Town Council is seeking sanction to the borrowing of £1,251 for a h.p. supply to the mills of Leigh Spinners, Ltd.

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London.—BATTERSEA.—The Borough Council Electricity Committee has authorised electricity services to 61 premises at a cost of £538; mains extensions for private services at £3,418; extensions for public lighting and conversion of gas lamps at £506; and replacement with armoured cable of old vulcanised bitumen distributors at £2,022.

HAMPSTEAD.—*Year's Working.*—The accounts of the electricity undertaking (engineer: Mr. J. Leadbeater) for the past year show a total revenue of £161,715, working expenses £120,944, and gross profit £40,771. The figures for the preceding year were:—Income, £162,170; working expenses, £107,652; gross profit, £54,518. Of the gross profit, £40,008 was absorbed by capital charges and a sum was contributed to repayment of capital outlay, leaving a net deficit of £22.383, as against a net surplus of £16,039 in 1927-28. The sales of electrical energy increased from 17,487,668 kWh to 21,306,463 kWh, and the maximum supply demanded from 10,700 kW to 12,775 kW. The average price per kWh fell from 2.23d. to 1.78d.

HAMMERSMITH.—The Borough Council has received an application for a supply of electricity amounting to 2,000 kW required for the extension of Olympia. It will be necessary to provide two 6,600-V e.h.p. three-phase mains between the generating station and Olympia, in the place of the existing single-phase mains, and also to equip sub-stations provided by the consumers with two 2,000-kW banks of Scott-connected transformers and two three-phase, 500-kW transformers, together with switchgear. At the generating station two panels and switches will have to be added to the main e.h.p. switchboard to deal with this supply. The total estimated cost of the works amounts to £13,087.

HACKNEY.—The Electricity Committee has recommended to the Borough Council the adoption of a scheme for the hiring out of British-made irons at the rate of 1s. a quarter.

Lytham-St. Annes.—SUPPLY INAUGURATION.—The Mayor recently performed the ceremony of inauguration of the electricity supply to the townships of Warton and Freckleton. The energy is supplied by the Corporation over a 6,600-V line to the main sub-station at Warton.

Macclesfield.—OVERHEAD LINE PROTEST.—The Rural District Council has decided to protest against the proposal of the Electricity Co. of Macclesfield, Ltd., to erect overhead lines at Poynton, particularly in view of the fact that an assurance had been given that underground cables would be laid. The Cheshire County Council is also opposing the use of overhead lines.

Manchester.—PROGRESS DURING APRIL.—During the month of April the Corporation electricity undertaking showed an increase in connections of 4,466 kW, bringing the total up to 386,606 kW; and the number of applications received for supply, including those for additional supplies, was 1,030, representing a total of 2,682 kW. The number of hired cookers connected increased by 81, bringing the total of hired cookers actually connected to 5,263. Applications for the hire of cookers totalled 118. Two new sub-stations were put into commission, and additional plant was installed at three existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 5,984 consumers, and sanction had been given involving 1,791 consumers. In order to reduce the cost of l.p. distribution, application is being made to the Electricity Commissioners to approve a system using paper-insulated, lead-sheathed, compounded and water-proofed cable, laid direct in the ground without armouring, but with protective covering consisting of wooden planks, reinforced-concrete slabs, concrete, or hard burned tiles. Approval for the use of paper-insulated, lead-sheathed cable drawn into pipes or ducts, or laid solid in troughs, is also being applied for.

Marple.—ELECTRICITY SUPPLY.—The Urban District Council decided at a recent meeting to expend a sum of £38,100 on an electricity scheme for the town. It is hoped to have a supply available before the winter season.

Northern Ireland.—BANGOR.—At a recent meeting of the Borough Council it was stated that the Ministry of Commerce had granted its sanction to the borrowing of £37,750 on account of the £50,000 required for carrying out works in connection with the electricity scheme, but with regard to the proposed loan of £6,300 in respect of working capital had stated that that application would have to be made to the Ministry of Home Affairs. With regard to a further sum of £5,950 proposed to be expended on mains and services, further application could be made when the expenditure of that amount was necessary. Plans and specifications were forwarded by Messrs. Sayers & Co., the Council's consultants, and it was resolved that tenders be invited for carrying out the works.

Nuneaton.—LOANS.—The Town Council is to apply for sanction to loans totalling £8,500 for electricity services.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SKIPTON.—Industrial power on maximum demand system: From 4d. to 3d. per kWh for first 60 kWh per quarter per kW of maximum demand and 1½d. per kWh in excess of this amount.

HAMILTON.—Standard lighting flat rate: From 5½d. to 5d. per kWh. Contract tariff rate: Fixed charge unchanged, "unit" charge from 1d. to ¾d. per kWh. Power: 2d. per kWh for the first 2,000 kWh, 1½d. for the next 12,500, 1¼d. for the next 37,500, 1d. for the next 37,500, and ¾d. per kWh for additional energy.

Swansea.—SUB-STATION EQUIPMENT.—The Corporation Electricity Committee has authorised the installation of additional switchgear and transformers at sub-stations at a cost of £1,640.

United States.—TIDAL POWER DEVELOPMENT.—According to *Power*, Dexter L. Cooper, Inc., has applied to the Federal Power Commission for a licence covering a proposed tidal power development at Passamaquoddy Bay. The proposed scheme is for the installation of plant having at the outset a capacity of 464,000 h.p., which will be increased eventually to 1,087,000 h.p. The project involves the construction of a series of dams connecting the mainland with islands across the mouth of Passamaquoddy Bay to impound tidal waters within that bay. Another series of dams is to be constructed between Passamaquoddy Bay and Cobscook Bay. The power house is to be erected at that point. In addition, there will be a series of dams across the mouth of Cobscook Bay to exclude tidal waters. A recently-adopted feature of the project is a plan to pump water from Haycock Harbour into a reservoir to be constructed on the mainland at a height of 140 ft. above sea level. Water will be pumped into this reservoir at times when excess power is available and drawn down when tidal power is at its minimum. To furnish the necessary power for pumping, it is proposed to install five 41,000-h.p. units. By utilising this power it is expected that many steam plants in Maine, in north-eastern Massachusetts, and in New Brunswick can be superseded. The scheme is estimated to cost $93,000,000, and is expected to take three years to complete.

Uruguay.—HYDRO-ELECTRIC SCHEMES.—Congress has authorised the expenditure of 300,000 pesos (£60,000) on fresh studies of hydro-electric works, and the National Council of Administration has appointed a Commission of seven engineers to complete the surveys already commenced on the Rio Negro and make similar investigations on the Salto Grande and Queguay rivers.—*Reuter's Trade Service* (Montevideo).

Tramway and Railway Notes.

Glasgow.—PINKSTON STATION.—Following on the refusal of the Electricity Commissioners to consent to the application of the Corporation to install plant at Pinkston generating station, the Tramways Committee on June 18th approved a recommendation by the Sub-Committee on Works that the following plant should be installed to replace existing plant: (*a*) Six boilers to replace 14 of the 22 boilers installed in 1901, (*b*) new switchgear to replace present switchgear installed in 1907, and (*c*) a new 10,000-kW turbo-alternator to replace two of the present turbo-alternators. As this is entirely replacement, and does not increase the capacity of the station, the consent of the Electricity Commissioners is not necessary. The matter will come before the Corporation for approval at the next meeting. It is estimated that the cost of the scheme will be approximately £218,500.

London.—SUBWAYS.—At a meeting of the London County Council, held on June 18th, it was decided to accept the principle of uniting buildings of any description by subway or otherwise to underground or tube railway stations, provided that adequate precautions are taken against fire and panic and that traffic conditions will be alleviated in the neighbourhood. The first application which is to be considered is for a subway connecting the Dominion Theatre with Tottenham Court Road tube station.

Sunderland.—YEAR'S WORKING.—The accounts of the working of the Corporation tramway department (general manager and engineer: Mr. C. A. Hopkins) show a total revenue of £122,442 and working expenditure of £99,256, leaving a gross profit of £23,186. The figures for the preceding year were: Income, £128,899; working expenses, £101,361; gross profit, £27,538. From the gross profit is deducted a debit balance from the motor-omnibus service of £1,922 and an unemployment grant of £131 is added, making a total of £21,395 available. After payment of capital and income tax charges there is a balance of £15,417, which is allocated as follows:—Repayment of loans, £10,078; renewal fund, £5,339. The capital expenditure during the year amounted to £24,984, of which £18,687 was spent on buildings at the Fulwell depôt and £5,845 on permanent way. The number of passengers carried decreased from 30,921,458 to 29,337,273, and the car miles run from 1,701,470 to 1,628,715. The traffic revenue per car mile fell from 18.182d. to 17.7d.

United States.—NEW YORK.—A collision occurred on June 19th between two trains of the elevated railway at a sharp curve opposite the Cathedral of St. John the Divine, 150 ft. above the street level. One train ran into the rear of the other, causing a small fire among the wreckage. One person was killed and several injured.

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Telegraph and Telephone Notes.

Brazil.—COMMUNICATION SERVICES.—Despite the great development of the country, it is estimated that there are only 102,362 miles of telegraph wires in operation in Brazil, or only 2.5 miles per 1,000 of the population. The number of telephones in use in Brazil is returned at only 105,209, or only 2.6 per 1,000 inhabitants.

The Brazilian Telephone Company, a Canadian undertaking which operates local telephone service in over 300 cities in the Federal district and the States of Rio de Janeiro, Minas Geraes, Sao Paulo and Parana, has undertaken an extensive construction programme in connection with its local and interurban services. The company now has over 100,000 telephones in its system, and the first multi-office automatic exchange in Brazil was installed in Sao Paulo in July, 1928, and another large one will be ready for service late this year. The programme of extension for the city of Rio de Janeiro contemplates the installation of approximately 30,000 automatic telephones in the next two years. Agreements have also been reached with the competent government authorities whereby the Brazilian Company will install additional automatic exchanges in the towns of Campos, Campinas, Jahu, and Bello Horizonte, State of Minas Gerase, as well as ordinary battery or magneto exchanges in nineteen other towns.

Finland.—NEW RADIO STATION.—It is stated that the Finnish Post and Telegraph Administration has received three offers for the establishment of a new radio station at Helsingfors. They have been submitted by the German Telefunken Gesellschaft, the English Marconi Company and the American Standard Company.

International Telephony.—ENGLAND-ITALY.—The British Postmaster-General announced last week that the Anglo-Italian telephone service (hitherto restricted to Milan, Genoa, and Turin) had been extended in Italy to Rome, Venice, and Bologna. Communication with the latter places will be restricted initially to subscribers in the London telephone area, but will be made available to the provinces as soon as circumstances permit.

Radio at Sea.—SHIP-SHORE TELEPHONY.—Wireless tests are to be begun immediately between the s.s. *Leviathan* and the American Telegraph and Telephone Company's experimental station at Deal, New Jersey, with a view ultimately to establishing a regular telephone service between ships at sea and any home office in the United States. A regular service from the *Leviathan* is contemplated in the autumn.—*Reuter's* (New York).

United States.—FIVE YEARS' TELEPHONE GAIN.—The rapid expansion of the telephone system in the United States is illustrated by figures just published in the report of the Washington Federal Census Bureau. Statistics show that the number of telephones has increased during the past five years by an average of 5.8 per cent. per annum, while the population has increased at the average rate of 1.50 per cent. Thus, the rate of telephone increase has been nearly four times that of the increase of population. Florida, with 103.7 per cent., shows the largest rate of increase over the period, a gain attributable to real estate development between 1922 and 1925; California ranks second with an increase rate of 57.9 per cent., and New York State shows an increase of 45.8 per cent. The total number of telephones in the United States at the close of 1927 was 18,522,767, or one to about every six of population (for comparison, the total number of telephones in this country in December, 1927, was very nearly 1,600,000, or one to every 30 persons). The principal figures in the report are:—

	1922.	1927.	Per cent. increase.
Systems, or lines ...	57,253	60,148	5.1
Miles of single wire	37,265,958	63,836,182	71.3
Number of telephones ...	14,347,395	18,522,767	29.1
Number of exchanges ...	19,260	20,225	5.0
Number of calls ...	24,647,560,860	31,614,172,621	28.3
Investment in plant and equipment	£441,036,600	£709,774,900	60.9
Operating revenue	£133,113,700	£204,714,700	53.8

MERGER LAW.—General Harbord, president of the Radio Corporation, declared at a convention this week that the cable and wireless merger in Great Britain must affect profoundly American trade throughout the world. He deplored the passage of the law forbidding such a merger in the United States, and he urged a modification of the law, so that the United States could preserve for itself its position in the world of communications. He pointed out that the new British system served practically every important port and city in the world.

Radio Notes.

Austria.—GRAZ STATION.—The reason why the official opening of the new station at St. Peter-bei-Graz had to be postponed until June 17th was the damage done by lightning during thunderstorms recently. On June 10th aerials 80 feet from the ground were blown down.

New Zealand.—LICENCE INCREASES.—The New Zealand radio year, which began on April 1st, opened auspiciously, says *World-Radio*, for the drop in the licence numbers did not prove to be so great as it was last year, which fact reflects favourably on the improved service which is being rendered by the Broadcasting Company. The licence totals on April 30th were as follows, the numbers in brackets being the corresponding figures for March 31st:—listeners' 35,880 (44,810), dealers' 652 (1,509), and amateur transmitters' 132 (192). The nationalisation of the Australian stations, their prospective increase in power, and their assurance of better programmes will almost certainly result in greater listening in New Zealand.

A further step in the N.Z.R.B. Company's progressive policy was marked by the official opening of 2YB, New Plymouth, on April 28th. The company has announced its intention of opening relay stations at ten provincial centres so soon as time and funds allow, and they will all be connected to the main stations by land lines.

North Regional Station.—SLAITHWAITE SITE?—There is a probability of the proposed new north of England regional broadcasting station being erected at Pole Moor, Slaithwaite, near Huddersfield. The clerk of the Slaithwaite Urban District Council has met B.B.C. and Post Office officials regarding a proposed underground cable which would serve the suggested station, the site of which is on the edge of the moors in a very elevated position. For some time tests have been carried out on the site, along with similar tests made at Bacup and Milnrow, in Lancashire, and other places. If erected, the new station will replace those at present operating at Manchester, Liverpool, Leeds-Bradford, Sheffield and Stoke.

Rumania.—"PIRATES."—The broadcasting administration announces that not only will any unlicensed apparatus be confiscated, but any person who puts up an aerial will also be fined, like the owner, up to £13, or sent to prison for a term not exceeding two years. The new station in Bucarest is to be opened in August.

The Kilohertz.—USE ABANDONED.—It will be remembered that for some time past the term kilohertz (kh.) has been substituted in *World-Radio* for kilocycle (kc.), the reason being that kilohertz is a term indicating a rate of speed, *i.e.*, one thousand cycles per second. Now, however, it has been decided by international consent that, since the expression kilohertz is not in general use, it should be abandoned and frequencies expressed in terms of "kilocycles per second." In common with other nations, the B.B.C. will henceforth conform to this rule, and express its frequencies by the formula "kc./s."

Weather Chart Broadcasting.

In conjunction with the Air Ministry, Wireless Pictures (1928), Ltd., is at present carrying out a very interesting series of experiments. On Tuesdays and Thursdays between 2 p.m. and 2.25 p.m. synoptic weather charts are being broadcast from the Daventry (5XX) station of the British Broadcasting Corporation. Reports upon the reception of the charts from as many different places as possible would be of the greatest value to those who are conducting the test. Any reader who possesses a Fultograph can obtain a supply of prepared paper and envelopes, as well as full particulars of the reports required, by writing to Wireless Pictures (1928), Ltd., Dorland House, 14-16, Regent Street, London, S.W.1. If it is demonstrated that weather charts and forecasts can be sent in a few minutes from a central station to all parts of the country, as well as to airships and aeroplanes in flight, it will be realised that a big step forward has been made in reducing air risks, for pilots will be able to see at a glance the state of the weather in districts towards which they are flying.

Television in Germany.

Inquiries confirm the reports in the Berlin Press that a large and powerful combination has been formed to work the Baird system of television in Germany, says the *Daily Telegraph*. In addition to the English Baird Television Development Co., Ltd., partners in this concern will be: the Zeiss works, which will supply the optical elements of the installations: Bosch Co., Stuttgart, which will make the necessary motors; and the Loewe-Radio Co., which specialises in wireless equipment. This success seems to have been due to the impartial encouragement of the German Government. As a result of a visit to London of Wireless Commissioner Bredow and his chief engineer, Mr. Baird was invited to experiment in Berlin. Trial transmission has been going on there for some time past, and was picked up at the Baird laboratories in Long Acre, London. Apparently it is the intention of the German Government to encourage the development of television.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 15th. State Electricity Commission of Victoria. Two 750-kVA transformers and spares. (B.X. 5325.)*

July 23rd. Posts and Telegraphs Department. Telegraph instruments. (B.X. 5323.)*

July 24th. Victorian Railway Commissioners. Electric overhead travelling cranes, spare motors, and trolley wires. (A.X. 8092.)*

SYDNEY.—August 12th. Department of Public Works. Auxiliary hydro-electric generating plant for Burrinjuck. (B.X. 5365.)*

Belgium.—IXELLES, BRUSSELS.—July 5th. Supply of 887, 220 and 444 d.c. ampere-hour and watt-hour meters. Particulars for 6¾ fr. from Service de l'Electricité, 22, Rue d'Alsace-Lorraine, Ixelles.

Carlisle.—July 12th. Electricity Department. Supply, delivery, and erection of switchgear for use in an 11,000-V, 3-phase, 50-cycle sub-station. (June 28th.)

Chile.—VALPARAISO.—July 12th. Ministry of Marine. Two aerial towers for the new wireless station at Arica. (A.X. 8134.)*

SANTIAGO.—August 16th. Departments de Materiales y Almacenes, Chilean State Railways. Materials, including underground cable, train lighting material, lamps, &c. (C. 3069.)*

Croydon.—July 4th. Electricity Department. Supply of 25,000 tons of coal suitable for use on chain grate mechanical stokers. (June 28th.)

Dundee.—July 10th. Electricity Department. One seven-panel e.h.p. compound-filled sub-station switchboard for a 6,600-V, 3-phase, 50-cycle system. (June 28th.)

Edinburgh.—July 8th. Electricity Supply Department. One automatic electric elevator for Portobello power station. Specifications, &c., from Mr. E. Seddon, engineer and manager (£1 1s. deposit).

Egypt.—CAIRO.—July 15th. Ministry of Interior. One 250-kVA Diesel engine-driven a.c. generating set, with switch and control gear. (B.X. 5331.)*

August 15th. Diesel engine alternator for the Zagazig Power Station. (B.X. 5393.)*

August 13th. Supply of an electric power station, with underground and overhead network, for the town of Maghagha. (B.X. 5318.)*

July 13th. Egyptian State Railways. Supply of underground unarmoured, lead-covered, paper-core telephone cable, approximately £E25,000 to £E26,000.

Glasgow.—July 3rd. Corporation. Electric lighting installation at Plantation Baths and Wash-houses. Specifications from office of Public Works, 64, Cochrane Street.

July 4th. Electricity Department. Extension of the overhead charging feeder system, and charging plant at the Govan refuse destructor station garage. Specifications, &c., from the general manager, 75, Waterloo Street, Glasgow, C.2.

Holywood.—July 2nd. Urban District Council. Laying and erection of l.p. underground and overhead mains and h.p. cable, erection of l.p. switchboard, h.p. armour-clad and truck-type switchgear, and 3-phase transformers. (June 14th.)

India.—SIMLA.—July 8th. Indian Stores Department. 30-kW oil engine-driven generating set for the Military Engineering Services, St. Thomas Mount, Madras. (B.X. 5364.)*

July 12th. Three continuous wave wireless transmitting sets, 580 to 3,000 meters. (June 28th.)

Lincoln.—Bracebridge Mental Hospital. Electrical installation for two new villas at Bracebridge, near Lincoln. (See this issue.

London.—CENTRAL ELECTRICITY BOARD.—July 22nd. Supply, delivery and erection of central indicators and telephones for the Central Scotland Electricity Scheme. 1927. (June 7th.)

July 27th. Supply, delivery, and erection of 132,000-V overhead transmission lines for the Mid-East England Electricity Scheme, 1929. (June 28th.)

LONDON COUNTY COUNCIL.—July 8th. 150 complete bodies for tramcars, 150 sets of swing bolster bogie trucks, 150 electrical equipments for tramcars, &c., and 150 magnetic track and wheel brake equipments. (June 7th.)

STEPNEY.—July 4th. Parish Guardians. Installation of two electric lifts, &c., at the South Grove Lodge, and one electric lift at the St. George-in-the-East Hospital. (June 28th.)

METROPOLITAN ASYLUMS BOARD.—July 10th. Supply and fixing of a complete wireless installation at Princess Mary's Hospital, Cliftonville, Margate. (June 28th.)

New Zealand.—WELLINGTON.—Posts and Telegraph Department. July 6th. V.i.r. wire. (B.X. 5411.)* July 9th. Dial cords. (B.X. 5412.)* July 10th. Lead-sheathed, enamelled and cotton core, contractor cable (B.X. 5413.)*

July 3rd. Black adhesive insulating tape. (B.X. 5378.)*

August 7th. Enamelled and silk-covered resistance wire. (B.X. 5322.)*

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

September 4th. Government Railways. Motor generator. (B.X. 5308.)*

AUCKLAND.—August 19th. Auckland Electric Power Board. Single-phase transformers. (B.X. 5324.)*

South Africa.—PRETORIA.—Posts and Telegraphs Department.

August 1st. Telephone cable. (B.X. 5345.)*

August 8th. Telegraph materials, including iron tubular sidearms, porcelain insulators, paper sleeves, solder and insulating spindles. (A.X. 8112.)*

PIETERSBURG, TRANSVAAL.—August 13th. Municipal Council. Steam-raising plant, engine alternator and switchgear. (A.X. 7983.)* H. and l.p. cable, lamps and sundries. (B.X. 5312.)*

JOHANNESBURG.—August 1st. South African Railways and Harbours. 10-ton electrically-driven overhead travelling crane for Maritzburg workshops. (A.X. 8105.)*

Sunderland.—July 8th. Electricity Department. Paper-insulated, lead-sheathed cable, rubber-insulated wire, meters, gasfilled and vacuum lamps. (June 7th.)

Uruguay.—PORT AUTHORITIES.—July 22nd. 300-kilo electro-pneumatic drop-hammer. (A.X. 7974.)*

Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Three 225,000-lb. boilers with economisers, air heaters, fans, &c. (June 7th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1

Contracts Closed.

Australia. — SYDNEY. — The Civic Commissioners have accepted the tender of Siemens Pty. (Australia), Ltd., for the supply of 145,900 yards of 30,000-V cable, pilot cable, and jointing material, at a cost of £266,083.—*Reuter's* (Sydney).

Aylesbury.—Town Council. Accepted :—
15 transformers (£477).—English Electric Co., Ltd.

Barnes.—Urban Council. Accepted :—
Cables in connection with the bulk supply.—Hackbridge Cable Co., Ltd., and the Greenwich Cable Works, Ltd.

Basingstoke.—Town Council. Accepted :—
500-kW motor-generator set (£2,178).—British Thomson-Houston Co., Ltd.

Bedford.—Electricity Committee. Recommended :—
Battery extension (£339).—Chloride Electrical Storage Co., Ltd.

Brighton.—Lighting Committee. Accepted :—
Acid neutraliser (£185).—Tudor Accumulator Co., Ltd.
Four automatic coal weighers (£680).—W. & T. Avery, Ltd.

Croydon.—Electricity Committee. Recommended :—
Two kVA transformer kiosks.—Metropolitan-Vickers Electrical Co., Ltd.
One 100-kVA transformer (£112), one 250-kVA ditto (£180).—British Electric Transformer Co., Ltd.
Two sets of oil-immersed fuses (£190), one armour-clad switch (£193).—A. Reyrolle & Co., Ltd.

Dundee.—The Corporation Electricity Committee last week considered tenders for the supply of cable from British, Belgian and Dutch firms. Without discussion the committee accepted the offers for Belgian and Dutch cable, these being about 19 per cent. lower than the British quotations.

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Grimsby.—Electricity Committee. Recommended:
Boiler feed pump (£344).—Rees Roturbo, Ltd.
Runaway for coal plant (£860).—Herbert Morris, Ltd.

Government Contracts.—The following Government contracts were placed during May, 1929:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Aluminium ingots, sheets and sections.—British Aluminium Co., Ltd.
Controlling boards, &c.—Whipp & Bourne, Ltd.; H. W. Sullivan, Ltd.
Electric cable.—Anchor Cable Co., Ltd.; British Insulated Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; Edison Swan Cables, Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India Rubber Works, Ltd.; India Rubber, G.P. and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; St. Helens Cable & Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.
Cells.—Fuller Accumulator Co., Ltd.; D.P. Battery Co., Ltd.
Engine room fans.—Electro-Dynamic Construction Co., Ltd.
Motor generators.—Haslam & Newton, Ltd.
Magnetic keys, &c.—Veritys, Ltd.
W/T transformers.—Ferranti, Ltd.; W. H. Wilson; Foster Engineering Co., Ltd.
W/T transmitters, panels, &c.—Gambrell Bros, Ltd.; H. W. Sullivan, Ltd.
W/t tuners and amplifiers.—H. W. Sullivan, Ltd.; Plessey Co., Ltd.; Radio Instruments, Ltd.
W/T valves.—General Electric Co., Ltd.; Mullard Radio Valve Co., Ltd.

WAR OFFICE.

Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.

POST OFFICE.

Manufacture, supply, drawing-in and jointing cable.—Guildford-Basingstoke-Reading: Johnson & Phillips, Ltd.; London-Leatherhead: Siemens Bros. & Co., Ltd.
Distribution switchboard, Rugby Radio Station.—Ferguson, Pailin, Ltd.
Electric goods lift, Metropolitan Automatic Exchange.—Keighley Electrical Engineering Co., Ltd.
Telephone exchange equipment.—East London Rubber Co. (E.C.2): Relay Automatic Telephone Co., Ltd.; Grimsby: Siemens Bros. & Co., Ltd. Crosby (Liverpool) and Jesmond: Standard Telephones & Cables, Ltd.; Hampstead: Ericsson Telephones, Ltd.. Subcontractors: Electric Construction Co., Ltd., for motor-generators; Crompton Parkinson, Ltd., for ringing machines; Pritchett & Gold & E.P.S., Co., Ltd., for batteries. Theydon Bois and Midland (Birmingham): Automatic Telephone Mfg. Co., Ltd.
Telephone Repeater Station, Derby, 4-wire repeater equipment.—Standard Telephones & Cables, Ltd.
Telephone apparatus.—Ericsson Telephones, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Standard Telephones and Cables, Ltd.; Telephone Mfg. Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.; Standard Telephones & Cables, Ltd.
Testing apparatus.—General Electric Co., Ltd.; E. Turner.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Connolly's (Blackley), Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.
Joint box castings.—Bradley & Turton, Ltd.; General Foundry & Engineering Co., Ltd.; Planet Foundry Co., Ltd.; United Steel Companies, Ltd. (Thos. Butlin and Co. Branch).
Electric clocks.—Magneta Time Co., Ltd.
Cords for telephones.—International Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Reliance Electrical Wire Co.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—J. Place & Sons, Ltd.
Dynamotors.—W. Jones & Co.
Electric light fittings.—Siemens Electric Lamps & Supplies, Ltd.
Electric hand lamps.—Revo Electric Co., Ltd.
Telegraphic ironwork.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; T. W. Lench, Ltd.; C. Richards and Sons, Ltd.; D. Willetts, Ltd.
Electric lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Motor-generator sets.—Bull Motors, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.; C. M. Powell Bros.
Bronze wire.—F. Smith & Co., Ltd.; Whitecross Co., Ltd.
Insulated bronze wire.—British Insulated Cables, Ltd.; Siemens Bros. & Co., Ltd.
Copper wire.—Edison Swan Cables, Ltd.; E. & E. Kaye, Ltd.; Nevill Druce & Co., Ltd.; Pirelli-General Cable Works, Ltd.; Whitecross Co., Ltd.
Cadmium copper wire.—British Insulated Cables, Ltd.; F. Smith & Co., Ltd.; Whitecross Co., Ltd.
G.I. wire.—W. Bain & Co., Ltd.; Shropshire Iron Co., Ltd.; Whitecross Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cable.—St. Helens Cable & Rubber Co., Ltd.
Cable and boxes.—W. T. Henley's Telegraph Works Co., Ltd.
Coal handling plant.—Mitchell Conveyor & Transporter Co., Ltd.
Electric lamps.—General Electric Co., Ltd.
Insulators.—Bullers, Ltd.
Meters.—Ferranti, Ltd.
Switchboard.—Switchgear & Cowans, Ltd.
Switchgear.—Electric Control, Ltd.; Ferguson, Pailin, Ltd.
Telephones.—Ericsson Telephones, Ltd.
Telephone cable.—British Insulated Cables, Ltd.; Siemens Bros. & Co., Ltd.; Callender's Cable & Construction Co., Ltd.
Train lighting equipment.—J. Stone & Co., Ltd.
Wire.—Whitecross Co., Ltd.; Elliott's Metal Co., Ltd.; F. Smith & Co., Ltd.

H.M. OFFICE OF WORKS.

Wiring Permanent Buildings, Belfast.—T. Clarke & Co., Ltd.
12 months' supply of electric lamps.—Metro-Vick Supplies, Ltd.

Ironbridge.—West Midlands Joint Electricity Authority. Accepted:—
Complete electrical generating plant for the first section of the Ironbridge power station:
One 50,000-kW turbo-alternator, transformers, and the necessary auxiliary equipment.—British Thomson-Houston Co., Ltd.
Condensing plant.—Hick, Hargreaves & Co., Ltd.
Feed pump.—G. & J. Weir, Ltd.
Three circulating water pumps.—Drysdale & Co., Ltd.
Further reference to this contract is made in our "Business Notes" to-day.

London.—HAMMERSMITH.—Electricity Committee.
Four 1,000-kVA and one 50-kVA transformers (£1,795).—British Electric Transformer Co., Ltd.
Two 500-kVA transformers (£456).—Hackbridge Electric Construction Co., Ltd.

WAR OFFICE.
12 months' supply of electric fans.—Metro-Vick Supplies.

METROPOLITAN ASYLUMS BOARD.—The undermentioned tenders were received for:
Installation of two electric lifts at Colindale Hospital:—

E. A. Foulds	£900
Titan Lift Co., Ltd.	960
Glasgow Engineers, Ltd.	1,079
J. Bennie, Ltd.	1,096
Medway's Safety Lift Co., Ltd.	1,180
W. Wadsworth & Sons, Ltd.	1,210
Express Lift Co., Ltd.	1,322
Pickerings, Ltd.	1,364
R. A. Evans, Ltd.	1,400
Waygood-Otis, Ltd.	1,430
Smith, Major & Stevens, Ltd.	1,675

Installation of fire-alarm system at High Wood Hospital for Children:—

Carr Bros.	£248
Telephone & Electrical Maintenance Co.	290
L. G. Tate & Co., Ltd.	315
H. Lewis & Co.	344
Alpha Manufacturing & Electrical Co., Ltd.	384
S. Reed & Sons	420

BATTERSEA.—Electricity Committee. Recommended:—
500-kVA transformer for Chatham House sub-station (£297).—British Electric Transformer Co., Ltd.
H.p. switchgear (£408).—A. Reyrolle & Co., Ltd.
L.p. switchgear (£244 and £322).—General Electric Co., Ltd.
Kiosk, transformer and switchgear for Battersea Park area (£337).—Ferguson, Pailin, Ltd.
Feeder panel for sub-station at Albert Bridge flour mills (£95).—Bertram Thomas.
Three feeder pillars (£290).—Callender's Cable & Construction Co., Ltd.
Pipework at power station (£1,495).—Babcock & Wilcox, Ltd.

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LONDON COUNTY COUNCIL.—Electrical work at extension of School of Art, Hammersmith :—

ALPHA MANUFACTURING & ELECTRICAL CO., LTD. (Accepted.)	£1,585
Smethurst & Co. (London), Ltd.	1,660
Stegman & Co.	1,695
H. J. Cash & Co., Ltd.	1,795
Electrical Installations, Ltd.	1,799
J. Briggs, Ltd.	1,841
A. Hawkins & Sons	1,998
Burdett & Co., Ltd.	2,000
A. Dean & Co., Ltd.	2,050
Berkeley Electrical Engineering Co., Ltd.	2,073
Pinching & Walton	2,220

Electric lighting installation at Marvel's Lane School, Lewisham :—

J. BRIGGS, ELECTRICAL CONTRACTORS, LTD. (Recommended.)	£365
Malcolm & Allan (London), Ltd.	369
A. Dean & Co., Ltd.	371
Stegman & Co.	375
Electrical Installations, Ltd.	386
H. J. Cash & Co., Ltd.	419

Stirling.—County Council. Accepted :—
Wiring contract in connection with the housing scheme.—J. & J. Duff.

Forthcoming Events.

Electrical Contractors' Association.—June 26th to 28th. Bournemouth. Annual Conference.

Institution of Mechanical Engineers.—June 25th-28th. Manchester. Summer Meeting.

Physical Society.—Friday, June 28th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting. Visit to Avonmouth Docks, Bristol.

North-East Coast Institution of Engineers and Shipbuilders.—July 2nd-4th. Summer meeting, Newcastle-on-Tyne.

Tramways and Light Railways Association.—Wednesday, July 3rd. Sheffield Annual Congress.

Institution of Electrical Engineers.—Thursday, July 4th. Annual conversazione at the Natural History Museum, South Kensington, S.W.

(South-Midland Centre).—Tuesday, July 2nd. Summer meeting. Visit to Avonmouth Docks.

Overhead Lines Association.—Friday, July 5th. Summer meeting. Charabanc tour in the Mid-Cheshire area.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of suppliers of the following :—

"DRENCO" electric iron.

GRANVILLE motors or starters.

Notes.

Very-high-pressure Steam Plant.

In 1923 the Compagnie des Centrales Electriques en Flandres ordered from the Brown-Boveri Co. a 1,700-kW turbine designed to work with steam at an absolute pressure of 725 lb. per sq. in., 442 deg. C., the highest steam pressure employed in Europe up to that time. The results given by the set proved so satisfactory that in 1927 an order was placed with the same company for a second turbine to work with steam at the same pressure and temperature, but having normal and maximum capacities of 6,600 and 8,000 kW. The two turbines work with a back-pressure of about 370 lb. per sq. in., the exhaust steam being employed to run the older condensation-type turbines. To meet the requirements of the new turbines, the boiler installation was altered from 327 lb. per sq. in. pressure and 325 deg. C. temperature to 810 lb. and 450 deg. C. It became necessary last year to arrange for a further extension of the generating plant, and an order was placed with the same manufacturers for a turbine capable of developing from 20,000 to 25,000 kW and of working with steam at 725 lb. and 442 deg. C. The turbine, which is the largest to be so far constructed for so high a working pressure, is of the three-cylinder type, and is designed to run at 3,000 r.p.m. Special attention has been devoted in the design to meet the particular requirements, especially in the low-pressure section of the machine. The difference in the temperature in each stage is very small, reaching only 150 deg. C. in the high-pressure section.

The shaft of the high-pressure rotor is rigidly coupled to that of the medium-pressure section, while the rotors of the medium- and low-pressure sections are connected by semi-flexible couplings. The fixed connection between the two first stages is provided with a thrust bearing, the two casings being thus free to expand separately without any strain on each other. The various component parts are all so designed as to secure uniform heating. The rotating portion of the high-pressure stage comprises a wheel with two crowns with impulse and reaction blades. The steam-distribution system is of the Brown-Boveri standard type. For the maximum economic output of 20,000 kW, steam is admitted above the impulse wheel which works with total injection at that power. For higher outputs steam is admitted below the action wheel directly to the reaction blades. The low-pressure section comprises two graduated rotors, each half rotor embracing five disks with one or two crowns of reaction blades. As there is no intermediate re-heating of the steam, the later stages of operation in the low-pressure section are associated with very wet steam, to deal with which a special condensed-water exhausting device is fitted. Below the third disk of each half rotor is a canal in which water, by centrifugal action, is collected and thence transferred with the steam used for heating purposes to the feed-water heater. The turbine is directly coupled to a 25,000-kW, 12,000-V, three-phase generator which operates at a power factor of 0.80. The overall length of the set is nearly 50 ft., and as it had to be installed in a room only 60 ft. in width, the exciter and the air-cooling fan had to be mounted above the alternator and separately driven by a small auxiliary turbine.

As a result of the high-pressure-steam working, it is claimed that the Langebrugge plant is now converting into electrical energy 23 per cent. of the calorific energy of coal consumed, against only 14 per cent. in the case of generating stations working at a pressure of 284 lb. per sq. in. The chief engineer of the station, Mr. Herry, is, however, still seeking to make further progress, work being now in hand on the installation of a Benson boiler designed to produce 100 tons of steam per hour at a pressure of 3,200 lb. per sq. in.

B.S.S. for Indicating and Recording Instruments.

Revisions of British Standard Specifications Nos. 89 and 90, dealing with indicating instruments and graphic (recording or chart-recording) instruments, respectively, have recently been issued. The technical requirements of these new specifications are similar to those of the previous editions, with the important exception, however, of the clauses dealing with the marking of the instruments and the issue of test certificates. In the past, difficulties have been experienced in connection with the provision of the independent test certificate required under the conditions governing the use of the British standard mark "BeSa," and in order to facilitate matters a report is now called for in place of the certificate originally required. The substitution of the report for the certificate arises from the fact that "certificates" issued by the National Physical Laboratory have acquired a special significance of their own in the eyes of the public, as something in the nature of a guarantee that the article concerned is a satisfactory one, quite independently of the British standard specification covering the article submitted for test. What is often required, however, is a plain statement from the testing authority to the effect that the article submitted—in this case the instrument submitted—conforms in certain respects to the appropriate British standard specification. Such a statement is now provided as a report, and the information to be furnished in the report is clearly stated in the specification. The significance of the use of the British standard mark "BeSa" on an instrument is also clearly defined in the new specifications, copies of which (Nos. 89-1929 and 90-1929) may be obtained, price 2s. 2d. each, post free, from the Publication Department, British Engineering Standards Association, 28, Victoria Street, S.W.1.

Electrical Slogans.

The slogan "Investigate Electric Heat," won the first prize of $250 in the recent industrial electric heat contest conducted by the Joint Committee on Electric Furnace Development of the National Electrical Manufacturers' Association and the National Electric Light Association. It was submitted by Mr. W. H. Steinhauer, of the Toledo Edison Company. The returns in the contest numbered approximately 800, and evidenced wide interest in the subject of industrial electric heat. Submissions were judged by a committee of three judges —Messrs. R. T. Kaighin, G. W. Tall, Jun., and F. M. Feiker, representing the National Electric Light Association, the National Electrical Manufacturers' Association, and the Society for Electrical Development, respectively. The second prize of $100 was awarded to Mr. C. H. Pfingsthorn for "Switch to Perfection with Electric Heat." "Electric Heat is Cheaper than Rejects" won the third prize of $50, and was submitted by Mr. E. A. Heath. Four other prizes, each of $25, were awarded for: "Use Electric Heat if You Want to Compete"; "Heat Electrically—It Makes Good Products Better"; "Electric Heat—the Production Heat with Laboratory Precision"; and "Safeguard Quality and Lower Costs with Electric Heat."

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Appointments Vacant.

Electrical engineer (£400) for Dumfries County Council. Two charge engineers for the Lancashire Electric Power Co. Assistant lecturer in electrical engineering at Bradford Technical College. Lady canvasser-demonstrator for Preston Corporation. Assistant experimental officer for Government experimental establishment, Biggin Hill, Kent. Lady demonstrator of electric cooking and other appliances for the Cheltenham Corporation Electricity Department. (See our advertisement pages to-day.)

Register of Light-Treatment Practitioners.

The Society of Apothecaries of London, at the suggestion of the British Medical Association, has formed a permanent scientific committee with regard to violet rays, radiation, and so forth, and is preparing a register of those practising light-treatment, so that the public may be protected and safeguarded in securing treatment by fully qualified people.

Educational.

MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY.—Prospectus of degree courses in technology, which include electrical and mechanical engineering and applied chemistry, can be obtained from the Registrar. (See our advertisement pages to-day.)

Institute of Transport.

Sir Josiah Stamp has accepted the office of President of the Institute of Transport in succession to Air Vice-Marshal Sir Sefton Brancker, whose year of office expires on September 30th. Other officers elected by the Council to take office on October 1st, 1929, were: Vice-presidents, Mr. A. L. Barber, Mr. R. Bell, Mr. S. E. Garcke, Mr. R. J. Howley, Sir Alfred Read, and Mr. H. A. Watson. Past presidents to serve on the Council, Sir Lynden Macassey, Sir Joseph Nall, Mr. R. H. Selbie, Mr. Roger T. Smith, and Air Vice-Marshal Sir Sefton Brancker. Honorary treasurer, Sir Henry Maybury. Honorary librarian, Mr. G. Ellson.

Institution of Mining Engineers.

For the general meeting of the Institution at Nottingham from July 10th to 12th an attractive programme of works visits, excursions, and social functions has been arranged. Amongst the papers to be read will be one by Dr. T. F. Wall on the "Electro-magnetic Testing of Wire Ropes."

N.E. England Electricity Scheme.

The Central Electricity Board has published the North-East England Electricity Scheme, which deals with a North-East Coast area of 5,050 sq. miles and will involve the gradual change-over of an extensive 40-cycle system to 3-phase 50 cycles. The scheme is the sixth of the series prepared by the Electricity Commission, and will be outlined in our next issue.

The Clyde "Grid" Crossing.

The River Clyde was closed to traffic for four hours on June 15th at Renfrew when cables were slung across, and crowds of spectators watched the linking up of the tall steel towers on the river banks which carry the 132-kV "grid" across the river.

The Physical Society.

At a meeting held on June 28th, a demonstration of some contact devices used with apparatus for the measurement of electrical resistance at high temperatures was given by Mr. J. L. Haughton, D.Sc., of the National Physical Laboratory.

A paper entitled "The Relation between Hydrogen Pressure and Filament Resistance in a Tube containing Glowing Tungsten" was submitted by Teresa J. Dillon, B.Sc., Ph.D., London School of Medicine for Women, who explained that when the filament is caused to glow, the gas rapidly disappears while the resistance of the filament rises progressively. The latter phenomenon can be used to measure the pressure of the hydrogen, and it was suggested that chemical action took place between the hydrogen and tungsten.

A paper entitled "The Absolute Measurement of Sound Intensity" was read by Mr. F. D. Smith, M.Sc., Admiralty Research Laboratory, Teddington. Sound pressure is received with a moving-coil receiver; the signal heard after suitable amplification is compared with the signal produced by a small known electromotive force e applied to the receiver and when the two signals are equal in intensity the following simple relation connects the total sound pressure P on the receiver with the electromotive force $P = eHl/Z_m$, where H is the strength of the magnetic field in which the moving coil, consisting of a length l of wire, moves, and Z_m is the motional impedance of the receiver at the frequency of the sound. The phase also of the sound can be determined with the aid of a phase-shifting transformer. Since the measurement is independent of the amplifying circuit, it is possible to use a high degree of amplification and very feeble sounds may therefore be measured.

The Heavy Oil Engine.

In our account of the discussion on Mr. G. Porter's paper on the above subject, which was read at the I.M.E.A. Convention, Mr. B. Kelly (Douglas, Isle of Man) was wrongly reported (June 21st issue, p. 1121). What he actually said, *inter alia*, was that their fuel figure, using 0.92 furnace oil costing 75s. per ton, worked out at 0.287d. per kWh generated. He mentioned later that they had now arrived at the state when they required units of from one to three thousand kW capacity, and were therefore putting down steam plant.

Electro-Farming.

In a paper presented to the Fourth International Congress on Rationalisation on "Electro-farming Economics," Mr. R. Borlase Matthews pointed out that electro-farming now had a definite status and a significant influence on the control and elimination of waste and the unnecessary costs of the present agricultural system. For instance, in nearly three hundred different ways labour could be saved by the use of electricity and a reduction in cost effected because electro-farming methods meant increased production. Thus the farmer gained a two-fold advantage, and the fact that he was enabled to increase his production would ensure abundant employment for the agricultural worker. The latter, freed by electric motors from such distasteful tasks as liquid-manure pumping, would be free for other work. Until intensive cultivation became the universal practice, there would be no need to worry about the displacement of man labour by electricity.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. J. WILLIAMS, technical assistant to the city electrical engineer, Salford, has been appointed technical assistant to the engineer, South-East England, Central Electricity Board. Mr. Williams was for many years on the staff of the Yorkshire Electric Power Co., and held successively the positions of assistant engineer in the Operation Department and superintendent of the Testing Department. On the occasion of his departure from Salford, Mr. Romero (city electrical engineer), on behalf of the staff, presented Mr. Williams with a sectional bookcase; a presentation of a camera was also made by Mr. Bunting on behalf of the members of Mr. Williams's department.

Mr. T. E. EACHUS, of St. Albans, superintendent of the Northern area of the North Metropolitan Electric Power Supply Co., who is leaving to become managing director of the Young Battery Co., Ltd., of South London, was on June 18th presented by the staff at St. Albans with a card table and an album containing the names of the subscribers from the company's undertakings at Harpenden, Hertford, Royston, Stevenage, and Welwyn, and the Overhead Line Department. Mr. Eachus has been with the company for 24 years, 21 of which he has spent at St. Albans.

Prof. RICHARD STANFIELD, M.Inst.C.E., M.I.Mech.E., &c., retires at the end of this session from the professorial chair which he has so successfully held for 40 years at Heriot-Watt College, Edinburgh. A committee has been formed to follow up the desire that has been widely expressed that the occasion should not be allowed to pass without some demonstration being made to the Professor of the high esteem in which he is held by thousands of students and others who have benefited from his instruction and friendship at the College. These and other admirers are invited to send subscriptions to the Hon. Treasurer, Mr. Wm. Watson, M.A., B.Sc., Heriot-Watt College, Edinburgh, as early as possible, and not later than September 15th. The presentation will take place in October, but its exact nature will be decided later in consultation with Prof. Stanfield. The joint hon. secretaries, Messrs. W. F. Oliver and A. Neilson, are anxious to be brought into touch with former students whom they cannot trace.

The marriage took place at Areley Kings Church, on June 10th, of Mr. PERCY NEALE MURDOCK, A.M.I.E.E., of Kingstown, Ireland, and Miss CHRISTABEL ELIZABETH TURNER, of Stourport.

The Basingstoke Town Council has granted an honorarium of £75 to the borough electrical engineer, Mr. SWABRICK, and one of £40 to Mr. CASTLE, for additional services in connection with extensions in the rural area.

The Times reports that the King of Italy has conferred the hereditary title of Marchese on Senatore MARCONI.

The Pretoria Town Council has appointed Mr. L. L. HORRELL electrical engineer and manager of its electricity

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department at a salary of £1,200-£1,375 per annum. Mr. Horrell has been connected with the department as assistant electrical engineer for the last 20 years. Before going to South Africa, as may be remembered, Mr. Horrell was on the staffs of the Bedford, Coventry, and Walsall electricity undertakings. His early mechanical training was gained at the old Great Northern Railway works at Peterborough.

The Southend-on-Sea Town Council has granted the borough electrical engineer, Mr. R. BIRKETT, a further three months' leave of absence owing to the condition of his health.

The Marconi International Marine Communication Co., Ltd., announces that Major BASIL BINYON, O.B.E., has been appointed a director of the company, and that the following rearrangement of duties of its higher officials will be effective from July 1st:—Mr. J. Lewis, personal assistant to Mr. F. S. Hayburn, deputy managing director; Messrs. A. R. Harding and R. Ferguson, joint general managers; Mr. J. A. Carswell, general manager for the North; Commander J. A. Slee, manager marine electrical equipments; Mr. W. Platt, manager, B.W.M.S. (vice Mr. R. Ferguson); Mr. J. Connell, deputy manager, B.W.M.S.; and Mr. B. Newton, contract manager (vice Mr. A. R. Harding).

The borough electrical engineer has informed the Brighton Electricity Committee that he has appointed Messrs. P. H. PEAKE and G. A. ROBERTS as sub-station attendants at the Southwick power station; that Mr. ANDERSON, one of the existing sub-station attendants, has obtained another appointment, and that he has appointed Mr. L. BROWN to fill the post.

The Bangor (Northern Ireland) Town Council has appointed Mr. R. S. IRWIN, of the Clones Electricity Co., as manager and engineer of the Bangor electricity scheme, at a commencing salary of £350.

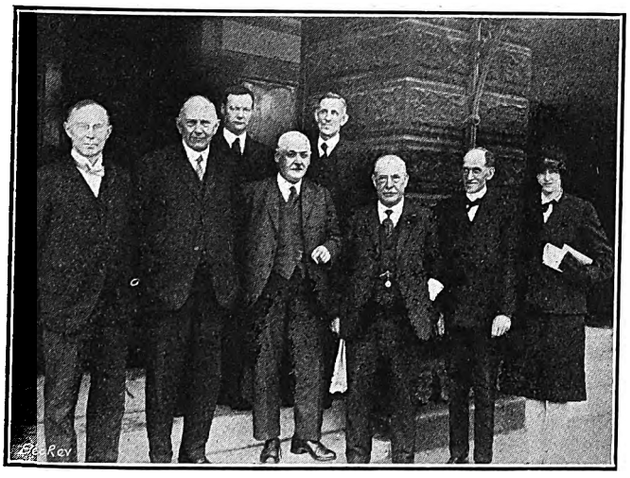
On the occasion of his leaving Odhams Press, Ltd., to join Edison Storage Batteries, Ltd., as assistant manager, Mr. W. E. WARRILOW, A.M.I.E.E., was presented with a cut glass vase and a silver salver bearing the signatures of his colleagues in the advertisement department.

A Manchester paper reports that Mr. W. S. JOHNSTON, manager of Dumfries electricity works, has been appointed manager of St. Helens electricity works at a salary of £800, rising to £1,000.

Fulham B.C. Electricity Committee recommends the appointment of Mr. E. CORNEY, relief charge engineer, as charge engineer, at an inclusive salary of £364 per annum.

Mr. R. W. LEEK has resigned his position as a director of Messrs. Devereux, Moodie & Co., Ltd., of Newcastle-on-Tyne and Durham, and has joined the firm of J. Mayo & Co., of Newcastle-on-Tyne, North Shields, and Hull.

The inaugural meeting of the North-West Midlands Joint Electricity Authority was held at Stoke-on-Trent on Monday last week. Sir HARRY HAWARD, Electricity Commissioner,



J. Templeman] *[Stoke-on-Trent.*

Stoke-on-Trent Officials at the N.W. Midlands J. E. A. Meeting.

outlined the objects of the new authority. Alderman H. LEESE (Stoke) was appointed chairman and Mr. W. A. FURMSTON (Leek Urban District Council) vice-chairman. A photograph of the Stoke officials taken after the meeting is reproduced herewith. The group includes Ald. Leese, Ald. G. Hassall, Ald. S. Sproston, Mr. J. Kent, Mr. C. H. Yeaman (chief electrical engineer of the Stoke-on-Trent undertaking), and Mrs. Yeaman.

Obituary.—MR. H. J. S. MACKAY.—Many people in the electrical industry will learn with regret of the death on June 19th of Mr. Henry John Sutherland Mackay, managing director of the Stirling Boiler Co., Ltd., at the age of 57. Mr. Mackay was educated at Glasgow University and the Technical High School, and served his apprenticeship with Messrs. Alex. Chaplin & Co., Govan. He also spent a term with Messrs. D & W. Henderson. From 1897 until the following year he was chief engineer in charge to Messrs. McLeay & McIntyre. He then went to the National Boiler & General Insurance Co., Ltd., as inspecting engineer, later becoming assistant chief engineer. He joined the Stirling Boiler Co. in 1902 as an engineer and became successively London manager and

The late Mr. H. J. S. Mackay.

Managing Director of the Stirling Boiler Co., Ltd.

general manager. He was appointed managing director of the company in 1916, and held that position at the time of his death. Mr. Mackay was a member of the Institutions of Mechanical Engineers and Marine Engineers, and an associate member of the Institute of Naval Architects. The funeral took place on Saturday last. A portrait of Mr. Mackay is reproduced herewith.

MR. R. MARSHALL.—The death has occurred in Kent of Mr. Roland Marshall, who was for 20 years chief electrical engineer to the Ayr Corporation. He was appointed in 1903 and retired on pension in 1923 when the Ayr electricity undertaking was taken over by the Ayrshire Electricity Board. Before his appointment to Ayr he was in the service of Mr. Robert Hammond, who, as consulting engineer, was responsible for the laying down of the Ayr station, and he took part in that work. During his 20 years' service with the Corporation Mr. Marshall was responsible for important additions to generating plant and extensions of mains. Latterly he was actively concerned on the project for making use of the water power of Loch Doon for the Ayr supply, and spent a great deal of time in working out details for the promotion of the scheme. It was a matter of great regret to him when the Town Council abandoned the scheme, relinquishing the powers which it had obtained to the Ayrshire Electricity Board. Mr. Marshall, who was unmarried, was about 56 years of age.

MR. C. W. HILL.—We have to record with feelings of personal regret, in which, we are sure, we shall be joined by many friends in the electrical profession and industry, the death of Mr. Claude W. Hill, A.M.Inst.C.E., M.I.E.E., M.I.Min.E. Mr. Hill was for many years past a well-known consulting engineer, but prior to this he had been connected with the management of many electrical plant manufacturing companies. As consulting engineer he was responsible for various important bridges, saw mills at home and abroad and other important works. He was the author of a well-known book on "Electric Crane Construction" and of another on "Toothed Gearing." He was a valued contributor to the ELECTRICAL REVIEW, his last article being on "Potentiometer Regulators" in our issue of June 7th. The funeral was to take place on Wednesday last at Streatham Park Cemetery.

MR. S. O. ALLEN.—We regret to record the death, in Liverpool, of Mr. Sidney O. Allen, district manager of the North-Western area of the Post Office Telephones.

HERR M. KUBIERSCHKY.—The death recently occurred suddenly in Rio de Janeiro of Herr Martin Kubierschky, the general director of the Mix & Genest Co., of Berlin. The deceased, who was 60 years of age, was visiting South America on behalf of his company, and was a leading authority on automatic telephony.

Will.—Mr. F. B. PELL, Associate I.E.E., of Leigh-on-Sea, left £1,895 gross and £612 net personalty.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

General Installation Co., Ltd.—Private company. Registered June 15th. Capital, £100 in £1 shares. Objects: To carry on business as electrical and general engineers, builders, contractors, &c. The directors are:—F. de C. Grylls, 183, Edgware Road, W.2, merchant; E. L. S. Wolf, B.Sc., 57, Thurleigh Road, S.W.12, engineer. Registered office: 183, Edgware Road, W.2.

Vandervell Electric Reproducing Co., Ltd.—Private company. Registered June 15th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, erectors, maintainers and repairers of and dealers in all wireless, telegraphic and telephonic apparatus, valves, instruments, equipment and accessories, &c. The subscribers (each with one share) are:—E. H. Wiseman, 8, Severn Avenue, Gidea Park, Romford, Essex, clerk; S. E. Penhallow, 112, Regent Street, W.1, clerk. Solicitors: J. D. Langton & Passmore, 111, Old Broad Street, E.C.

Swift Transports, Ltd.—Private company. Registered June 17th. Capital, £10,000 in £1 shares. Objects: To carry on the business of proprietors of light railways and tramways, trolley vehicle systems, lorries, omnibuses, and motor and other vehicles, &c. The subscribers (each with one share) are:—W. N. Browning and W. H. Lovett, 16, Great George Street, S.W.1, clerk. J. S. Brockley signs as director. Registered office: Staines Road, Hounslow.

Clarith Reproducers, Ltd.—Private company. Registered June 17th. Capital, £2,000 in £1 shares. Objects: To acquire the business now carried on by J. I. Smith and A. E. Clarke at 3, Queen Square, Leeds, as the "Clarith Reproducers," including the registered trade mark "Clarith," and to carry on the business of designers and manufacturers of and dealers in all kinds of apparatus for wireless transmission and reception of both sound and pictures, gramophones, sound recorders, amplifiers and producers, &c. The subscribers (each with one share) are:—A. E. Clarke, 3, Queen Square, Leeds, consulting engineer; J. I. Smith, Swalewell Hall, Pudsey, Yorkshire, gramophone manufacturer. Solicitors: Simpson, Curtis, Dixon and Burrill, Leeds.

Harmonic Radio Co., Ltd.—Private company. Registered June 21st. Capital, £100 in £1 shares. Objects: To carry on the business of wireless engineers, manufacturers of and dealers in radio apparatus, &c. The first directors are:—B. H. J. Kynaston, 172, Trent Boulevard, West Bridgford, radio engineer; J. Kynaston, 172, Trent Boulevard, West Bridgford, cashier. Registered office: 13, Forman's Buildings, Goldsmith Place, Nottingham.

Woodall & Partners (1929), Ltd.—Private company. Registered June 20th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for, and dealers in all kinds of plant, machinery and electrical equipment, contractors for the installation of all kinds of electrical appliances, &c. The directors are:—E. S. Hare, 47, Port Tennant Road, Swansea; Dorothy Alexander, Tea Tree Cottage, Fetcham, Surrey.

Weinbau Incandescent & Electrical Co., Ltd.—Private company. Registered June 19th. Capital, £10,000 in £1 shares. Objects: To acquire the business of merchants, warehousemen, manufacturers, importers, and exporters of and dealers in incandescent gas light apparatus and fittings, electric lamps and bells, electric meters and switchgear, all kinds of electrical fittings and accessories, and all other appliances appertaining to lighting and heating, formerly carried on by M. Weinbaum at 419-423, Commercial Road, E.1. The permanent directors are:—M. Weinbaum (governing director), and A. H. Weinbaum, both of 56, Amhurst Park, N.16. Registered office: 419, Commercial Road, E.1.

Norcold, Ltd.—Private company. Registered June 24th. Capital, £30,000 in £1 shares. Objects: To adopt an agreement with S. Smith and J. D. Tait, to develop and turn to account all rights now held by them in the "Narco" refrigerating system (U.S.A. and Canadian rights excepted) and the assets comprised in the said agreement, and to carry on the business of manufacturers of, agents for and dealers in refrigerating apparatus and machinery, stoves, heating apparatus, electrical machinery and components, air compressors, household utility apparatus, &c. The directors are:—J. D. Tait, Strand Palace Hotel, Strand, W.C.; J. D. Wilson, 33, Herondale Avenue, S.W.18; S. Smith, 67, Westborough, Scarborough. Secretary: J. D. Tait. Registered office: Bush House, Aldwych, W.C.2.

Associated Electrical Supplies, Ltd.—Private company. Registered in Belfast on June 11th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical supplies, apparatus and plant, &c. The directors are:—J. P. Graham and C. J. Graham, Lagan Mills, Dromore, building and engineering contractors. Registered office: Lagan Mills, Dromore, Co. Down.

Official Returns of Electrical Companies.

Triotone, Ltd.—Debenture dated June 7th, 1929, to secure £700, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. K. Brown, Lennox House, Norfolk Street, W.C.2.

S. B. Hereford, 41, Wigmore Street, W., was appointed receiver and manager on June 12th, under powers contained in debenture dated June 7th, 1929.

Richmore Valve Co., Ltd.—C. H. Shelvoke, 33, New Hall Street, Birmingham, was appointed receiver on June 7th, 1929, under powers contained in debentures dated October 18th, 1928.

Oldhill Manufacturing Co., Ltd.—Debenture dated June 1st, 1929, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Rebecca Cohen, 22, Lealand Road, Tottenham, N.15.

Flexible Electric Cords, Ltd.—Debenture dated May 30th, 1929, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. G. A. Riley, The Ridgway, Enfield.

Colne Valley Electric Supply Co., Ltd.—Satisfaction to the extent of £2,325 on May 31st, 1929, of debenture stock secured by trust deeds dated July 4th, 1925, and November 20th, 1926, securing £100,000.

"M.P.A." Wireless, Ltd.—Issue on June 12th, 1929, of £5,370 debentures, part of a series already registered.

Micanite & Insulators Co., Ltd.—Satisfaction in full on May 24th, 1929, of debentures dated March 26th, 1908, and November 20th, 1916, securing £25,000.

James Boardman, Ltd.—Mortgage dated June 3rd, 1929, to secure £500 charged on land and buildings in Blackburn. Holders: H. S. Haworth and P. Haworth, 7, Lord Street West, Blackburn.

Kinetic Co., Ltd. (Old Company).—T. Rimington, 43, Gallowtree Gate, Leicester, ceased to act as receiver or manager on June 8th, 1929.

J. Smith & Son (Brighton), Ltd.—Two mortgages, dated June 3rd, 1929, to secure £2,500 and £5,000, respectively, charged on the company's undertaking and property, including uncalled capital. Holders: Mrs. M. A. Smith, 21, Windlesham Gardens, Brighton; and J. D. Smith, Hills Down, Heath Road, Haywards Heath.

Robinson & Rex, Ltd.—Debenture dated May 25th, 1929, to secure all sums not exceeding £400 for which the chargee may become liable by virtue of his guarantee to Barclay's Bank, Ltd., charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. J. Mott, 12, York Buildings, Adelphi, W.C.

Eddystone Components, Ltd.—Satisfaction in full on April 14th, 1928, of second mortgage debenture dated June 30th, 1927, securing £1,000. (Notice filed June 18th, 1929.)

"K.N." Electrical Products, Ltd.—Debenture dated May 31st, 1929, to secure £1,000 charged on the company's property and assets, present and future, including uncalled capital. Holder: P. Ferguson, "The Garth," Grange Road, Highgate, N.6.

Electro-Dynamic Construction Co., Ltd.—Memorandum of deposit on June 10th, 1929, to secure all moneys due or to become due from the company to Barclays Bank, Ltd., charged on lease of premises in rear of 733b, Old Kent Road, S.E.

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City Notes.

Electric Supply Corporation, Ltd.

The annual meeting was held on June 17th, Mr. J. G. B. Stone (chairman) presiding. In presenting the report and accounts (ELEC. REV., June 14th, p. 1066), the chairman said that the lamp connections showed an increase of 7 per cent., and the electrical energy sold for all purposes increased by 5½ per cent. to over 11½ million kWh, the demand for domestic power and heating showing an increase of 12 per cent. Gross earnings were practically stationary because of reductions in charges to consumers. Reviewing the position of the subsidiary companies, the chairman said that the sale of the Dollar and Jedburgh undertakings was made at satisfactory figures, and the whole of the share capital of the Steyning Electric Light Co., Ltd., had been purchased. The Steyning Company had applied for an extension of its area which would join up with Hassocks on one side and would extend its field of operations to Pulborough. The Alton Company had applied for an extension of its area to cover the whole of the Alton rural district, and the Petersfield Company had applied for the whole of the Petersfield rural district and a small portion of Midhurst rural district. If those applications were successful the associated companies would have control of electricity supply over a large and compact area in Central Sussex. In this area there was the Burgess Hill undertaking, owned by another company, which they had arranged to supply in bulk. The Central Sussex Electricity, Ltd., had also applied for an extension of the Haywards Heath area. The supply of electricity in the area of the Uckfield Act and in that of the Hassocks and Hurstpierpoint Order had been deferred as a result of the passing of the Electricity Act of 1926, pending the adoption of a scheme for the district by the Central Electricity Board. The progress of the Haywards Heath undertaking had been hampered for the same reason. After considerable negotiations, through the good offices of the Central Electricity Board, the company had been able to secure a supply of electricity in bulk somewhat earlier than it would otherwise have been available under their scheme. It was hoped that that supply would be delivered at Hurstpierpoint by the end of the year, and the company had undertaken to distribute it from there throughout the area in question. A bulk supply from Portsmouth to Petersfield had not yet been obtained, but it was hoped that it would be available shortly, when it was proposed to change over the present system of supply. New plant had been installed at Alton and Newhaven. A Special Order was being promoted for the transfer of the Exmouth undertaking to a local company in exchange for shares in that company. When those shares had been obtained, it had been agreed to dispose of them and those of the Wellington Company on satisfactory terms. There had been considerable delay in the construction of the power station at Peterhead, but it was now nearly completed, and the machinery was in course of erection. The report and accounts were adopted.

United River Plate Telephone Co., Ltd.

The annual meeting of this company was held on June 18th. Mr. H. M. Pease (deputy chairman) who presided, in submitting the report and accounts (*vide* ELEC. REV., June 21st, p. 1114) referred to the offer of the purchase of the holdings of the ordinary shareholders by the International Telephone and Telegraph Corporation of New York, which offer was accepted by the majority of shareholders. It was the wish of the Corporation that all the original directors should remain on the board, but while this could not be arranged they were glad that Mr. Kingsbury, Mr. Anns and Mr. Howard-Williams were able to continue to act. The company had continued to make fair progress, but the accounts had been adversely affected by the cancellation in October last of the increase in tariffs granted in October, 1922, without the company being heard. Another difficulty had been a serious strike which took place in Rosario last July, which resulted in considerable loss before a settlement was arranged, and later in the year they were threatened with a strike in Buenos Ayres, and an arrangement was not come to with the men until early in March. This arrangement would entail a considerable increase in the working expenditure, and they were looking to the Argentine Government to sanction adjustments of the tariffs, so as to enable the company to earn a reasonable return. The total capital expenditure during the year amounted to £1,096,757, which included £754,034 for new exchanges and extensions of the system. The number of stations had increased during the year by 16,684 and the total was now 194,566. Of these 131,154 were in Buenos Ayres and suburbs. The programme of converting the manual-operated exchanges in Buenos Ayres to automatic had been continued and the most important exchange known as the "Avenida" was changed over in a new building built for that purpose and also for housing the administrative and accounting departments. Extensions were also carried out to other automatic exchanges and over 60 per cent. of the equipment in the capital was now actually working on an automatic basis. At the present moment equipment equal to 53,000 lines was in course of installation or manufacture. When this was completed—at about the end of 1931—Buenos Ayres would be approximately 90 per cent. automatic. The laying of the underground trunk cable between Buenos Ayres and Rosario had been postponed, but carrier equipment enabling several conversations to be superimposed upon the existing circuits had been installed and would shortly be brought into service. Carrier equipment had also been installed between Buenos Ayres and Bahia Blanca and this was expected to be opened for public service shortly. Practically all of their 430 exchanges in the Argentine Republic were connected to the city of Buenos Ayres. The total mileage of single wire provided was now approximately 703,000, of which 50,000 miles represented aerial long-distance and junction lines. The staff had increased from 10,500 to 10,601. The report and accounts were adopted.

Electric Construction Co., Ltd.

The annual general meeting was held on June 18th, the managing director (Mr. James Gray) presiding in the absence of the chairman through indisposition. In submitting the report (*vide*, ELEC. REV., May 31st, p. 977), Mr. Gray said that it was with much regret that the directors submitted accounts showing a large reduction in net profit. This would appear the more inscrutable when he told them that the demand for electrical machinery had been well maintained during the past financial year. The volume of work produced, stated in kilowatts, exceeded the previous year by 40 per cent., and, in fact, was the largest output that the company had accomplished. This activity was probably general, but the supply for the time being exceeded demand, and prices had consequently drifted to a level which left little or no margin over the costs of production. It would interest them to know that the average reduction in prices during the past five years had been not less than 30 to 40 per cent. On two previous occasions they had indicated how the operation of the Electricity Act, 1926, should benefit them, and while much had been accomplished by the Central Electricity Board, their orders so far had been chiefly for large turbo-alternators and high-pressure distribution lines, in the manufacture of which they were not engaged. When the time arrived, however, for replacing the present 25 cycle motors, manufacturers like themselves would have a better opportunity of obtaining a share of the developments now proceeding. Reviewing the whole position, they did not take a pessimistic view of the prospects. They felt that the conditions were only transient, and were capable of being solved by manufacturers themselves. It was in this spirit that the board decided to transfer £10,000 from the dividend equalisation fund to enable a final dividend on the ordinary shares to be paid this year. This fund was constituted entirely from undistributed profits after the war with the intention of providing against evil days, and, much as they regretted the necessity of drawing upon the fund, they thought that they were entitled to a little credit for foresight which was not conspicuous among many larger concerns at that time. The report was adopted.

Whitehall Electric Investments, Ltd.

The annual meeting was held on June 20th. The Hon. Clive Pearson (chairman) presided, and in presenting the report and accounts (ELEC. REV., June 21st, p. 1114) said that an agreement was signed in October last for the sale of holdings in the various Chilean and Mexican companies to the American and Foreign Power Co., Inc. The sales of their investments realised a profit of £2,738,793. Referring to the formation of Hallminster Investments, Ltd., and Whitehall Canada, Ltd., these subsidiary companies would act as preliminary investigators and only the finally selected investments would take their place among the securities held direct by the company. Through the intermediary of Whitehall Securities Corporation, Ltd., they had acquired controlling interests in a number of companies operating electricity undertakings in Devon and Somerset. Statutory powers were being obtained for the development of a large area in which these undertakings would be linked up by h.p. transmission lines, and the service extended to neighbouring towns and villages. The provision of a bulk supply of electricity was being negotiated and energy would also be available from the "grid" when in due course this reached the district. So far as plans had matured, this enterprise would require an investment of some £750,000 over the next two or three years. The extensions which would be made in the system of distribution would reach many districts not yet served, and it was anticipated that at the same time the *per capita* consumption of the present users of electricity would respond to the improved facilities which would be provided. The directors were considering other investments in electrical and other public utility undertakings, in some of which they anticipated obtaining share control. The company's assets had been considerably increased, and its earning capacity consequently enhanced. The trustees for the debenture stock holders held shares and securities having a value of over £5,000,000. The report and accounts were adopted.

General Electric Co., Ltd.

The profit for the year ended March 31st last amounted to £1,084,078, as compared with £1,057,867 in 1927-28. A balance of £338,456 brought forward is added, making £1,422,534. From this are deducted debenture interest, depreciation (£206,055), contribution to pension fund (£24,662), and preference dividends, and £130,000 (as last year) is put to reserve. It is proposed to maintain the ordinary dividend at 10 per cent., and £362,072 remains to be carried forward. The directors point out that the gradual improvement referred to in last year's report has been maintained. During the period the company's works have been fully employed. The output, both

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at the heavy engineering works and at the telephone works, has reached a high level, and the volume of orders received has been satisfactory. The demand for general electrical commodities has shown a steady expansion, which has to some extent counteracted a tendency towards lower prices. The volume of overseas trade has been well maintained. The branches in India and Argentina have had another successful year, and some improvement occurred in South Africa. In Australia and China, however, conditions have remained difficult. The growth of the company's business has called for additional accommodation for both the manufacturing and sales organisations. New h.p. switchgear and transformer works have been erected at Witton, and the head office has been extended by the purchase of adjoining premises. The liquid resources of the company have been reduced from £1,780,000 to £1,519,000. The number of employés at the end of March last was 22,237. The annual meeting is to be held at Magnet House on July 4th.

Delhi Electric Supply and Traction Co., Ltd.

The accounts for the year ended December 31st last record a net profit of £59,558 against £49,639 in 1927, the conversion rate being 1s. 4d. per rupee in each year. Since January 1st, 1929, the rate has been raised to 1s. 6d. After adding profit on exchange, interest, &c., and deducting expenses there remains £62,887 to which is added £1,582 brought forward, making £64,469. The general reserve receives £25,028, £10,000 is allocated to depreciation and renewals, £8,000 to taxation reserve and £1,500 to staff benefit. A final dividend of 8 per cent. is recommended, making 12 per cent. for the year, as for 1927. Negotiations are in hand for obtaining a bulk supply from the Government power station at New Delhi. Reductions in charges were made in November last and further reductions are contemplated, dependent upon favourable terms for the bulk supply. Mr. K. A. Scott-Moncrieff has been appointed to the board. An extraordinary meeting is called for July 1st for the purpose of considering resolutions dealing with the directors' remuneration, the capitalisation of profits, &c. It will also be proposed that the capital of the company be increased to £200,000 by the creation of 30,000 new shares of £1 each, and that £50,000 of the undivided profits be capitalised for distribution as bonus shares to the existing shareholders. These resolutions, if passed, will be submitted for confirmation at the annual meeting on July 17th.

Stock Exchange Notices.

The officially undermentioned have been ordered to be quoted:—

Chelsea Electricity Supply Co., Ltd.—8,989 ordinary shares of £1 each, fully paid, Nos. 425,489 to 434,477.

Constantinople Telephone Co.—£1,496 six per cent. certificates (bearer) of £22 each, fully paid, Nos. 4,353 to 4,399 and 4,401 to 4,421.

Ever-Ready Co. (Great Britain), Ltd.—395,200 ordinary shares of 5s. each, fully paid, Nos. 1,976,001 to 2,371,200.

Mersey Power Co., Ltd.—550,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 550,000.

Underground Electric Railways Co. of London, Ltd.—2,949 ordinary shares of £1 each, fully paid, Nos. 7,164,609 to 7,167,557.

Callender's Cable and Construction Co.—186,000 ordinary shares of £1 each, fully paid, Nos. 930,001 to 1,116,000.

Dealings in the following have been allowed by the Committee under Rule 159:—

British Electric Traction Co., Ltd.—19,788 new deferred ordinary shares of £1 each, fully paid, Nos. 214,482 to 234,269.

Application has been made to the Committee to allow the following to be officially quoted:—

Central Electricity Board.—£3,000,000 Central Electricity 4 per cent. stock, 1959-89, scrip fully and partly paid.

Lisbon Electric Tramways, Ltd.

The report for the year ended December 31st last shows a net profit of £161,399, as compared with £161,876 in 1927. A balance of £17,587 brought forward is added, making £178,986. From this £50,000 is transferred to reserve, £10,000 to exchange reserve, and £10,000 to the staff benefit fund. A final dividend of 4 per cent. is recommended on the ordinary shares, making 7 per cent. for the year, as against 6 per cent. in the previous year, leaving a balance of £16,880, carried forward. During the year the number of passengers carried increased by 8,293,536 to 112,874,963. The report refers to the death of Mr. A. O. Kolkhorst, the general manager and chief engineer, and the appointment of Mr. R. H. Harvey as his successor.

British Electric Traction Co., Ltd.

The accounts of this company were abstracted in our issue of June 7th, p. 1022, and the annual meeting was held on June 17th. Mr. J. S. Austen (chairman), who presided, said that the profits for the past year showed an advance of £17,000. The holding in the London and Suburban Traction Co. had been sold. That was an amount of nominally over £850,000, and was the largest holding the company had in any single undertaking. Referring to the sale of the Shropshire, Worcestershire and Staffordshire Power Co., in which they held about one-third interest, it was rather difficult to give the exact amount of profit which was made out of the deal, because the shares were mainly held by associated companies of which they did not hold the entire share capital, but the profit came nearer £700,000 than to £600,000. With regard to earnings, at the moment they were lagging behind the capital value. The reason for that was merely that they had received money which was not immediately remunerative. The chairman concluded with a reference to the retirement of Mr. Garcke. The report and accounts were adopted.

Brazilian Traction, Light and Power Co., Ltd.

The annual meeting was held in Toronto on June 20th. Mr. Miller Lash (president), in calling attention to the reconstruction and extension of the mechanical shops in Rio de Janeiro and Sao Paulo, pointed out that their scope was not limited to repair work, but a great deal of material required for the company's business was manufactured in them more quickly and at less cost than if the material was imported. In referring to the telephone section of the enterprise, he mentioned that the installation of the automatic telephone system at Bello Horizonte was being proceeded with, and the telephone system in the neighbourhood of Cataguazes, consisting of about 1,000 telephones and 1,200 km. of toll lines, was being acquired. The company had acquired two telephone companies during the year. The report and accounts were adopted.

Marconi's Wireless Telegraph Co., Ltd.

The directors announced last week that sufficient shares of the company had already been deposited with the Bank of England under the Merger Plan to warrant their concluding that the required percentage of "assented" shares would be obtained to enable the Plan to become operative. Having regard, however, to the imperial and national importance of the scheme, they expressed the hope that the number of "assented" shares would be much in excess of the minimum required merely to put the Plan into operation. Consequent upon this announcement it was stated that the committees formed for the protection of the holders of the company's £1 shares had decided that owing to insufficient support they did not intend to proceed with their scheme for the formation of a holding trust. Those who do not assent to the Merger Plan will remain shareholders of the Marconi Co.

Swedish-Mexican Telephone Company.

The report for 1928 of the Mexikanska Telefon A.B. states that the company has obtained a renewed concession from the Government within the Mexican Federal Area for a period of 50 years in place of the old concession which would have expired in 1933. During last year there was an increase in the number of connections, both in Mexico City and in the country's network; the local systems in Pachuca and Morelia were taken over, and the extension of the general network and interurban lines proceeded in a satisfactory manner. The accounts show net profits of 1,224,000 kr., and the dividend remains at 18 kr. per share.

Victoria Falls and Transvaal Power Co., Ltd.

A final dividend of 1 per cent. (making the maximum of 10 per cent. for the past year) has been declared on the preference shares, together with a dividend of 3 per cent. in respect of the half-year ending June 30th. The final ordinary dividend is 12 per cent., less tax, making 15 per cent. for the year (as for 1927).

Chadburn's (Ship) Telegraph Co., Ltd.

The report for the year ended March 31st last shows that after certain sums have been written off for depreciation, &c., and a debit balance of £1,570 in the previous year has been allowed for, there remains £5,022. The directors propose to pay dividends on the preference shares, leaving £1,422 to be carried forward.

Major & Co., Ltd.

The profit for the year ended March 31st last was £12,190, to which is added £1,252 brought forward, making £13,442. The directors recommend that dividends be paid on the preference shares, leaving £2,942 carried forward. The position of the company has so far improved that it is hoped to resume payment of dividends next year on both classes of ordinary shares.

Meters, Ltd.

Speaking at the annual meeting on June 20th, the chairman (Mr. G. H. Braddock) said that the past year had been one of considerable anxiety to the management owing to the reduced demand for meters and to certain changes in types. Their electricity meter company, British Electric Meters, Ltd., continued to progress, and bade fair to prove a successful and valuable property soon.

Greenwood & Batley, Ltd.

The net profit for the year ended March 31st last was £28,385, to which is added £13,459 brought forward, making £41,844. After allocating £6,000 to depreciation, the directors recommend a final dividend of 2½ per cent. on the ordinary shares, making 5 per cent. for the year (same as last year), and £11,397 is carried forward.

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Worcester Electric Traction Co., Ltd.

The net profit for 1928 was £8,113, to which is added £1,539 brought forward, making £9,652. The directors propose to place £2,738 to reserve, and pay a dividend of 5 per cent. for the year on the ordinary shares, leaving £2,144 carried forward. The whole of the tramways and light railways of the company were taken over by Worcester Corporation on May 31st, 1928, and the completion of the purchase took place on March 1st last.

Edmundson's Electricity Corporation, Ltd.

The report for the year ended March 31st last states that the 4½ per cent. first mortgage debenture stock, amounting to £328,077, has been redeemed. The net profit for the year was £149,272, after providing for income-tax and debenture interest to date of redemption (against £125,083 for 1927-28). A balance of £38,388 is added, making £188,660. From this the preference dividend is paid; £8,501 is written off capital expenses; £25,000 is placed to reserve; and £3,000 to staff benevolent fund. It is proposed to pay a final ordinary dividend of 4½ per cent., making 8 per cent. for the year in the case of the old shares (against 10 per cent.), and leaving £34,159 to be carried forward. Sir James Devonshire, K.B.E., and Sir Douglas Newton, K.B.E., M.P., have been appointed directors, and the former has been elected chairman.

J. G. White & Co., Ltd.

The net profit for the year ended February 28th last was £71,661, to which is added £5,157 brought forward, totalling £76,818. Dividends paid absorb £72,000, leaving £4,818 carried forward.

Rothesay Tramways Co., Ltd.

The net profit for 1928 was £4,513, and after setting aside £4,022 for depreciation and adding £1,855 brought forward, there remains £2,346. The directors propose to pay a dividend of 5 per cent. on the preference shares, leaving £1,846 carried forward.

W. T. Henley's Telegraph Works Co., Ltd.

The directors recommend a final dividend on the ordinary shares of 2s. 6d. per share, making, with the interim dividend of 1s. 6d. per share already paid, 4s. per share for the year, as for 1927-28. They also recommend a cash bonus of 2s. per share (against 1s.).

Edgar Allen & Co., Ltd.

The net profit for the year ended March 31st last was £16,783, as compared with £22,366 in 1927-28. It is again proposed to pay a dividend of 2½ per cent., free of tax, for the year on the ordinary shares, leaving £7,101 carried forward.

Wemyss and District Tramways Co., Ltd.

The net profit for 1928, including £167 brought in, was £7,817, and after providing for reserves in subsidiary companies (£4,096), interest (£6,560), debenture stock redemption account (£200), and placing £1,000 to reserve, there is a balance carried forward of £56.

A Large Japanese Issue in America.

An issue of $11,450,000, three year, 6 per cent. gold notes of the Toho Electric Power Co., Japan, at a price yielding over 7.40 per cent. was offered in New York last week.—*Reuter.*

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

City of London Radio Corporation, Ltd.
Southern Lighting & Ignition Co., Ltd.

Montreal Light, Heat and Power Consolidated.

A dividend has been declared on the common shares of $0.60 per share for the quarter ending June 30th.

East African Power and Lighting Co.

The directors recommend a dividend on the ordinary shares of 6½ per cent.

French Companies.

The *Société de Manufacture Parisienne de Fils et Cables Electriques* reports net profits for 1928 amounting to 173,000 fr.; the dividend is 10 per cent.

The *Société des Etablissements Gaiffe-Gallot et Pilon* records a net surplus of 2,399,000 fr. for 1928, including the balance forward; a dividend of 30 fr. per share is being paid.

The *Société de Constructions Electriques de France* records gross profits of 10,297,000 fr. for 1928, as against 10,962,000 fr. in the previous year. The net profits, which have been carried forward, amount to 851,000 fr., as compared with 129,000 fr. in 1927.

The *Compagnie Parisienne de Distribution d'Electricité* reports gross profits of 108.8 million fr. for 1928, as compared with 103.6 millions in the previous year. The net profits are returned at 35.4 million fr., permitting of the payment of a dividend of 65 fr. per share, as in 1927.

Stocks and Shares.

MONDAY EVENING.

THERE are too many counter-attractions for the ordinary man and woman to pay any particular heed to Stock Exchange markets at the present time. With the end of the first half of the year, a mild amount of window-dressing takes place, and, although there is little likelihood of an alteration being made in the Bank Rate, the approach of every Thursday brings in its train a shade of uneasiness that finds reflection to-day in the dullness which prevails amongst gilt-edged securities. New issues are going none to well. In regard to those that came out last year, many stand at such heavy discounts as to suggest that there must be a very large section of the public holding shares at prices substantially higher than those current to-day. The inference is that a great deal of capital is locked up in more or less non-productive channels; and, also, that a great deal of it will turn out, ultimately, to have been lost.

Electricity Supply.

The markets for what may be described as investment industrials show some degree of irregularity. Electrical supply descriptions are mainly very firm. County of London ordinary rose to 56s. Electrical Distribution of Yorkshire shares are better at 37s., and Midland Counties, after dipping to 1 11/16, recovered to 35s. British Power & Light shares are dull at 1s. discount. Scottish Power went back a few pence, but rallied to 33s. 6d. Atlas dropped to 28s. 6d., Northamptons, in which there seems to be a fairly large speculative account, went back to 51s. 6d. after being 53s. There was a recovery from the lower price, and at the time of writing the shares stand at 52s. 3d. Electric Supply Corporation shed 2s. 6d., and are 53s. 9d. A good deal of business is taking place in this department. Activity centres around a few of the shares, of which County of London and Northampton make good examples. A rise in Delhi Electric Supply & Traction lifted the price to 2⅞. Bagdad Tramways & Electric Lighting "A" shares can be sold, jointly with the "B," for 20s. and 1s. respectively.

Whitehall Electric.

Whitehall Electric preference are unchanged. The chairman took advantage, at the meeting last week, to explain at some length why the directors decided to dispose of the company's Chilean and Mexican holdings. He pointed out that the offer of the Americans was made at an attractive price, and that the money received by the Whitehall Electric Investments would enable the company's interests to be spread over more than two countries. From the American point of view, the buyers were advantaged, however, in being able to extend their interests in the two countries already mentioned. The Whitehall Electric Company is understood to have acquired a fairly large interest in certain electrical undertakings which operate in Devonshire and Cornwall.

Marconis.

The directors of Marconi's Wireless Telegraph Company, in announcing that sufficient shares of the company had already been deposited with the Bank of England, under the plan of May 14th, to make the plan operative, venture to hope that a much greater number of shares than 60 per cent. will come into the proposed re-arrangement. It would almost appear as though a good many Marconi shareholders, taking it for granted that the plan would go through, have not troubled to send in their assent, and that the directors wish to persuade as many as possible of their fellow-proprietors to agree to the scheme. It is reported that a good proportion of the cable companies' shareholders have sent in their compliance with the proposals. Unless the time is extended, the last day upon which share certificates can be deposited with the Bank of England is Friday in this week. The intention to form an investment company has been abandoned by those who proposed this step to holders of Marconi £1 and preference shares. The committees adhere to the view that although the market in the £1 shares is likely to be a restricted one, those holders who decide to stand out of the merger company will ultimately benefit.

The price of Marconi Marines is 1/16 better at 3¼, that of the parent shares remaining at 3⅞. Movements in the cable stocks and shares have been uninteresting. A new company is projected for exploiting a television apparatus, to be sold at 50s., which is now under the consideration of the Postmaster-General and Herr von Mihaly, its Hungarian inventor. Applications for the newly-issued Venezuelan Telephone shares had to be sent in, accompanied by £1 per share for full payment, on Wednesday in this week at the latest. The price of these new £1 shares is about 2s. 6d. premium, the old, preference and ordinary alike, being 25s.

Henley's and G.E.C.

Henley's announce a final dividend of 2s. 6d., making 20 per cent. for the year, and a cash bonus of 2s. The latter is 1s. more than last year's distribution, so that dividend and bonus come to 30 per cent. as compared with 25 per cent.

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The shares have risen ⅛ on this eminently satisfactory result, but the yield on the money is still so meagre as to hint at hopes being entertained of fresh favours to come in the shape of new issues at some future date. The General Electric Company has decided to repeat its previously-paid dividend of 10 per cent. on the ordinary shares. The company's profit of £1,084,077, for the year ended last March, was £26,200 more than that of the preceding twelve months. The incident of the company's proposed new issue of shares, the acrimonious discussions thereby aroused, the visit of American delegates, and the withdrawal of the share-offer at the very last moment, are all too fresh in public memory for them to require more than passing reference. The present price of the ordinary shares is 2⅝, about 1/16 lower, on the dividend announcement. Earlier this year it rose at one time to 4¼. The 6½ per cent. preference shares stand at 23s.

Other Manufacturing Shares.

Partly by reason of the good Henley's result, British Insulated have risen 3/16 to 3⅞, and Callenders a similar fraction to the same price. Enfields are ⅛ up at 4⅜. The demand for all these shares has been so steady for months past that the supply is now limited. Siemens have gone back a trifle to 30s. 9d. The preferences keep good at 33s. Crompton Parkinson ordinary are firmer at a guinea. There has been an abrupt shake-out in Associated Electrical Industries ordinary shares. At 46s. 3d., the price shows a fall of 5s. 9d. New York is supposed to have provided the shares whose sale caused the fall in the price. India Rubber shares weakened to 15s. Ever Readys at 21s. 6d. have given way a little. Amongst iron and steel descriptions, Vickers are a dull spot at 9s. 4½d. Nothing favourable in the rubber market has occurred to arouse the list of prices from its somnolence.

Home Railway Hopes.

Marked improvement took place in Home Railway stocks following upon an informal conference between Mr. J. H. Thomas and the companies. The meeting is to be the first of a series designed, apparently, to assist the railways to a position wherein they will be better able to co-operate in the Government's policy for provision of more employment. This is not the way in which the official statement phrases the announcement, but the Stock Exchange market decided that something was going to be done for the railways, and, in the advance of steam stock prices, Underground Electric participated, the incomes being 2 up, at 110. Central London Assented Ordinary is 1 down, at 72, and Districts eased off to 76. Other London traction issues are dullish, with London United Tramways 4 per cent. debenture a couple of points down at 62. British Electric Traction deferred is 25 lower at 1,375, a drop that does not look serious when matched against the rise of 350 points secured earlier in the present month.

Dollar Stocks.

Holders of American Telephone & Telegraph stock are given the opportunity for subscribing to a new issue of 4½ per cent. gold bonds. On these there is a market premium of 4 to 5 points, for the bonds make a sound investment and are good enough to take up. It is greatly to be feared that many investors, failing to realise the value of rights, neglect to take advantage of the profits that they can secure, and to which they are properly entitled. American and other dollar stocks have developed strength. Hydro-Electrics are up to 40¼. Brazilian Tractions at 59½ have gained 3 points. From Brussels it is reported that a new company with a capital of 500 million francs has been formed to operate electrical and public utility enterprises in various European countries.

British or American Control.

Quite a lot of very interesting discussion centres upon the question as to whether it is a good thing or not for British companies to prohibit foreign interests from obtaining any measure of control. Foreign, in this connection, is usually another name for American. A number of well-known British companies—and every week adds fresh names to those already on the list—have taken steps that preclude the possibility of control passing out of British hands. This is tantamount to telling the Americans that they may buy our shares as investments, but that they can expect no power in shaping a company's policy or its development. In other words, foreign capital is discouraged instead of being invited, contrary to the practice of various European nations which have found the influx of American money a useful stimulus to their commercial energies.

American Money.

Protagonists of the theory of free trade in such a matter maintain that, if Americans think themselves capable of managing our industries better than we can, they might just as well be allowed to try, provided they pay a much higher price than the industries are valued at on the basis of current Stock Exchange quotations. The Americans' experience over their purchase of the White Star line is not such as to prove that the British sellers are always wrong. To the average mind, there is something rather disturbing in the fact that even a theorist can cast doubt upon the apparent truism that British control is essential for British companies.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Approx. Dividend. 1927.	1928.	Price June 21 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/6	—	5 5 8
City of London	1		10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1		6	23/-	—	5 4 4
Clyde Valley	1		8	36/3	—	... ...
County of London	1	7½	10	56/-	+6d.	3 11 5
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	53/9	+⅛	4 1 9
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-xd	—	5 3 5
London Electric	1	8½	9	28/-	—	5 0 0
Metropolitan	1	9	9	47/6	—	3 16 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	35/6	+1/-	3 14 4
Mid. Elec. Power	1	15	8	37/6	—	4 5 4
Newcastle-on-Tyne Ordinary ...	1	6	6	27/-	—	4 9 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/6	+6d.	4 15 7
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	2	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	—	6 1 3
Yorkshire Elec.	1	8	8	36/6	—	4 7 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	72	—1	5 11 1
Metropolitan	"	8	8½	60½	—	5 15 8
do. District	"	4	5	76	—⅛	6 11 7
Underground Electric	£1	5	7	23/-	+6d.	6 1 9
do. do. Income ...	Bonds	6	6	110	+2	5 9 1

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24½	—	6 3 6
Automatic Telephone	1	10	12½	2 1/16	—	6 1 1
Eastern Extension	10	10	10	26½	—	*3 15 6
Eastern Tel. Ord.	Stock	10	10	265	—	*3 15 6
Globe Tel. and T. Ord.	10	10	10	27¾	—	*3 12 0
do. do. Pref.	10	6	6	118	—	5 5 6
Great Northern Tel.	10	20	—	31½	—	... —
Indo-European	25	10	10	50½	—	*4 19 0
Marconi	10/-	10	20	8⅞	—	... —
Marconi-Marine	1	12½	15	8½	+1/16	4 13 4
Oriental Telephone Ord.	1	12	12	3½	+	... —
Western Telegraph	10	10	10	26½	—	3 15 6

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3 9/16	—	7 14 4
do. do. 2nd Pref. ...	5	6	6	8⅝	—	8 5 6
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	"	5	5	1375	—25	... —
do. do. Pref. Ord.	"	8	8	130½	—	6 9 7
Brazil Traction	100	7	8	55½	+3	3 7 3
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	94½	+⅛	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/6	—	... —
London United Tram Deb. ...	Stock	4	4	62	—2	6 9 1
Mexico Trams, 5% Bonds	—	5	5	75½	—	6 13 9
Mexican Light Common	100	Nil	Nil	74½	—	... —
do. 7% Pref.	100	7	7	74½	—	9 8 0
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... —

MANUFACTURING COMPANIES.

		1927.	1928.			
Assoc. Elec. Ord.	1	6	—	46/3	—5/9	2 12 6
Babcock & Wilcox	1	13	15	68/9	—	*4 14 4
British Aluminium Ord.	1	10	10	51/3	—	*3 18 9
British Elec. Transformer Pref. ...	1	7	7	18/9	—	9 6 8
British Insulated Ord.	1	15	15	3⅞	+1/16	8 17 4
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	3¾	+1/16	8 17 4
do. 6½% Pref.	1	6½	6½	12	—	5 4 6
Crompton Parkinson Ord.	5/-	—	—	21	+1/-	... —
do. 8% Pref.	1	8	—	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 9
do. 5% Deb.	Stock	5	5	86½	—	5 15 1
Electric Construction	1	7½	5½	18/9	—	5 17 4
Enfield Cable Ord.	1	20	20	4⅜	+⅛	4 11 4
English Electric	1	Nil	Nil	6/3	—	... —
do. do. Pref.	1	8	Nil	8/3	—	... —
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	10	10	2⅜	—1/16	8 16 1
Henley...	1	25	30	6⅞	+¼	4 10 6
do. 4½% Pref.	5	4½	4½	4⅞	—	5 6 8
India-Rubber		Nil	Nil	16/-	+1/16	... —
Johnson & Phillips		10	—	36/3	—	5 10 4
Siemens Ord.	1	7½	7½	30/9	—6d.	4 17 7
Telegraph Construction	12	10	10	23½	—¾	*4 19 8

* Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during May.

IF the General Election activities had any effect at all upon our electrical export and import trade during May, it was not an adverse one. The Board of Trade returns show that in the three sections—exports, imports, and re-exports—values were higher than in the previous month and in May, 1928. The general exports from this country also showed substantial increases in the two comparisons.

Electrical exports during May reached the highest level recorded since September, 1926, when submarine cable rose to the abnormal figure of £668,510. Last month submarine cable was responsible for only a small contribution to the large total. The greatest increase as compared with April occurred in the item "Insulated wires and cables." In the machinery section there was a net increase of about £51,000, while unenumerated electrical goods rose by nearly £46,000. Meters and instruments showed the largest proportional rise. The decreases were not of important dimensions. In comparison with May last year, the total increased by over a quarter of a million. This was mainly due to rises in unenumerated goods and apparatus (£114,395), insulated wires and cables (£109,906), and non-submarine telegraph and telephone wires and cables (£66,268). The machinery section showed a net decrease of £45,213; the other decreases were mainly of a minor nature. The month's augmentation of exports has raised the total for the completed portion of the year above that for the corresponding period of 1928, although it will be seen that the increase in imports has been much greater.

The import total for May was also well above the average and over £75,000 above the preceding month's figure. Among the items the increases and decreases were equal in number, the outstanding item being a rise of £38,000 in the machinery class. The greatest decrease (£11,889) occurred in the case of carbons. The May imports were over £150,000 above those of the corresponding month of last year, attributable chiefly to rises in telegraph and telephone apparatus (£52,439), unenumerated goods and apparatus (£30,441), and insulated wires and cables (£28,035).

There was a substantial increase in the value of re-exported goods, mainly in the unenumerated class.

The following table analyses the electrical machinery exports during May according to destinations:—

Destination.	May, 1928. £	May, 1929. £	Inc. or dec. £
Europe	94,037	98,467	+ 4,430
Japan	28,962	7,752	−21,210
South America ...	82,665	40,219	−42,446
South Africa ...	42,826	40,169	− 2,657
British India ...	113,754	112,432	− 1,322
Australia ...	112,906	92,552	−20,354
New Zealand ...	18,083	13,855	− 4,228
Canada	32,685	37,184	+ 4,499
Other countries ...	80,651	118,726	+38,075
Totals ...	£606,569	£561,356	−£45,213

In view of the general increase in exports, this decline in the machinery class is notable. Exports to South America were halved, while Japan and Australia took considerably smaller quantities. It is interesting to see that shipments to European countries keep up well, as this near-at-hand market is generally the most difficult to penetrate. Assuming "other countries" to be outside the Empire, foreign markets absorbed about two-fifths of the electrical machinery exports, while the Dominions took three-fifths.

During the first five months of the year the total value of British electrical machinery exports was £2,733,171, as compared with £2,843,528 in the corresponding period of 1928. There were decreases in the two specified classes, but a rise in the unenumerated section. Exports to British India showed an increase of over £160,000, and those to European countries rose by about £47,000. On the other hand, South America's share fell by about £194,000, and that of "other countries" by £86,000.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for May, 1929.	Inc. or dec. as compared with April, 1929.	Inc. or dec. as compared with May, 1928.	Electrical imports for May, 1929.	Inc. or dec. as compared with April, 1929.	Inc. or dec. as compared with May, 1928.	Electrical re-exports for May, 1929.	Inc. or dec. as compared with April, 1929.	Inc. or dec. as compared with May, 1928.
Electrical goods and apparatus (unenumerated)	£324,154	+ £45,995	+ £114,395	£131,229	− £1,055	+ £30,441	£11,779	+ £5,182	+ £4,291
Insulated wires and cables ...	340,101	+ 54,800	+ 109,906	82,534	+ 16,720	+ 28,035	1,670	+ 1,161	+ 537
Glow lamps	61,203	+ 8,565	+ 9,881	23,000	− 376	− 4,138	640	− 57	+ 491
Arc lamps and parts ...	712	− 1,328	− 1,499	1,115	+ 749	− 3,003	—	− 41	—
Batteries and accumulators ...	85,864	+ 9,713	− 6,776	51,019	+ 8,394	+ 3,579	1,464	+ 1,266	+ 492
Meters and instruments ...	47.379	+ 17,346	+ 8,528	29,338	+ 14,813	+ 10,399	809	− 489	+ 489
Carbons	384	− 314	− 524	9,880	− 11,889	− 28	380	+ 162	+ 225
Switchboards (not telegraph or telephone)	3,928	− 1,129	− 517	—	− 131	− 4,524	43	+ 37	+ 18
Electrical Machinery—									
Electrical machinery (unenumerated)	325,349	− 3,743	− 6,687	184,128	+ 38,151	+ 3,700	13 928	+ 2,083	+ 1.107
Railway and tramway motors	23,916	+ 8,338	− 40,460	—	—	—	—	—	—
Other motors and generators...	212,091	+ 46,417	+ 1,934	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	138,372	− 7,196	+ 66,268	3,488	− 2,583	+ 472	—	—	− 67
Submarine telegraph and telephone cable	15,361	− 5,903	+ 5,060	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	271,430	+ 4,389	− 8,515	102,954	+ 12,655	+ 52,439	5,994	+ 1,332	+ 3,890
Totals	£1,850,244	+ £176,010	+ £250,994	£618,685	+ £75,448	+ £150,672	£36,707	+ £10,636	+ £11,493
	Exports			Imports			Re-Exports		
Increases for five months ...	+ £171,277			+ £250,057			+ £1,291		

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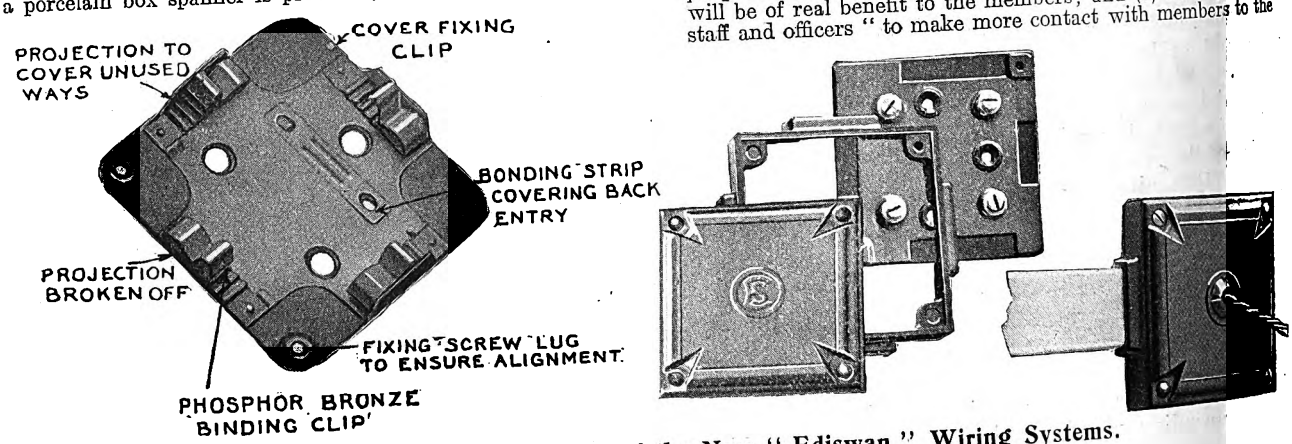
Electrical Installation Notes.

Recent Developments at Home and Overseas.

New Ediswan Wiring Systems.

IN the concluding instalment of our description of the I.M.E.A. Convention Exhibition last week we gave some illustrated particulars of the new wiring systems evolved by the EDISON SWAN ELECTRIC CO., LTD. On Thursday last week the systems were explained in some detail at a gathering of technical Press representatives. Supplementing the information which we have already given, we may say that the accessories appear to have been designed to facilitate the work of installation in every direction and to make a neat and safe job independent of the wireman's skill. In the earthed metal system the most notable accessory is the connector box, which is a unique example of mild-steel press-work. The four ways are closed in by means of easily-removed bent-up pieces, and a visible bonding clip of special design holds the cables against a very strong pull. The box is square and, with variations in the cover, is used for all positions—as a ceiling rose, switch box, plug box, &c. Only two fixing screws are necessary. When used as a ceiling rose the box is equipped with a novel and very efficient cord grip suitable for circular or twisted flex; this has slots which engage with projections in the centre hole, and screwing is thus rendered unnecessary. A connector similar to the "Ramie" porcelain thimble is used, but safe connection is ensured by the use of a cadmium-coated steel spring. The spring is inside the porcelain thimble, and once the pair are screwed home the thimble can be run back to enable the spring to be inspected in position. To assist in tightening up, a porcelain box spanner is provided; the other end of this is threaded and can be used to twist up the wires in the first place. Binding strips and special earth clips form another feature of the system. As regards the insulated system, its principal attribute is its neatness and handsome appearance. Chocolate coloured bakelite is used for the boxes which are cleanly moulded. The box is in three parts: the base and cover are of common design and there is an intermediate piece, forming the sides, which is suited to the purpose of the box, *e.g.*, tee, three-way, etc. As a ceiling rose the box employs the special cord grip already mentioned. The entries are fitted with extension pieces to shroud the ends of the channelling, obviating the necessity for careful shaping or fitting. The channelling is of magnolia, a hard and handsome wood; it is erected after the running of the wires by merely pushing it over phosphor-bronze spring clips which are entirely concealed. Moulded corner pieces are provided to eliminate mitreing and both surface and internal angle patterns are made to shroud the ends of the channel. The system has been designed principally for use with the company's "Virite" cable or flat c.t.s. cable.

Fig. 1 is a view of the base of the earthed-system box; fig. 2 shows the three sections of the moulded box; and fig. 3 illustrates the box used as a ceiling rose.



Figs. 1, 2 and 3.—Components of the New "Ediswan" Wiring Systems.

Some Contracting Industry Figures.

According to Ministry of Labour records there are 14,200 men and 1,300 women, a total of 15,500 people, engaged in the electrical wiring and contracting industry. Of these 1,130 or 7.3 per cent. were unemployed on May 27th, 1929.

The last annual report of the Executive Committee of the National Register of Electrical Installation Contractors showed that at April 5th, 1929, the number of contractors on the Register was 1,202. The last Year Book of the Electrical Contractors' Association indicated that of the membership of about 1,100 in July, 1928, approximately 650 were registered.

Installation Licences in Australia.

The Sydney *Daily Guardian* states that sweeping reforms in connection with the licensing of electrical contractors and electricians in New South Wales are to come into force on July 4th. On that date the newly appointed Licensing Board will bring into force the provisions of the Act passed by Parliament last session. Thereafter a person holding an electrician's licence will be prohibited from carrying out installation work on other than his own premises, except as the employé of a licensed electrical contractor. No electrical installation may be made by an unlicensed person except under the strictest supervision of a licence-holder. All persons, firms, or companies who contract for electrical installation work must be licensed: where the contractor does not personally do the work he must employ constantly on the job until it is finished at least one licensed electrician. Faulty electrical installations will carry a severe penalty, and licences may be suspended or cancelled for other breaches.

The Board was to hold an examination in June for candidates for licences, and licences were to be issued to successful candidates employed in the trade upon production of satisfactory evidence of their experience.

"Ourselves Alone."

In a recent issue of *Electrical Contracting* (Chicago) the American Association of Electragists (contractor-dealers) was urged:—(1) To withdraw from all electrical industry alliances and industry conference work and devote all of its time, money and energy to the interests of its members only; (2) To tackle one or two problems of the electrical contractor each year and let nothing prevent it from finishing those problems; (3) To set apart a certain large amount of its time and money for the purpose of helping local chapters to organise in a way that will be of real benefit to the members; and (4) To require the staff and officers "to make more contact with members to the end that members, by a better understanding of the work and policies of this national body, become proud of membership."

A Faked "Earth" Connection.

The same periodical reports that an electrical contractor of Louisville, Kentucky, has been fined $10 each in five cases of faking "ground" connections. He was indicted in nine cases, but four were dismissed. The Louisville ordinance requires that the system grounding conductor be enclosed in conduit for protection. This conduit, if rigidly connected to service switch box or service pipe and bonded to water pipe, may also serve as conductor grounding equipment. The contractor in question ran the ground pipe in the usual way, from switch box to the water pipe, but instead of pulling the No. 8 system grounding conductor through the conduit, he removed the insulation from short pieces of wire and stuck them in each end of the pipe. Then, to get contact for the inspector's test, he placed small wooden plugs in the pipe to hold the wire against the conduit.

Defective Equipment in New York.

In a re-inspection of buildings during 1928 the New York Board of Fire Underwriters examined installations in 4,970 buildings, including 18,489 "equipments." Of the latter, 10,368, or 56 per cent., were found defective; in 5,777 cases the defects were subsequently corrected.

Contractor Licensing Bill Rejected.

The Montana (United States) Legislature recently rejected a Bill providing for the licensing of electrical contractors and the setting up of a State board of examiners to adjudge the fitness of contractors to hold licences.

Apprentices' Classes at Hull.

In Hull the electrical contractors have made special arrangements with the Education Committee for classes for their apprentices. The fees are to be paid by the contractors and the classes will occupy part of the working day.

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The National Physical Laboratory.

An account of the annual inspection by the General Board and some details of the new extra-high-voltage section of the laboratory.

THE annual inspection of the National Physical Laboratory by the General Board took place on June 18th. Favoured with fine weather, as this function, which is assuming somewhat of a social character, invariably is, the number of visitors invited is growing larger each year. They were received by Sir Ernest Rutherford, president of the Royal Society and chairman of the Board; Sir Richard Glazebrook, chairman of the Executive Committee; and Sir Joseph E. Petavel, director of the laboratory. Tea was served as usual in the aerodynamics building.

Of the numerous departments inspected, chief interest centred this year in the new extra-high-pressure section of the laboratory, which is considered to be in certain respects unique, and should prove to be invaluable for dealing with a number of problems of immediate urgency to the electrical industry of the country, particularly in relation to the new national electricity scheme, in which a voltage of 132 kV will be generally used, and for some purposes even higher voltages.

The high-voltage laboratory is a separate building with a large hall of about 120 by 60 sq. ft. floor area, and 44½ ft. high, containing the high-voltage transformers in a pit at one end about 7 ft. deep. At the other end of the building there is a doorway 35 ft. high and 35 ft. wide, through which high-voltage conductors can be taken into the open. On one side of the building are three windows, each 10 ft. square, with their centres 23 ft. above floor level, also for carrying high-voltage conductors out into the open. On the other side of the large hall there is a range of smaller rooms, 16 ft. high, on two floors; their total length is about 134 ft. On the ground floor is the room for the power plant, 53 ft. by 21 ft., arranged to be close to the transformers. It is equipped with a 5-ton hand-operated travelling crane. Next to the staircase at the other end is the control room, with a large glass partition, some sections of which can be opened, separating it from the large transformer hall. From a 35-ft. level on the staircase a door opens on to a gallery, 3 ft. wide, supported on the wall of the hall, from which a view of the transformer plant and the apparatus under test can be obtained from above.

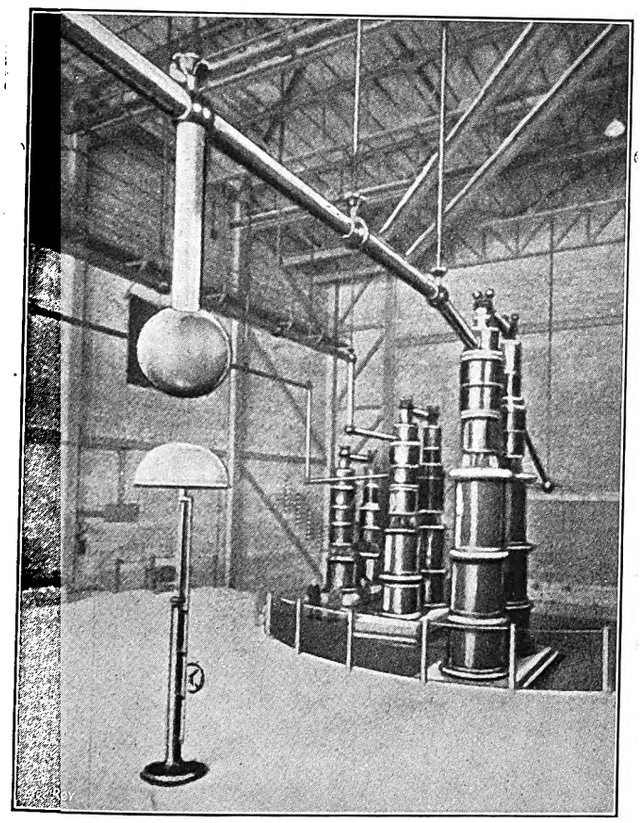

Fig. 1.—Extra-high-voltage Transformers.

The high-voltage transformers were supplied by Messrs. Ferranti, Ltd., to the design of Messrs. E. Haefely & Co., of Bâle, Switzerland, who constructed certain parts. The main qualities considered in choosing the type of transformer were flexibility and adaptability for various research purposes and for facilitating the carrying out of accurate measurements, while providing adequate power over a wide range of voltage. The air-cooled type was chosen chiefly because it enables connections to be made to a number of points along the secondary winding, to which electric shielding devices can be connected, such as are necessary for use with resistances required for the measurement of power, phase angle, voltage, &c., at high voltages. The importance of being able to obtain 3-phase high pressures led to the choice of three transformers of similar electro-magnetic characteristics, while to obtain the highest single-phase voltage available, given three such transformers, it was necessary that they should be capable of operating in cascade connection.

The nominal output decided upon was 500 kVA at a million volts, the current being 0.5 A, to obtain which the three transformers are each rated at 375 kV. The primary voltage chosen depended to some extent on the easier construction of a winding for 500 A at 1,000 V than for 1,000 A at 500 V, on account of the greater flexibility of the conductor and the smaller current. The three transformers can be used in parallel. Their secondary windings are in two halves, which can be put in parallel, enabling the full nominal output of each transformer to be obtained at 187 kV.

The transformers are on insulating stands (figs. 1 and 2) in the form of varnished-paper cylinders, which increase in height to correspond with the increase in voltage to earth when they are in cascade connection. The transformer of the highest voltage is of a total height of 33 ft., including the stand; the stand weighs 5 tons and the transformer 9 tons. The transformers are arranged at successively increasing distances from the walls, with suitable isolating switches for the primary circuits having subsidiary isolating links in series with them.

A travelling electric crane of 3 tons capacity runs on a girder fixed to the underside of the roof principals. It divides over the pit into two branches, so placed that a direct lift can be obtained over the two vertical limbs of each transformer. The control switch and regulator are connected by flexible cables and sockets to permanent underground wiring, and are situated close to the edge of the pit in such a position that the operator has a good view of the transformers and over the floor of the building generally. The regulating apparatus is portable and can be removed if required, covers being provided for the ends of the underground connections. The crane system circuit is earthed when the high-voltage plant is in use, the traversing and lifting regulators being left "on" to ensure that the crane and the nine conductor rails feeding it cannot attain a high voltage to earth by induction or otherwise.

As regards the mode of operation, when the transformers are in cascade connection the primary circuit is supplied from the power plant at any pressure up to 1,000 V. One pole of the supply and one end of the secondary winding of No. 1 transformer are earthed. The voltage builds up to 187.5 kV along one vertical set of secondary coils, downwards, and at the bottom of the set the winding is connected to the transformer core, which is maintained at the mean voltage of the winding, so that the insulation is not subjected to more than half the voltage generated by the transformer. The other half of the secondary builds up from 187.5 to 375 kV. The second transformer is fed from this 375 kV point and from another point on the winding of the first transformer 125 kV below it, *i.e.*, 250 kV above earth. The corresponding points on the winding of the second transformer are connected to these, but inverted, so that the voltage builds up backwards as compared with No. 1. What is normally the primary circuit of No. 2 transformer, which is connected to one end of the secondary winding, thus acquires a voltage of 625 kV above earth. Between transformers 2 and 3 the 1,000-V primary windings are used as the transfer circuit, so that the third transformer adds its rated voltage of 375 kV, making 1,000 kV. Neglecting the losses in the transformers, for an output of 500 kVA, corresponding to 0.5 A at 1,000 kV, the input to No. 1 transformer is 500 A at 1,000 volts. The output from No. 1 supplied to Nos. 2 and 3 is 375 kVA. This is supplied at 125 kV, so that the transfer current between transformers 1 and 2 is 3 A. The transfer between transformers 2 and 3 is 187.5 kVA at 1,000 V, the corresponding current being 187.5 A. Fig. 3 is a reproduced photograph of a million-volt spark obtained from the N.P.L. plant.

Transformers of the air-insulated type for unusually high voltages can hardly be designed on ordinary lines without considerable magnetic leakage, the effect of which is enhanced when they are used in cascade. To reduce this a compensating winding is employed, the principal section of which surrounds the core in the neighbourhood of the main primary

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winding, and to it are connected other coils in parallel, so placed as to assist in compensating for the magnetic leakage which would otherwise occur. The convenient place for the compensating winding is close to the core, and, in order to fix its potential, it is definitely connected to the core at one point. The nominal voltage of the winding can have any desired value within reasonable limits, its function being to deal with a definite number of ampere-turns. It was thought desirable to choose 1,000 volts for the purpose, corresponding to the voltage of the generating plant. The compensating

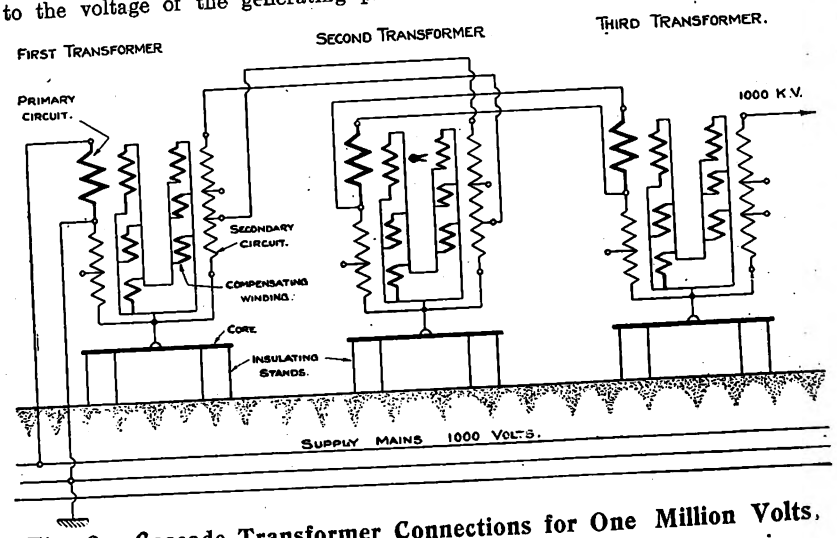

Fig. 2.—Cascade Transformer Connections for One Million Volts.

winding can then be used as the main primary circuit, allowing an additional degree of flexibility in the operation of the transformers.

The regulation of the voltage of the transformers is effected by variation of the field current of the alternators supplying them. In order to obtain low voltages without working the magnetic field of the alternators at an inconveniently low value, when instability might arise, intermediate auto-transformers can be inserted and so arranged as to give 0.5, 0.25, 0.15, 0.10, or 0.05 of the applied voltage at the various tappings, 187.5 kVA being available from each at 500 volts, and less in proportion at the lower voltages. To enable the transformers to be used in different circuits and in different combinations, six connecting mains for their primary circuits are available from the power room. The circuits are of bare copper rod, rated at 500 A, supported on porcelain insulators sufficiently high on the wall to be out of reach.

The generating plant, which was designed and constructed by the British Thomson-Houston Co., Ltd., consists of two alternators, each rated at 350 kVA, single-phase, at 0.3 power factor, each having eight poles, giving a frequency of 50 cycles per second at 750 r.p.m. They form the centre pair of four machines coupled together, of which the end two are the motors. Two generators of 350 kVA each were chosen, in preference to one machine of double this value, so as to give two sources of supply having any desired voltage ratio and phase relation. The rated output is available at 50 cycles over a range of voltage from 800 to 1,200. The phase adjustment is achieved by rotating the stator of one of the generators (which is mounted on rollers) by means of a motor and worm and screw gear; this operation can be carried out from the control station. Particular attention has been given to the wave form of the alternators, which gave excellent results when tested for sinusoidal perfection of wave form by very sensitive instruments.

The control room on the ground floor has a clear view over the main floor of the transformer hall through a glass partition 15 ft. high. The chief operator has on his right a small push-button panel, by which he starts and stops the motors of the main generating plant, using either or both of the two motors at will. The connections of the starting resistances of the motors are operated by contactor switches, which automatically cut out sections of the resistance as the speed increases. There are also push buttons which operate the trip mechanism of the main switches. Close at hand are also a set of four small switches by which, through relays, the control room and main hall can be put in darkness. One of the lighting circuits in the hall is operated through an automatic dimmer, so that any person in the hall has about 10 seconds warning before it becomes completely dark. On the vertical front of the desk are hand wheels for operating the coarse and fine resistances in the fields of the main driving motors. The speed is indicated by an electrically-operated instrument made by Messrs. Evershed & Vignoles, Ltd., consisting of a permanent-magnet dynamo driven by a belt from the shaft of the generator plant, the indicator being a voltmeter graduated in revolutions per minute. For the more accurate adjustment of speed to a definite frequency, such as 50 cycles per second, a stroboscopic method is used.

On the left side of the control desk are the instruments which show the voltages and current in the circuits in use and indicate the positions of the switches in the power room. There is also a multiple-circuit telephone at hand with connections to the power room, the transformer pit, the far side of the main floor, and the gallery. In the control room also is a set of electrostatic precision instruments with large circular scales, consisting of voltmeters and a wattmeter with their switches and calibrating resistances.

The equipment, including the three main transformers of 1,000/375,000 volts each that are rated at 500 kVA and capable of delivering 1,000,000 volts when connected in cascade, fig. 2, has been in use for testing purposes for about six months. Provision is being made for water resistivity conditioning plant (10,000 ohms per c.c. has been agreed upon internationally) for testing insulators under artificial rain, and also under oil up to a temperature of 100 deg. C.

Some of the apparatus on view, more particularly a large high-voltage air condenser and a shielded water-tube resistor, have been developed and used for research on dielectric losses, particularly in power transmission cables up to 150,000 volts; this work is in progress for the Electrical Research Association. Visitors saw a demonstration of the effect of a rotating electric field on certain types of insulation. A rotating field was produced in the space between three similar conductors spaced at the corners of an equilateral triangle when they were connected to a three-phase supply. Three spheres placed a few diameters apart formed a convenient system of conductors, a foot in diameter, and the speed of rotation of the field was 50 revolutions a second. When insulating material is placed in a rotating field, one effect of dielectric absorption is that a mechanical force acts on it, tending to drag it in the direction of rotation of the field. Materials containing small amounts of moisture frequently show considerable absorption effects and, as there is normally a certain amount of water in paper, a cylinder of paper a foot in diameter was made to rotate in the manner indicated when the three spheres were connected to a three-phase supply of about 300,000 volts, the speed of rotation of the cylinder being one or two hundred revolutions a minute.

The arcs formed between three points connected to a three-phase supply may take the form of a triangle, or they may join together and form a Y: three-phase arcs at about 400,000 volts were also shown, arranged vertically so as to be more easily visible.

Whilst space limitation does not permit of reference to all the investigations that are being carried out, some of the activities of the wireless division of the Electricity Department may be noted. For instance, when the overall sensitivity of a wireless receiver is to be measured, the set is placed in

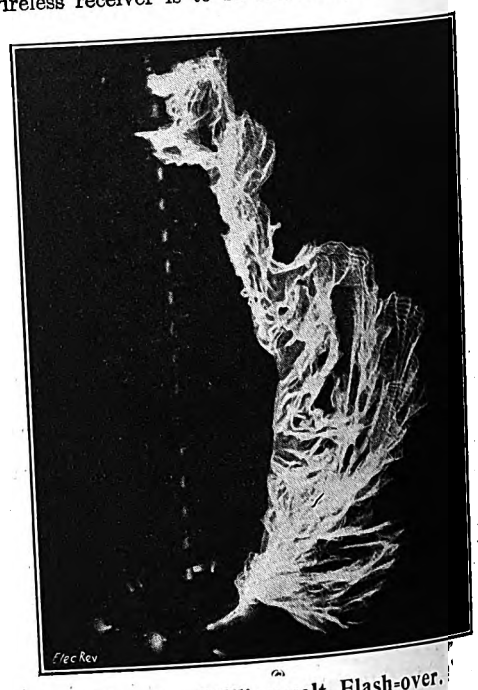

Fig. 3.—Million-volt Flash-over.

a room which is specially screened from external disturbance by having its walls, floor, and ceiling covered with small-mesh wire netting. Measurements made inside the room have shown that on broadcast wave-lengths the strength of field of wireless waves is reduced to about 5 per cent. of the value of the field outside the room. In an adjoining room the valve oscillators which supply the necessary current for the test are contained inside a cabin which is entirely screened with tinned iron sheet. In this case it is necessary to obtain much more perfect screening than is possible with wire netting.

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This screened cabin is provided with a trap-door entrance closed by a mercury seal, and in view of the air-tight nature of the cabin, special arrangements have been made to ensure adequate forced ventilation. The ventilating tubes are of special design to permit the flow of air and prevent the passage of electric waves, the circulation of the air being obtained by means of a small rotary pump.

The true rendering of speech and music in wireless reception depends in no small measure upon the design and choice of the components used to amplify up to loud-speaker strength the small rectified voltages provided by the high-frequency and detector stages of a receiver. Advances in the design of intervalve transformers and other coupling arrangements have resulted from accurate measurements of the amplification made at a number of telephone frequencies throughout the range of audibility. The apparatus developed at the Laboratory for this purpose is believed to be of high accuracy and of great flexibility. The method of measurement used consists in providing a small voltage by means of the potential difference across a low resistance through which an alternating current of known and adjustable frequency passes. The same current provides a much larger variable potential difference by flowing through a variable resistance and the primary winding of a variable mutual inductance. From the resistance and mutual inductance combination, a voltage of any magnitude and phase angle within the compass of the apparatus may be obtained. If, now, the small fixed voltage first referred to is applied to the valve amplifier, it can be so arranged that the resulting large voltage given by the amplifier is just balanced by the variable large voltage. The known ratio of the two voltages thus gives a direct measure of the amplification of the amplifier. From measurements made over a range of frequency from 25 to 6,000 cycles per second, a curve may be drawn which shows immediately the quality of the amplifier. In an ideal case, the curve is a horizontal straight line, indicating constant amplification.

In the main wireless hut the valuable application of wireless to navigation was illustrated by a portable radio compass, or direction-finder. The instrument exhibited has been especially built for field observation work, and particular attention has been paid to portability, accuracy, sensitivity, and wide range of working wave-lengths. It uses a supersonic heterodyne seven-valve receiver, and has a working wave-length range of from 30 to 4,000 metres, to cover which range two separate frame coils are employed, and the receiver is entirely self-contained in a screened box.

For use in experimental work with direction-finders, and also for field strength measurements, it is convenient to have a self-contained portable transmitter; the particular model shown was a two-valve arrangement having a working range of from 30 to 2,000 metres. The whole transmitter is operated from a 12-volt accumulator, a suitable machine being incorporated in the set to generate the necessary current at the high voltage of 600. The maximum power input is of the order of 50 watts, which, in favourable circumstances, gives an available range for measurements of about 50 miles.

Apparatus was shown for the transmission and reception of very short waves (1.5 to 15 metres) which is being used in the study of the technique of wireless wave propagation. For certain purposes, *e.g.*, the adjustment of a receiving set to a known wave-length, it is convenient to have a small portable generator, or heterodyne wave-meter, capable of producing modulated waves which can be heard in telephones after rectification, without requiring a separate heterodyne generator. Several models of such a generator, operating on various ranges between the limits of 4 and 20,000 metres, were shown.

The accompanying illustrations have been reproduced from the National Physical Laboratory Report for the year 1928, which was abstracted in the ELECTRICAL REVIEW, May 3rd, p. 805, and May 10th, p. 848, by the permission of the Controller of H.M. Stationery Office.

Nottingham's New Council Buildings.

An example of the advantages of co-operative design and craftsmanship, and resource of the architect, decorative artist, and illumination engineer.

THE regret of Nottingham's citizens at the change in the character of the great old Market Square, which the Corporation's plans necessitated, has merged into pride of their new Council House and Exchange, which was officially opened by the Prince of Wales last month.

Designed by Mr. T. Cecil Howitt, the buildings have taken two years to complete, a fitting home of civic government and a symbol of prosperity. The dignity of the marble entrance hall on the ground floor and the grand staircase, fig. 3, is much enhanced at night by an arrangement of "Gecoray" reflectors, fitted with flame-sprayed "Osram" lamps, sunk in an invisible cornice round the periphery of the base of the dome. Round the dome itself in circles are six graduated tiers of 24 windows, each fitted with specially prepared glass of amber tint that is deeper in the lower tiers, and gradually fades to clear transparency in the windows at the eye of the dome. The light from the cornice is reinforced by an additional set of 15 flood reflector lamps at various corners in the girders outside the dome.

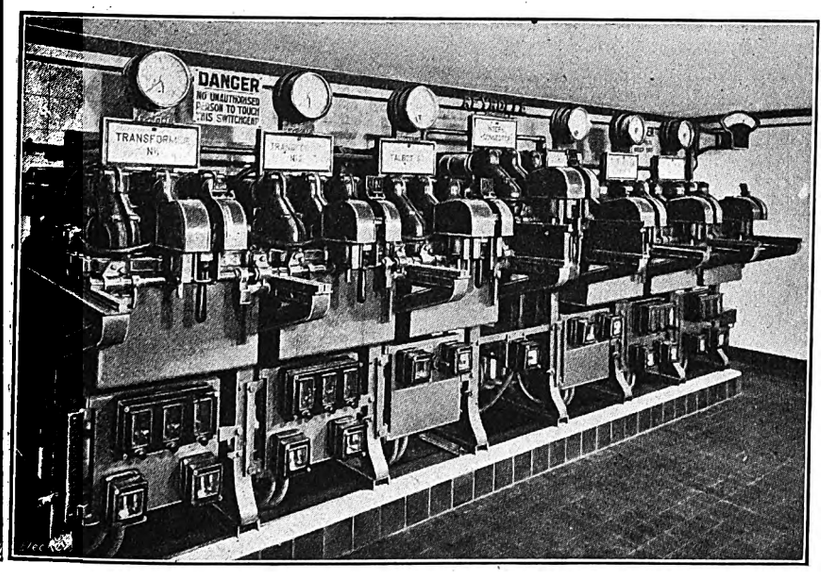

Fig. 1.—High-pressure Sub-station Switchgear.

On the first and third floors are a series of reception, dining, ante and sitting rooms, and the library for the use of members of the City Council. They have their particular schemes of interior decoration and lighting; for instance, in the members' room and library a shadowless glow is obtained from no less than 385 lamps in a series of specially-designed trough reflectors set in the concealed cornice, sunk in the interval between the top of the panelling and the curve of the ceiling. In the dining room, which will accommodate 100 guests, the selected scheme of illuminating the fine plaster and panelling to produce the specific effect demanded by the architect has been well achieved by the use of 144 reflectors equipped with "Pearl" lamps and disposed within the sunk cornice, the indirect illumination being without shadow of any kind, or glare.

In an ante-room on the same floor the panelling and furniture are well defined by 384 lamps in trough reflectors of special contour arranged in the cornice and concealed behind the panelling, while the fireplace is flanked on either side by two 6-ft. handsome silver standards, each containing six lamps, and in the centre of the room is an octagonal table with four "Pearl" lamps concealed beneath an ornamental panel in the centre.

The new Council Chamber on the third floor, considering the size of the building as a whole, appears to be comparatively small for the special reason that, after allowing ample seating accommodation, the volume was kept to a minimum to reduce acoustic difficulties. The floor is heavily carpeted, and the wall panels are made of thickly padded quilt, exactly matching the colour of the woodwork, so that at first sight the two materials are indistinguishable. A series of graduated ceiling panels culminates in a large semi-circular lay-light, through which daylight is admitted to the room. In order to intensify the light reflected from the cornice, the ceiling is cone-finished

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next to the walls, and evenly diffused uniform illumination is thereby obtained; 224 reflectors are used, each containing a "Pearl" lamp, disposed along the whole length of the semi-circular cornice, concealed behind the top of the panelling. As will be seen in fig. 2, light is reflected into every corner of the chamber.

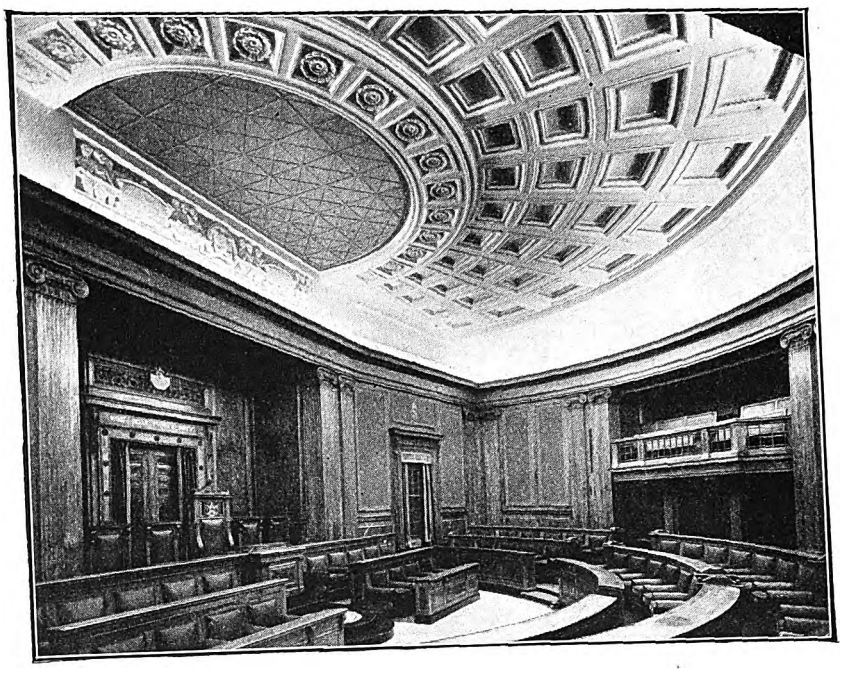

Fig. 2.—The Council Chamber.

The two division lobbies outside the Council Chamber have dome-shaped ceilings, and lend themselves to brilliant illumination, each being lighted by 40 "Striplite" fittings concealed in a sunken cornice on a similar principle to that employed in the other rooms already described. All the corridors on the second, third, and fourth floors, the kitchens, service rooms, lavatories, and auxiliary staircases, are lighted no less efficiently with adaptations of the standard "Unalux" three-lamp fittings, the metal work being of solid chased bronze.

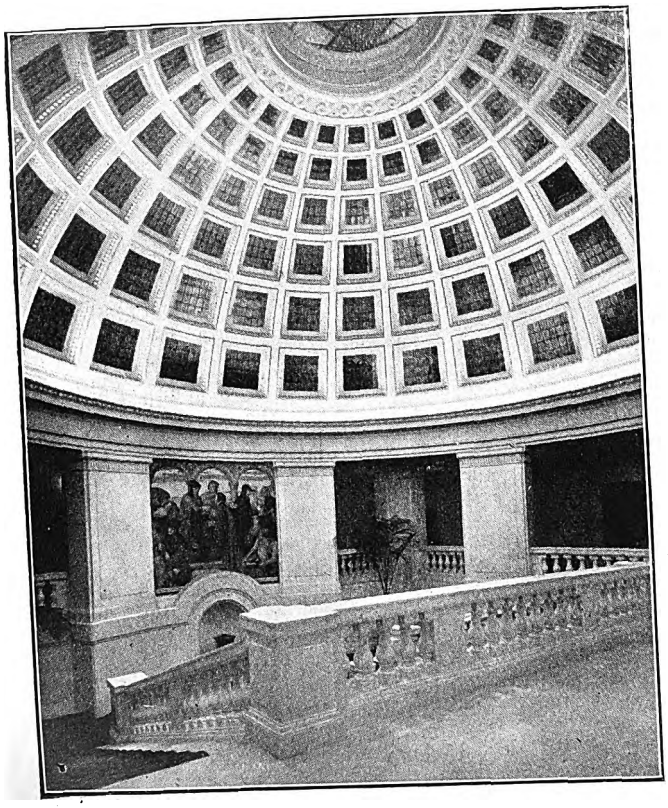

Fig. 3.—Illuminated Staircase Dome.

The floodlighting of Exchange Row, fig. 4, the name given to the arcade which runs between the two wings at the rear of the main front block, calls for comment. This new shopping way is T-shaped in form, wide, and of unusually lofty dimensions; the barrel roofs are 60 ft. high, and at their intersection form the main dome feature with an inner dome rising 90 ft. above the pavement. The illumination of the shops will supplement the floodlighting by 68 reflectors concealed behind the tall Greek vases arranged on each side of the arcade along the projecting masonry above the shop facias. The reflectors have been intentionally fitted with lamps of only a moderate wattage, in order to give a more subdued tone, thereby obviating any suggestion of competition with the necessarily greater degree of brilliancy required in the lighting of the shop windows. In order to accentuate the colouring of the four frescoes painted between the supporting arches of the dome, batteries of reflectors are disposed below the frescoes.

The artificial lighting of the new Council House, one of the largest public buildings in the kingdom, is yet another proof of the progress that has been made in the adequate illumination of such buildings, and the gratifying results which the architect and the Illuminating Engineering Department of the General Electric Co., Ltd., have achieved entitle them to congratulation. The task of the electrical contractors, Messrs. W. J. Furse & Co., Ltd., of Nottingham, who carried out the whole of the electrical installation, was one of magnitude and difficulty.

The switchgear for controlling the electricity supplied to the Exchange buildings has been supplied by Messrs. A. Reyrolle & Co., Ltd. It is of their well-known metal-clad horizontal draw-out type, and is situated in a sub-station in the basement. There are two boards, one of seven panels for 6,600-volt, 3-phase working, and the other of 15 panels for 400-volt, 3-phase, 4-wire working. The former, fig. 1, consists of two incoming feeder panels with a capacity of 300 amperes, four transformer panels of the same capacity, and one bus-bar section panel. The feeder panels and section panel have inverse time-limit overload and earth leakage protection, and the transformer panels inverse time-limit overload and Merz-Price protection. The l.p. board consists of ten 400-ampere feeder panels with inverse time-limit overload protection, one 2,000-ampere section panel, and four 1,000-ampere transformer panels with time-limit overload and Merz-Price protection.

An interesting method has been adopted for connecting the transformers to the l.p. switchgear. The transformer room is immediately behind the switch room, and special cable boxes have been fitted to the l.p. gear and shaped so that they project through the dividing wall into the transformer room,

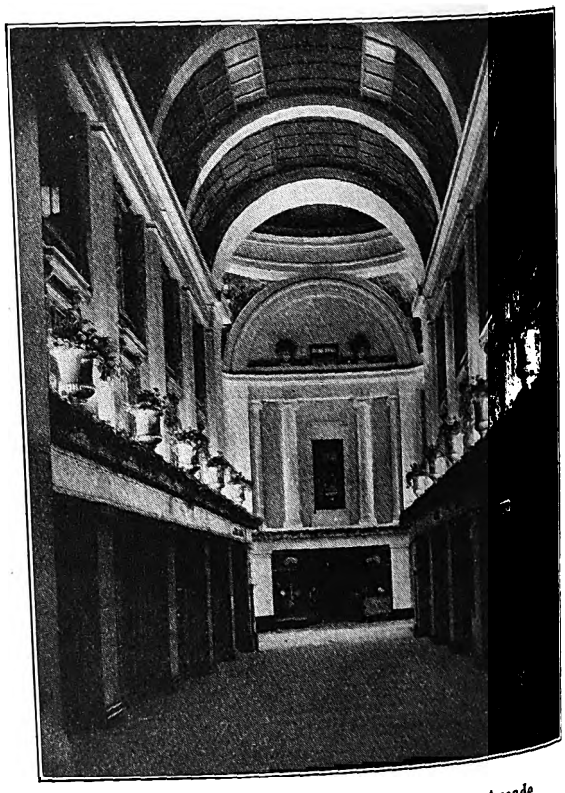

Fig. 4.—Exchange Row Shopping Arcade.

cables have then been taken from the transformers straight to the boxes.

The lighting arrangements throughout the building are an example of the many advantages of close co-operation between the skill of the architect, the craftsmanship of the decorative artist, and the science and resource of the lighting expert, of which the citizens of Nottingham may well be proud.

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Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

A Baking Oven.

The accompanying illustration, fig. 1, is of the "Onward" electric oven recently introduced by Messrs. Edwin Chambers, Ltd., Onward Works, Leeds Road, Bradford. It is made in two standard sizes for working at 230 V. The smaller model

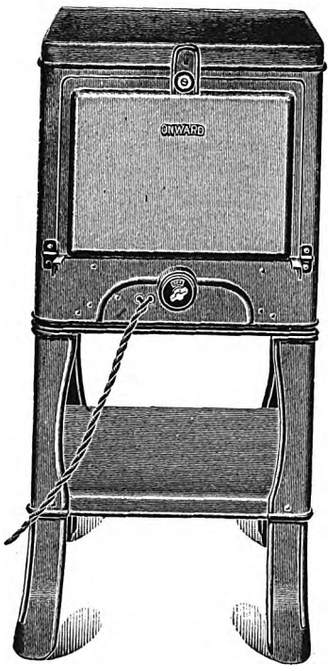

Fig. 1.—The "Onward" Oven.

has inside dimensions of 12 in. by 12 in. by 9 in., and a loading of 1,000 W. The other oven is loaded at 2,000 W, and the internal measurements are 14 in. by 14 in. by 12 in. Three-heat control is provided for the larger oven. Both models are complete with two oven shelves and a grid. The ovens may be supplied with or without the stand.

New Domestic Supply Charges.

A somewhat drastic departure from the usual method of charging for electrical energy used for domestic purposes is represented by the "domestic tariff" recently adopted by the NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD. The outstanding points are that the "two-part" principle is eliminated, or at any rate apparently so as far as the consumer is concerned, and in its place a sliding-scale system is adopted. The following table is self-explanatory of the new system:—

Number of Assessable Rooms.	Units per quarter at 6¾d. per unit. Winter qrs.	Summer qrs.	Next Units per quarter at 3½d. per unit. Winter qrs.	Summer qrs.	Next Units per quarter at 1d. per unit. Winter qrs.	Summer qrs.
4 or less	32	16	26	13	500	250
5	38	19	30	15	550	275
6	50	25	40	20	600	300
7	64	32	52	26	650	325
8	82	41	66	33	700	350
9	102	51	82	41	750	375
10	122	61	98	49	750	375
11	142	71	114	57	750	375
12	162	81	130	65	750	375
13	182	91	146	73	750	375
14	202	101	162	81	750	375
15	222	111	178	89	750	375

All energy consumed in excess of that shown under 1d. per unit is charged for at ¾d. per unit.

By "assessable rooms" is meant all rooms which may be broadly classed as living rooms.

A Luncheon Club's Electric Kitchen.

Some interesting particulars are given in *Electrics* of the electric cooking installation at the kitchen at Ergon House, the headquarters of the London Power Co., Ltd. The cooking equipment was supplied by the JACKSON ELECTRIC STOVE CO., LTD. It includes a No. 9 double-oven range fitted with side elements and equipped with an illuminated switchboard. Three-heat control is provided, and the loading of each oven is 4½ kW. There is also a No. 24D cooker, with two standard ovens loaded at 2.7 kW. The whole is surmounted by a cast-iron hob containing five hotplates and one grill, the top of the grill being available as a simmering or boiling plate. Three-heat regulation on all of the above sections is provided. Over the hob, mounted on two cast-iron brackets, are two No. 260-type hot cupboards, the space between the bottom of the hot cupboards and the top of the hob being filled in with a tiled-pattern splash plate. Each hot cupboard is controlled by a s.p. rotary indicating switch. The total loading of this cooker is 19.1 kW. A four-plate boiling table fitted with a circular 12-in. boiling plate of the "Sadia" pattern is also installed. The loading of each plate is 2.7 kW. An illuminated switchboard is also fitted to this equipment. A fish fryer measuring 18 in. by 18 in. is another feature. The loading of this appliance is 5.75 kW, and it is arranged for various degrees of heat regulation. The heating elements are not attached to the pan in any way, so that the latter may be totally immersed in boiling water for cleaning purposes. There is also a No. 283 hot cupboard with sliding doors. The top of the hot cupboard is arranged with two carving wells and a Bain Marie or water bath. The loading for this hot cupboard is 7.14 kW. A "Frigidaire" electric refrigerator serves for the necessary food storage. The whole of the hot-water supply for the kitchen is provided by two 25-gallon calorifiers with a total loading of 12 kW, each tank being fitted with thermostatic control. The installation provides 100 lunches daily.

A New Electric Oven.

The new model-124 electric oven has recently been introduced by the ARORA CO., Loughborough, to compete with the Continental and American ovens which are being sold in increasing quantities in this country. It has been designed on thoroughly practical lines, giving a clear internal cooking space of 14 in. wide by 15 in. high by 13 in. back to front. The special feature is the introduction of iron tubular heaters, the electrical elements of which are totally-enclosed; in fact, the whole of the interior may be swilled out with water without the slightest risk of shock. Another feature is that the oven is heavily packed for economical running costs; the heating tubes are entered from the back, and two are placed normally on each side at the bottom, but provision is made for two extra tubes at the top when desired.

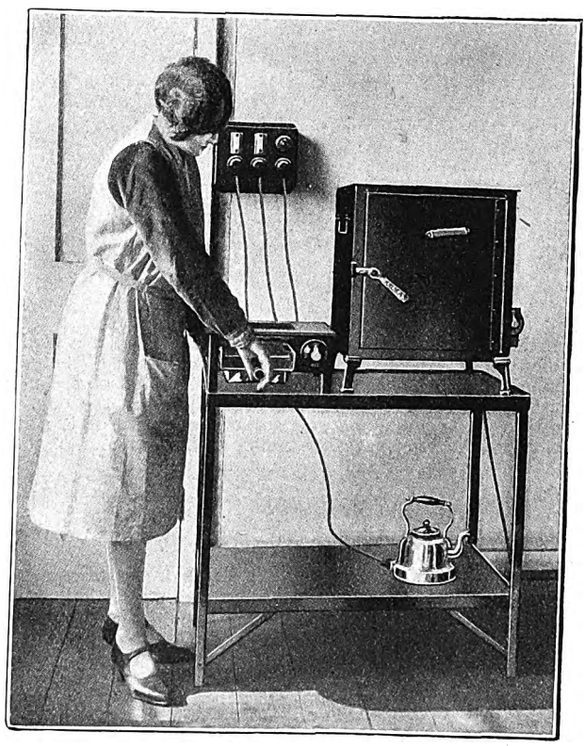

Fig. 2.—"Arora" Cooking Outfit, including New 124 Oven.

The removable electrical elements are supported throughout on refractory insulating material in 3-in. interlocking sections, enabling any length of heater to be built up. All connections are external to the outer walls of the oven, and in spite of the low loading a well-designed British-made

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3-heat rotary switch of 9-A capacity is included. The standard size and the standard loading offered have been specially designed to meet the requirements of modern housing schemes. Each heating tube is loaded at 375 watts. On maximum loading a temperature of 400 deg. F. is attained in 40 minutes. The accompanying illustration, fig. 2, shows a complete "Arora" cooking equipment, comprising the No. 124 oven, with a 15-in. stand, and a No. 104 boiling plate and grill.

Portable Meter Box-Seats.

Referring to the equipment recently introduced by the Brompton and Kensington Electricity Supply Co., Ltd., which was described under the above heading in our issue of May 31st, p. 987, we learn from A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1, that they have patented a zero-resetting device for use with meters used in hotels, &c., for electric fires. By such means a guest is prevented from having the benefit of the coin inserted by his predecessor. Incidentally, the hotel proprietor pockets the leavings.

A New Vacuum Cleaner.

We have received from Messrs. L. BENN & CO., LTD., the following particulars of the "Demon" electric vacuum cleaner, fig. 3, for which they are the world concessionaires. The exposed metal parts are heavily nickel-plated, highly polished and guaranteed not to discolour. The body is covered with an attractive imitation leather jacket of maroon, and a handle is provided to carry the machine from room to room. It weighs only 7 lb., is well-balanced and very compact in design. Gliders are fitted in place of wheels. The dust bag is invisible to the eye and will hold several pounds of dust. A special tag is provided for emptying, so that the hands cannot be soiled. Specially-designed steel clasps hold the dust bag to the body of the cleaner, and they are so fitted that they

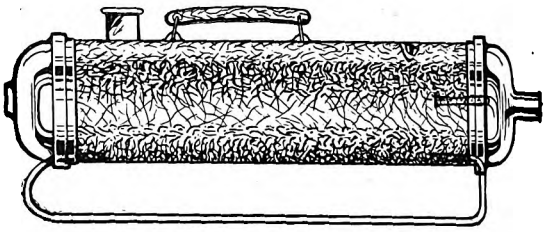

Fig. 3.—The "Demon" Vacuum Cleaner.

cannot snap. There is an adequate length of silk flex, together with a standard power plug and switch. A Universal motor, suitable for either d.c. or a.c., is used, and a modern fitting eliminates the need for oiling. The loading of the motor is about 180 W.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Flexible-wire Grip for Wall Plugs.

In a new range of B.E.S.A. 3-pin plugs which have been introduced by Messrs. JULIUS SAX & CO., LTD., 27, Lower Mall, Hammersmith, W.6, is incorporated what is claimed to be a very effective flexible-wire grip. As depicted in fig. 1, the

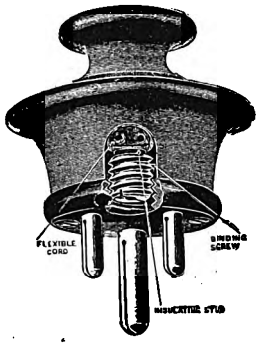

Fig. 1.—"Julius Sax" Plug, showing Cord-grip Arrangements.

arrangement is simple and consists merely of a binding screw threaded through the fibre base of the plug, so that a flexible cord of small or large diameter can be "cord gripped" between the point of the screw and the interior of the top of the plug. An insulating stud forms the gripping surface at the point of the screw. The plug pins and socket tubes are of the solid types, and together ensure, it is claimed, the maximum amount of contact possible, without overheating.

A Paint-spraying Set.

Messrs. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, Kingsway, W.C.2, have recently introduced a new model of "Sprayit Electrically," which, it is claimed, embodies a positive agitation of the materials in the container. The equipment consists of two separate essential parts, the compressor unit, and the agitator gun and container, with the necessary connections. The small rotary motor compressor unit weighs only 5 lb., and is capable, it is claimed, of producing a constant pressure of 25 to 30 lb. per sq. in., which pressure is stepped up by a specially designed fluid tube and nozzle assembly. The agitator-type gun weighs 1 lb., and is equipped with an instantaneous air control. By merely changing the nozzles the spray can be regulated from a ½-in. strip to a 7-in. band. The loading of the motor is under 200 W.

An Improved Indicator.

The "Bardisk" indicator, fig. 2, which has been recently introduced by Messrs. S. TAYLOR & SONS, LTD., 38a, St. Martin's Lane, W.C.2, relies for its action on the flywheel effect of a heavy dial, with the result that it is unaffected, it is claimed, by external shocks and can be made very robust. The dial consists of a brass disk, 2 in. in diameter, mounted on a steel axle, with a soft-iron roller arm attached near the periphery. The frame of the indicator is made of soft iron, lead coated, and in it are mounted symmetrically side by side two electro-magnets; above the magnets is fixed a rocker lever carrying two armatures, so that when one armature rests on one electro-magnet, the other leaves a gap of about ⅛ in. The disk is mounted in the frame, so that the movement of the arm of the disk is through the arc above the rocker lever, and the arc in this case is arranged to be 90 deg. The front bearing for the disk is provided by a narrow bar, fixed to the main frame, top and bottom, which also serves to conceal the black indicating bar in the "off" position. The roller arm, being an unbalanced weight on the disk, comes to rest, under gravity, on one of the two armatures. When a current passes through the electro-magnet opposite to that on which the arm rests, the armature closes with a snap, thereby causing the other armature, on which the arm rests, to move suddenly upwards, giving an impulse to the disk, which absorbs the energy like a flywheel, and so continues to revolve through the arc when the arm reaches the other armature; it is then magnetically held down by the electro-magnet, so preventing

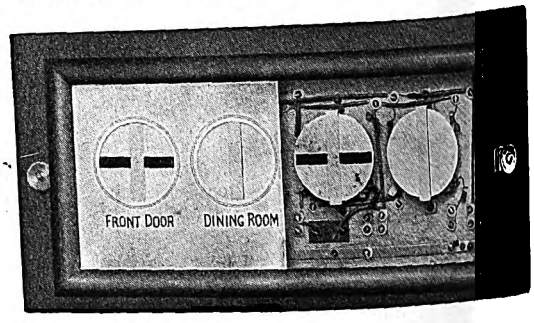

Fig. 2.—The "Bardisk" Bell Indicator.

any rebound of the disk. The replacement is effected by passing a current through the other electro-magnet in a similar manner.

A New Lamp Lock.

The accompanying illustration, fig. 3, shows a new type of "Lamlok" ring which has been introduced by LAMLOK, LTD., 163, Vivian Avenue, Wembley, Middlesex, for dealing with H.O. lampholders, and its application to a bakelite holder. The pins of the lamp register into two "beds" or recesses formed in the ring. The lamp is inserted into the holder in the usual manner, and by screwing up the screw which is tapped into

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the boss on the ring, a tilting action is brought about round the pins of the lamp, one side of the ring being raised, while the other side is depressed. In this manner any movement of the ring is restrained, and the lamps are securely locked in the

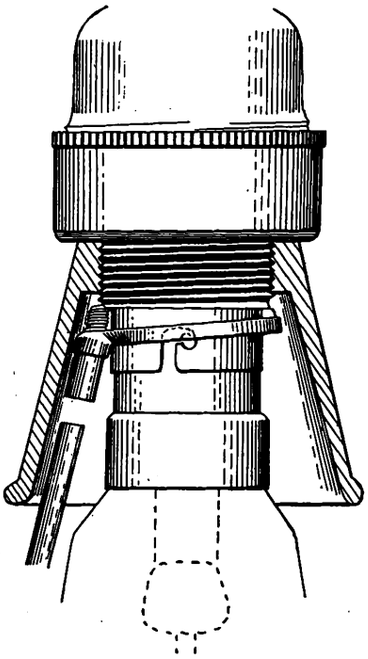

Fig. 3.—Action of "Lamlok" Ring for H.O. Holders.

holder. No damage, it is claimed, is done to the lamp, which can be removed at will by any authorised person using the standard Lamlok key.

Bakelite Lighting-fittings Accessories.

Among recent additions to the wide range of lighting pendants of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, are a number of fittings incorporating bakelite accessories. In these, bakelite ceiling roses, galleries, and lampholders take the place of the more common form of porcelain roses and metal galleries and holders. The new accessories are of high-class finish, and are claimed to be immune from flymarks, tarnishing, and discolouring; moreover, they are practically shockproof. They are supplied in lustrous oak finish and will harmonise with any surroundings. G.E.C. bakelite accessories have not hitherto figured as integral parts of lighting fittings suitable for domestic offices, corridors, and the like.

Improved Electric Fans.

In order to anticipate a sudden and heavy demand for electric fans this summer, the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has prepared large stocks of table or bracket models. These, it is claimed, are of high efficiency, and are capable of operating satisfactorily under the most severe working conditions. The range, it is said, will satisfy every

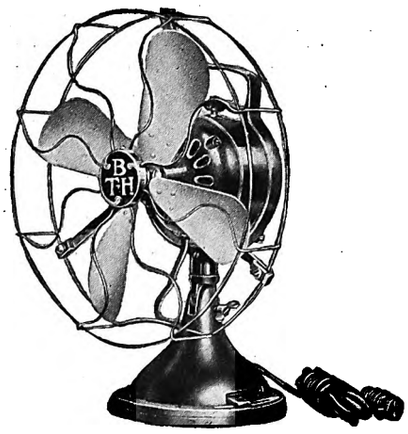

Fig. 4.—Table-type B.T.-H. Fan.

requirement in the home, office, shop, &c. The fans are manufactured in two patterns—oscillating and non-oscillating. All sizes are arranged to permit of adjustment in a horizontal or vertical plane. They can be converted from the table type, fig. 4, to the bracket type by turning a wing screw with a cone point which registers in a socket in the tongue of the hinge and effects a positive clamp. This construction is claimed to be superior to the form of hinge which depends entirely upon friction. The swivel adjustment provides an equal and easy means of changing the direction of the breeze on the horizontal plane.

Reviews.

The International Aspect of Electrical Communications in the Pacific Area. By L. B. TRIBOLET, Ph.D. Pp. vii+282. London: Humphrey Milford, Oxford University Press. Price 11s. 6d. net.

The study of electrical communications must always be of first-rate importance to this country with its world-wide Empire, but at no time has it been so important as at present. We are just embarking on a new era of world-wide communication, not only in telegraphy, but in telephony and pictures.

Until just after the war this country undoubtedly led the world in communication facilities, and, as Dr. Tribolet says, "London is the cable centre of the world," but he goes on to say that "New York is now the wireless centre of the world." Both statements are no doubt correct at the moment, but the whole aspect of communication is changing so rapidly that it is impossible to look ahead with any degree of certainty.

In reviewing British cable activity in the Far East and in South America, the author has some rather bitter, and we think unmerited, remarks both as to the means employed and the ends aimed at. He says, for example, "The Eastern and the Great Northern Companies secured secret monopoly agreements in China which were aimed against the United States," and he makes several similar statements about our endeavours to develop communication facilities in the Far East and in South America. But anyway, there is plenty of room now, with the new developments, for all countries to share as much as they desire in extending facilities for communication throughout the world. Our own endeavours will continue to be primarily governed, as no doubt will those of the United States, by the needs of commerce and business generally, without interfering with the special interests of any particular country or countries.

The author points out that the United States Government has hitherto followed the policy of breaking up monopolies, and of regulating the development of electrical communications in the international sense, leaving the management to private enterprise; but he adds in a rather surprising footnote: "Perhaps Government ownership will come about 1945 when a good many of the contracts of the Radio Corporation of America with foreign countries expire." Another surprising footnote, from the purely technical point of view, is that, according to some of the U.S. experts, "the principles involved in the use of spark sets have not been developed and tremendous new discoveries may await us in that field."

The book gives an excellent account of the international aspects of electrical communication in South America, China and Japan, as found, not only in formal international agreements, but also in arrangements made by syndicates, corporations, and the like. It is published at a most opportune moment just when we in this country are forming a merger of cables and wireless for Imperial communications, and when the International Telephone and Telegraph Company of America is proposing to purchase the Radio Corporation in order to form a world-wide communication system.

This is a book which should be read by all those who are connected with the development of international communication.

Actinotherapy for General Practitioners. By H. G. FALKNER. Pp. x+152. Illustrated. London: Bailliere, Tindall and Cox. 1927. Price 7s. 6d. net.

This work is divided into twenty-three chapters, of which the first ten deal with natural and artificial sunlight, equipment, dosage and technique, and the remainder with specific applications of the treatment to the various disorders for which it is indicated. The author's observations and recommendations are based on his extensive experience of the application of ultra-violet radiation as a curative agent, and should prove a valuable record to general practitioners (to whom the book is primarily addressed) who contemplate the employment of actinotherapeutic methods in their practices.

The purely medical section is one with which the reviewers are not fully competent to deal, but the first section calls for comment as it seems unfortunate that a medical writer addressing himself to the profession should employ terms and make statements open to most serious criticism.

Without wishing to appear pedantic, the author's persistent use of the word "ray" *in the singular* is highly objectionable, as for example (pp. 8 and 9)—"In 1895 X-ray was discovered by Röntgen" and again, "Ultra-violet ray is a very pleasant treatment." Apart from the fact that this is the kind of language to be expected only from the unqualified advertisers of artificial sunlight clinics, a ray is a purely theoretical conception, of use in connection with calculations and text-book diagrams.

In spite of a statement made by Dr. Falkner in his intro-

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duction that "nearly every instrument maker in the kingdom has his own special lamp upon the market, many of which are not suitable for the general practitioner," one may venture to assert that every instrument maker of repute has "lamps" which *are* suitable for general purposes, and that the makers are almost invariably able and most willing to give expert opinions regarding their performance and use.

In his chapter on "Artificial Ultra-Violet" the author states: "An important point in the writer's lamp is that it is so constructed that it can be raised or lowered at will. . . . *It gives the carbon, tungsten, or metallium separately*, and as stated before, it does not necessitate moving the patient." The meaning is obvious enough, but such looseness of expression has surely no place in any serious printed book of the present day.

In his tenth chapter (Technique) Dr. Falkner makes some suggestions to practitioners intending to take up the use of ultra-violet radiation. The third of these reads as follows: "Obtain some knowledge of electricity, if only the rudiments. Very few medical men know anything about electricity."

Apart from such defects as those mentioned, the work may afford useful guidance to the practitioner who is concerned more with the conditions of the human subject amenable to treatment by means of ultra-violet radiation than with the physical theory of the rays themselves or the principles of the equipment wherewith they may be produced.

Kempe's Engineer's Year Book, 1929. 36th Edition. Edited by H. R. KEMPE and W. HANNEFORD SMITH. Pp. 3289+lxxvii; illustrated. London: Crosby Lockwood & Son. Price 30s.

Again the great bulk of this book has been increased—this time by 120 pages—and the difficulty of seeking information in the three thousand odd pages has therefore been increased. To review the work as a whole is a task for which sufficient time and space cannot be found, and we will confine our attention more particularly to the "Electrical engineering" section, although perhaps as much, if not more, electrical engineering material is "hidden" in the remainder of the work. This section is much the same as in other recent editions, but it is interesting to note that some of the "old" illustrations have been replaced by others representing more up-to-date machines, &c. The criticism that the section "Domestic uses of electricity" is dismissed in under two pages, while one particular firm's well-known wiring system is given about four pages, is worth repeating. The opening chapter of the book has for long been an outstanding feature of the work, and particular attention is drawn to this year's clear and concise resumé of recent developments in the electricity supply industry in the sub-section "Electricity supply."

Sir Joseph Wilson Swan, F.R.S. A memoir by M.E.S. and K.R.S. Pp. 183; plates, 6. London: Ernest Benn, Ltd. Price 7s. 6d. net.

This is a very charming, interesting, and appreciative memoir by two of the children of a great inventor, who, applying very early and continuously through an exceptionally long and active life natural originative inventive genius of an extremely high order, unhelped, or shall we say unhindered, by much scholastic or any university education, largely assisted in revolutionising both photography and electric lighting, both at that time in their infancy, besides making numerous valuable contributions to other practical arts and sciences. Though descended on both sides from families of Scottish descent, Sir Joseph Swan's parents had come south and had settled in the County of Durham about the middle of the eighteenth century, and Sir Joseph himself was born in the year 1828 at Sunderland.

As he himself said in later years, his education was, according to common rule, rather neglected; but he owed much of his true education to that neglect, as he was very much left alone and allowed to roam about and see what he could, while about that time he made his first acquaintance with electrical phenomena, shown to him with an electrical machine by a friend of the family. As to this and his other experiences as a child, and as to his education at a dames' school, the story of his early life in this memoir should itself be studied.

At the early age of twelve we find him apprenticed to a Sunderland firm of druggists, both partners in which died within the first three years of his entering the firm, which freed him to join his friend, John Mawson, in his business of chemist and druggist at Newcastle-on-Tyne, which he did in 1846 when he was a lad of eighteen. Within another ten years Mawson and Swan were making their celebrated photographic collodion, for which there rapidly sprung up a large demand for the wet-collodion process.

About a year later, Mawson, who was Sheriff of Newcastle, perished in an explosion of nitro-glycerine, discovered in a Newcastle stable, and supposed to have been of Fenian origin; so Swan was left to manage his rapidly growing chemical business alone. For the next few years he was largely occupied in developing the carbon permanent process of photographic printing, which he patented in 1864, for the practice of which the present writer held a licence from the Autotype Co., Swan's licensees under his patent, when he—the writer—was still a boy at school. Later, Swan invented the half-tone block for ink printing presses, and later still introduced, about the year 1877, the first commercial gelatino-bromide photographic dry plates of wonderful rapidity. In 1879, Swan patented the first bromide paper, still so much used for photographic printing and enlarging.

Other important inventions due to Swan were the cellular lead plate electric storage battery, which he patented in 1881, and which still survives, and that of cellulose threads, exhibited by him at the Inventions Exhibition in 1885 under the description of artificial silk, which was the progenitor of the enormous manufacture of the similar material which still continues under the same name.

No doubt Swan's chief fame is due to his invention of the carbon-filament incandescent lamp, in the invention of which he anticipated Edison and everyone else, though electrical distribution with lamps, dynamos and batteries all in parallel, at constant potential, was first patented by St. George Lane Fox Pitt. Curiously enough, however, though the carbon lamp was probably the most profitable and most interesting of Swan's inventions from an electrical point of view, and led to other lamps with filaments of different material, it was the most evanescent of his inventions, as carbon lamps are now entirely superseded by those with filaments made of tungsten; while his several photographic inventions, his improvements in storage batteries, and his artificial silk, still continue in use and to fructify.

The memoir gives a very life-like account of a most remarkable and modest personality, whose great success was due to his exceeding patience as well as to his brilliant inventiveness.

A. A. CAMPBELL SWINTON, F.R.S.

Electrical Transmission and Distribution. Vols. V and VI. Edited by R. O. KAPP, B.Sc. Pp. 1,007—1,563; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. each volume.

The sub-title of the two volumes of this work under review is "Sub-Station Work," and, broadly speaking, these volumes deal with the theory, construction, operation and maintenance of sub-station machinery, including automatic switchgear. There are no less than nine contributors to these two volumes, and while the engagement of so large a number of writers to deal with the field covered has doubtless ensured that each phase of the same has been treated by a specialist, a compensating disadvantage appears to have arisen in that there is a considerable amount of overlapping, whilst the two volumes, considered as a treatise on sub-station work, are lacking in unity of logical sequence. As examples of the overlapping referred to, we note that the reactance method of the voltage control of synchronous convertors is dealt with by two contributors. Mercury arc rectifiers are referred to in three separate sections, whilst, although automatic sub-stations form the subject matter of a separate section, this matter occupies a considerable amount of space in a previous section dealing with the maintenance and operation of sub-station plant. The method of treatment adopted in some sections of these volumes is in marked contrast to that noticed in previous volumes, in that a distinct theoretical bias is observable. In the section dealing with mercury-arc rectifiers, the theoretical side of the subject is very marked, and there are some formidable integrals which are hardly likely to be of great interest to the majority of the readers of the book. We do not wish our note of the theoretical parts of these volumes to be interpreted as a criticism. They are a useful and instructive supplement to the descriptive matter, although in the section on static transformers there is a tendency to include matter of the conventional a.c. text-book character. Although these volumes will undoubtedly appeal to sub-station engineers and operators, the bad arrangement of the matter contained therein somewhat impairs their utility, and as general works of reference they rank below the previous volumes of the series.

In Vol. V, transformers and rotary converting machinery are dealt with by Dr. S. P. Smith and Dr. M. G. Say. The section dealing with transformers is generally good. The theoretical treatment of converting plant is distinctly useful, but, from a practical and descriptive standpoint, the section dealing with this plant is somewhat meagre. The section by Mr. C. W. Jolley, dealing with mercury-arc rectifiers, is an excellent one, and the theory of these machines is admirably dealt with, whilst the descriptive matter is useful and illuminating. This section will be of particular use to electrical men who have yet to make their acquaintance with the mercury arc rectifier. The final section of Vol. V is contributed by Mr. C. W. Marshall. This deals with the handling, care, and protection of transformers, and, whilst being somewhat sketchy in construction, it contains some useful and practical matter for those concerned in the maintenance of static transformers sub-stations.

The first section of Vol. VI, from the pen of Mr. P. Kemp, is entitled "Alternating Current Sub-Stations." Beyond some discursive descriptive matter relating to modern sub-station lay-outs, this section contains very little which is not treated in logical sequence in other portions of the book. The middle section of this volume deals with testing, maintenance and operation work in sub-stations. Three contributors have collaborated to produce this section, and it is consequently somewhat heterogenous in character. We find, however, much useful and practical matter regarding the testing of switch and protective gear, staff organisation, and operating routine, some very interesting notes on traction supply, a considerable amount of descriptive matter relating to the mercury-arc rectifier which forms a useful supplement to the section dealing

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with this subject in the preceding volume; and, finally, a considerable amount of space devoted to the maintenance and inspection of automatic sub-stations. The final section of the volume is entitled "Automatic Sub-Stations," and is generally descriptive of the principles of operation of the gear in such sub-station, and its application to lighting and traction requirements. This section might well have been placed before the one now preceding it.

Annual Tables of Constants, and Numerical Data, Chemical, Physical, Biological and Technological. Edited by Dr. R. ANDUBERT, Ch. de Massacré, Dr. A. BUFFAT, L. DURAND, and Dr. G. FCEX. Illustrated. Paris: Gauthier-Villars and Cie. Price 90 fr.

This book contains certain abstracts from the complete Volume VI (1923-4) of the above-named annual tables.

The abstracts combined here are such as are of special interest to electrical workers, and give, in the form of curves and tables, the most up-to-date data which have been established in all branches of electricity, together with full references to the original sources and sufficient explanatory matter to define the units employed in all cases. The subjects covered are: (1) electricity (electric conductivity, dielectric constants, thermo-electric forces, electric arcs and discharges, losses in insulation, resistance materials, fusing currents, increased resistance to alternating currents, heating of machines; (2) magnetism (in pure metals, in alloys, permanent magnets, magneto striction, para- and dia-magnetism, atomic moments, magneto-chemistry, magneto-optics, &c.); (3) electrochemistry (conductivity of electrolytes, fused salts, ionic conductivity, dissociation constants, primary cells, accumulators, photo-electric cells, contact potentials, decomposition potentials, &c.).

The collection is a valuable one, and contains much that could otherwise only be obtained from the original sources. The explanatory matter is in French.

The index to the 174 pages in the volume is given in French, German, English and Italian, but only occupies some 3½ pages, and is hardly detailed enough for such a work of reference. It might well be supplemented by alphabetical subject and name indexes.

High-speed Circuit-breakers.

Features of the Equipment Recently Introduced by the General Electric Co., Ltd.

A NEW type of high-speed circuit breaker recently developed by the General Electric Co., Ltd., will, it is claimed, clear the worst type of short-circuit in approximately 1/100 second. It is particularly suitable for use with d.c. traction circuits at pressures of 600, 1,500, and 3,300 volts, as well as for other circuits where heavy overloads or short-circuits may occur. It may also be used with automatically-controlled convertors or rectifiers, and operated from remote positions. The breaker may be closed manually, by local and distant electrical control, or by supervisory control. It can be arranged with auto-reclosing features, coupled with protection against persistent overload, while a number of electrical interlocks, carried on the framework, together with suitable relays, control these features. When required the breaker may be mounted on a removable truck, as in fig. 1, with all the necessary plugs and sockets for the main and auxiliary connections.

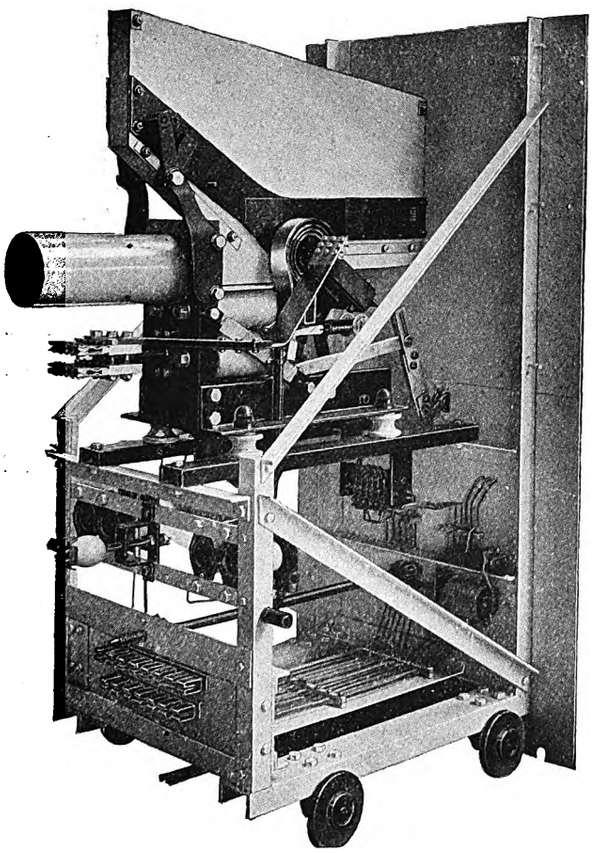
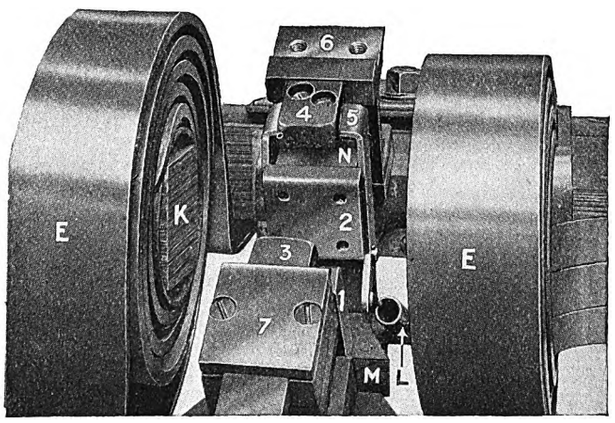


Fig. 1.—Circuit Breaker on Truck Cubicle; 1,500 V.

The construction of the apparatus is depicted in figs. 2 and 3, the former illustration being a close-up view of the contacts.

The moving contact is carried at the top of the duralumin arm controlled by strong springs, the parts being so located that the hold-on armature acts as a fulcrum, through which the pull of the springs is transmitted to the contacts to hold the latter firmly together. Auxiliary contacts are provided which open an instant later than the main contacts, so that there is no arcing on the main contacts. The moving auxiliary contact is a plain copper rod which can be set up many times before it needs replacing. Both the main and auxiliary contacts are located in a strong magnetic field provided by a powerful blow-out magnet, while the arc is broken in a large arc chute. This is hinged and can be thrown back and retained by a hooked catch to permit inspection of the contacts. On its outside surfaces the chute carries long iron pole pieces for the blow-magnet, and, internally, it has long arcing horns which engage with their respective contacts when the chute is in its working position. The magnetic field is so directed that the arc is immediately forced off the auxiliary contacts on to the arcing horns, and the poles of the arc then kept moving along the horns until the arc is sufficiently extended, and finally broken. In order to reduce the mechanical shock on the armature when the contacts close, an air dash pot is fitted. This allows the breaker to close and be held firmly on any load below that for which the overload release is set.



E, blow-magnet windings; K, blow-magnet; L, spring controlling auxiliary contact; M, hold-on armature; N, top of duralumin switch arm; 1, positive (fixed) contact (has ball and socket-fixing arrangement for quick adjustment); 2, negative (moving) contact; 3, positive (fixed) auxiliary contact; 4, positive (moving) auxiliary contact. (Note good condition after a series of short-circuit tests on 2,000-kW rotary convertor, 1,500 volts, through external resistance of only .0025 ohm); 5, frame carrying auxiliary contact 4; 6, engaging surface for negative arcing horn; 7, engaging surface for positive arcing horn, also clamp for adjusting 3.

Fig. 2.—Circuit Breaker Contacts.

The overload release consists of windings carrying the load current, so arranged that they strengthen the field in the cores of the hold-on magnet, but not in its armature. When the load has grown to a pre-determined amount it sufficiently saturates the magnet cores, lowering their effective permeability until the magnet hold-on windings are no longer able to maintain sufficient flux in the armature which is thus released.

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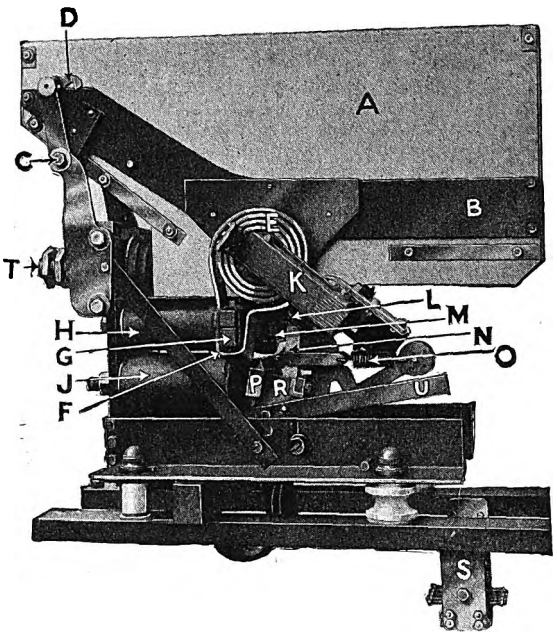
If the load current rises suddenly in the releasing windings, the flux which they generate cannot immediately be forced through the hold-on magnet, because of the reaction of its hold-on winding, and also because of eddy-current effects in the solid cores of the magnet. Consequently, the armature is immediately robbed of its magnetism, in order to feed that part of the magnetic circuit controlled by the releasing coils. This gives quick action, and discriminates between a slowly-increasing overload and the sharp rise that is experienced under short-circuit conditions. As the quick magnetic changes



A, arc chute; B, blow-magnet pole extensions; C, pivot for arc chute; D, catch for arc chute; E, blow-magnet winding; F, releasing-winding (one turn looped from blow-magnet winding); G, pole pieces (for field created by releasing winding); H, hold-on windings; J, closing coil; K, blow-magnet; L, spring controlling auxiliary contact; M, hold-on armature; N, duralumin switch arm (open position); O, opening springs; P, closing armature; R, pivoted frame carrying P, and also pivot for N; S, frame carrying electrical interlocks; T, positive terminals; U, bar for hand closing-handle removed.

Fig. 3.—Construction of Circuit Breaker.

are restricted to the iron of the armature and the pole pieces, all of which are laminated, and as there is a large air gap in the magnetic circuit controlled by the releasing windings, the armature is released at the moment when the current reaches the critical value for which the release has been adjusted. Adjustment of the release is obtained by varying the current in the hold-on windings by means of an adjustable resistance connected in series. No mechanical alterations are necessary, and a change can be effected by remote control, or automatically, if desired.

Legal.

Carew & Keeble v. Palmer.

IN the Chancery Division, on June 21st, Mr. Justice Maugham granted an injunction to Messrs. Carew & Keeble, 44 & 46, Kingsway, W.C., proprietors of an electrical device called the "Gacor flasher," restraining Leonard Palmer, trading as the Eagle Electric Co., 1 & 3, Regent Street, W., the owner of a device known as the "Eagle blinker," from issuing threats of legal proceedings for infringement to purchasers of the plaintiffs' patented article.

Mr. SHELLEY, for the plaintiffs, explained that the "flasher" was a sort of adaptor which, when attached to an electric lamp, caused it to flash on and off. In consequence of the defendant's action the plaintiffs had suffered serious loss of business.

Mr. JACOB, for the defendant, said he had threatened nobody with any proceedings, and the plaintiffs' action was, according to Mr. Palmer's affidavit, due to a misunderstanding. The real defence to a motion of this kind was an action for infringement, but the defendant was unable to do that because, although he had paid for a licence under the patent for the "blinker," he could not get it.

His LORDSHIP said it was a clear case for an injunction to restrain threats, and the costs would be costs in the action.

Marconi Royalties Appeals Succeed.

IN our last issue we reported that Mr. Justice Luxmoore had allowed the appeals of Marconi's Wireless Telegraph Co., Ltd., from orders made by the Comptroller-General of Patents directing the company to grant manufacturing licences upon special terms to the Brownie Wireless Co. of Great Britain, Ltd., and the Loewe Radio Co., Ltd.

In the Brownie case, after reviewing the evidence, his Lordship said that he could not agree that the Brownie Co. had established three essential things: (1) That the patentees had refused to grant the applicants a licence on reasonable terms; (2) that the trade or industry of the country or persons was prejudiced by the refusal of the grant; and (3) that the grant of a licence was in the public interest. His Lordship held that the applicants merely wished to enter an existing industry; that the terms of the licences granted by the Marconi Co. were reasonable, and that the public was already well served.

As regarded the Loewe case there had been no definite refusal of a licence. He thought, however, that when a licence was granted to the applicants, the terms fixed by the Comptroller-General, *viz.*, 10s. for a triple valve and 7s. 6d. for a double one, were reasonable. He considered that it would not be reasonable to treat them as three or two separate valves with a 12s. 6d. royalty on each. In conclusion, his Lordship said that he hoped that the parties would be able to come to terms.

Alleged Long-Firm Fraud.

BEFORE Mr. Justice McCardie, at the Central Criminal Court on June 13th, the hearing was commenced of the case against C. M. Ellison, traveller, S. Coster, electrician, G. Sturley, engineer, and J. C. Sturley, job buyer, who were charged with obtaining wireless goods by false pretences with intent to defraud. The accused pleaded not guilty.

Mr. MCCLURE, who appeared for the prosecution, said that the defendants were charged with conspiring together and with other persons unknown to cheat and defraud persons who might be induced to supply goods on credit. The firm from whom a large quantity of valves had been obtained was Cleartron (1927), Ltd. The prosecution alleged that the fraud started when the defendant Ellison sent a letter to Cleartron, Ltd., suggesting that he should represent them and obtain orders for radio valves. As a result he was appointed as a traveller in the East and North of London, and immediately a number of bogus orders began to come in from the other defendants. Goods were delivered and never paid for. An order came to Messrs. Cleartron from a firm known as J. H. Denny. That was a firm which it was alleged never existed at all. Orders for cords amounting to £130 were given in the name of George Sturley. They were supplied, but not paid for. In August of last year an order for 24 dozen valves to the value of about £41 was received from J. C. Prill & Co., of Perth Road, East Ham, the registered address of J. C. Sturley. A sum of £10 was all that was received in payment for those goods. Another order for 12 dozen valves was given by Frederick Ashley & Sons. It was alleged that that firm was really Coster, who was also known as Coleman. Their place of business was a cellar under a garage.

On June 17th the defendants were found guilty, and Det.-Sergt. Clark said that Ellison had been previously convicted and bound over for conspiracy to defraud by a system of long-firm fraud with another man. The defendant, G. Sturley, was now serving a sentence of eight months' hard labour for larceny, and he had also previously been convicted. The other Sturley had also been sentenced on several occasions for burglary and forgery. Coster was an undischarged bankrupt and had also been convicted of carrying on long-firm frauds. Long-firm frauds were undoubtedly on the increase.

The Judge sentenced Ellison, Coster and G. Sturley to three years' penal servitude and J. C. Sturley to 15 months' hard labour.

Earlsdon Radio Supplies Co., Ltd.

A PETITION for the compulsory winding-up of this company, of 44, Albert Street, Newark, was granted by Judge Hildyard at the Nottingham County Court last week.

Mr. C. CURSHAM, representing the petitioning creditors, said that the nominal capital of the company was given at £500, and the issued capital at £205. There had been a judgment for £232 for goods sold and delivered, and as that judgment had not been satisfied, the petitioning creditors, Burgoyne Wireless, Ltd., London, applied for the Order.

One-piece E.H.P. Insulators.

The high voltages at which electric power is now being transmitted in Germany have created many problems for manufacturers of porcelain insulators. Hitherto, it has been necessary to use insulators built up in sections. For use in connection with one of the recently-completed 220,000-V lines, the Hermsdorf-Schomburg Isolatoren Gesellschaft has lately succeeded in producing porcelain insulators in one piece; they stand 8 ft. 2 in. in height and have an outside diameter of 39 in.; as they weigh nearly 20 cwt., it will be realised that the greatest care had to be taken and special plant installed to ensure even firing of the whole of the refractory material used in the manufacture of the insulators.

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Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Price of Brains.

I usually read the REVIEW from cover to cover, and therefore cannot miss the "joke column" by the way. I note in the current issue that a certain town council invites applications for the post of burgh electrical engineer at a salary (?) of £150 per annum. Thank heaven I am not looking for a job, and I pity the poor down-and-out electrical engineer who is the successful applicant for such a post. This sort of thing is degrading to the whole electrical engineering profession, and if it continues we shall soon find our friends being offered a few iron washers in return for their highly efficient service.

Alex. Milne.

Glasgow, E.2, *June 22nd*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1928.

1,695. "Electric rotary convertors." Allmänna Svenska Elektriska Aktiebolaget. August 12th, 1927. (295,368.)

2,566. "Coupling of two alternating-current mains of different frequencies." Siemens-Schuckertwerke Akt. Ges. February 18th, 1927. (285,478.)

5,899. "Magnetic cores for electro-magnetic devices." J. H. Buchanan and Associated Electrical Industries, Ltd. February 24th, 1928. (312,658.)

5,963. "Electric lamps for the production of ultra-violet rays." W. D. Verschoyle. February 25th, 1928. (312,591.)

6,060. "Excitation of dynamo-electric machines." English Electric Co., Ltd., and J. C. Wilson. February 27th, 1928. (312,616.)

6,061. "Electric couplings for galvanic batteries." Oldham & Son, Ltd., and W. D. Wilde. February 27th, 1928. (312,617.)

6,067. "Methods of manufacturing electric lamps, discharge tubes, and the like." A. Lierenfeld. February 27th, 1928. (312,659.)

6,345. "Protective devices for electric generating and transmitting systems." English Electric Co., Ltd., and F. A. Harper. February 29th, 1928. (312,622.)

6,936. "Electric couplings." A. Reyrolle & Co., Ltd., and F. Coates. March 6th, 1928. (312,701.)

7,033. "Electric signalling." Siemens Bros. & Co., Ltd., and D. A. Christian. March 6th, 1928. (312,706.)

7,389. "Diaphragms and the like for electrolytic cells." Dr. A. Wacker Ges. für Elektrochemische Industrie Ges. and Dr. H. Muller. March 9th, 1928. (312,713.)

7,427. "Electric motors." G. H. Fletcher, R. Brooks, and Associated Electrical Industries, Ltd. March 9th, 1928. (312,715.)

7,729. "Electrically-propelled locomotives and trains." G. R. Higgs and Associated Electrical Industries, Ltd. March 13th, 1928. (312,720.)

7,942. "Voltmeter." W. M. Thornton. March 15th, 1928. (312,724.)

8,241. "Protective arrangements for electric power lines or the like." J. Whitcher, R. O. Kapp, and C. G. Carrothers. March 19th, 1928. (312,725.)

8,328. "Systems of electric motor control." British Thomson-Houston Co., Ltd., F. H. Harris, L. R. Nixon, and J. V. Peacock. March 19th, 1928. (312,730.)

8,647. "Devices employing electromagnets." G. Wall and Associated Electrical Industries, Ltd, March 21st, 1928. (312,734.)

8,682. "Automatically-operated electric switches." J. Alexander. March 22nd, 1928. (Cognate application, 15,867/28.) (312,735.)

9,060. "Tanks, more particularly for oil-immersed electrical apparatus." E. J. Jenkins. March 24th, 1928. (312,740.)

10,020. "Electric relays." International General Electric Co., Inc. April 4th, 1927. (288,210.)

10,986. "Electrical phase convertors." M. Moneyron. April 21st, 1927. (289,054.)

10,993. "Electrically-operated loud-speakers." C. J. Nesbitt-Dufort and O. & S. Oilless Bearing Co., Ltd. April 13th, 1928. (312,756.)

11,815. "Arrangement for the testing of electric resistances by means of a cross-coil instrument." Siemens & Halske Akt. Ges. June 24th, 1927. (Addition to 288,288.) (292,579.)

12,182. "Arrangement to protect capacitive loud-speakers against breakdown." M. Von Ardenne. April 28th, 1927. (289,472.)

12,252. "Process and apparatus for timing the ignition of electric projectile fuses." Rheinische Metallwaaren-und Maschinenfabrik. April 28th, 1927. (Addition to 273,338.) (289,473.)

13,101. "Circuit breakers affording overload protection for two electric motors of different powers." A. Reyrolle & Co., Ltd., and H. Bickerton. May 4th, 1928. (312,779.)

13,554. "Sparking plugs." B. Hopps and A. M. Lodge. May 8th, 1928. (312,782.)

15,694. "Telephone apparatus for self-connecting telephone-exchange offices." C. Hill. May 29th, 1928. (312,807.)

15,910. "Electric cells or batteries." W. Peto, H. M. Genese, and Pritchett and Gold & E.P.S. Co., Ltd. May 31st, 1928. (312,810.)

16,315. "Method of treating substances used for the impregnation of cables." Felten & Guilleaume Carlswerk Akt. Ges. March 30th, 1928. (308,748).

16,733. "Filter for preventing distortion of telephone currents." Soc. des Téléphones Grammont. June 15th, 1927. (Addition to 287,847. (292,144.)

17,226. "Printing telegraph receiver." F. W. Cook. June 14th, 1928. (312,821.)

17,285. "Variable-capacity electrical condensers." A. Preen. June 14th, 1928. (312,822.)

17,289. "Insulating compound for electrical conductors." Cablon, Ltd., and Dussek Bros. & Co., Ltd. January 11th, 1928. (303,852.)

17,297. "Thermally-operated electrical switches." N. Dennes and Associated Electrical Industries, Ltd. June 14th, 1928. (312,823.)

17,706. "Electric dry cell." H. Shimidzu. June 19th, 1928. (312,828.)

19,967. "Means for effecting the accurate or relative synchronism of working motors, for instance, for driving paper-making machines." Akt. Ges. Brown, Boveri et Cie. July 8th, 1927. (293,708.)

20,755. "Electric accumulators." H. Dean and Chloride Electrical Storage Co., Ltd. July 17th, 1928. (312,848.)

20,989. "Apparatus for electric farming which may serve for hail protection." P. Lepine. July 19th, 1927. (294,183.)

21,713. "Electric accumulators." B. Heap and Chloride Electrical Storage Co., Ltd. July 26th, 1928. (312,851.)

21,749. "Electric switches." G. H. Ide and H. L. Bentley. July 27th, 1928. (312,853.)

21,750. "Electric tumbler switches." G. H. Ide and H. L. Bentley. July 27th, 1928. (312,854.)

22,210. "Control system for rectifiers and other high-vacuum apparatus." Associated Electrical Industries, Ltd. August 6th, 1927. (295,031.)

22,318. "Electric transformers." International General Electric Co., Inc. August 2nd, 1927. (294,962.)

23,842. "Electrical apparatus for measuring the acuteness of hearing." Siemens & Halske Akt. Ges. September 1st, 1927. (296,433.)

24,770. "Loud-speakers." Ideal Werke Akt. Ges. für Drahtlose Telephonie. April 5th, 1928. (309,115.)

25,705. "Ventilation of dynamo-electric machines." General Electric Co., Ltd., and F. M. Jackson. September 7th, 1928. (312,879.)

26,987. "Electric motors." E. D. Feldman. September 20th, 1928. (312,885.)

26,997. "Electromagnetic compasses of the earth inductor type." British Thomson-Houston Co., Ltd: September 22nd, 1927. (297,465.)

27,920. "Battery hand lamp." Burgess Battery Co. October 10th, 1927. (298,531.)

31,338. "Electric conductors for high voltages." International General Electric Co., Inc. October 29th, 1927. (299,717.)

33,388. "Ignition systems of internal-combustion engines." Alvis Car and Engineering Co., Ltd., and G. T. Smith-Clarke. November 14th, 1928. (312,894.)

1929.

11,967. "Electro-deposition of metals." Electro Bleach and By-products, Ltd., J. Hollins, and D. Jepson. February 25th, 1928. (Divided application on 312,395.) (312,598.)

12,030. "Electro-deposition of metals." Electro Bleach and By-Products, Ltd., and J. Hollins. February 25th, 1928. (Divided application on 5,977/28.) (312,599.)

12,031. "Electro-deposition of metals." Electro Bleach and By-products, Ltd., J. Hollins, and D. Jepson. February 25th, 1928. (Divided application on 312,395.) (312,600.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 19th:—

Si-men-sch (Chinese lettering and design). Nos 498,932 to 498,402 inclusive. All goods in Classes 7, 8, 9, 10, 11, 13, 18, 21 and 22. No. 498,402. Class 50. Electrical insulating substances and materials, &c.—Siemens and Halske, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2.)

Mic. No. 479,196. Class 8. Components of telegraphic, telephonic and radio apparatus.—Micanite and Insulators Co., Ltd., Blackhorse Lane, Walthamstow, E.17.

Teletone. No. 502,394. Class 8. Instruments and apparatus for radio signalling, thermionic amplifiers and parts thereof, &c.—Lichtenberg & Jones, Ltd., 12, Emerald Street, W.C.1.

Electric Light's Jubilee.

The proposed world-wide celebration of "Light's Golden Jubilee" has aroused interest, and we are pleased to learn that the Council of the (British) Institution of Electrical Engineers has addressed a letter to the National Illuminating Committee of the United States, which is organising the celebrations, and also to similar committees in other countries, requesting the recognition of the pioneer work of Sir Joseph Swan by associating his name in some way with the proposed celebrations. The I.E.E. draws attention to the fact that on December 20th, 1928, it celebrated the jubilee of the making and public exhibition of the first carbon incandescent lamp by the late Sir Joseph Swan, whose name was subsequently associated with that of Mr. T. A. Edison in the Edison and Swan Electric Light Co., of Ponders End, near London. Actually the production of that lamp slightly ante-dated the independent invention of the incandescent carbon lamp by Mr. Edison, and the fact that Swan's was the first practical incandescent lamp is one of which we in England have always been rather proud.

The International Illumination Commission will hold its triennial session in England in 1931, and it will be coupled with an important illumination congress. All the illumination interests in this country are so much occupied with preparations for the congress that the I.E.E., which is strongly supporting the congress, feels that it would prejudice the success of those preparations if any extensive part were taken in further celebrations before that date. So far as this country is concerned, it is felt that the cause of good lighting can best be served by concentrating attention upon the forthcoming congress. The Institution of Electrical Engineers has, however, every sympathy with the efforts that will be made this year to attract widespread public attention to the subject.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ARBROATH.—Cinema; Clark & Blyth, architects.

BARNET.—Houses (153), Wood Street, for Auburn & Sons, builders.

BATH.—Additional 100 houses, Twerton, for the T.C.; city engineer.

BECKENHAM.—School (400 places), for the E.C.; Harris and Porter, architects, 16a, John Street, Adelphi, W.C. (returnable deposit of £5 5s.).

BEDFORD.—Premises for Marks & Spencer, Midland Road; Usher & Anthony.

BENFIELDSIDE.—School extensions (£8,580); Durham County Education Committee.

BILSTON.—Houses (154), for the U.D.C.; Eadie Towers and Co., builders, Wolverhampton.

BIRMINGHAM.—Cinema, High Street, Aston, for Cinema Proprietors, Ltd.; Satchwell & Roberts, architects, 7, Waterloo Street.

BLANDFORD.—Pumping station and sewage disposal works, for the T.C.; W. H. Radford & Son, engineers, Albion Chambers, King Street, Nottingham (returnable deposit of £3 3s.).

BOURNEMOUTH.—Bakery and flour store, Charminster Road; P. Parsons & Sons. Church, Charminster Road; Rev. O. H. Shiner. 'Bus station, The Square, for Hants & Dorset Motor Services, Ltd.; Jackson & Greenen, architects.

BRIDGWATER.—Additional 98 houses for the T.C.; borough surveyor.

BRIGHTON.—Cinema, East Street and Grand Junction Parade; Associated British Cinemas, Ltd. Alterations and additions, Palladium, King's Road; Blue Halls, Ltd.

BURNHAM (BUCKS).—Four-bay factory, Slough Estates, Ltd.; Canteen and restaurant, Buckingham Avenue; Taylor, Walker & Co.

BURY ST. EDMUNDS.—Housing scheme (40), for the T.C.; R. H. Beaumont, borough surveyor (returnable deposit of £2 2s.).

CATTERICK CAMP (YORKS).—R.C. Church; Leonard Stokes and Drysdale, architects, London; William Ainley, Ltd., builders, York.

CHESTERFIELD.—Church; Rev. C. Mudford, St. Augustine's Vicarage.

CHINGFORD.—Telephone exchange for H.M. Office of Works, King Charles Street, London, S.W.

DARTFORD.—52 houses, Dartford Road and Stanham Road; W. J. Brise.

DONCASTER.—Technical and mining college; Director of Education. R.C. schools (£9,000); T. Jenkinson, Ltd., builders.

FARNHAM.—Cinema; A. L. Mackie.

FARNHAM ROYAL.—Housing scheme (800), for Slough Estates, Ltd. Business stores, Slough & District Co-operative Society, Ltd.; secretary.

FIFESHIRE.—School at Sinclairtown, Kirkcaldy. New Kirkcaldy High Primary School and reconstruction of Kirkcaldy West School; clerk, Education Authority, Kirkcaldy.

GOLDTHORPE.—Senior school (900 places), for West Riding E.C.; director of education, Wakefield.

HEYWOOD.—Paper mill extensions (£50,000 to £100,000), for Yates, Duxbury & Co., Heap Bridge.

HORNCHURCH.—Houses, Hillcrest Road; H. Saulsby (36), G. Crabb (22), Martin & Pearce (48); Cherry Tree Lane, C. G. Brooker (31).

HYTHE.—Houses, with electrical work, for the T.C.; F. S. Longley & Sons, builders.

ILFRACOMBE.—Pavilion extensions (£16,000), for the U.D.C.; surveyor.

KNOTTINGLEY.—Re-erection of portion of glassworks, for Bagley & Co. (£20,000).

LAURENCEKIRK.—School (£17,750); J. Miller, executive officer, Kincardineshire Education Authority.

LEIGHTON BUZZARD.—Development of Ivinghoe estate, Edlesborough (600 houses), for Farmborough Bros.; R. Humphreys, surveyor, East Twickenham.

LICHFIELD.—Sewage disposal works, Burntwood and Chasetown (deposit £2 2s.); C. E. Mays, engineer to R.D.C.

LINCOLN.—Extensions, technical college, with electrical engineering section, for the Governors; clerk.

LIVERPOOL.—Promenade extension scheme, Otterspool; land steward and surveyor, Municipal Buildings, Dale Street.

LONDON (WHITECHAPEL, E.).—Laboratory, East London College; L.C.C. & London University.

(STAMFORD HILL, N.).—Extensions, stores depôt (£15,500); L.C.C. architect.

(PECKHAM, S.E.).—Secondary school, Homestall Road (£35,500); C. P. Roberts & Co., Ltd., Holborn.

(SOUTHWARK, S.E.).—Reconstruction, John Ruskin school, Avenue Road (£32,500); L.C.C. Education Committee.

(CLAPHAM, S.W.).—Alterations, 68 to 86, Clapham Road; E. W. Wallis.

(BRIXTON, S.W.).—Enlargement, School of Building, Ferndale Road (£33,400); L.C.C. Education Committee.

(WESTMINSTER, S.W.).—Buildings, Approach Road, Milford Lane and Water Street, for Victoria Embankment Properties, Ltd.; Grace & Farmer. Rebuilding, 10, 11 and 12, Smith Square, for incorporation with Westminster House, Millbank; British American Tobacco Co., Ltd. Buildings, Vincent Street; Sir Edwin Lutyens. Buildings, for Imperial College of Science and Technology, Prince Consort Road; Sir Aston Webb & Son.

LOWESTOFT.—Factory extension, St. Peter's Street; P. W. Watson & Sons, Ltd.

MANCHESTER.—Public washhouse, Moss Side; city architect, Town Hall.

MERTHYR TYDFIL.—Mineral water factory, for Mr. Horrocks; Rees S. Harper, architect, Cefn.

MITCHAM.—Central school, Rowan Road (£34,940); G. H. Denne & Son, Ltd.

NEWCASTLE-UNDER-LYME.—New wing, High School (deposit £10 10s.); H. Poole, clerk to the governors.

PONTEFRACT.—Extensions, Tower Works, for Dunhills, Ltd.

RADLETT (HERTS.).—Church (£6,500), for the Congregational trustees; Smee & Houchin, architects, Fleet Street, London; Willmott & Sons, builders, Hitchin.

RAMSGATE.—Electric light plant installation, Haine hospital (£3,200), for Isle of Thanet Joint Hospital Board; Mr. Monkhouse, engineer.

RAVENSTHORPE.—Business stores for Long Buckby Self Assistance Industrial Society, Ltd.; Lawson Carter and Coles, architects, 31, Market Square, Northampton (returnable deposit of £1 1s.).

RICKMANSWORTH.—Two schools, for Herts. E.C.; director of education, Hertford.

ROXBURGHSHIRE.—Conversion of mansion at Hawick into hostel; clerk, Education Authority.

ST. ALBANS.—Housing scheme (46), for the R.D.C.; H. F. Mence, architect, 43, Upper Lattimore Road (returnable deposit of £2 2s.). Rebuilding, Chequers cinema and theatre (£6,000), for Herts. Cine-Theatre Corporation, Ltd.; H. F. Mence and H. R. Finn, architects.

SALFORD.—Additions to Union Infirmary, Stott Lane, Hope (deposit £2 2s.); W. T. Gunton & Son, architects, 10, Marsden Street, Manchester.

SCARBOROUGH.—Hospital (£120,000), for the committee; secretary.

SELSDON.—School (624 places), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

SOUTH BENFLEET.—School extensions (200 places), for Essex E.C.; W. O. Lester Smith, director of education, Chelmsford.

SOUTHPORT.—Adaptation of Palais de Danse as a cinema; manager.

STALYBRIDGE.—Domestic science centre at Girls' Central school (deposit £2 2s.); P. Howard, architect, 88, Mosley Street, Manchester.

STOCKPORT.—Re-erection of bleachworks and warehouse, for Robert Bailey & Son, surgical dressing manufacturers, Marriott Street Mills.

STRETFORD.—Domestic science centre, at Seymour Park Council School, Old Trafford; Percy Howard, architect, 88, Mosley Street, Manchester.

SWANSEA.—Low level drainage scheme (£108,000); borough engineer. Extensions, Technical College (£26,442); Griffith Davies & Co.

TORQUAY.—Cinema, Castle Circus, with electrical work, for the Burlington Picture House (Torquay), Ltd.; architects, Bridgman & Bridgman, Torquay, and Robert Atkinson, 36, Bedford Square, London, W.C.

TYNEMOUTH.—Theatre, Russell Street, North Shields; Dixon & Bell.

UTTOXETER.—Housing scheme (70), for the U.D.C.; surveyor.

WELLINGBOROUGH.—Additional 124 houses, for the U.D.C.; surveyor.

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The ELECTRICAL REVIEW

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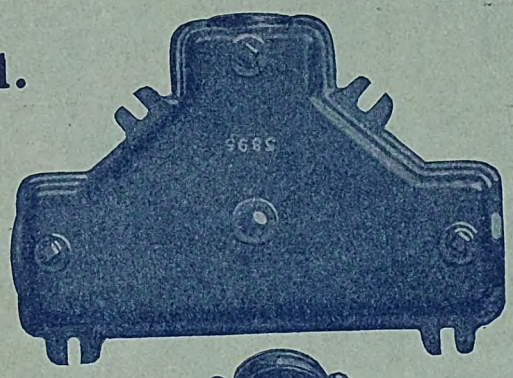

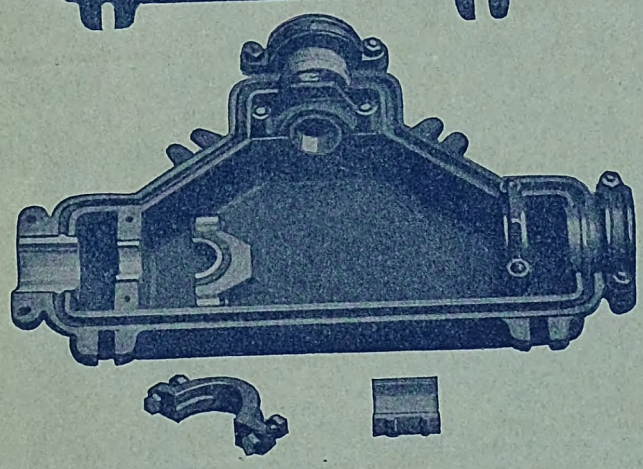

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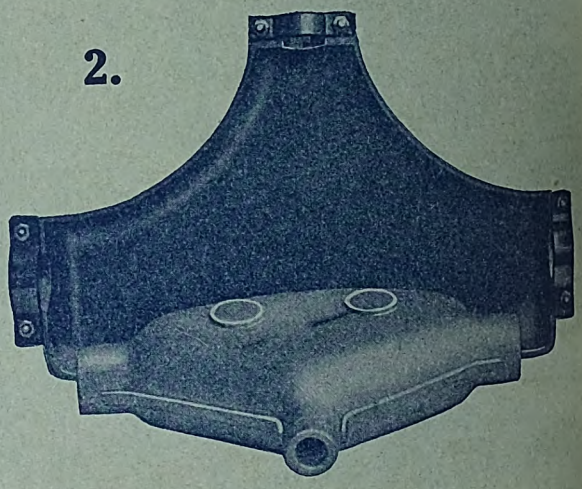

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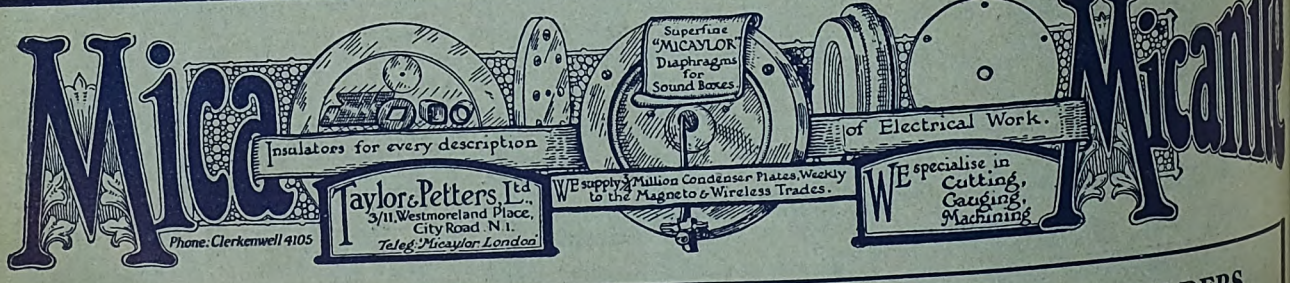

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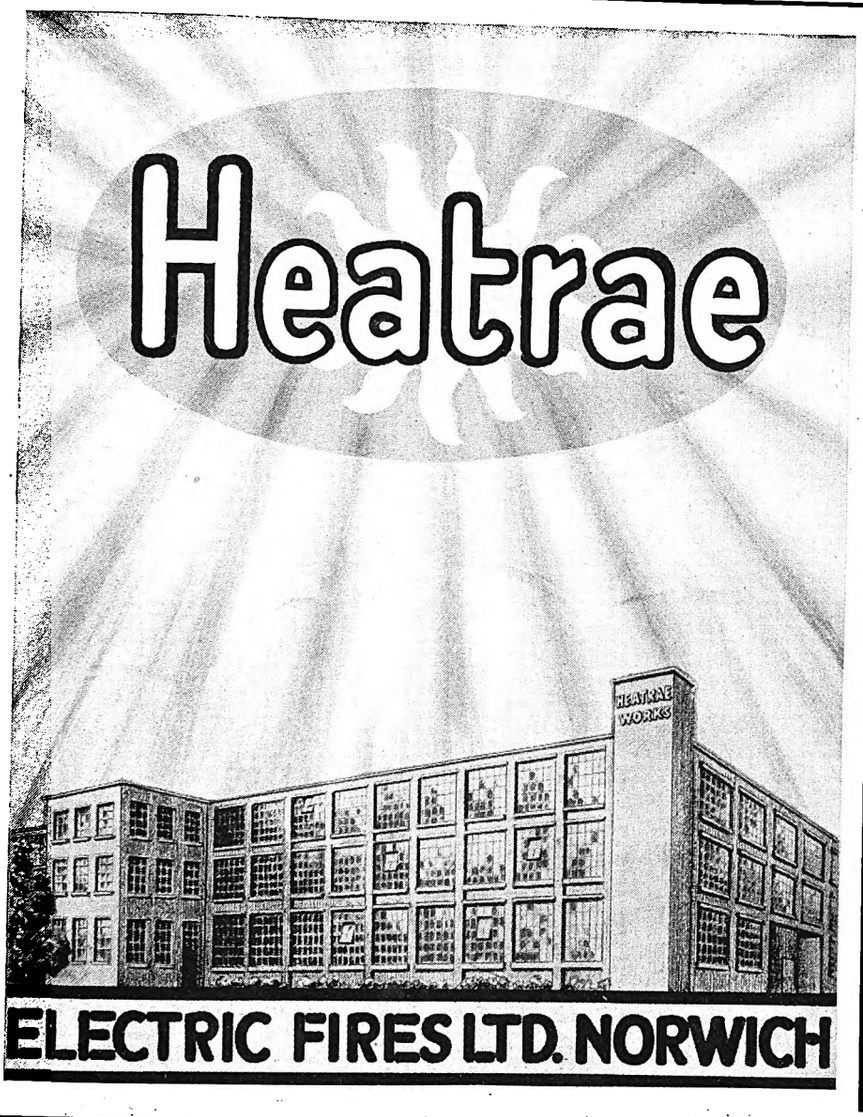

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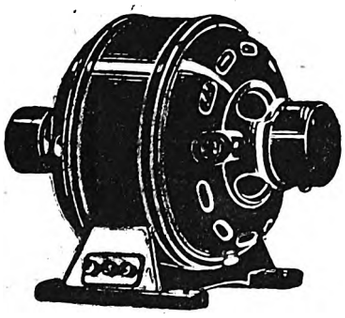

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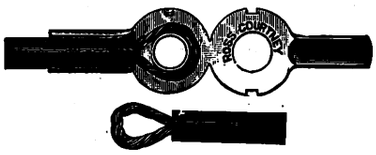

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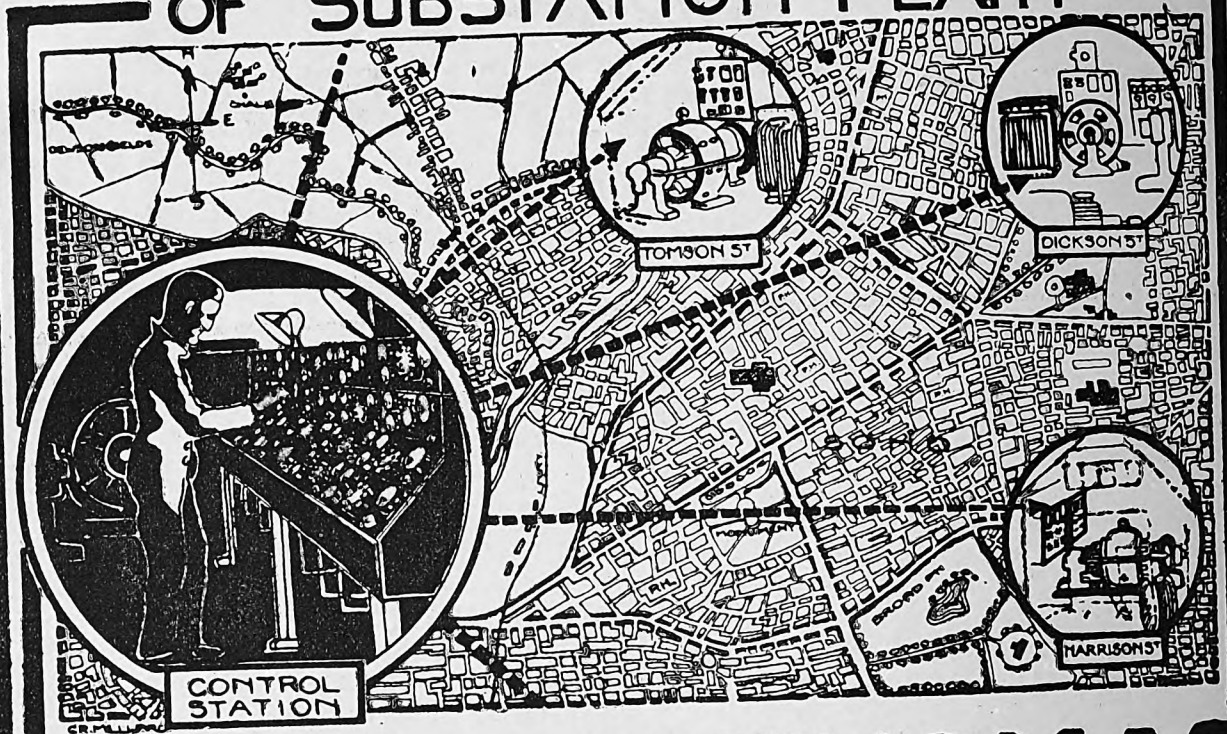

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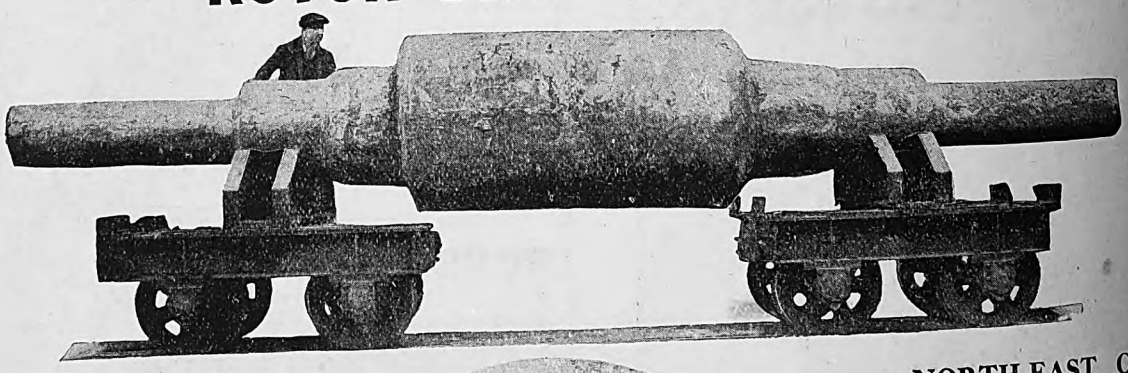
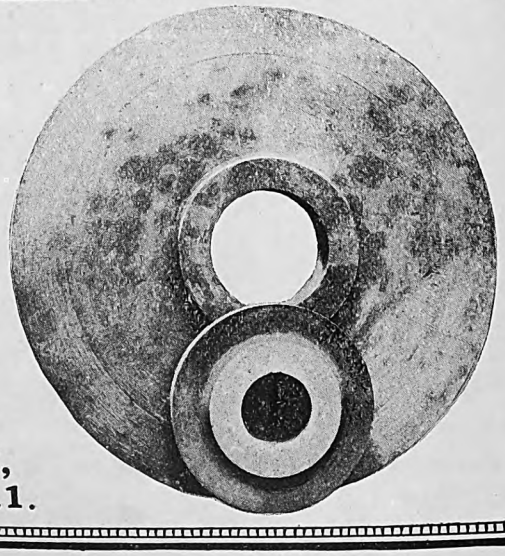


ABOVE is illustrated a forging for a rotor, weighing 43 tons before being machined. Two turbine discs are also shown, the larger of which weighs 30 cwts. and is 70" in diameter.



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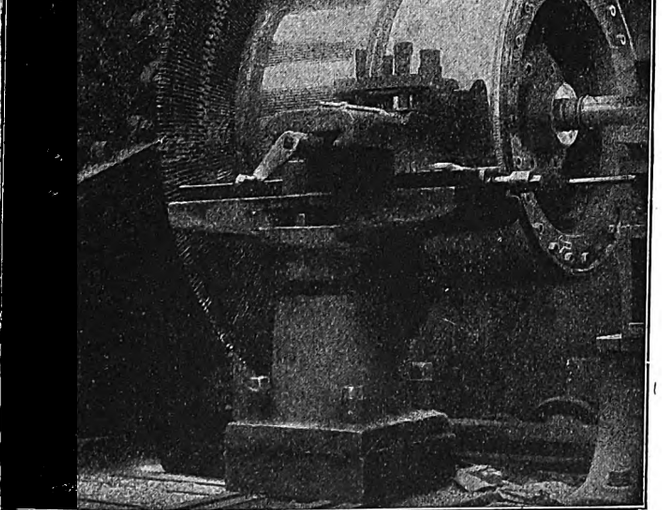

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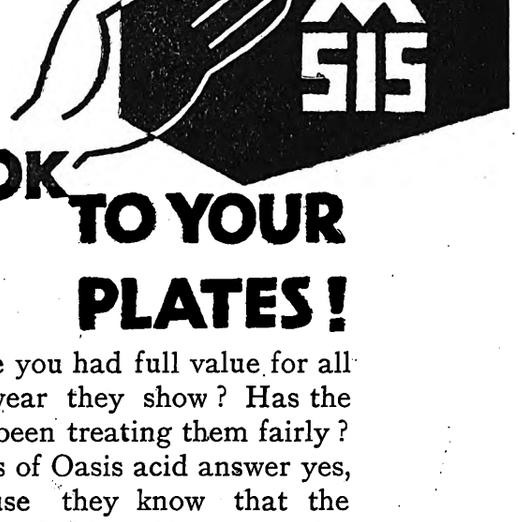

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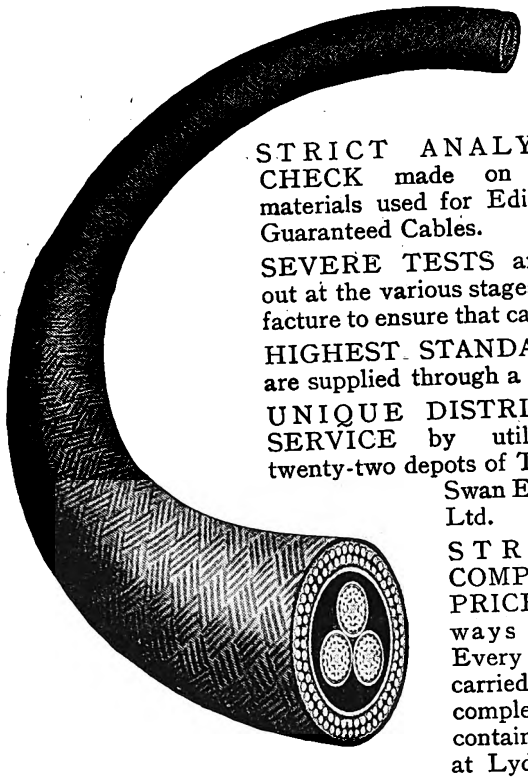

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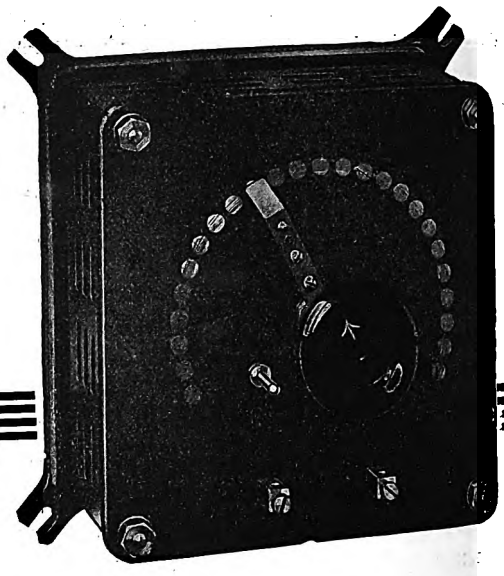

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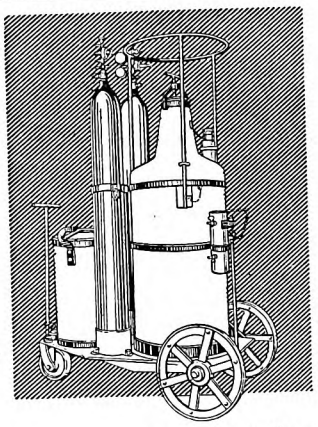

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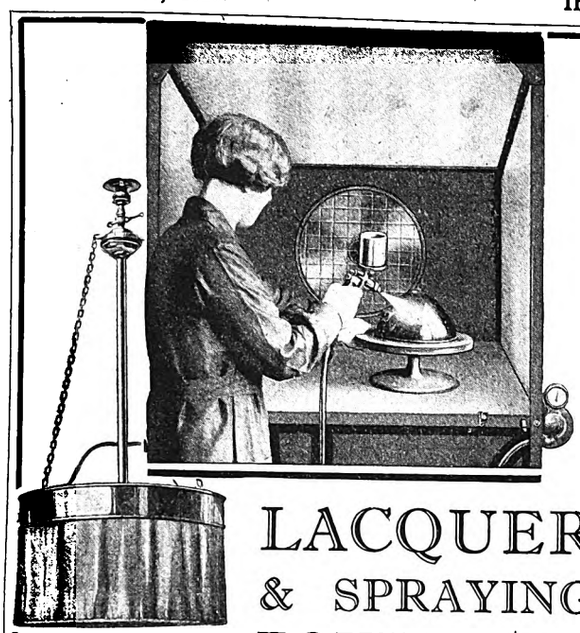

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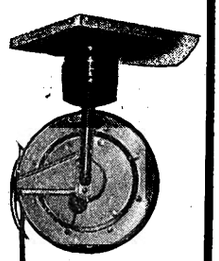

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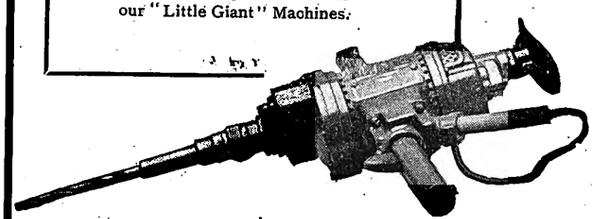

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Branches all over the world.

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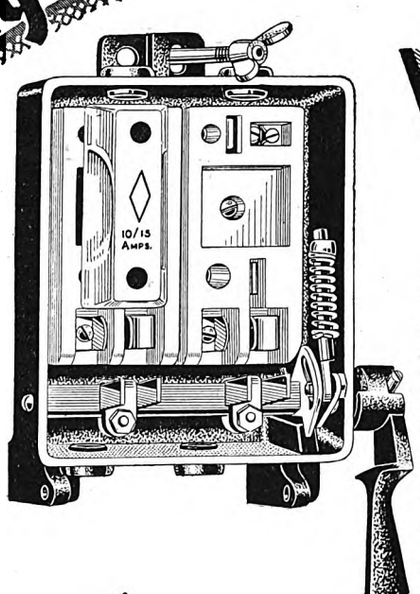

VINETTE
IT *MUST* BE

Birmingham and other Electric Supply Authorities have standardised it for housing scheme installations while hundreds of contractors also specify it as a matter of course.

Ever since its introduction the Vinette Switch Fuse has been a favourite among miniatures. What is the reason?

The advanced design of the Vinette created a new standard of reliability. Organised large-scale production followed and consequent bed-rock prices.

The Vinette Miniature Switch Fuse is ideal for house or small motor and other industrial circuits. If only the best is good enough for you, you cannot do better than write at once for full particulars and name of nearest Agent.

VINCENT

VINCENT SWITCHGEAR MANUFACTURING CO. LTD.
SAMPSON ROAD NORTH • BIRMINGHAM

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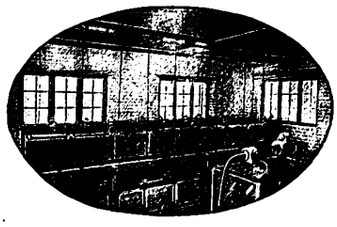
IN THE LAND of THE PHAROAHS

MANY "HART" BATTERIES are installed in a land whose history and achievements will live through the ages.

In Egypt, as elsewhere in all parts of the World, "HART" BATTERIES are preferred by users because they can rely upon those properties of constant voltage, high efficiency and ability to withstand heavy discharge without injury for which, for nearly 40 years, "HART" BATTERIES also have been famous.

HART

THE BATTERY OF QUALITY



HART ACCUMULATOR CO. Ltd.,
STRATFORD, LONDON, E.15.

List of Branches:—
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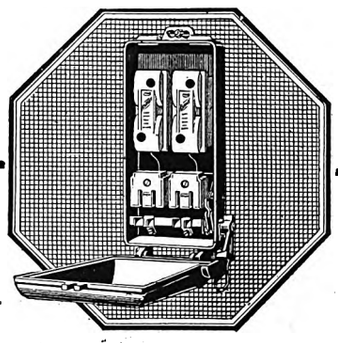
Goodall Ad.

M·E·M



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The "Memrex" series of switches was designed to eliminate trouble for the installation engineer and the user, and at the same time to reduce installation costs.

There is no better switch at the price.

There is no cheaper switch of the quality.

"Memrex" is made for 500 volt pressure in 15-30-60-ampere capacity. D.P. and T.P. with and without fuses.

See that "Memrex" is used on your jobs. It will reduce your costs and ensure your reputation.

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ALWAYS LEADING

MIDLAND ELECTRIC Manufacturing Co, Limited.
BARFORD ST. BIRMINGHAM
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SPECIALISTS IN IRONCLAD SWITCH & FUSE GEAR

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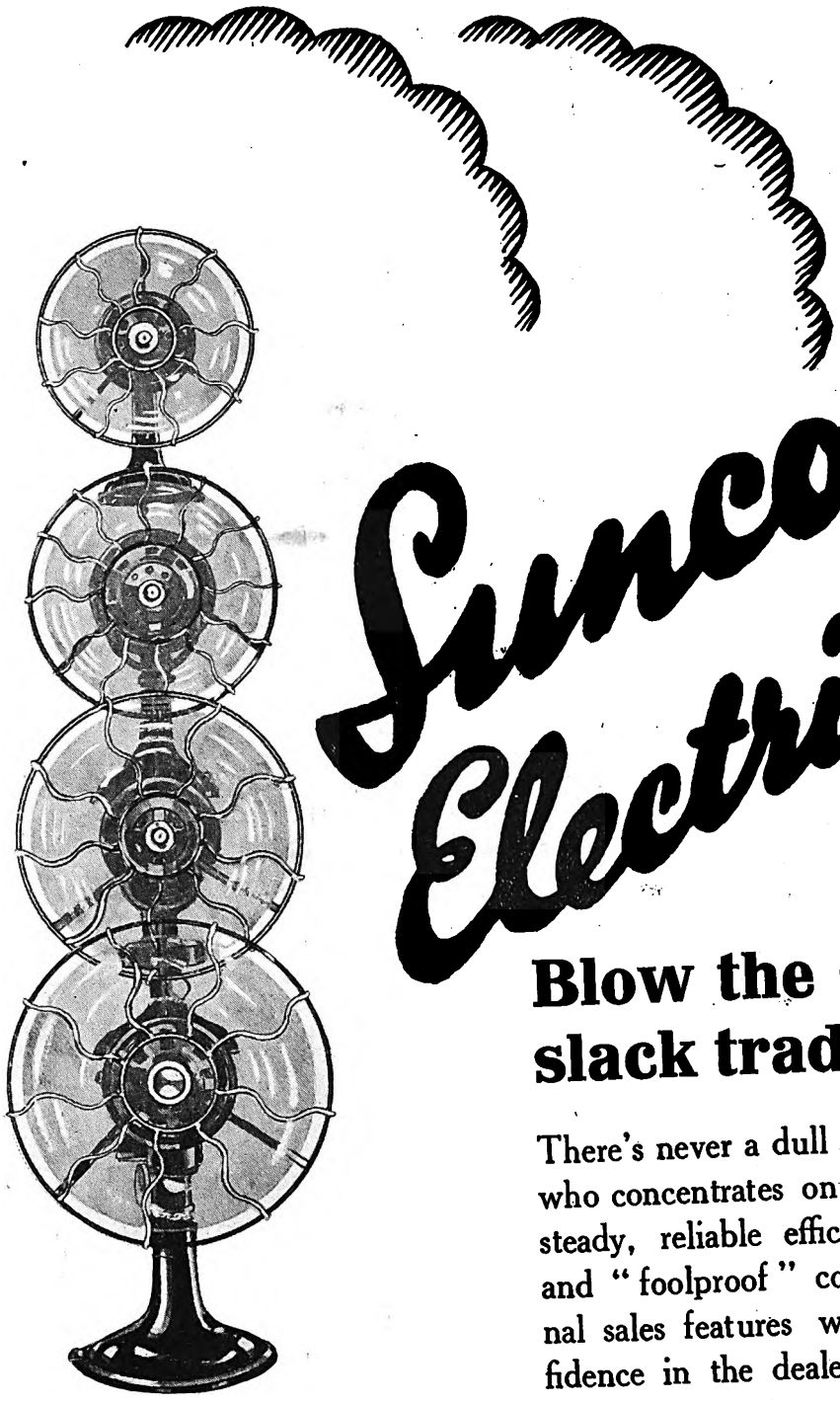

Sunco Electric Fans

Blow the Clouds of slack trade away—

There's never a dull season for the dealer who concentrates on Sunco Fans. Their steady, reliable efficiency, silent running and "foolproof" construction are cardinal sales features which engender confidence in the dealer and satisfaction in his client.

That is why sales of Sunco Fans have increased year by year. Make sure of your share of this business by having a few of the more popular models in stock for window display.

Remember, too, that the range of Sunco Fans is complete, and includes types to suit every need. Desk and Wall types, Oscillating and Non-oscillating, Cabin and Ceiling, Ventilating and Exhausting models for D.C. or A.C. are always in stock in all standard voltages.

Ask for our Fan Catalogue.

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Telegrams:—
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DI-ELECTRIC STRENGTH

3352 VOLTS PER MIL

and after 48 hours' immersion in water

2784 VOLTS PER MIL

SPECIFIC RESISTANCE

$5{\cdot}9 \times 10^{14}$ w/cm³

ARE OFFICIAL TEST READINGS OF

213 "ARMACELL"

Heat and Humidity dangerously lower the di-electric strength of most insulating varnishes

213 "ARMACELL"

ENSURES SAFETY

AT ALL WORKING TEMPERATURES AND UNDER VERY EXACTING CONDITIONS.

When heated from 15° to 90° C. its di-electric strength **falls only 18·5%**

When immersed 48 hours in water its di-electric strength **falls only 17%**

The Insulation Resistance of

213 "ARMACELL"

EQUALS THAT OF GOOD RUBY MICA.

HIGH TENSION OIL WATER

No. 1255B "Ohmaline"

(BLACK INSULATING VARNISH)

MEETS EVERY NEED.

Di-electric Strength **1500 Volts per mil.**

Falls after 48 hours in water **only 3·3 per cent.**

HOT-OIL PROOF.

"SHAYDOLITE"

LAMP LACQUERS SURPASS

ALL SPRAYED LAMPS FOR RICHNESS OF COLOUR.

A wide range of Colours in Clear, Opal & Frosting Finish

APPLIED IN A MINUTE.

"INSULDERM" ENAMEL

HEAT-RADIATING

OIL-PROOF. **FLEXIBLE.**

Prevents Sparking at Commutator Ends

Breakdown Voltage 3600 Volts p·0·1 mm.

Suitable for HARD-WORKED TRACTION MOTORS.

"We never had a breakdown with 'INSULDERM'"

said a New Zealand Tramway Co. after 'Insulderm' had overcome constant trouble.

Also for coating Cotton-Covered and Enamelled Wire.

"ANTI-SULPHURIC"

ENAMEL

IS STILL THE FINEST PROTECTOR

from Acid Fumes and Spray in Battery Rooms, Chemical Works, Mines, &c., &c.

QUICK-DRYING. **GLOSSY.**

In all usual colours.

INSIST ON SEEING OUR NAME ON EVERY CAN.

WE ARE SPECIALISTS in the production of Paints, Enamels and Varnishes for Protective Work of all kinds. Our wide experience and technical resources are AT YOUR SERVICE for the asking.

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Paper Sheets, Rods, Tubes, Cylinders, Panels.
Fine Cloth and Canvas Sheets and Rods and machined articles.

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Dark Grey, Fullerboard and Armaslot Insulation.
Bends without cracking.
Does not become brittle or shrink when stoved.
Ideal Slot Insulation.

ESSELLIDE GREYFULLER BOARD
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BLACK ADHESIVE TAPE

Prompt and careful attention to all enquiries and orders.

All qualities offered proved by constant and continuous use to be suitable in every way for Insulation Work and to give the best results.

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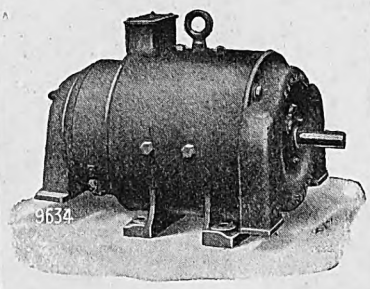
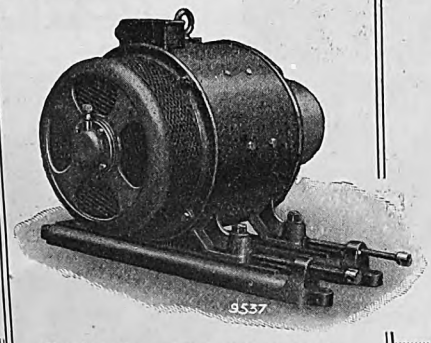


Drip-proof D.C. Motor.



Enclosed-ventilated D.C. Motor.

Causes of breakdown

Faulty Commutator Construction.

Probably the weakest link in the construction of a D.C. machine is the commutator, and soundness of design and of manufacture are therefore absolutely essential. The commutators of Ransomes' Motors receive unusually careful attention. Only materials of the highest class are used for segments, insulation, sleeves and rings. After assembly hydraulic pressure is applied while hot and the most rigid tests are carried out, including centrifugal ageing.

Ransomes

D.C. MOTORS

Illustrated catalogue of both A.C. and D.C. machines will be sent on application. Ask also for particulars of our Motor Generator Sets, Steam-driven Generating Sets, etc.

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IPSWICH, ENGLAND.

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Every marine engineer knows

that electrically driven auxiliaries effect great fuel economies as against steam.

that electrical plant can be made as reliable as steam

and that a big step towards reliability is to instal the recognised "marine" control gear—"Brookhirst."

but *did* you know —

that Brookhirst "Marine Type" Control gear has been considerably improved recently ?

and that these improvements and some recent installations are shown in a new publication just published ?

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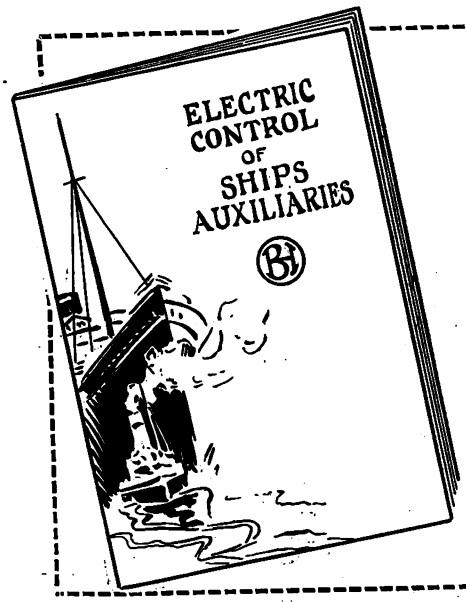

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Signature.....

Firm.....

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Address.....

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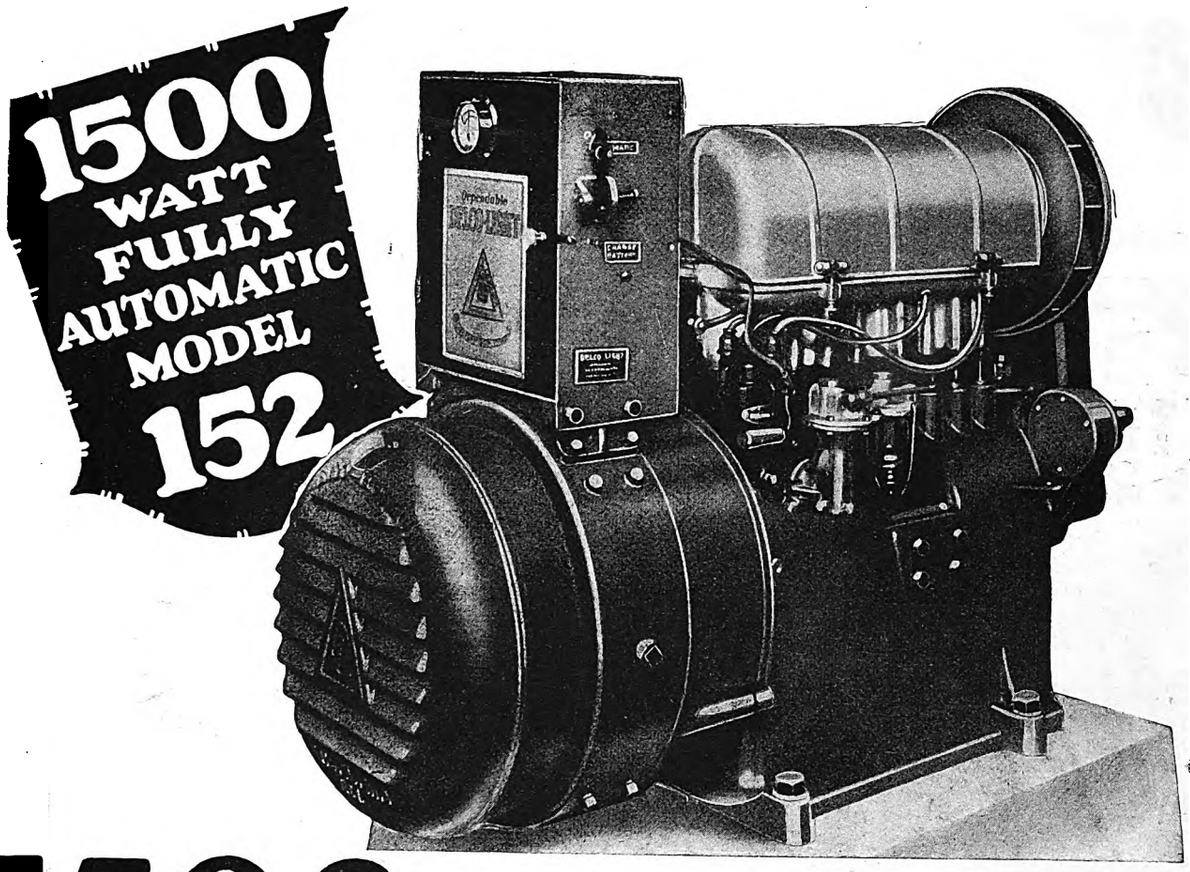

1500 WATTS — of Dependable-Economical Power

Here is a POWER and LIGHTING Plant, generating a load of 1500 watts—sufficient for every requirement of home, farm, dairy and business—that is automatic even in its economy.

This plant does not start until the load reaches 300 watts, and when it falls to 175 watts, the plant automatically cuts out. All demands of current up to 300 watts are supplied by a 16 cell Chloride Battery, which is automatically trickle-charged. This exclusive feature reduces the running cost on small loads to a minimum and prevents unnecessary wear-and-tear, bringing down the inclusive cost of current production to 3d. a unit.

Delco-Light Model 152 starts and stops automatically. It is lubricated automatically. The battery is charged automatically, and automatic warning is given of fuel shortage. Its 4 cylinder overhead valve engine is air-cooled.

All-round dependability, easy starting under all climatic conditions, trouble-free service—all these are built into this sturdy plant. And yet it is moderately priced.

You should know more about Delco-Light Model 152.

DELCO-LIGHT WATER SYSTEMS, TOO
give unfailing service, delivering an abundant stream of water when and wherever required. Full information & prices on request.

SEND THE COUPON NOW

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(Dept. F.10)
FRIGIDAIRE, LTD.,
Frigidaire House,
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VAUXHALL BRIDGE RD., WESTMINSTER,
LONDON, S.W.1.

Please send me full particulars of Delco-Light Model 152—

NAME.....

ADDRESS.....

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Dependable DELCO-LIGHT

A PRODUCT OF GENERAL MOTORS.

B

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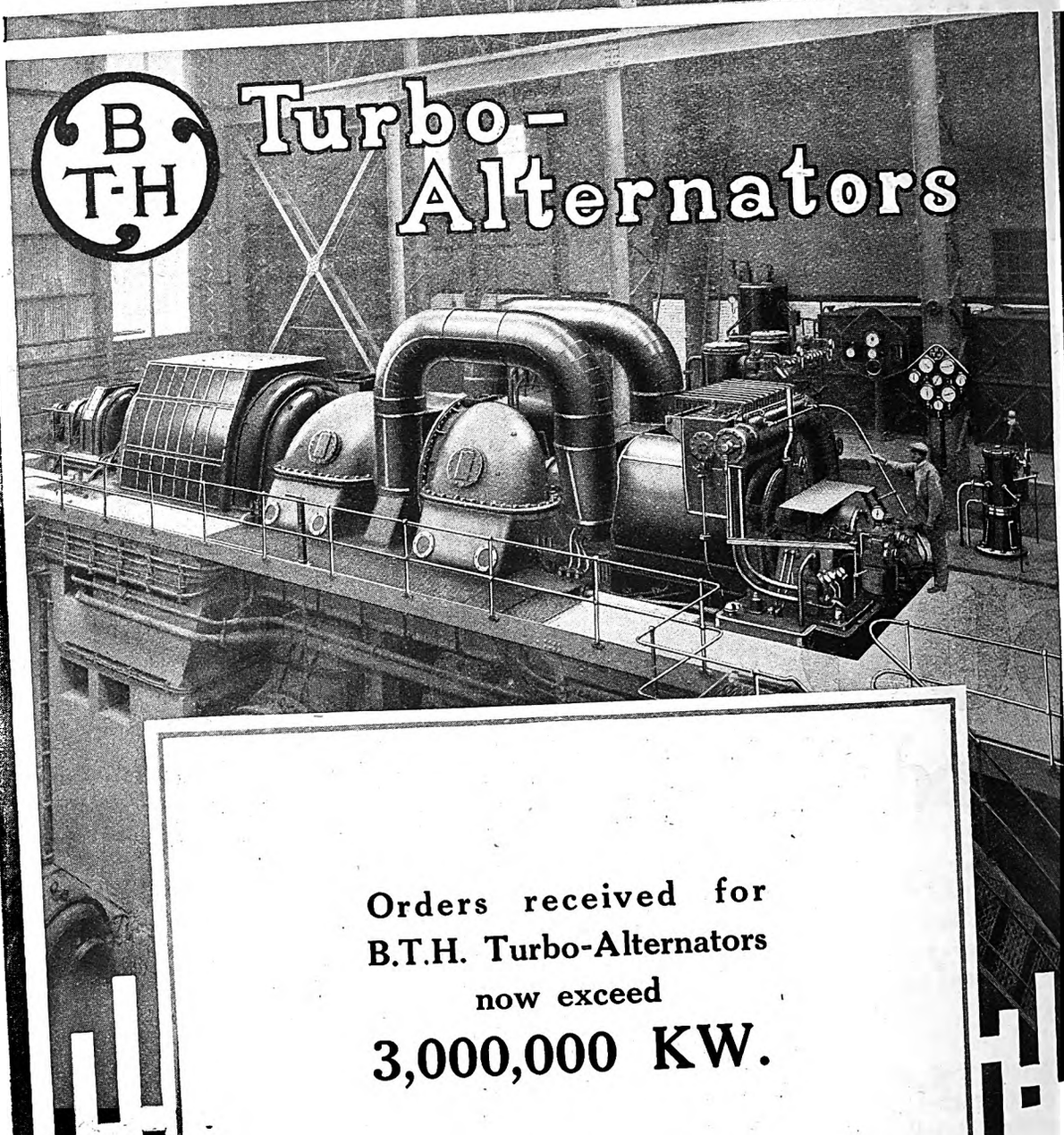

Orders received for
B.T.H. Turbo-Alternators
now exceed
3,000,000 KW.

The illustration shows a 20,000 KW. (double-cylinder double flow) 3,000 R.P.M. B.T.H. Turbo-Alternator installed in the Longford Power Station of the Coventry Corporation.

The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

Head Office: Rugby, England. London Office: "Crown House," Aldwych.

Works: Rugby, Birmingham, Willesden, Coventry and Chesterfield.

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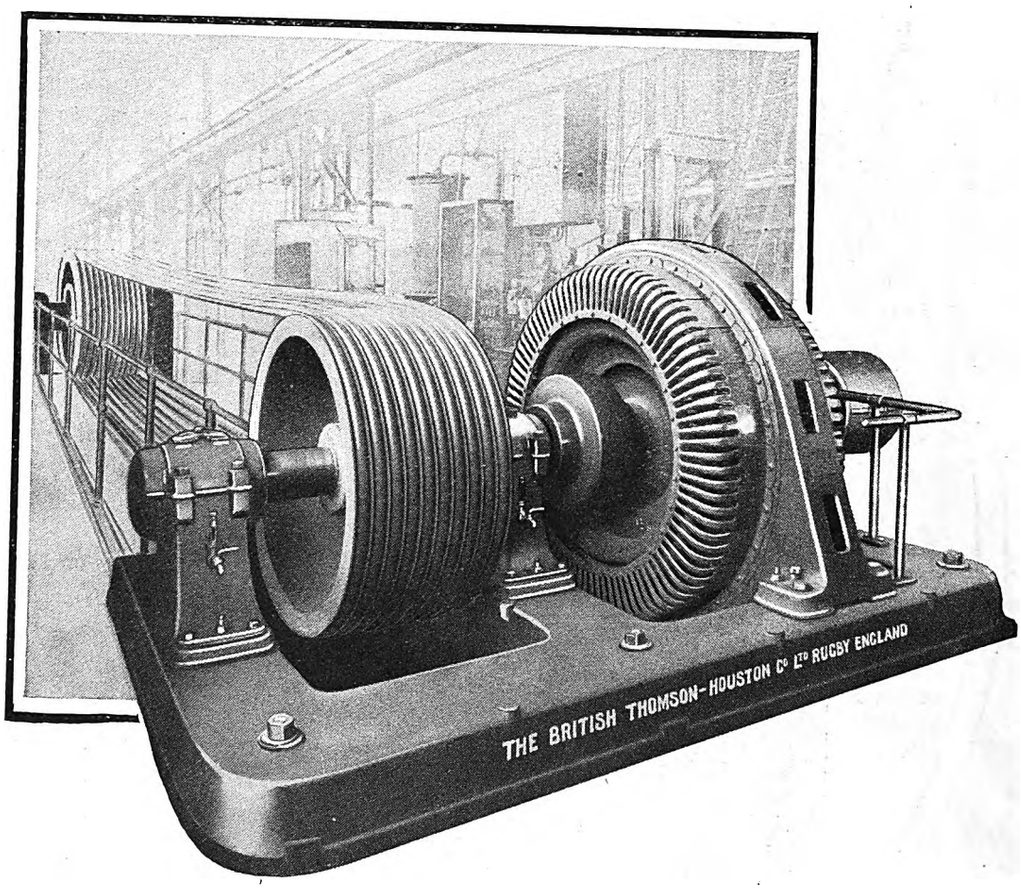
B T-H

"No-Lag" Power-Factor Correction Motors

TRADE MARK



360 H.P. Motor driving Special Tube Mill.

Higher Power Factor—Lower Power Bill

NOT LONG AGO "power factor" was an unknown quantity to the average motor user. To-day everyone realizes that low power factor means uneconomical generation and distribution—and the burden falls on the power user ultimately.

A "NO-LAG" MOTOR can be arranged to run at any desired power factor or to effect any degree of power factor improvement. Every duty within the scope of the ordinary induction motor can be performed by it without *any* additional complication.

A DEFINITE REDUCTION in the power bill can be effected in many cases, by installing "No-Lag" motors, due to the substantial rebates offered by many Supply Authorities, while to the user who generates his own power, they effect substantial economies by improving the capacity of his generating and distributing plant.

The British Thomson-Houston Co., Ltd.

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B T-H VERTICAL SPINDLE MOTORS

for

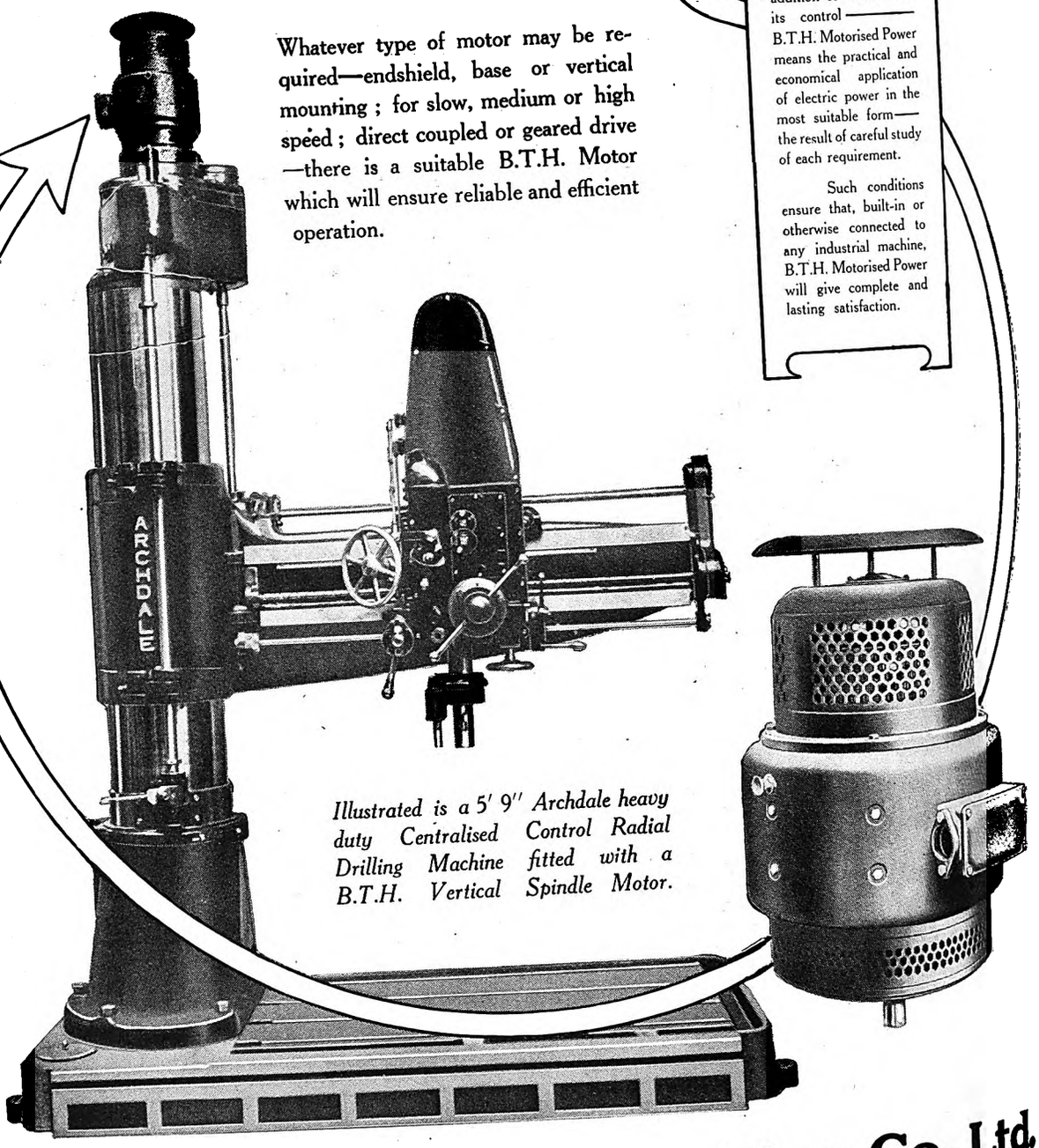
Machine Tools

B.T.H. MOTORISED POWER

——More than the addition of a motor and its control ——— B.T.H. Motorised Power means the practical and economical application of electric power in the most suitable form—— the result of careful study of each requirement.

Such conditions ensure that, built-in or otherwise connected to any industrial machine, B.T.H. Motorised Power will give complete and lasting satisfaction.

Whatever type of motor may be required—endshield, base or vertical mounting; for slow, medium or high speed; direct coupled or geared drive —there is a suitable B.T.H. Motor which will ensure reliable and efficient operation.



Illustrated is a 5′ 9″ Archdale heavy duty Centralised Control Radial Drilling Machine fitted with a B.T.H. Vertical Spindle Motor.

The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

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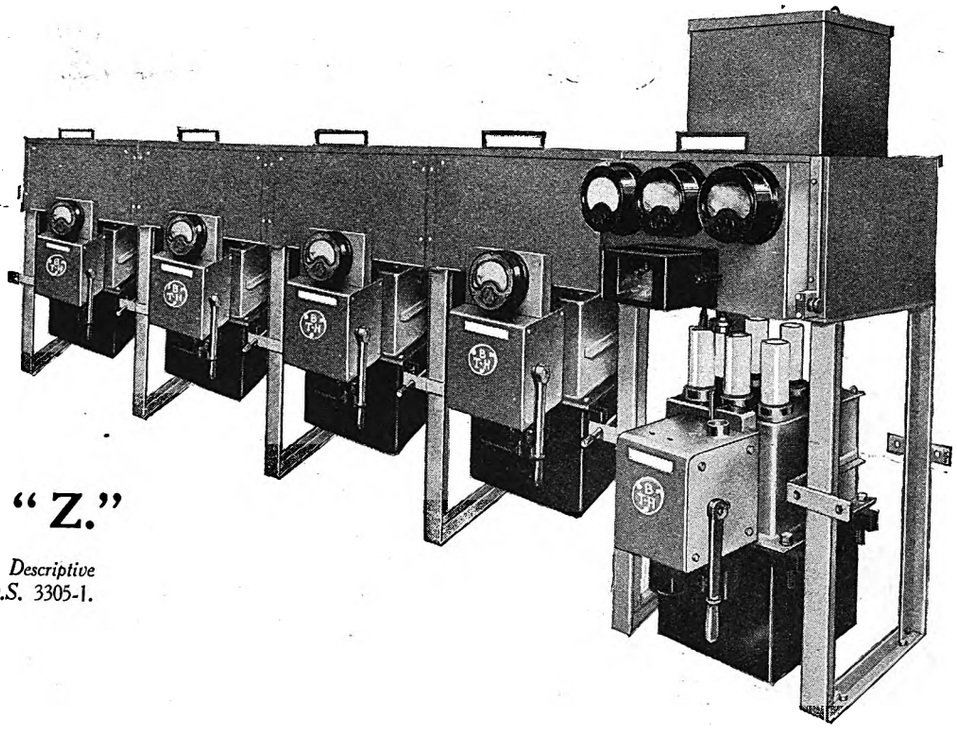
Switchgear

Metal Clad—Vertical Plugging



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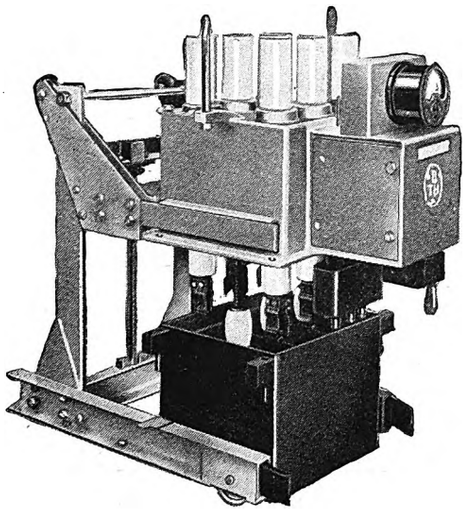

Circuit breaker withdrawn and tank lowered for inspection.

Metal-clad construction is made commercially applicable for small as well as large circuits by this new design of switchgear, which has been introduced by this Company to meet all the ordinary requirements of electric power distribution at home and abroad.

Space economy has been achieved without sacrifice of safety, and the saving effected as compared with truck type switchgear, of equivalent rating, is 25% in the space necessary for installation and operation and 43% in cubic content.

It embodies the following features :

Oil or compound filling may be adopted.

No oil or compound tight joints between equipments.

Current transformers housed in circuit breaker top casing, readily accessible and interchangeable.

Voltage transformer with current limiting resistance and fuses completely inaccessible until dead and earthed.

Perfected self-aligning contacts.

Automatic interlocks to prevent inadvertent mishandling.

The British Thomson-Houston Co., Ltd.

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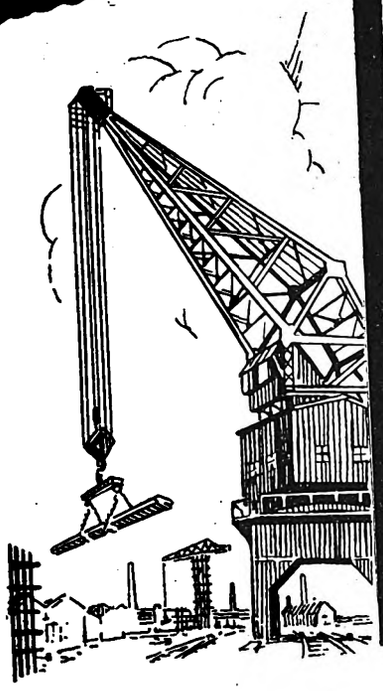
FOR RELIABLE Land and Marine installations!



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FREDERICK SMITH & CO.
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——the Conduit with 30 years' Reputation for Uniform Quality Easy Erection Clean Threads Perfect Finish

But—— do not spoil an otherwise good installation by using cheap fittings. ¶ See that every bend, every tee, every box is SIMPLEX too, and ensure an all-round excellence.

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Branches at London, Glasgow, Manchester, Liverpool, Bristol, Newcastle, Nottingham, Leeds, Cardiff, Sheffield, Belfast, and in Overseas Dominions.

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THE PIONEER

"There's no sense in going further—it's the edge of cultivation." Kipling.

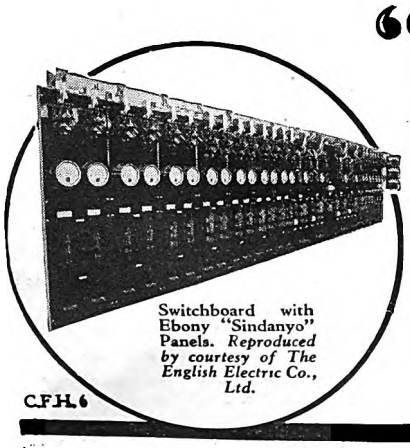
IN an Industry, if it is to survive, there must always be those that give brains and capital freely in the attempt to win better and still better value for the users of their products and whose trail of progress is blazed by rejected ideas and scrapped equipment.

EBONY "SINDANYO" represents seven continuous years of scientific investigation in the laboratory, the workshop and in service; it is no accident, as are the materials it is rapidly superseding, but is to-day *exactly what we intended it to be* when first we set out to produce it, ten years ago.

There is no valid reason why any manufacturer of Switch and Control Gear should continue to mount apparatus on the *unscientific* materials that were only just good enough at the birth of the Electrical Industry and which, under to-day's conditions, are fundamentally unsound, when the use of Ebony "Sindanyo" *not only raises the standard of quality of the complete product*, but actually materially reduces the total cost of production of the unit.

One of our Engineers is at your service at all times to discuss this unique material with you.

Please write for BROCHURE No. 13.



Switchboard with Ebony "Sindanyo" Panels. *Reproduced by courtesy of The English Electric Co., Ltd.*

C.F.H.6

"Sindanyo" REGISTERED

INSULATING BOARD.

·DIELECTRIC·HOMOGENEOUS·STRONG·

TURNER BROTHERS ASBESTOS COMPANY LTD., ROCHDALE, ENGLAND

Manufacturers of

EVERYTHING IN ASBESTOS

for the

Electrical, Electro-Chemical and Mechanical Engineering Industries

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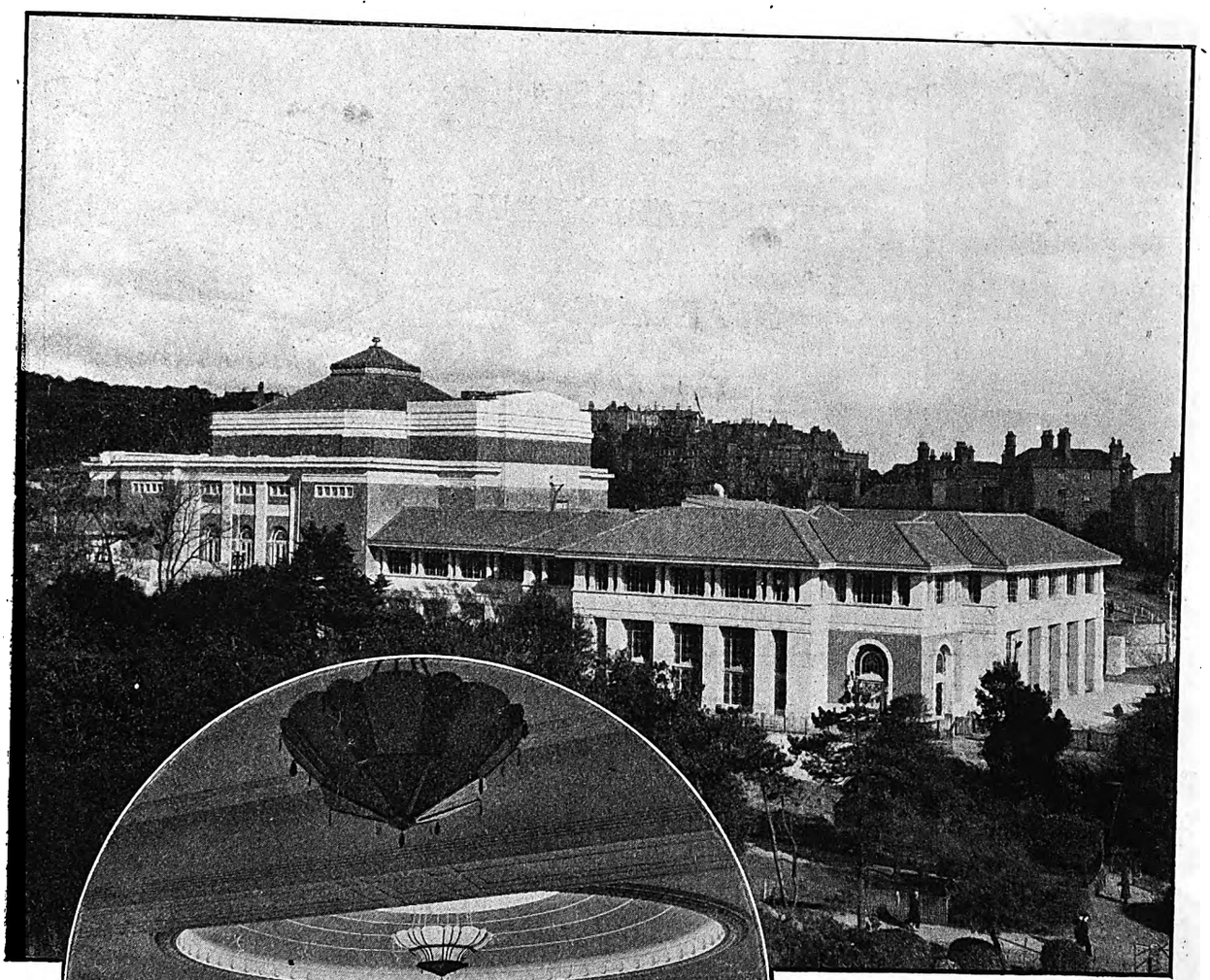

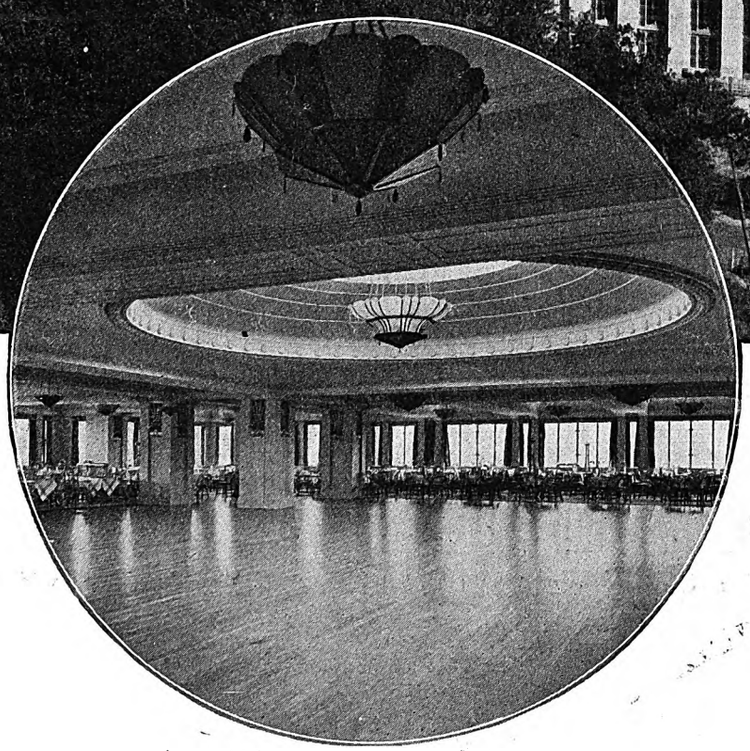

The Bournemouth Pavilion is the crowning glory of the architecture of this South Coast watering place. It took four years to build and cost £250,000. It is the first Bournemouth building in which a three-phase supply has been used.

E.C.A. Conference, Bournemouth

June 26th 27th 28th

The venue for several of the important functions at this annual conference of members of the E.C.A will be the *New Pavilion* in which are installed

24 Miles of

HENLEY

C.M.A. (Regd) CABLE

The giant Cunarder "AQUITANIA," which will be visited by delegates on Friday, June 28th, is the largest steamer to be built in Great Britain. She is illuminated with 13,000 lights and Henley Cables are installed throughout.

499 A

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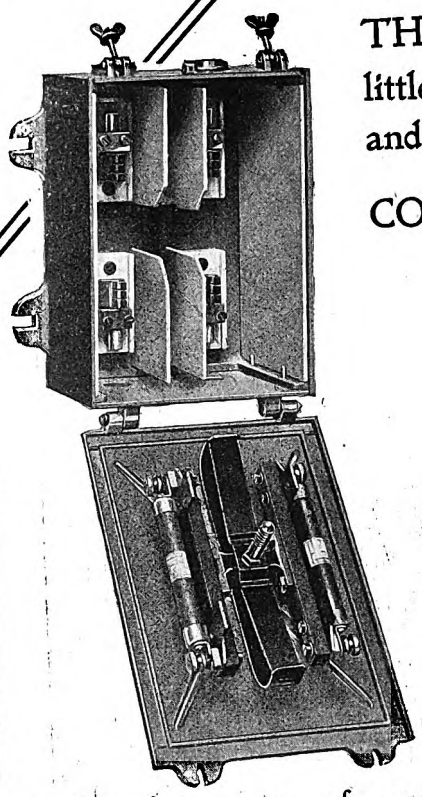

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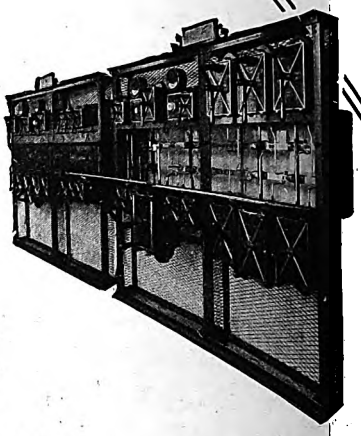
CONSIDERABLY LESS,

so why not STANDARDISE



BERRY'S IRONCLAD SWITCHGEAR

as separate units; and/or for making up SWITCH-BOARDS for which it has no serious rival.

If you are not already conversant with all our patterns, write for copy of our loose-leaf Switchgear Catalogue which gives full particulars with prices and dimensions.

BERRY'S ELECTRIC, (1928) LTD.

LONDON: 86 and 86, Newman Street, W.1.
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An Ideal Combination FOR INDUSTRIAL PURPOSES

MODEL 539
MINIATURE PORTABLE CURRENT TRANSFORMER
The companion instrument to Model 528 A.C. Ammeter.

The introduction of the Model 539 Current Transformer makes it possible, for the first time, to measure A.C. currents ranging from 0·2 of an ampere to 200 amperes with small, high grade, light weight, low cost instruments.

The equipment consists of the Model 539 Transformer, weighing only 2⅝ pounds, having self contained primary ranges of 2/5/10/50 amperes with inserted primary ranges of 50/100/200 amperes; with a miniature A.C. Ammeter, Model 528, having a full scale reading of one ampere.

The Model 539 has a one ampere secondary with a secondary burden of 2 volt-amperes maximum. This Transformer, in combination with the Model 528 one-ampere instrument, covers a wide and useful range of current measurements. The Transformer has a guaranteed accuracy of 1% on frequencies of 25 to 150 cycles.

The self-contained primary ranges are changed by an unique range-changing switch, a noteworthy achievement in design which assures speed and ease of operation.

Model 539 Current Transformer, list price **£6 10s.**
Model 528 Ammeter, one ampere, list price **£3 10s.**
Model 528 Voltmeter, 150 and 15 volts, list price **£3 10s.**

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STANDARD THE WORLD OVER
Pioneers since 1888

Advt. of Weston Electrical Instrument Co., Ltd., 15, Gt. Saffron Hill, London, E.C.1

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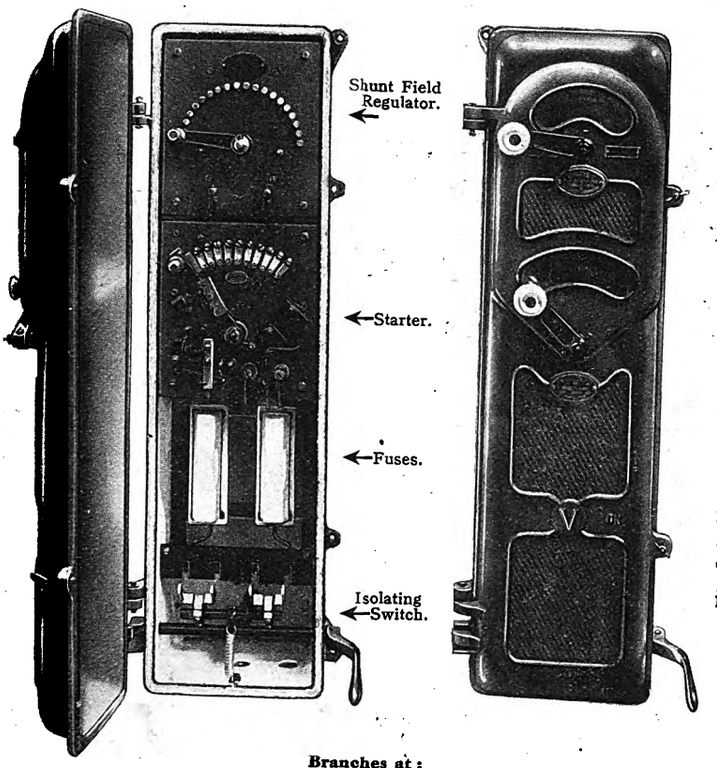
"Efficiency at low cost."



"Aston" D.C. Motor Starting Panels have a big reputation for the highest efficiency and reliability.

The increasing demand has enabled us to produce these panels at a very low price without interfering in any way with the high quality.

The Panel illustrated is for controlling constant and variable speed motors, from ½ to 100 B.H.P.

All the necessary apparatus for control is in the form of separate standard units housed in a neat cast-iron box, dust and weatherproof. The units are easily accessible from the front and can be detached in a few minutes, should inspection be necessary, without removing the box after it has been installed.

These panels can also be supplied with Contactors in place of Fuses.

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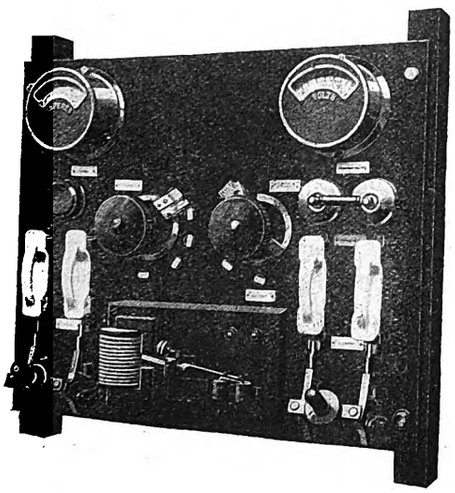
BCM/BHH

TUCKER TELAC



Tucker Switchboards and Switchgear Components

are made and built throughout under the expert supervision of the Tucker Technical staff.

All small components are made in our works by automatic machinery—thus ensuring absolute accuracy and inter-changeability. Component parts too large for manufacture by automatic machinery are accurately made by hand to gauge.

Like every other Tucker product these patterns will be found to conform to the highest standards of mechanical and electrical efficiency.

Enquiries are invited for L.T. switchboards both of the slate panel and ironclad unit types on skeleton angle iron framework.

Battery charge and discharge switchboards for private house installations a speciality.

The TUCKER 14 Groups comprise:—

- Tumbler Switches *Surface, Semi-recessed, Flush and Ironclad*
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- Ironclad Fuses
- Switchboards
- Switchgear

Tucker TELAC

J. H. TUCKER & Co., Ltd., Kings Rd., Tyseley, Birmingham.

E

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Successful test results from Bennis Coking Stokers!

THE illustration shows "Bennis" Coking Stokers and self-cleaning compressed air furnaces at a Paper Mill where smokeless combustion is an all-important consideration. The tests shown below are being obtained weekly and though we cannot mention the name we have permission to refer prospective purchasers to the installation.

If you are interested in smokeless combustion combined with efficiency, write for particulars to-day.

BENNIS PATENT COKING STOKERS

ED. BENNIS & Co. Ltd.
LITTLE HULTON
BOLTON

LONDON OFFICE:-
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WESTMINSTER S.W.1
Telephone:- 0627 Victoria
Telegrams:- "BENNIS Phone London"

SMOKELESS COMBUSTION AND HIGH EFFICIENCY

Particulars of the Tests

No. of Boilers	3 Lancashire.
Size	8′ 6″ dia. × 30′ long.
Hours Worked	136.
Total Fuel Burnt	267 tons or 598,080 lbs.
Coal Burnt per Boiler per Hour...	1,466 lbs.
Grate Area per Boiler	38 sq. ft.
Lbs. of Fuel per sq. ft. grate per hour	38 lbs.
Average Steam Pressure ...	160 lbs.
" Feed to Economiser ...	110° F.
" Added Superheat ...	100° F.
Factor of Evaporation	1·209.
Actual Evaporation per hour ...	38,000 lbs.
" " per Boiler per hour ...	12,666 lbs.
Lbs. Water per lb. coal actual...	8·6.
Evaporation per hour as from and at 212° F.	45,942 lbs.
Evaporation per Boiler per hour as from and at 212° F. ...	15,314 lbs.
Lbs. of Water per lb. Coal ...	10·4 lbs.
Calorific Value of Fuel, B.Th.U.	13,200.
Efficiency % (Boiler, Econ. Sup.)	76·4%.

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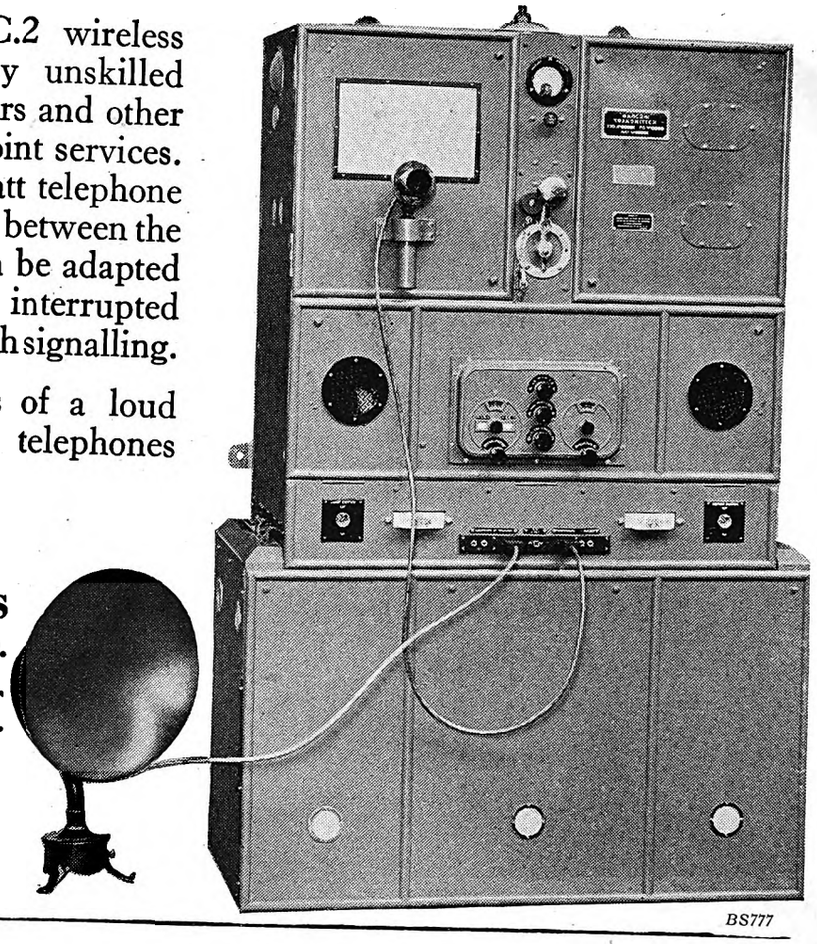
MARCONI WIRELESS TELEPHONE SETS

THE Marconi Type X.M.C.2 wireless telephone set is for use by unskilled personnel on whalers, trawlers and other fishing vessels, and for point to point services. Although it is primarily a 500 watt telephone set operating on a fixed wavelength between the limits of 150 and 450 metres it can be adapted for continuous wave (C.W.) and interrupted continuous wave (I.C.W.) telegraph signalling.

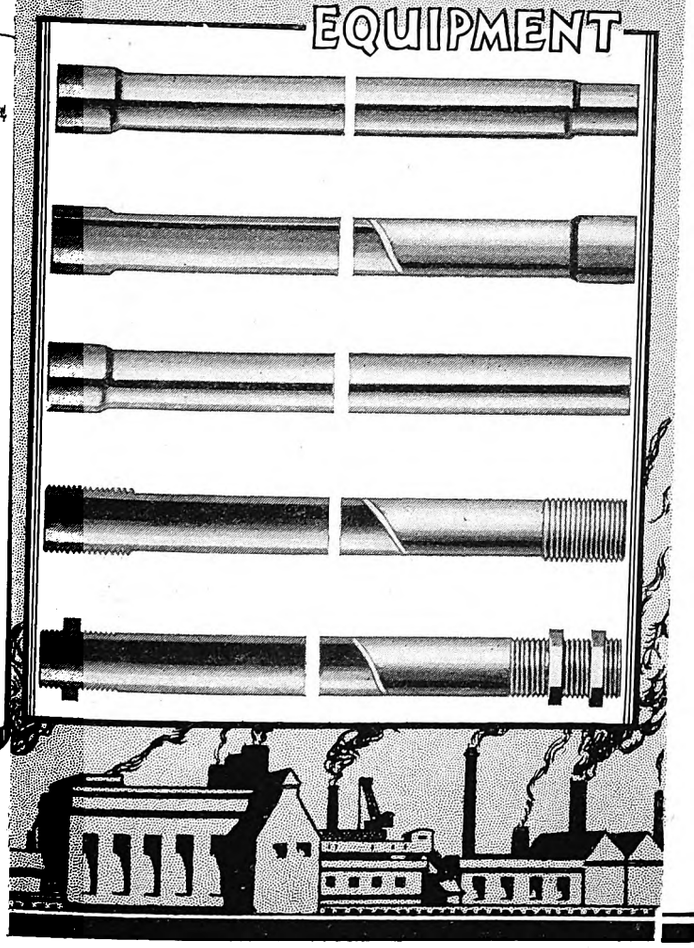
Reception is normally by means of a loud speaker, but the ordinary head telephones are also provided.



MARCONI'S WIRELESS TELEGRAPH CO., LTD.
MARCONI HOUSE,
STRAND, LONDON, W.C.2.

BS777

TUBES FOR POWER STATION EQUIPMENT



We specialize in Hot Rolled Weldless Steel Boiler Tubes, Steam Mains, Superheaters, etc., and can give quick delivery of large quantities of Boiler Tubes for re-tubing Power Station Boilers, etc.

The illustrations show types of Boiler and Stay Tubes used for standard practice, but we are continually manufacturing to suit special conditions.

We supply in accordance with the specifications of the British Admiralty, Lloyds, Board of Trade, British Corporation, Insurance Companies, etc., etc.

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Whilst glareless lighting is now universally recognised as an enormous advance on the employment of the clear glass lamp, and our Pearl lamps discreetly hide the glare of the filament — we particularly recommend

CRYSELCO

Gasfilled OPAL LAMPS

— The Ultimate in Glareless Lighting

because the famous two-skin construction not only ensures a brilliant white light with a gently diffused radiance, but means actually less deterioration in use. That is why they attract such wide attention.

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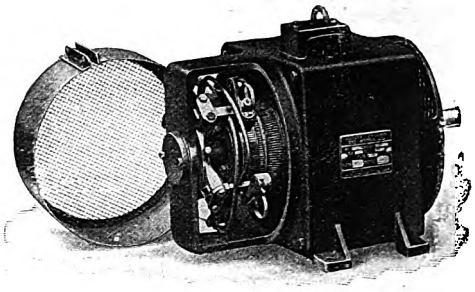
D.C. MOTORS & GENERATORS



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With Higher Efficiency and Better Accessibility.

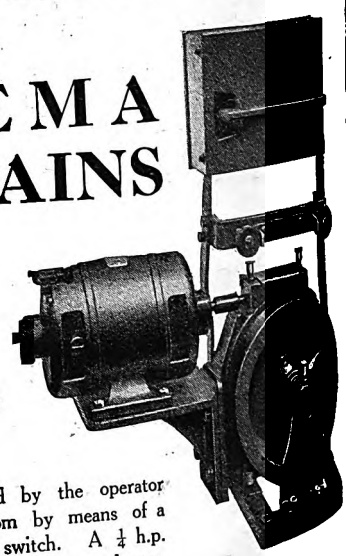
Compare these Figures and Send for our List.

H.P.	R.P.M.	HEIGHT.	LENGTH.	WIDTH.	WEIGHT.
2¾	1100	12¼	18⅝	9¼	140 lbs.
5	1100	13½	19¾	10⅝	200 "
10	1100	15¼	24	12¼	300 "
20	1000	17½	30	14¼	500 "

Strictly to B.E.S.A. Temperature Rise.

"VICTORY" DYNAMOS & MOTORS, LTD., DAVID STREET, :: LEEDS.

CONTROL GEAR
for
CINEMA CURTAINS



Positive Action—no slipping.

The Control is worked by the operator from the Bioscope room by means of a two-way push button switch. A ¼ h.p. motor, coupled direct to worm and gear, assures non-slip and positive action. The curtain travelling track, of substantial design, suitable for light or heavy curtains, is included. We manufacture Electrical Effects for Theatre, Cinema and Ballroom. British Made throughout.

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TRADE SIROCCO MARK

EVERY Sirocco Heating and Ventilating Equipment is carefully designed to suit the building to which it is applied—Fan and duct-work amply proportioned to supply and distribute a generous measure of air to every spot; a Heater to maintain a comfortable temperature on cold days; a washer to cleanse the air and render it fresh and invigorating.

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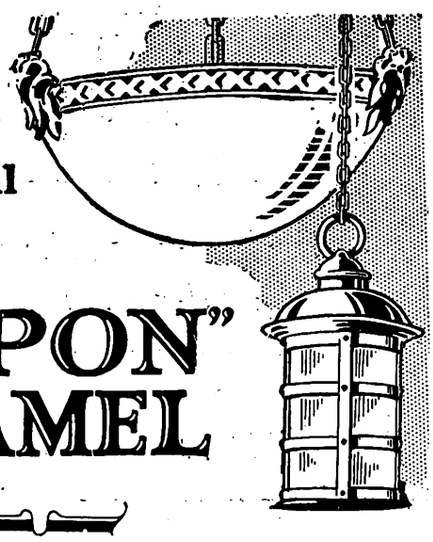

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"Zapon" Enamel is a cellulose lacquer especially suitable for electrical equipment. Whether applied by spray, brush or dipping, it forms a hard tough skin on the metal which is impervious to moisture or the chemicals of the atmosphere, does not discolour in the sun or in moderate heat, and yet does not dull the brightest surface.

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Electrical Review.

EPCO

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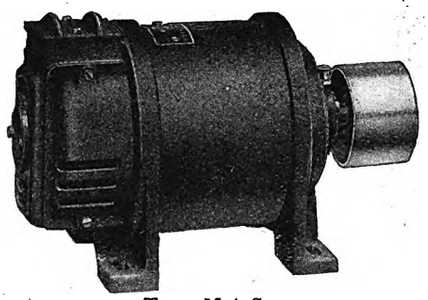

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"THE LITTLE MOTOR WITH THE BIG HEART."
¼ - ⅓ & ½ H.P.
A.C. & D.C.
INTERCHANGEABLE MOTORS.
HIGH TORQUE.
SILENT RUNNING.
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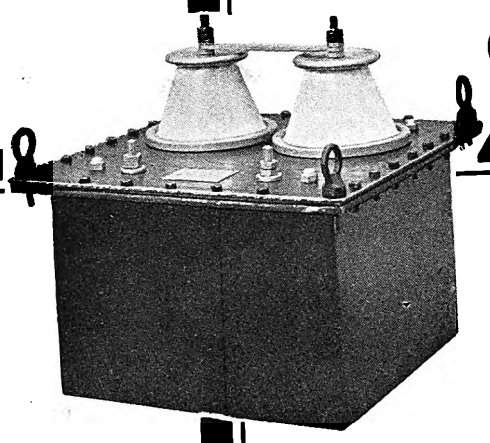
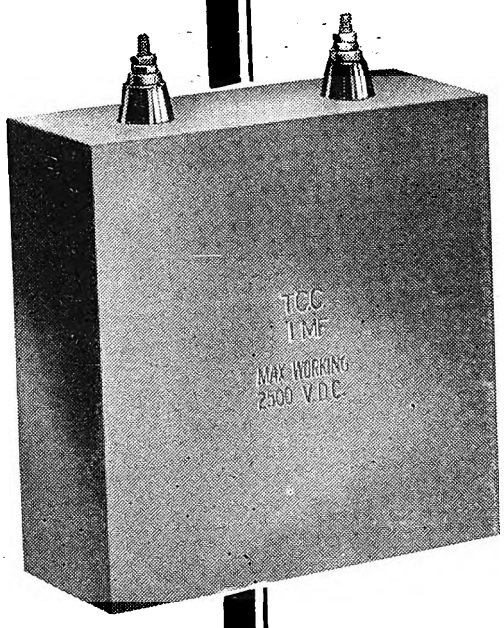
T. C. C.

TRANSMITTING & SMOOTHING CONDENSERS





"T.C.C." Condensers will not let you down at the critical moment—they are built to give years of continuous service. That is why they are used by the leading Radio technicians, the Admiralty, the G.P.O., and the world's Cable Companies. That, too, is why you are safe in saying "T.C.C."

T.C.C. Transmitting Condensers.

The Condenser illustrated above has a capacity of ·001 mfd., and is required to work at 7,000 volts and to pass 65 amps. at 200 metres. It is of the oil immersed type.

Condensers for all purposes including: Power Factor Improvements, Wireless Reception, Smoothing, Telegraphy.

"T.C.C." Transmitting Condensers have been working at Post Office and Broadcasting Stations for years and have given satisfaction. We invite your enquiries giving details as to capacity and voltage, etc.

T.C.C. Smoothing Condensers.

Because of their unfailing reliability "T.C.C." high voltage Smoothing Condensers are universally used by transmitters and experimenters, who must have a first-class component in which to place their confidence. Below is a list of standard capacities in three different voltages—these are kept in stock. Paper Condensers can be supplied for working up to 20,000 volts.

Condensers for Maximum Working Voltage of 800 Peak Value. (Tested 1500 V.D.C.)							
CAP. MFD.	s.	d.		CAP. MFD.	s.	d.
1	7	6		5	24	6
2	10	0		6	28	6
4	19	4				

Condensers for Maximum Working Voltage of 1500 Peak Value. (Tested 2500 V.D.C.)					
·5	8	0	2	15	2
1	10	0	4	28	6

Condensers for Maximum Working Voltage of 2500 Peak Value. (Tested 5000 V.D.C.)			
1 mfd.	£1	8	0
2 mfd.	£2	10	0
4 mfd.	£4	17	6

TELEGRAPH CONDENSER CO., LTD.,
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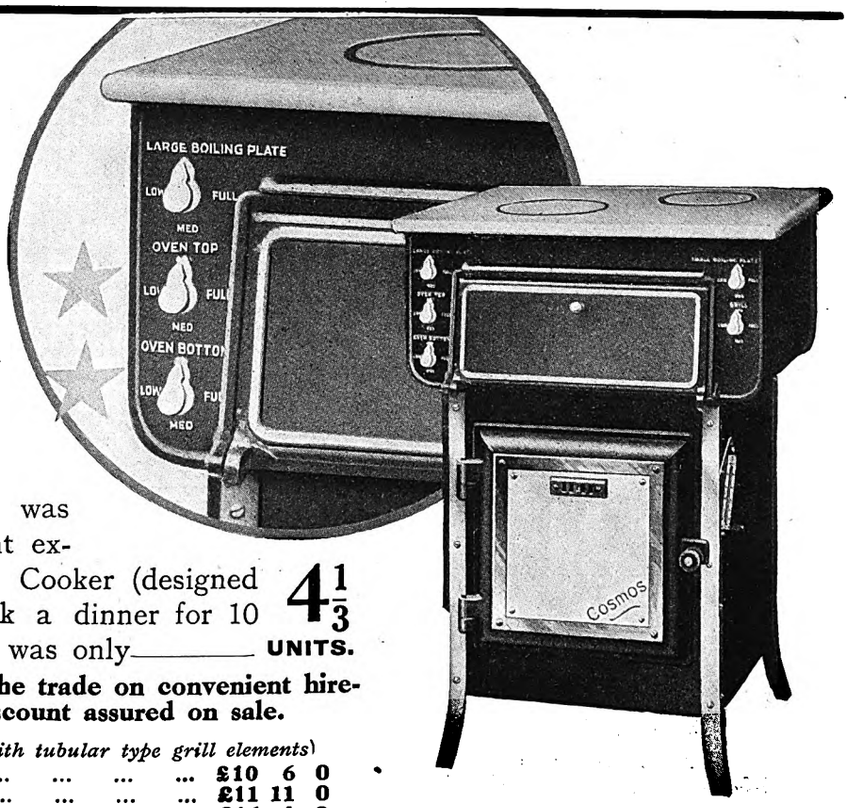
TOP *AND* BOTTOM HEAT

Recent correspondence in the electrical journals has emphasized the weakness in design of electric cooker ovens without provision for "bottom" heat. The popularity of Cosmos Cookers is no doubt in part due to the fact that they have always had three-heat control of both TOP and BOTTOM oven heating.



Cosmos Cookers have always had Bottom Heat.

The efficiency of Cosmos Cookers was effectively demonstrated at a recent exhibition, where a medium size 2001 Cooker (designed for six persons) was used to cook a dinner for 10 persons. The Electricity consumed was only $4\frac{1}{3}$ UNITS.

Cosmos Cookers are supplied through the trade on convenient hire-purchase terms, and the contractor's discount assured on sale.

NOTE THE REVISED PRICES *(with tubular type grill elements)*

Bungalow Model (one boiling plate)	£10 6 0
Bungalow Model (two boiling plates)...	£11 11 0
Medium Size Model (two boiling plates)	£16 4 0
Large Size Model (two boiling plates)	£16 16 6
Large Size Model (three boiling plates)	£19 4 0

METRO-VICK SUPPLIES (Pro. Associated Electrical Industries, Ltd.), 155, Charing Cross Rd., London, W.C.2

ENCLOSED BOILING PLATES — TUBULAR TYPE GRILL ELEMENTS — PARTS EASILY INTERCHANGEABLE — INSIDE ENAMELLING OF CASING

SC P45

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Efficiency with Economy

Vibration Proof
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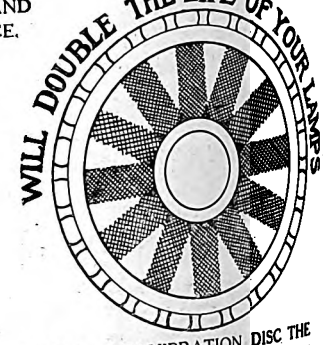
Fool Proof

40 WATT BRACKET FITTING WITH OR WITHOUT BRASS GUARD AND LOCKING DEVICE.

40 WATT PENDANT FITTING WITH OR WITHOUT BRASS GUARD AND LOCKING DEVICE.

150 WATT GUARDED FITTING WITH CLEAR WELL GLASS.

All fittings can be supplied with Looping-in Base and Anti-Vibration Lamp Discs.



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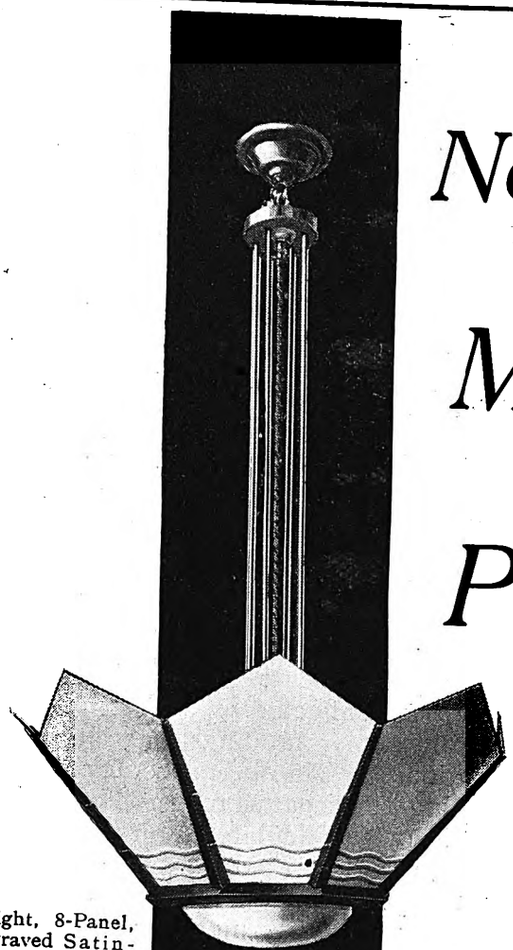
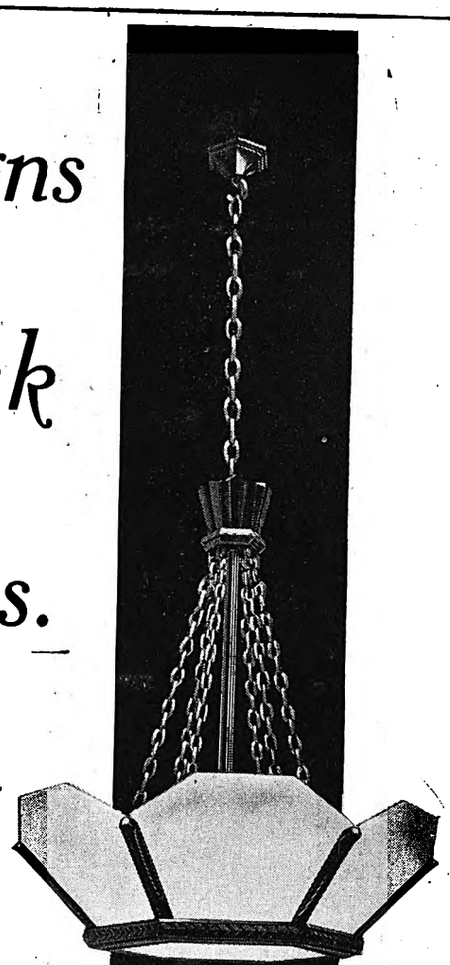
New designs in Met-Vick Panel Pendants.



-Light, 8-Panel, ngraved Satin-lass Pendant. letal - work fin-shed in Green Bronze.
RICE £21 : 18 : 6
(*Cat. No. 1514/7*).



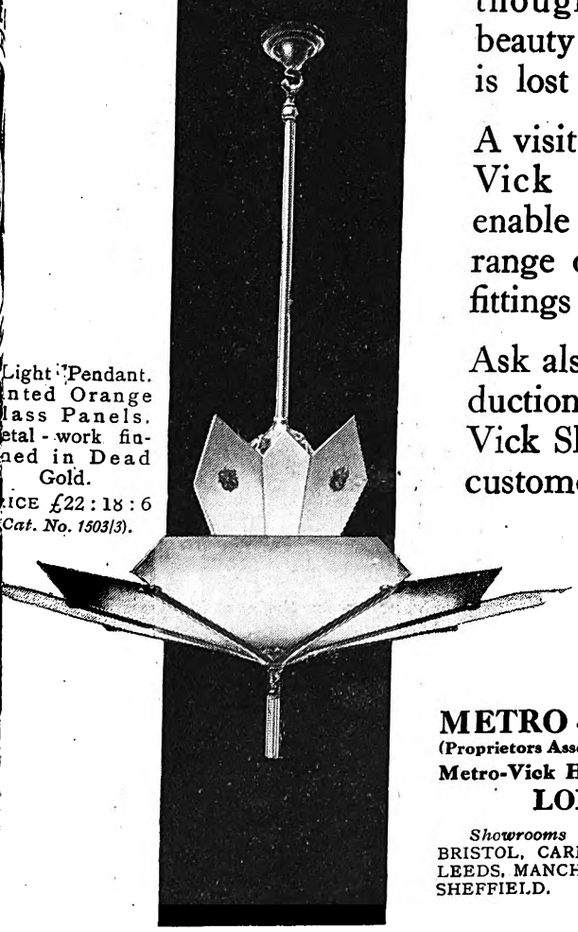
3-Light, 6 Pressed-Glass Panel Pendant. Metal-work finished in Oxy. Silver.
PRICE £16 : 18 : 6
(*Cat. No. 1504*).

The demand for electric light fittings in the modern and futuristic styles has been well met by many attractive designs by Metro-Vick Supplies.

The illustrations are representative of this series, though much of their beauty and lighting effect is lost on paper.

A visit to our local Met-Vick Showroom will enable you to see a wide range of these and other fittings in actual use.

Ask also for book of introduction tickets to the Met-Vick Showroom for your customers' use.



Light Pendant. nted Orange lass Panels. etal - work fin-ned in Dead Gold.
ICE £22 : 18 : 6
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6-Light Pendant. Engraved Satin-Glass Panels. Metal - work finished in Dead Gold.
PRICE - £27 : 5 : 0
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Showrooms at:— LONDON, BIRMINGHAM, BRISTOL, CARDIFF, EDINBURGH, GLASGOW, LEEDS, MANCHESTER, NEWCASTLE-ON-TYNE, SHEFFIELD.

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ONE OF THE J.&P. PAGES

Changing Mary

Here is a reproduction of Episode IV of "Episodes at Elmdene," dealing, as you may see, with a topic of perennial poignancy, and using it as a powerful argument in favour of electricity, and incidentally of the

J. & P. Wiring System.

Like the other arguments in this unique propaganda booklet, it cannot fail to get right home to those who read it, and you will agree when you see a copy that this is a book which will certainly be read from cover to cover.

Husbands who do not want to place an order with you would be well advised to keep it out of the house.

Send for a specimen at once, and then order a supply overprinted with your name and address, for distribution to every non-electric home in your district.

IV.

He: "*Mary* has given notice? Just after I had stopped calling her Kate! And Kate left before I had stopped calling her Jane. But, seriously, Pamela, what is the matter with them? Is this house regarded as a vacation training centre, or are you on the black list, or what?"

She: (resignedly) — "Oh, nothing like that. I can produce excellent testimonials from the whole battalion of them. They all sympathise with me. It's just the work."

He: "Ah! I thought there was some dark secret. Of course, if you ask them to *work* . . . . . ."

She: "They have such an easy time in those new houses in Laurel Park. Electric light, electric irons, vacuum cleaners —"

He: "I wonder people there need maids at all."

She: "Many of them don't. But certainly those who do need servants find it easier to keep them."

6

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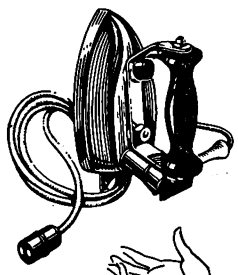

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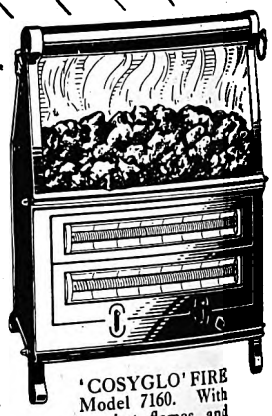

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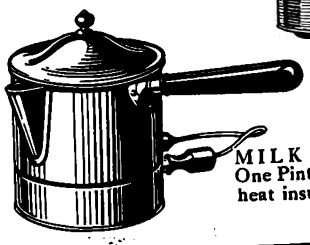

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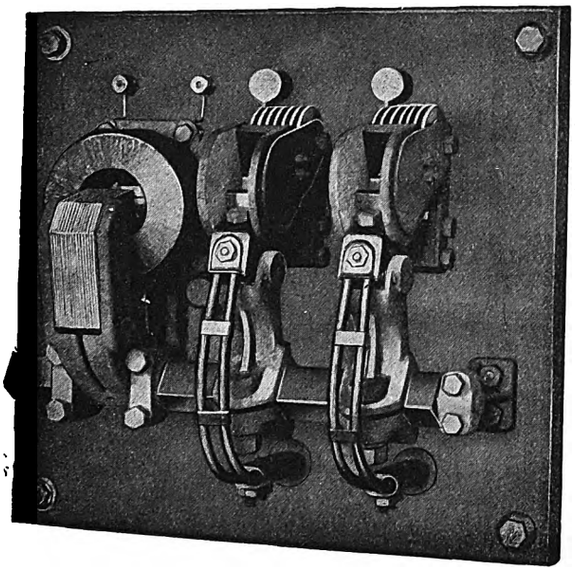

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Is instructed to Sell by Auction, mostly without reserve, on WEDNESDAY NEXT, JULY 3rd, at 11.30 prompt, The remaining portion of a cancelled shipment of LOUD SPEAKERS, BROWNIE AMPLIFIERS, &c.

A Liquidator's Stock of 1,000 Beco Loud Speaker Units, 2,000 L.F. Transformers, 40 Portable Wireless Sets (3-, 5- and 7-valve), 20 2-valve Sets, large quantities of Horn and Cone Loud Speakers, Walnut Cabinets, Portable Set Cases, 50 1-valve Sets, 1,000 Variable Condensers, .0003 and .0005, 250 Fuller's Intervalve Transformers, 2,000 Fixed Condensers, Gambrell All Mains Set, 300 Ediswan, Fuller and Minilux Loud Speakers, 100 Peto Radford 20-volt Accumulators, &c., &c.

Stock of an Electrical Goods Factor, including—

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SITUATIONS VACANT.

Latest time for receiving, 5 p.m. Tuesday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

COUNTY BOROUGH OF WEST HAM.

Appointment of Electrical Engineer and Manager.

THE Council of the County Borough of West Ham invite applications for the position of Engineer and Manager of their Electricity Undertaking.

Candidates must have had considerable experience in connection with large electricity supply undertakings, including sales and wiring departments, and a sound knowledge of the commercial management of such undertakings. He will be entirely responsible also for advising on and carrying out all extensions to plant and mains, and such other duties as are appropriate to the management of an electricity undertaking. The successful candidate will be required to devote his whole time to the duties of the office.

The salary will be at the rate of £1,750 per annum, with advancement to the appropriate grade of the A.M.E.E. scale in operation at the end of two years satisfactory service. Housing accommodation, on terms, is available if desired. Canvassing is strictly prohibited.

The appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act, and to a medical examination for the purposes of that Act, and the statutory contributions to the Superannuation Fund will be deducted from the salary.

Applications, on forms which may be obtained from the undersigned, accompanied by copies of three recent testimonials, must be returned not later than 12 noon on Saturday, 13th July, 1929.

GEORGE E. HILLEARY,
Town Clerk.

Town Hall, West Ham,
27th June, 1929. 2012

SITUATIONS VACANT.—*Continued.*

ASSISTANT EXPERIMENTAL OFFICER.

REQUIRED, for Government Experimental Establishment at Biggin Hill, Kent, an Assistant Experimental Officer for design duties. Candidates should have at least 10 years' experience in a supervisory capacity in a general engineering workshop, also some experience in the design of naval or military field equipment. They must have a knowledge of acoustical engineering and the manufacture of acoustical instruments, also of electrical engineering, particularly of electrical control systems, relays, and arc lamps. They must have some experience in a drawing office. Salary, £250, rising by increments of £15 to £350, with Civil Service bonus in addition. Entry will be made at the bottom of the scale, the bonus on which is at present approximately £111. Preference to ex-Service candidates.—Application, giving age, qualifications, copies of testimonials, &c., should be made by letter to the Secretary, R. E. Board, 14, Grosvenor Gardens, London, S.W.1. 1967

COUNTY COUNCIL OF DUMFRIES.

Gretna and Dornock Electricity.

THE Council require the services of an Electrical Engineer whose duties will include (1) supervision of the reconditioning of plant formerly used for the distribution of electricity in the Gretna and Dornock districts, (2) the erection of additional plant, and (3) the management, under the Council, of electricity supply in the area to which the Gretna and Dornock Electricity Order applies.

Experience of high-voltage transmission and distribution at 400/230 volts essential. Age not exceeding 32 years. Salary £400 per annum. Three years agreement. Further particulars and conditions from undersigned, with whom applications on prescribed form must be lodged on or before 5th July.

JOHN ROBSON,
County Clerk.

County Buildings,
Dumfries, 19th June, 1929. 1949

COUNTY BOROUGH OF PRESTON.

Electricity Department.

APPLICATIONS are invited for the post of Female Canvasser-Demonstrator. Experience with electrical apparatus, including cookers, and a thorough knowledge of cooking essential.

Commencing salary £3 per week.

Canvassing members of the Council, either directly or indirectly, will be deemed a disqualification.

Applications, endorsed "Canvasser-Demonstrator," stating age, experience, and present position, accompanied by copies of not more than three testimonials, to be sent to the Borough Electrical Engineer, 40-41, Lune Street, Preston, not later than 9 a.m. on Wednesday, July 3rd, 1929.

ALFRED HOWARTH,
Town Clerk.

Town Hall, Preston,
19th June, 1929. 1956

BOROUGH OF CHELTENHAM.

Electricity Department.

DOMESTIC SUPPLY.

APPLICATIONS are invited for the position of Lady Demonstrator of electric cooking and other domestic appliances in the above department. Candidates must have had a good general education, and must possess a knowledge of cooking and of domestic electric appliances, and be competent to canvass for, demonstrate, and advise on the use of electric appliances.

Commencing salary £208 per annum.

Schedule of duties and application forms can be obtained from the undersigned. Application forms, with copies of testimonials, must be returned to the undersigned not later than Thursday, the 11th July, 1929.

WALTER J. BACHE, M.I.E.E.,
Borough Electrical Engineer.

Municipal Offices, Cheltenham,
25th June, 1929. 1998

THE LANCASHIRE ELECTRIC POWER COMPANY.

Charge Engineers.

THE above company have vacancies for two Charge Engineers at their Radcliffe Power Station. Salary, Grade 8, Class H.

Applications should be sent immediately to the

RESIDENT ENGINEER,
The Lancashire Electric Power Company,
Radcliffe, Lancs.

1959

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SITUATIONS VACANT.—*Continued.*

BOROUGH OF BASINGSTOKE.

Electricity Department.

APPLICATIONS are invited for the position of Assistant Engineer in the Electricity Department of the Corporation.

Applicants must be British subjects, under the age of 35 years, and have had experience in the operation and maintenance of Diesel engines, direct and alternating current machinery, and distribution. Salary £300 per annum.

Applications in candidate's own handwriting, stating age, education, Diesel engine experience, technical qualifications, and experience, &c., together with copies of three recent testimonials, must be forwarded to the undersigned in sealed envelope, endorsed "Assistant Engineer," not later than 9 a.m. on Tuesday, the 2nd July, 1929.

Canvassing members or officers of the Council, directly or indirectly, will disqualify.

F. H. SMITH,
Town Cl.

Municipal Buildings,
Basingstoke, 17th June, 1929. 1921

BRADFORD EDUCATION COMMITTEE.

TECHNICAL COLLEGE.

APPLICATIONS are invited for appointment as Assistant Lecturer in Electrical Engineering in the College.

Salary according to the Burnham Scale, which is from £186 to £480 per annum. Commencing salary according to qualifications and experience.

Further particulars of the appointment and forms of application may be obtained from the Director of Education, Town Hall, Bradford, and completed forms should be returned to the Principal of the College not later than 10th July, 1929.

THOS. BOYCE,
Director of Education.

1958

SALESMEN.

FERGUSON, Pailin, Ltd., Higher Openshaw, Manchester, invite applications for positions as Salesmen. Switchgear specialists who have had technical training, works, drawing office, and estimating experience will be considered, even though they have had no previous sales experience.—Apply (in writing only), stating age, experience, and salary required. 1960

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A JUNIOR Assistant for switchgear test house; experience with modern types of measuring instruments essential.—Reply, 1969, Electrical Review, 4, Ludgate Hill, London.

ASSISTANT Electrical Designer required for Scotland. Preference given to candidates with experience in modern alternators and synchronous motors. State age, qualifications and salary required.—2010, Electrical Review, 4, Ludgate Hill, London.

AUSTRALIA.—Designing Draughtsman wanted. Thorough knowledge automatic contactor control equipment. Available September. Essential give fullest details, experience, age, training, salary required, and present position.—Write 9940, Electrical Review, 4, Ludgate Hill, London.

CLERK, book-keeping, &c. Knowledge electrical contractor's office essential.—Write, stating age, experience, and salary required, 1870, Electrical Review, 4, Ludgate Hill, London.

CLERK, junior, required in electrical engineer's office in London for follow-up order department; one with knowledge of electrical accessories, fittings, &c. Age 18-20.—Write, giving full particulars and salary required, to 9982, Electrical Review, 4, Ludgate Hill, London.

CLERK (male or female), experienced electrical trade typing, invoicing, costing, correspondence and general routine of contractor's office. State experience and wages required.—9845, Electrical Review, 4, Ludgate Hill, London.

CONTRACT Department Manager required for West London district by manufacturers of small electrical parts and accessories. Only first class men with commercial and practical experience need apply.—Write, stating age, experience, and salary required, to "Contract," c/o Bernard Smith Advertising Service, Ltd., British Columbia House, 1-3, Regent Street, London, S.W.1. 1948

DRAKE & Gorham Wholesale, Ltd., require a Manager for their Dublin branch. Irishman preferred with personal connection in the Free State. Payment by salary and commission.—Apply R.W.S., Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.2. 2009

SITUATIONS VACANT.—*Continued.*

DRAUGHTSMAN and Tool Designer for bakelite moulds required. Permanency for suitable man.—Solidite and Synthetic Mouldings, Ltd., Albion Works, North Street, Clapham, S.W.4. 1882

DRAUGHTSMAN for power transformer work required by the British Electric Transformer Co., Ltd., Hayes, Middlesex, to whom applicants should state age and experience, and salary required. 1816

DRAUGHTSMAN required for d.c. and a.c. switchgear. Admiralty and Marine experience preferred.—State age, experience, and salary required, to Brookhirst Switchgear, Ltd., Northgate Works, Chester. 1989

DRAUGHTSMAN required for switchgear, h.t. and l.t. layout, steel cubicles, kiosks, &c.—Apply, stating age, experience, salary required, to Crompton Parkinson, Chelmsford, Essex. 1952

DRAUGHTSMAN required immediately for d.c. and a.c. machines; speed and accuracy essential, knowledge of Admiralty requirements an advantage.—Write, stating age, experience, and salary required, to 1961, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN (junior), with good electrical and mechanical knowledge, required for electrical apparatus, London area. Write, stating age, experience, and salary required.—1957, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN, with sound mechanical knowledge and technical training, required for radio works (Mitcham district, London).—Apply 1994, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN, with experience in the design of modern sub-station and industrial oil switches of the e.h.t. type.—Reply, stating salary required, to 1968, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMEN.—The British Thomson-Houston Co., Ltd., Rugby, has vacancies for mechanical and electrical Draughtsmen.—Apply, stating age, experience, and salary required, to Manager, Drawing Offices, B.T.H. Co., Ltd., Rugby. 1807

DRAUGHTSMEN required for high and low tension switchgear. Experience on outdoor e.h.t. gear desirable.—Apply, stating age, full experience, and salary required, to the General Electric Co., Ltd., Witton, Birmingham. 1920

DRAUGHTSMEN required for switchgear contracts; h.t. and l.t. sub-station and industrial gear.—Apply, stating experience, salary, and age, to 1953, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMEN, experienced in a.c. and d.c. control gear. State age, full particulars, experience and technical training, and salary required.—Allen West & Co., Ltd., Brighton. 9929

ELECTRICAL Engineer, to take charge of electrical contracting department of engineering firm in West of England. Must be between 30 and 40 years of age, with technical education, and have had previous experience in management, estimating, and supervising electrical installations, country house plants, motors, &c. State all details and salary required.—9918, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer required as Manager for associated Australian company of large electrical concern, manufacturing all branches of electrical plant. Besides technical and commercial knowledge, essential that applicant shall have experience of handling large contracts and be accustomed to negotiations with Government bodies and prominent industrial concerns. State training, experience, age, salary required.—1856, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineers in London require Junior Assistant in their switch and fuse department; age 18-20. Must have electrical knowledge.—Write, stating experience and salary required, to 9981, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN.—Really capable man wanted for wiring up test board to diagrams by radio works (Mitcham district, London).—Apply 1995, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN for Copper Mines in Cape Colony. Must be experienced, with thorough knowledge of d.c. machines and apparatus; preferably a man who has had previous experience in mining work. Should be able to rewind armatures and be familiar with use of shop machines.—2002, Electrical Review, 4, Ludgate Hill, London.

ELECTRIC Heaters.—Representatives wanted for Yorkshire, West of England, and London, on commission.—Apply 9928, Electrical Review, 4, Ludgate Hill, London.

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SITUATIONS VACANT.—*Continued.*

ELECTRIC Heating and Cooking.—Practical Works Man required on production and development; good disciplinarian. Must have sound experience and good knowledge of elements, Birmingham district.—Fullest details, remuneration, when free, 9846, Electrical Review, 4, Ludgate Hill, London.

ENERGETIC young man to take over Managing Directorship of small electrical contractor's business. Salary £340. —9818, Electrical Review, 4, Ludgate Hill, London.

ENERGETIC Representative (London and suburbs), to handle several specialities on commission. Excellent prospects for the right man.—9922, Electrical Review, 4, Ludgate Hill, London.

ESTIMATING Department.—Assistant wanted in London office of large manufacturers of supplies. Thorough knowledge of accessories, industrial and decorative lighting fittings, domestic apparatus, &c., essential.—Write, stating age, experience, and salary required, to 2011, Electrical Review, 4, Ludgate Hill, London.

GENTLEMAN wanted at once to Canvass for the sale of electric refrigerators, and general household electrical apparatus. Car or motor-cycle essential. Preference given to those with similar experience. Salary and commission.—State age and experience to Advance Electrical Co., Opera House Buildings, Tunbridge Wells. 9960

GOOD Electrician Wireman. State age, rate, and detailed experience. Country district.—9889, Electrical Review, 4, Ludgate Hill, London.

INSPECTOR, first class man, to take charge of raw material inspection and radio apparatus and component for large works (Mitcham district, London).—Apply 1996, Electrical Review, 4, Ludgate Hill, London.

INSTRUMENT Makers urgently required for general high-grade work.—Apply, giving full details of experience, Smiths (MA), Cricklewood, London. 1893

LARGE Electrical Company interested in entertainment world has immediate vacancies for a number of Electrical Engineers with good knowledge of electrical amplification. Must be prepared to travel British Isles and Europe. Minimum salary £250 to start. Higher dependent on experience. Splendid opportunities of advancement. Long hours, interesting work, rapid advancement.—Write, giving age, education, experience, knowledge of languages if any, and references to 1997, Electrical Review, 4, Ludgate Hill, London.

LIFTS.—Experienced Layout Draughtsman required conversant with best practice; progressive position to man with all round knowledge.—2004, Electrical Review, 4, Ludgate Hill, London.

MAINTENANCE and Development Engineer required by West London firm of scientific, electrical, and mechanical engineers. Applicants must have held similar positions and have up-to-date theoretical and practical mechanical and electrical knowledge. Building experience an advantage.—Reply, stating age, experience and salary required, to "Engineer," c/o Bernard Smith Advertising Service, Ltd., British Columbia House, 1-3, Regent Street, London, S.W.1. 1947

MECHANIC.—Improver required for mines in South Africa. Must be familiar with shop machines, turning, and able to do general fitting.—2001, Electrical Review, 4, Ludgate Hill, London.

METROPOLITAN-Vickers Electrical Company, Ltd., Trafford Park, Manchester, requires a Designing Draughtsman for switchgear. Must be neat, quick, and accurate, and have had experience in the designing of switchgear for all voltages. State training, experience, and salary required.—Apply by letter, addressed to the Company's Employment Department, marked "Switchgear Draughtsman." 801

RATE Fixer wanted, London area. Electrical firm.—Apply, giving experience and wages required, to 1950, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVES wanted to sell "Ostar" gasfilled lamps and other electrical goods to the trade and to large consumers. Only live men with experience and good selling abilities need apply. Good money can be earned by such men. —Apply, with particulars, 9953, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVES required for London and provinces by a manufacturer of E.L.M.A. lamps. Excellent prospects for gentlemen with first-class connections amongst trade and large consumers; proved sales record essential.—In your application please state, in confidence, experience, age, salary required, and area covered, to 1963, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVES required for London, Southern and Home Counties, Wales, and the West, to run the highest type of reflector lamp for industrial, street, and general lighting. Only those considered who have live connections with corporations, contractors, architects, and consulting engineers, &c., and who cover their territory by car. Liberal commission. —9935, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

REPRESENTATIVES (3), Midlands, Northumberland, North Scotland, required to sell "Ostar" gasfilled lamps to large consumers. Lamps are licensed, fully guaranteed, branded and cartoned, and subject substantial discounts. Only experienced travellers considered who can give concrete proof of live connection with works, theatres, hotels, stores, &c.—Give full particulars and terms expected to 9819, Electrical Review, 4, Ludgate Hill, London.

REQUIRED, by large company operating in the Middle East, one Assistant Electrical Engineer for electrical repair workshop. Candidates must be trained armature winders, and should have had practical experience of switchgear repairs on oil-immersed switches of both cubicle and ironclad types; also repairs to transformer windings. Preference will be given to candidates with a knowledge of instrument repairs and to those who have had control of labour. Age 25-30. Only single men need apply. Commencing salary £450 per annum. Agreement for one year, extendable to cover three years. Free passage out and home, free medical attention, free furnished bachelor quarters, but without messing.—Apply, with copies of testimonials (not returnable) to 1966, Electrical Review, 4, Ludgate Hill, London. Please quote 2690 F.S.

REQUIRED immediately, Draughtsmen, experienced in design of apparatus and equipment for automatic or manual telephone exchanges.—Write General Electric Co., Telephone Works, Stoke, Coventry. 1820

REQUIRED immediately, man, fully conversant with exhausting wireless valves, both automatic and hand pumping.—Write, stating age, experience, and salary required, to 1946, Electrical Review, 4, Ludgate Hill, London.

SALESMEN required by well-known firm of manufacturers about to put on the market a new range of electric lighting plants and pumps. Fixed area, and car supplied.—Only men with first-class connection and experience should write to 9930, Electrical Review, 4, Ludgate Hill, London.

SHORTHAND Typist required in electrical engineer's office. Must be thoroughly experienced. Remington machine.—Write, stating salary required, to 97a, Dalston Lane, E.8. 9945

TELEPHONE Engineer required for Hongkong. An assistant telephone engineer who has had experience in the working and maintenance of automatic exchanges and subscribers' instruments. Applicants must be single and under 30 years of age. Applications from married men will not be considered.—Write for terms of engagement and forms of application to the Oriental Telephone & Electric Co., Ltd., Alderman's House, Alderman's Walk, Bishopsgate, London, E.C.2. 9983

TOOL Turners, Universal Millers, Press Tool Fitters urgently required. Good wages, good prospects.—Apply, giving full details of experience, Smiths (MA), Cricklewood, London. 1892

WANTED, Representative for Kent and Sussex, calling upon leading contractors and public bodies; should have existing connection and central station experience. Preferably owning own car. Commission basis.—9947, Electrical Review, 4, Ludgate Hill, London.

WANTED, for service in South America, four first-class Cable Operators, single men, age not over 30 years. Must have good references. Three-year contract; first class passage out and home. Good prospects.—Apply All America Cables, Room 437, Bush House, Aldwych, W.C.2. 1951

WANTED, smart young Salesman to sell motor-'bus and garage equipment, also certain tramway and railway specialities; good salary and liberal commission; those with mechanical knowledge and own car preferred.—Apply in first instance to 2007, Electrical Review, 4, Ludgate Hill, London.

WANTED, Salesman, having good connection with wireless dealer, for first-class radio side line, on commission.—Particulars, 9931, Electrical Review, 4, Ludgate Hill, London.

WHOLESALE house has vacancies for smart young men to train as Outdoor Representatives. Some knowledge of electrical and radio goods essential. Applicants must be prepared to serve indoors during training period at nominal salary. Exceptional opportunity for energetic young men. London applications only.—Write, giving full details to Mr. Spencer Orgel, 92-94, Paul Street, London, E.C.2. 1808

WINDING Shop Charge Hand wanted, used to mass production of fractional horse-power motors. Give full details of experience, technical training, age, whether married or single, and salary required.—2006, Electrical Review, 4, Ludgate Hill, London.

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

HORSHAM Urban District Council (Mains Assistant); Graham Amplion, Ltd. (Assistant to Engineer); Box 1806 (Sales Manager and Salesman).

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SITUATIONS WANTED.

Advertisements are inserted under this heading at 14s. per inch.

STEEL-CORED ALUMINIUM OVERHEAD LINES.

TRANSMISSION Line Engineer, 5 years' experience district supervision, negotiation, layout, many miles steel cored aluminium e.h.t. lines, also copper, copper cored steel, and steel lines, pilot and telephone cable, outdoor and indoor switchgear, sub-stations, underground cable, transformers, &c., desires senior post. Highest references. Free end of June.—9853, Electrical Review, 4, Ludgate Hill, London.

CONTRACT AND SALES ENGINEER.

A CAPABLE Electrical and Mechanical Engineer, public school, college, and engineering apprenticeship, desires new appointment, where his wide contract and sales experience in connection with prime movers and electrical machinery for central generating stations, factory, mill, and colliery electrification could be utilised. Painstaking and conscientious. Excellent testimonials.—9943, Electrical Review, 4, Ludgate Hill, London.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words

A COOKING and Heating Engineer, competent Works Manager, wishes make change. Expert production, design, and works routine; conversant all types of apparatus; 23 years' experience in above branch.—9969, Electrical Review, 4, Ludgate Hill, London.

A COMPETENT Works Manager desires change, wireless, gramophones, switchgear, good organiser, up-to-date in all methods of production and management. Keen, thorough, reliable. Age 39.—9968, Electrical Review, 4, Ludgate Hill, London.

ADAPTABLE Electrical Fitter and General Engineer, machine, tool, fitting, assembling, and drawing experience, 6 and 4 years same firm and year away, outside experience, age 26, single, Englishman, genuine, requires appointment abroad; any progressive proposition considered.—9814, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, capable, keen, desires progressive change; estimating, assistant to works manager, or similar capacity; 5 years' shops, 4½ years' comprehensive experience D.O., estimating departments and supervision: electric fittings, fixtures, general engineering, ship and railway metal furnishings. Good education. Age 25.—9990, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER will Represent wholesale house; commission and part expenses. Glassware or accessories. Very fine connection most main towns. Own car.—9937, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder, 9 years' experience in d.c., a.c. traction work; also experience in small work.—Treadaway, 87, Woodland Road, Southall, Middlesex. 9835

ARMATURE Winder (25), 11 years' experience, a.c., d.c., all types, large or small. Rewinds, repairs, commutators. Splendid references.—J. Hardy, 7, Bertal Road, S.W.17. 9956

ARMATURE Winder, 13 years' experience, repairs, rewinds, all types, including car starters, dynamos, maintenance. —Cobb, 11, Coliston Road, S.W.18. 9910

BOOK-Keeper, general Clerk, age 29, 12 years' experience in electrical industry, supply company and contractors, desires progressive position. Excellent references.—9885, Electrical Review, 4, Ludgate Hill, London.

CABLES.—Gentleman, many years' practical experience manufacture electric light and power cables, desires responsible post. Full details to genuine inquirers.—9856, Electrical Review, 4, Ludgate Hill, London.

CHIEF Accountant (31) desires similar post with greater scope for advancement. Fully conversant with all clerical and secretarial work of electrical undertaking. Can keep complete set of books and compile balance sheet. Excellent references.—Write 9880, Electrical Review, 4, Ludgate Hill, London.

CLERK (28) seeks situation, stores; 10 years' experience, typing, card-indexing, stock-keeping; good knowledge screws, terminals, engineers' supplies and repetition work. Excellent references.—Brown, 217, Lillie Road, Fulham, S.W.6. 9843

CLERK, six years' costing and ordering, desires progressive situation; technical knowledge. Age 22. London district. —9965, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN, having had first-class training with well-known electrical firm, desires a progressive appointment. Age 20 years.—9855, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, young, requires situation as Maintenance Engineer, in factory or. shop. Experienced in all power and lighting installation, workshop repairs, &c.—Mitchell, 35, Stonehill Road, Chiswick, W.4. 9899

SITUATIONS WANTED.—*Continued.*

ELECTRICAL and Mechanical Engineer (36), fluent French, wishes to join concern requiring representation in France. Capital available.—9898, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, whose home is in Rhodesia, desires post with British company operating in South Africa or Rhodesia. Three years' day course engineering, diploma, A.M.I.E.E. examination, 6 years' experience of transformers, switchgear, and converting plant, including 2 years chief tester and 1 year technical sales.—9989, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, age 29, specialise heavy power, cranes, plant, &c., i.c., Diesel and steam experience; quick at fault finding; used to control men. Permanent progressive post, anywhere. Write appointment.—E.F., 53, Woodgrange Drive, Southend-on-Sea. 9976

ELECTRICAL Engineer, well known Leicester and county, desires appointment as Representative for firm of good standing. Other districts considered.—Engineer, 18, Melbourne Road, Leicester. 9836

ELECTRICAL Engineer (25) desires progressive post; 6 years' practical experience; also 5 years' technical training. Drawing office, electro-medical and X-ray apparatus, generating station and 'bus electrical equipment.—9973, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer requires position on power station or as Electrical Maintenance Engineer in a factory. Had experience with motor and rotary convertors, a.c. and d.c. motors and generators, and most types of instruments and switchgear made by the B.T.H. A.M.I.E.E. exam., Regent Street Polytechnic diploma.—9925, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer (28), excellent college and works record, wide experience, desires progressive position. Hard work preferred.—9829, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, lighting, power, bells, telephones, all systems; experienced.—B.O., The Fernery, Morden Road, Merton. 9966

ELECTRICIAN (27), fully experienced all systems and branches electrical installation work, seeks permanency. Town or country.—6, Elsley Road, S.W.11. 9988

ELECTRICIAN or Wireman's Mate wants work; ten years' electrical experience.—Ab, 56, Windermere Road, Ealing. 9951

ELECTRICIAN wants job, anywhere, all systems.—B., 119b, Anerley Road, S.E.20. 9952

ELECTRICIAN Wireman, competent workman, requires employment. Long experience all branches. References. —C., 140, Oxford Gardens, W.10. 9978

ELECTRICIAN'S Mate (20) seeks situation; 3 years' experience; town or country.—Mate, 24, Coleman Road, Camberwell, S.E.5. 9971

ELECTRICIAN (33), 15 years' all-round experience all systems, new, jobbing. Good mechanic and reliable workman.—Wells, 26, Bartholomew Villas, N.W.5. 9972

ELECTRICIAN (32), 15 years' experience, power and lighting, installations or maintenance.—9993, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN'S Mate, age 19, seeks situation; quick and reliable.—R. Bradley, 150, Kempton Road, East Ham, E.6. 9938

ELECTRICIAN'S Mate wants job; several years' experience. —F. Summers, 44, Aycliffe Road, Shepherd's Bush, W.12. 9959

ELECTRICIAN, 5½ years with electrochemical works and laboratories, and 17 years' general experience, possessing initiative, and used to taking charge of plant, making alterations to electrical systems, wants situation. Good references. —9832, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, first class, supervising, estimating; thorough mechanic. Age 34. Excellent credentials.—9869 220, Philip Lane, N.15.

ELECTRICIAN, long experience, installations and repairs. Anywhere.—14, Cambrian Grove, Gravesend. 9839

ELECTRICIAN, age 34, life experience, power, lighting, &c. —Croser, 4, Cobham Road, N.22. 9857

ELECTRICIAN, 20 years' experience all systems of lighting, 'phones, and motors.—F.C., 31, Godfrey Street, Chelsea, S.W.3. 9852

ELECTRICIAN, good, all systems; anywhere; excellent references.—Weston, 133, Lupus Street, S.W.1. 9906

ELECTRICIAN Improver, 8 years' experience with all systems of lighting, power, 'phones and bells.—F.S., 34, Stavordale Road, N.5. 9917

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SITUATIONS WANTED.—*Continued.*

ELECTRICIAN, experienced, lighting, power, jobbing; full or part time.—"Electric," 325, Kilburn Lane, W.9. 9923

ELECTRICIAN'S Mate (23) seeks situation, as Mate or Electrician Improver; 5 years' experience. Last job 3 years.—Goddard, 27, Orchard Road, Highgate, N.6. 9875

ENGINEER (28), experienced electric lighting and power, i.c. engines, producer gas plants, hydraulic presses and pumps, N.H.3 refrigeration, erection and repairs to machinery generally, also office experience of correspondence and drawing, desires factory or outdoor supervisory progressive post.—BM/ENRT, London, W.C.1. 9828

ENGINEER and Manager (small undertaking); last 9 years; rural areas; fully conversant with farming industry; desires post to develop rural load; interview preferred.—9876, Electrical Review, 4, Ludgate Hill, London.

ENGINEER Salesman (34), specialised experience switchgear and instruments, having connection amongst supply undertakings, consultants, and contractors in London and Home Counties. Thorough technical and commercial knowledge. Moderate salary; prospects.—9887, Electrical Review, 4, Ludgate Hill, London.

ESTIMATING, Buying and Sales Engineer (21), good experience fans, motors and motor-driven appliances.—G., 9, East Dulwich Grove, S.E.22. 9844

EX-ELECTRICAL Artificer, R.N., seeks situation on maintenance work. Thorough experience; electrical and mechanical.—Cameron, 80, Borough High Street, S.E.1. 9860

EXPERIENCE with domestic apparatus manufacturer—Birmingham or Midlands—required by technically trained student. Keen, willing worker. Moderate salary.—9847, Electrical Review, 4, Ludgate Hill, London.

FARADIAN (27), fully qualified, keen and energetic, requires a good, responsible and progressive post.—9881, Electrical Review, 4, Ludgate Hill, London.

IMPROVER, with good insight to installations, wants work.—W.S., 46, Mayton Street, N.7. 9967

LIVE Traveller, with London connection, desires to Represent enterprising electrical manufacturers or wholesalers.—9936, Electrical Review, 4, Ludgate Hill, London.

MANAGER, fully conversant power and lighting installation, good organiser (aged 29), 14 years' experience, seeks progressive position. Undeniable references.—9886, Electrical Review, 4, Ludgate Hill, London.

MAN (30), five years' cable-making experience, also technical knowledge wireman's electrical installation work, requires progressive position.—Jeffery, 10, Castle Road, Enfield Wash, Enfield. 9948

METER Fixer wants work; married.—A., c/o Sharpe, 42, Park Road, Uxbridge. 9964

PLUMBER-Jointer, disengaged, married; h.t. or l.t. Any district. Nine years' experience.—C., 71, Camborne Avenue, Ealing. 9900

PLUMBER-Jointer seeks position, home or abroad. Experience e.h.t., h.t., l.t., power station, all sub-station work, and mains distribution.—9942, Electrical Review, 4, Ludgate Hill, London.

PLUMBER-Jointer, h.t. and l.t. mains and service work.—9957, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVE, with established connection in electrical trade in Home Counties, desires appointment or Agencies. Own car.—9996, Electrical Review, 4, Ludgate Hill, London.

SALES and Bought Ledger Clerk seeks situation; age 24; 8 years' experience in accounts office; excellent references.—C.J.N., 5a, Chapter Street, S.W.1. 9824

STOREKEEPING, &c.—Gentleman desires situation (26), appearance and mannerisms older. Experience: storekeeping, store recording, knowledge of chasing and order office routine.—9837, Electrical Review, 4, Ludgate Hill, London.

TEST Assistant, or good Electrician Improver (22) desires good opening. Experience on switchboard, switchgear, domestic appliances, installations, &c.—9849, Electrical Review, 4, Ludgate Hill, London.

WIREMAN and Mate seek situation; good experience all branches.—S.M., 53, Brookfield Avenue, E.17. 9850

WIREMAN, experienced and reliable, d.c. and a.c. lighting and power. Disengaged.—G.P., 16, Cantrell Road, Bow, E.3. 9944

WIREMAN, competent and reliable; good references. Just disengaged.—"Electrician," 19, Bryantwood Road, London, N.7. 9950

WIREMAN wants good class work. Any system. Full district rate.—9977, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

WIREMAN'S Mate seeks situation; experience, lighting, &c.—K. Sharp, 9, Chancellor's Road, Hammersmith. 9963

YOUNG Man (21), with good wireless knowledge, also electrical, requires situation, any capacity.—Neale, 201, St. Mark's Road, W.10. 9895

YOUNG Electrician, lighting, power, &c., installation, maintenance, repairs, all systems. 1s. 6d.—9975, Electrical Review, 4, Ludgate Hill, London.

YOUTH, smart, desires situation in engineer's drawing office.—36, Leadale Road, N.16. 9891

FOR SALE.

Advertisements are inserted under this heading at 14s. per inch.

ELECTRIC LAMPS.

WE still specialise, and are the largest London stockists of all types of Electric Lamps.

EVERY TYPE OF ELECTRIC LAMP, INCLUDING GAS FILLED, IN STOCK IN ANY QUANTITY.

EVERY TYPE OF AUTOMOBILE BULB IN STOCK IN ANY QUANTITY.

The famous "Demon" Vacuum Cleaner should be a new money-making line for our customers. (AGENTS REQUIRED.)

Window Reflectors, Lamp Holder Flashers, Fans, Hair Dryers, Cables, &c., &c.

Send your orders and enquiries to the firm who can give you the best quality goods at the lowest prices in London.

L. BENN & CO., LTD.,
Reg. Offices and Warehouses, 8, Colonial Avenue,
Minories, E.C.3.
Telephone: Royal 9076-9077. 9995

ELECTRIC LAMPS.

WE are now open to contract to supply your next season's requirements, any types, any quantities, at exceedingly favourable prices.

Electric Lamps, Radio Valves and Car Bulbs.

Large Stocks New Pearl Lamps.
Quality and delivery guaranteed.
Types consistent to British Standards.

M.S.L., LIMITED,
Non-Combine Manufacturers,
Splendor House,
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LONDON, W.14.
9784

MIDLAND COUNTIES ELECTRICAL ENGINEERING CO., LTD.

Reduced Prices.

500 MOTORS, Dynamos, Transformers, all voltages and frequencies.

Switchgear, Instruments, Welders, Generating Sets, &c. In stock. Best makes. New and equal to new. Fully guaranteed. Inspection and enquiries invited.

MIDLAND COUNTIES ELECTRICAL ENGINEERING CO., LTD.,
Grice Street, Spon Lane, West Bromwich.
Telegrams: Rheostat, West Bromwich. 16

ELECTRIC MOTORS AND DYNAMOS.

WE hold one of the largest Stocks of New and Second-hand Motors. Second-hand Machines are thoroughly overhauled. Inspection and Tests can be made at our Works.

For Sale or Hire. Send your inquiries to Messrs.

BRITANNIA MANUFACTURING CO., LTD.,
22-26, BRITANNIA STREET,
CITY ROAD, LONDON, N.1.
Telephone: 5512-3 Clerkenwell. 13

10½-kW ELECTRIC GENERATING SET FOR SALE.

BELT driven; National Gas Engine; 220 volts d.c.; Switchboard, &c.
Good condition. May be seen working.
Further particulars may be obtained from The Engineer, Harrogate Gas Company, Harrogate. 1881

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FOR SALE.—*Continued.*

NON-COMBINE ELECTRIC LAMPS AND ELECTRICAL SUPPLIES.

LARGEST Stockists at Lowest Prices for:—
"OSTAR" GASFILLED,
TRACTION TYPE,
CARBON FILAMENT,
METAL FILAMENT,
SIGN TYPE (B.C. & E.S.),
CANDLE,
HALF WATT TYPE (CLEAR AND OPAL),
FLASH LAMP BULBS,
AUTOMOBILE LAMPS (ALL TYPES),
and
SILVERED REFLECTORS,
VACUUM CLEANERS,
FLASHERS,
BOWL FIRES, IRONS, TOASTERS, KETTLES AND DECORATIVE LIGHTING SETS (newest designs).
We welcome your enquiries for Price Lists and Quotations, and can assure you of our Best Service.

DIRECT ELECTRIC LAMP CO., LTD.,
72, Shoe Lane, London, E.C.4.
'Phone: City 7461. 'Grams: Metalfilam, Lud, London.
9970

PLEASE NOTE NEW ADDRESS.

THE ZENITH LAMP COMPANY,
53, Farringdon Road, London, E.C.1.
Telephone: Holborn 2053.

OWING to removal, 100,000 Lamps must be disposed of, comprising Metal Filaments, Traction, Half Watt Type, Opal, and Ostar Gasfilled Lamps.

No reasonable offer refused.

Send us your enquiry and offer.
9984

CENTURY LAMPS (LONDON), LTD.

GAS-FILLED Lamps up to 500 watt—Guaranteed non-infringing.
M.F. LAMPS,
TRACTION LAMPS,
HALF-WATT-TYPE LAMPS.
Highest quality. All sizes. Prompt delivery.
BEFORE ORDERING ELSEWHERE PLEASE OBTAIN OUR PRICES.
3, Gt. Winchester Street, London, E.C.2.
Tel. No.: London Wall 5942. 943

MOTORS & DYNAMOS, &c., D.C. and A.C.

WE carry a large and varied stock so that most inquiries can be met at reasonable prices with quality guaranteed. Stock includes:—
Motors.—3-ph., up to 100, 150, 225, 300, 400 and 500 h.p.
Alternators.—35 kVA, 220 V and 440 V, 3-ph., 50 per.
Transformers.—3-ph., 50 per., 500/100 V, and 480/220 V.
GREENHALGH BROS., Atherton, nr. Manchester.
17

WATER-TUBE BOILERS.

WATER-Tube Boilers for Sale, with immediate delivery: "B. & W.," "Stirling," "Woodeson," &c. Sizes from 5,000 to 30,000 lb., all working pressures. All recent make, in new condition. Erected complete and guaranteed. Economisers, Generating Sets., Motors, and all Auxiliaries.—Burford, Taylor & Co., Boiler Specialists, Middlesbrough. 21

CONDENSERS.

FOR Sale, complete power factor correction Condenser Equipments by British Insulated Cables, with or without auto-transformer and switchgear, 200 volts; one 3-phase, 73 kVA, another 185 kVA; also 2-phase equipments, 98 and 197 kVA. All 600 volts, 50 cycles, suitable any voltage with transformer.—1986, Electrical Review, 4, Ludgate Hill, London.

FOR SALE.—*Continued.*

"BARKERLITE" LAMPS.

The New Improved Gasfilled Lamp.
Prices much lower than any gasfilled lamp on the market.

OUR agents say:—"Your lamps are entirely satisfactory, and we will be able to move large quantities."
"We will be able to move considerably more than you stipulate, and ask that our quota for this area may be doubled."
Factors and Agents are advised not to miss this opportunity of "BIG BUSINESS" during the coming season.
Districts still open: Glasgow, Liverpool, Leeds, and a few others.
Write for terms, prices, &c.:
ROPODY UTILITY PRODUCTS,
21, South Street, Middlesbrough.
1965

LAMPS! LAMPS! LAMPS!

THE UNIVERSAL ELECTRIC LAMP CO., of Universal House, 89, Great Eastern Street, E.C.2, are able to offer GUARANTEED ELECTRIC LAMPS in ALL VOLTAGES AND WATTAGES.
Complete stocks of Ostar Gasfilled, Sign, Metal Filament, Traction, Half Watt Type (Clear, Opal and Daylight), Candle, Carbon, Autobulbs (Clear and Daylight), Natural Coloured Glass, Decoration Sets and Lamps, Flash Lamps, Wireless Valves, and guarantee you against
ANY INFRINGEMENT OF PATENT RIGHTS.
Write for Lists.
Telephones: Bishopsgate 6777, 6778, Tott. 1655.
65 Telegrams: "Youwelko, Finsquare, London."

ELECTRIC MOTORS.

WITH Switchgear, very cheap. Only few left. 400 volts, 3-phase, 50 periods.

60 h.p.	£60 each.
50 h.p.	£50 "
40 h.p.	£40 "
30 h.p.	£30 "
25 h.p.	£27 "
20 h.p.	£24 "
15 h.p.	£20 "
10 h.p.	£16 "
7½ h.p.	£12 "

By B.T.H. Co., Met. Vickers, English Electric, Westinghouse, &c., &c. All guaranteed O.K.
G.C.S. & CO., LOW LAITHES COLLIERY, WAKEFIELD.
1928

DIESEL ENGINES.

SEVERAL unused 2,000/3,000 b.h.p. M.A.N. Diesel Engines for disposal at attractive prices.
These engines are especially suitable for dealing with peak and emergency loads in large power stations, or as the main generating sets in moderate size stations. Immediate delivery.
Full details from J. W. R. WRIGHT, 66, First Avenue, Gillingham, Kent. 4

SPECIAL BARGAINS.

TWO 750-kW, three-phase, 50 cycle Turbo-Alternator Sets by Rateau. Year 1924-1927.
One 1,500-kW, six-phase, 50 cycle Rotary Convertor, d.c. side 560 volts, 300 r.p.m., with oil-cooled transformer.
Société ELECTRICITE & VAPEUR, 94, rue Sainte-Lazare, Paris.
1899

TO LAMP EXPORTERS AND WHOLESALERS.

ASK now our quotation for Electric Lamps (clear, Opal, Daylight). Prompt deliveries. Attractive prices for big quantities. Especially equipped for export to overseas.
THE RADIOLAMP WORKS, LTD.,
8, Korte Schyfstraat, Tilburg (Holland).
1869

30 YEARS' GUARANTEE.

400 D.C. and a.c. Motors, London Stock.
Ring CITY ELECTRICAL CO.,
Emerald Street, W.C.1.
'Phones: Holborn 9722; Rewinds 2083 Clerkenwell. 783

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FOR SALE.—*Continued.*

MYLAN & SMITH (ENGINEERS), LTD.

CHANGE OF ADDRESS.

Our Works and Offices are at Bamford, via Sheffield.

A selection from the miscellaneous section of our stock.

ELECTRIC MOTORS, A.C. AND D.C., ALL CIRCUITS.

WE have several hundreds of machines, from 5 to 500 h.p., actually in stock, at half makers' prices. Also control gear for same.

A.C. SWITCHGEAR.

One 40-amp. draw-out H.T. Circuit Breaker, totally enclosed, ironclad, triple-pole, oil-immersed, floor mounting, by Siemens, suitable for 50 periods, 3,000 volts, fitted with two overload and one no-volt releases. Ammeter.

One 200-amp. draw-out type Circuit Breaker, totally enclosed, ironclad, triple-pole, oil-immersed, floor mounting, by Siemens, fitted with no-volt and two overload releases. Ammeter 0/250 amps.

One 50-h.p., 440-volt Auto-Transformer Starting Panel, by Brookhirst, oil-immersed, totally enclosed, ironclad, floor mounting, fitted with no-volt and overload releases. Brand new.

One 55-h.p., 550-volt Auto-Transformer Starting Panel, by G. Ellison, oil-immersed, totally enclosed, ironclad, floor mounting, fitted with no-volt and two overload releases. Brand new.

ISOLATING SWITCHES.

Six 300-ampere, 3,300-volt Isolating Switches, single-pole, indoor knife type, arranged for front connection, and mounted on cast-iron base, by Westinghouse Co.

Six 100-ampere, 3,300-volt Isolating Switches, single-pole, indoor knife type, arranged for front connection, and mounted on cast-iron base, by B.T.H. Co.

HAULAGE GEARS.

One, electrically driven by H. C. & C. Grayson, rope speed ½ mile per hour; motor 3-phase, 50 periods, 400/440 volts, short rated by Westinghouse Co., complete with control gear.

FLYWHEEL.

One pulley type Flywheel, spoke pattern, 96-in. diameter by 28¾-in. face, 7-in. bore, length of boss 18¾ in. This flywheel is of the split type; weight approximately 2½ tons.

TRANSFORMERS.

(3-phase, 50 periods, oil-immersed, self-cooling.)

One 1,000 kVA, 3,300/440 volts, B.E.T. Co.

One 300 kVA, 3,300/440 volts, B.E.T. Co.

ALTERNATORS.

One 200 kVA, 250 revs., 3-phase, 50 periods, 440 volts (power factor 0.8) Sandycroft Alternator, complete with direct coupled exciter on combined bedplate, and suitable for either direct coupling or belt drive.

One 100 kVA, 500 r.p.m., 3-phase, 50 periods, 550 volts, rotating field, Greenwood & Batley Alternator, separately excited.

One 80 kVA, 500 revs., 3-phase, 50 periods, 440 volts, rotating field Greenwood & Batley Alternator, separately excited.

D.C. CONTROL PANELS.

Various d.c. Control Panels, up to 100 h.p., various makes, Brookhirst, Bray, Markham & Reiss, &c., &c.

D.C. CONTROLLERS.

Numerous d.c. drum type reversing Controllers, complete with resistances, various voltages up to 25 h.p.

REDUCTION GEARS.

Numerous worm type Reduction Gears, 7½ to 50 h.p., various makes.

The above represents only a small selection of our stock. Please send us your enquiries.

MYLAN & SMITH (ENGINEERS), LTD.,
Bamford, Via Sheffield.
'Phone: Bamford 25 & 34.
'Grams: Topical, Sheffield.
Works: Bamford, Derbyshire (L.M.S. Rly.).

3

FOR SALE.—*Continued.*

PLEASE NOTE.

WE would draw the attention of purchasers that we carry a stock of 500/1,000 Motors and Generators, both a.c. and d.c., from ¼ h.p. to 100 h.p., and we only handle modern machines, which we guarantee for twelve months.

Please send your enquiries to:—

THE CENTRAL ELECTRICAL ENG. WORKS,
119 & 120, Thomas Street, Bristol. 1144

CENTURY SINGLE PHASE MOTORS.

WE hold the largest stock of Repulsion-Induction Motors in England.

All sizes from ⅛ h.p. to 30 h.p.

All frequencies from 25-100 cycles.

The ideal motor for Change-overs, Refrigerators, Pumps, and all domestic motorised machinery.

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5, Chancery Lane, W.C.2.

Send for Priced Stock List No. 118. Telephone: Holborn 6001. 1887

SALE, HIRE OR HIRE PURCHASE.

MODERN used Electric Motors, d.c. and a.c., with a 12-months' guarantee.
Rewinds and Repairs. Machines loaned during repairs.
"Change Overs" carried out.
E. P. ALLAM & CO., LTD.,
107, Grays Inn Road, W.C.1. Holborn 5833. 1876

Advertisements are inserted under this heading at 1s. 9d. per line.

A SPECIAL Offer.—D.C. Motors to clear, all sizes. From 10s. per horse-power.—1979, Electrical Review, 4, Ludgate Hill, London.

ALTERNATING and Direct Current Electric Motors, ¼ to 100 h.p., new and second-hand. First-class machines with full guarantee. Hire or sale.—Electro-Generator Co., 5, Uxbridge Road, Shepherds Bush, W.12. Riverside 0488. 9924

BARGAIN.—27-h.p. "Westinghouse" Compound Interpole, 460 V, new spare armature, 490 revs., fan ventilated. £35 lot, to clear.—1982, Electrical Review, 4, Ludgate Hill, London.

BARGAIN.—28-h.p. "Crompton" compound Interpole, 440 V, 850 revs. Date 1924. £25.—1980, Electrical Review, 4, Ludgate Hill, London.

BARGAIN.—225-h.p., 500-volt, 3-phase, 50-cycle, 363-rev., slip ring a.c. Motor, A.E.G. £125.—1978, Electrical Review, 4, Ludgate Hill, London.

COMPOUND Interpole Motors, two, 25 h.p., 500 volts, 850 revs., Mavor & Coulson. £25 each.—T.P., 12, Bevington Hill, Liverpool. 1981

DIX Onemeter 55 Range Meter, micro and amps., milli and volts, ohms and megs., all on one precision moving coil, 55s. meter. Accurate and marvellously cheap.—Leslie Dixon Instruments, 218, Upper Thames Street, E.C.4. 10

DYNAMO, 14 kW, 220 volts, 250 revs., £15. On site London.—1977, Electrical Review, 4, Ludgate Hill, London.

DYNAMOS, 215 kW, 230 V, 250 r.p.m.; Steam Set, 26 kW, 105 V, £60; Motors, 110 V, ¼ to 80 h.p. Bargains.—"Engineer," 22, Prince of Wales Terrace, Scarborough. 9958

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FOR Sale, Petrol, Paraffin, and Crude Oil Engines and Generating Sets for lighting and power; all voltages, a.c. and d.c., from 1-500 kW.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 1987

FOR Sale, two vertical Gas Engine Sets, with producers, and direct coupled 220-kW, 230-volt generators.—1974, Electrical Review, 4, Ludgate Hill, London.

FOR Sale, 3½ kwt., 50-volt E.L. Plant, self-contained, Gardner-E.C.C., with switchboard; splendid condition. What offers?—Gilling, 40, Wood Street, Westminster. 9949

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FOR SALE.—*Continued.*

FOR Sale, four 40-h.p., 440-volt, 250/750-revs., compound, variable speed Motors.—1915, Electrical Review, 4, Ludgate Hill, London.

FOR Sale, Brush-Ljungstrom Turbo Set, 2,000 kW, 6,600 volts, 3-phase, 50 periods. New 1923.—1912, Electrical Review, 4, Ludgate Hill, London.

FOR Sale, 200-kW, 440-volt, 3-phase Steam Set, with condenser and switchboard. Purchaser to remove from present site.—1911, Electrical Review, 4, Ludgate Hill, London.

FOR Sale, 250-kW Belliss-Crompton Steam Generator, 440/550 volts, d.c.—Apply Borough Electrical Engineer, 36, Osborne Street, Colchester. 1993

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FOR Sale, two 300-kW, compound wound, 3-bearing Generators, 220 volts, 350 revs., with 5-panel switchboard. In first-class order. Price £400 the lot.—1187. Electrical Review, 4, Ludgate Hill, London.

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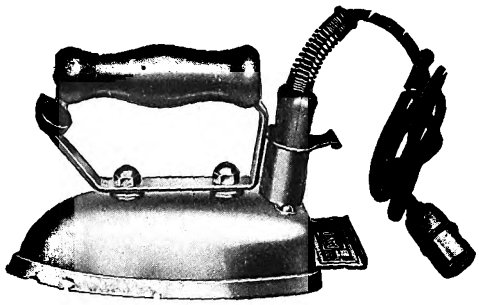

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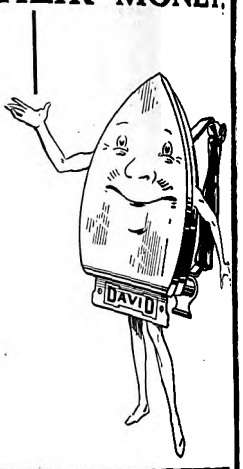

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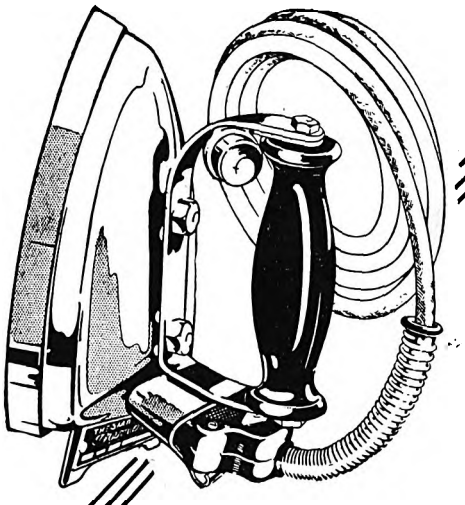

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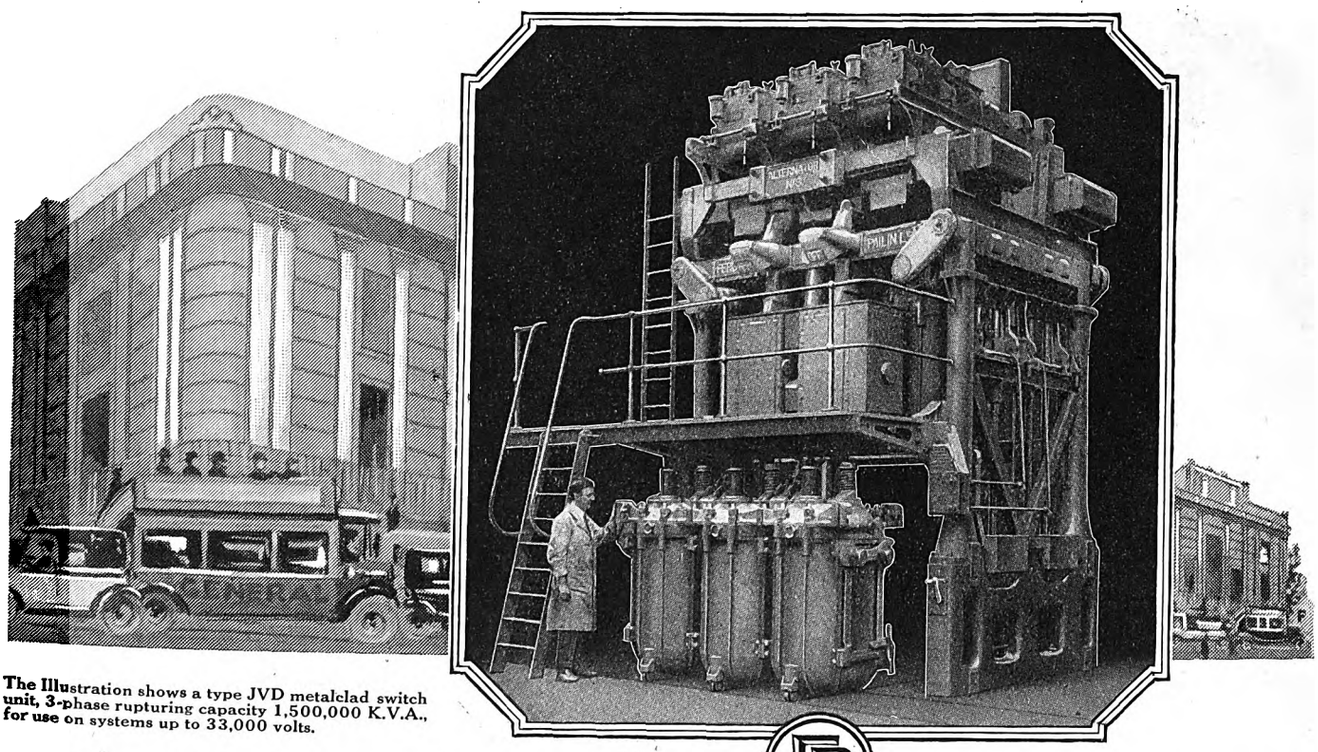

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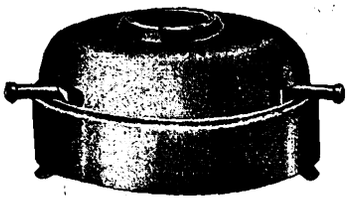

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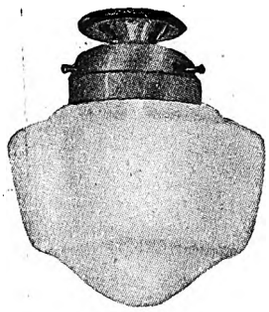

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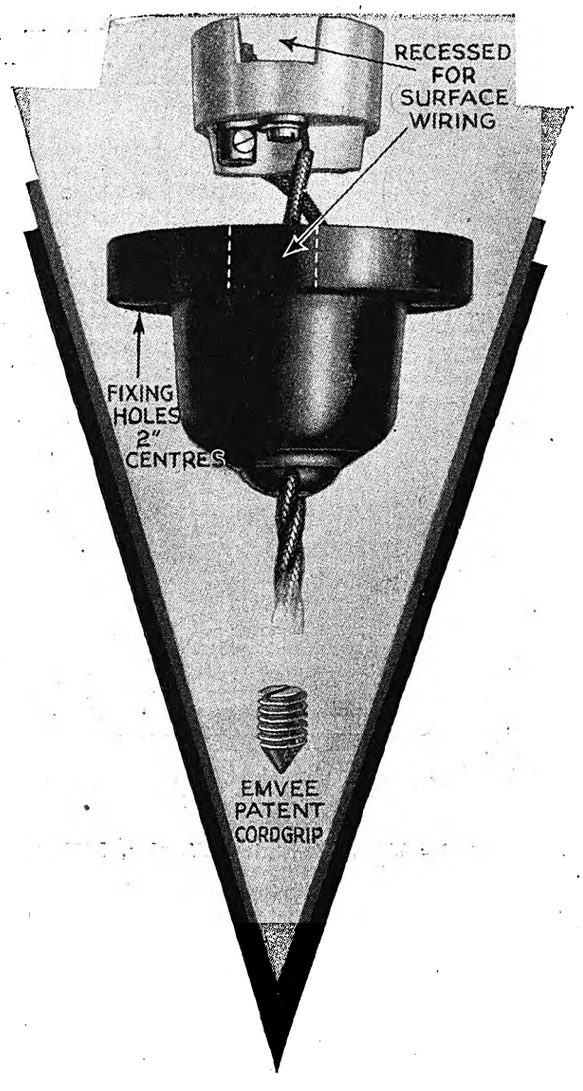

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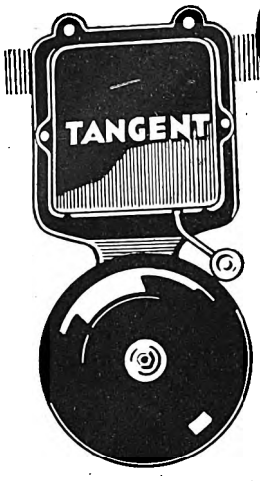

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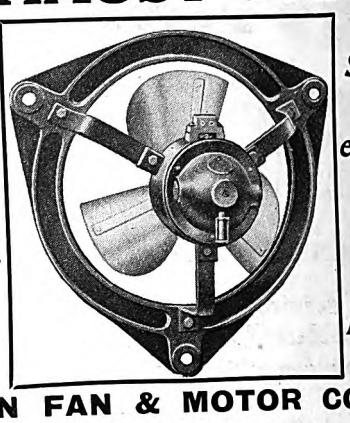

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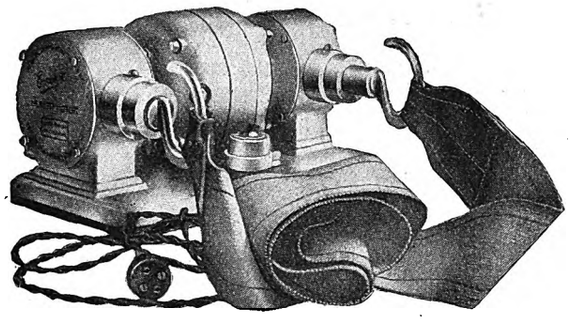

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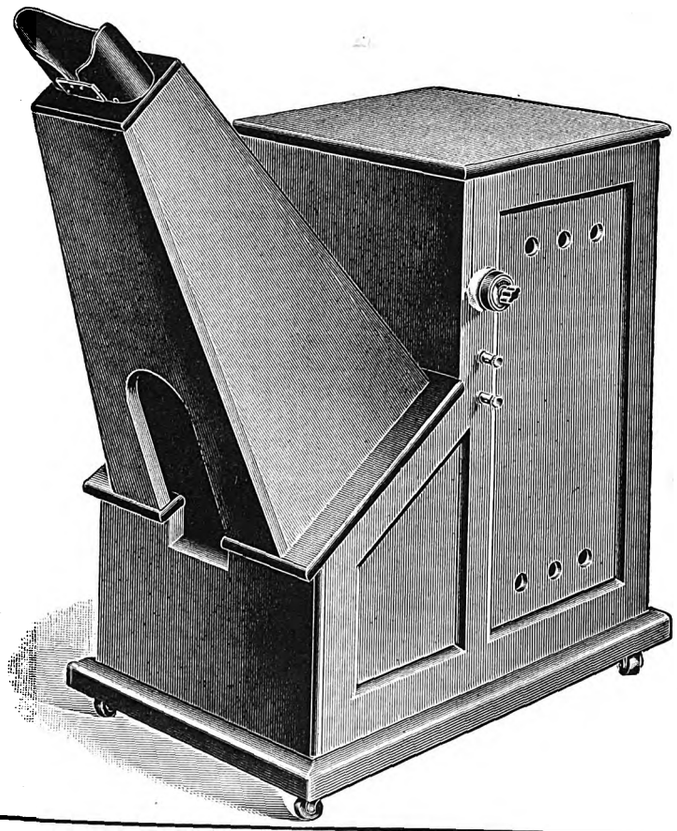

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OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

ELECTRICITY (SUPPLY) ACT, 1926.

North-East England Electricity Scheme, 1929.

WHEREAS the Electricity Commissioners have prepared and transmitted to the Central Electricity Board a scheme bearing the above short title and relating specifically to—

The Administrative Counties of Durham and Northumberland;

Parts of the Administrative Counties of the East Riding of Yorkshire and the North Riding of Yorkshire;

The City and County Borough of Newcastle-upon-Tyne;

The County Boroughs of Darlington, Gateshead, South Shields, Sunderland, Tynemouth, Middlesbrough, and West Hartlepool;

and dealing with the matters mentioned in Section 4 (1) of the Electricity (Supply) Act, 1926.

Notice is hereby given that the Central Electricity Board have caused the said scheme to be published, and that any authorised undertakers or other persons interested in the said scheme and desiring to make representations thereon may do so by forwarding the same by registered letter addressed to the undersigned and posted not later than the 30th day of July, 1929.

Copies of the said scheme and of a volume of particulars supplementary thereto may be obtained at the prices of one shilling and sixpence and three shillings and sixpence each, respectively, from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, and 120, George Street, Edinburgh.

Dated this 24th day of June, 1929.

RICHARD H. FOX,
Secretary to the Central Electricity Board.

Trafalgar Buildings,
1, Charing Cross, London, W.C.2. 1964

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Application for inclusion in the list from which selection will be made should be addressed in the first place to:—

HAROLD E. PAGE,
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Advertisements are inserted under this heading at 14s. per inch.

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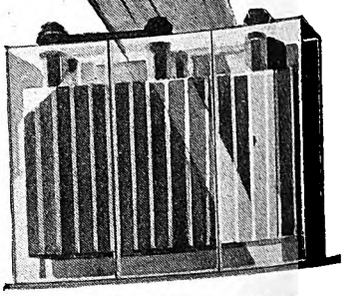

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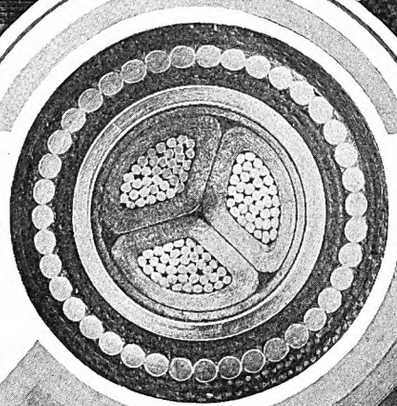

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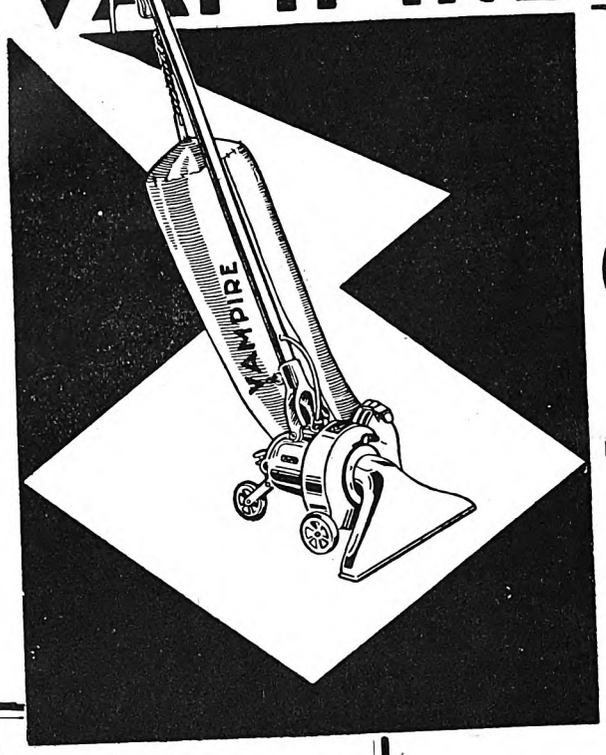

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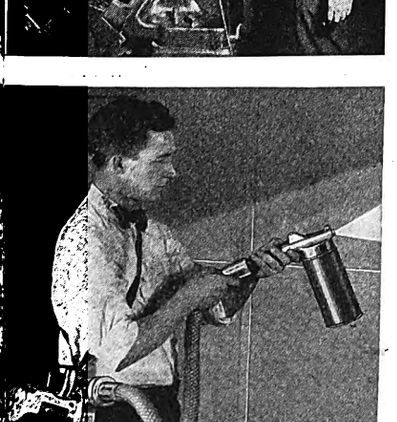

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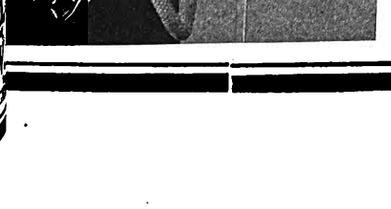

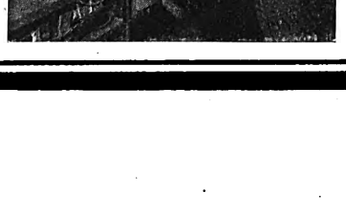

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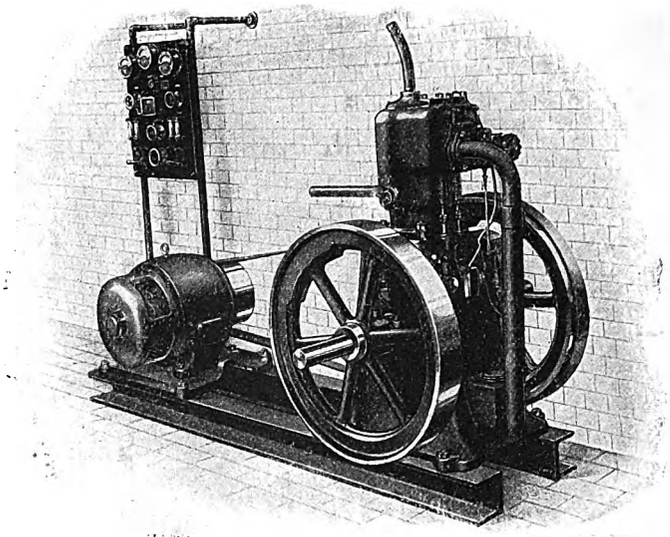

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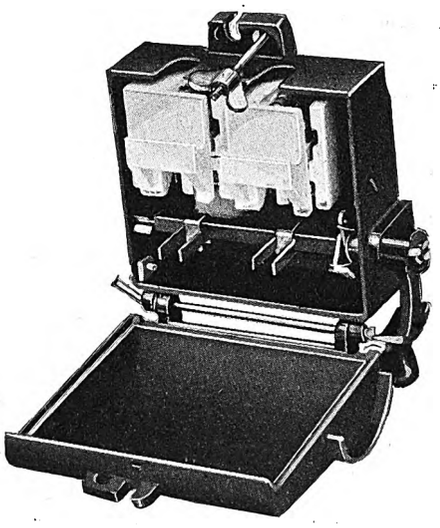

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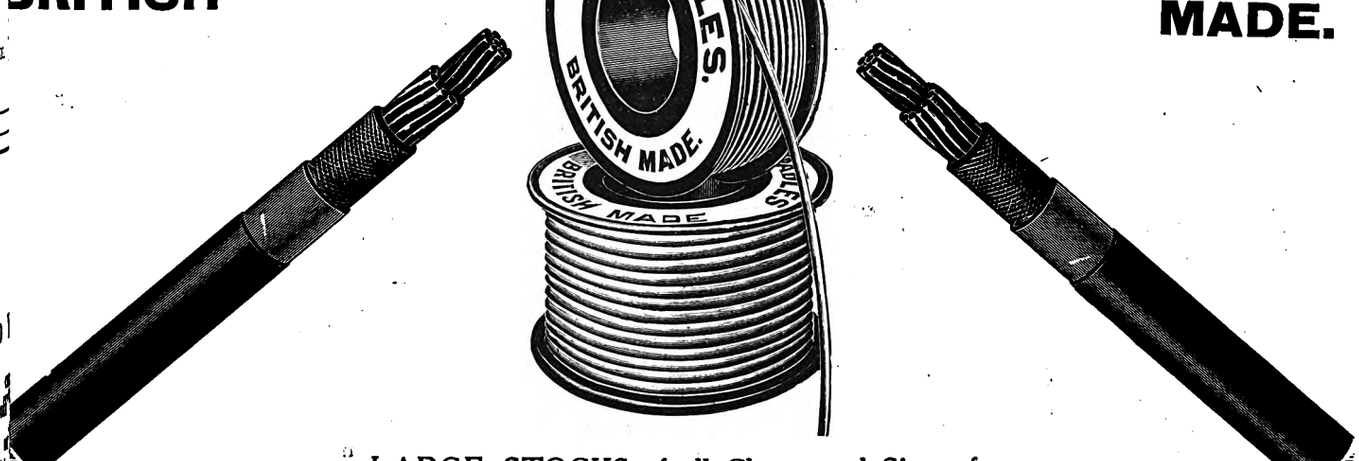

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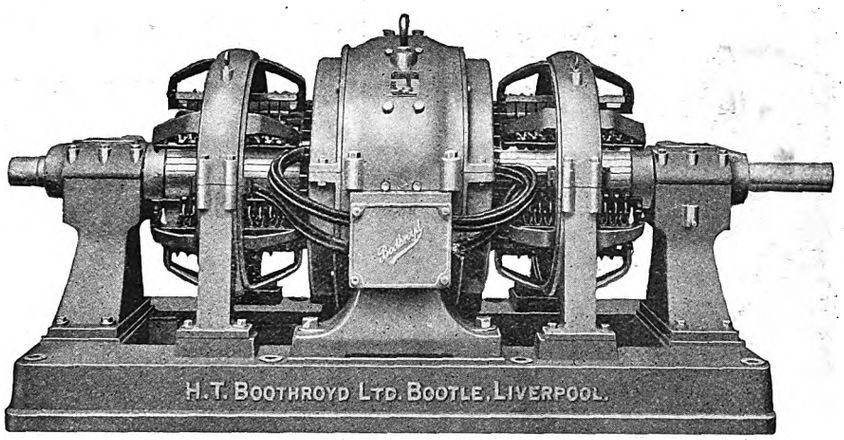

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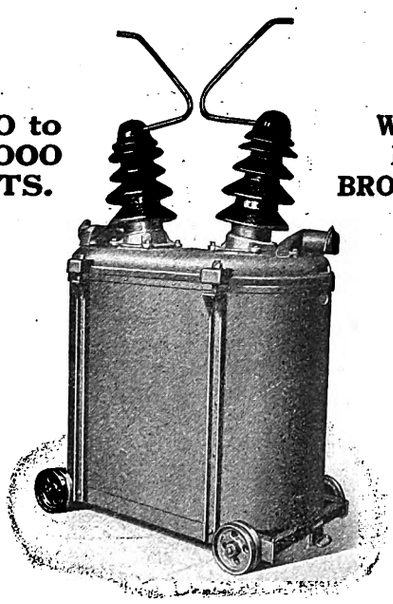

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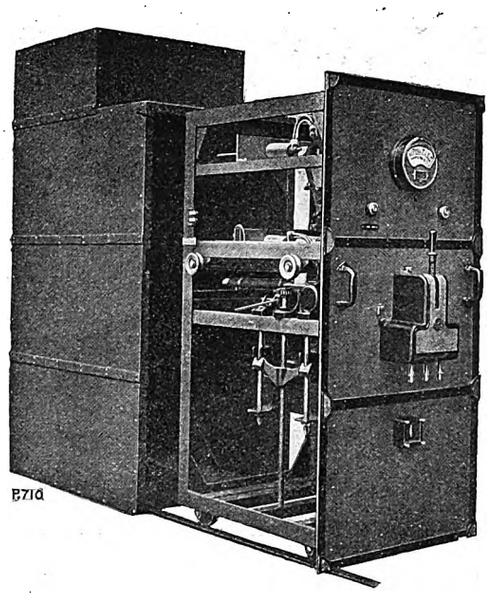

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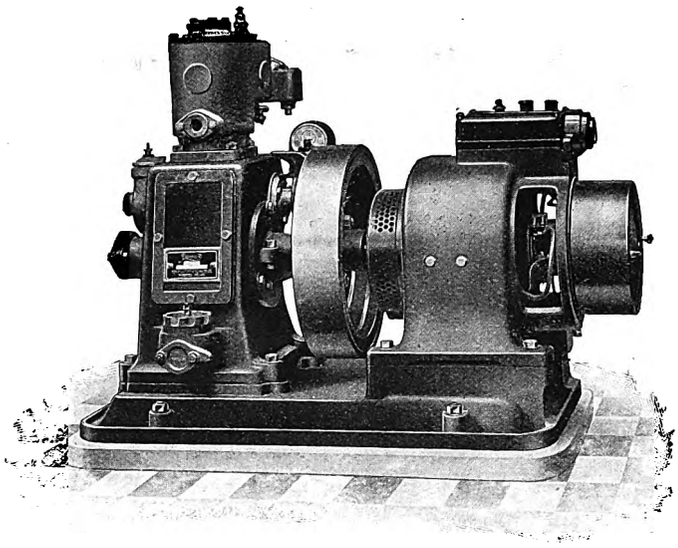

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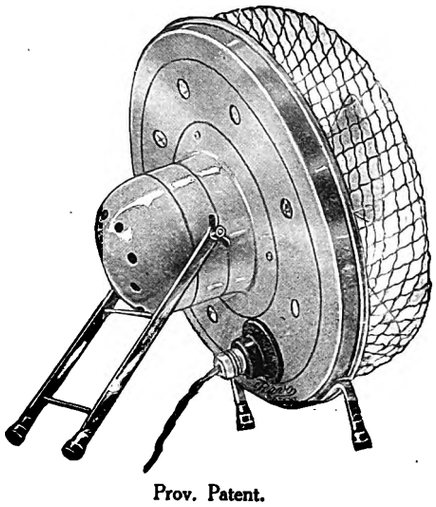

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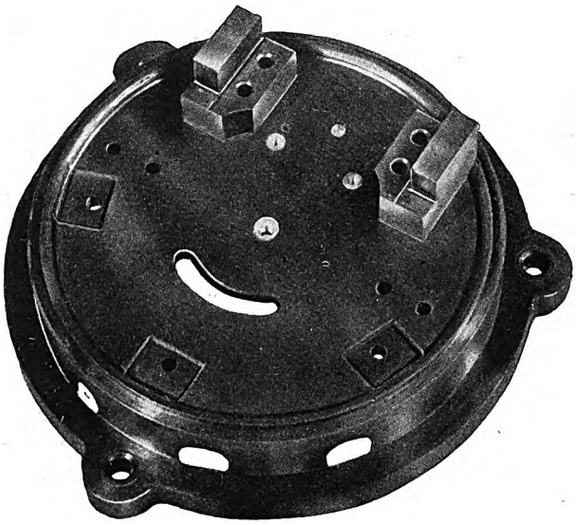

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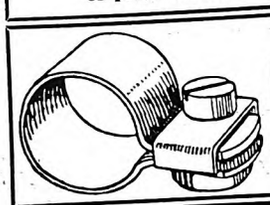

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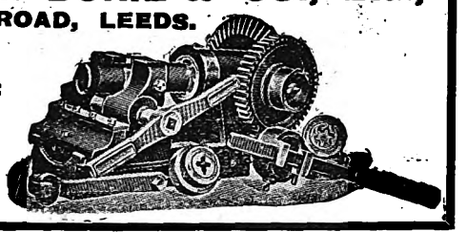

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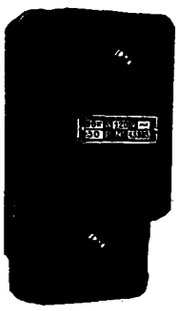

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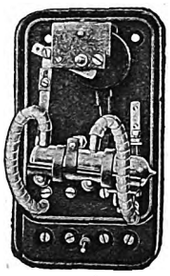

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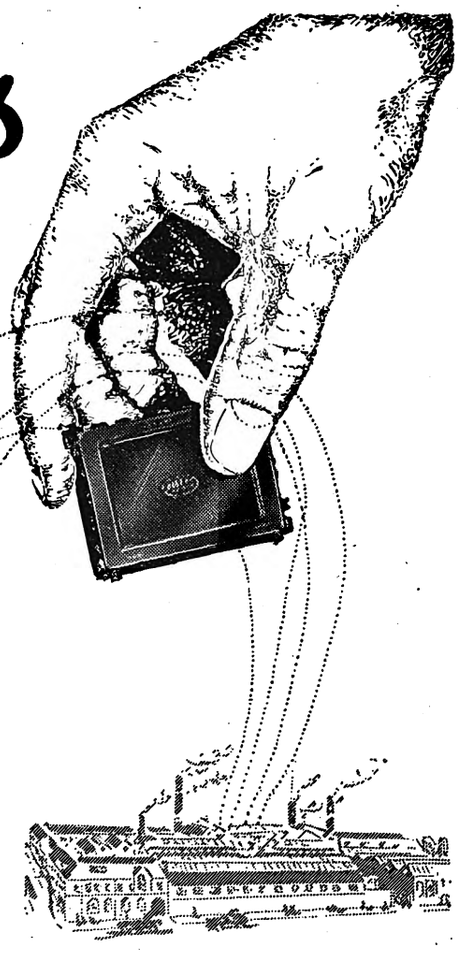

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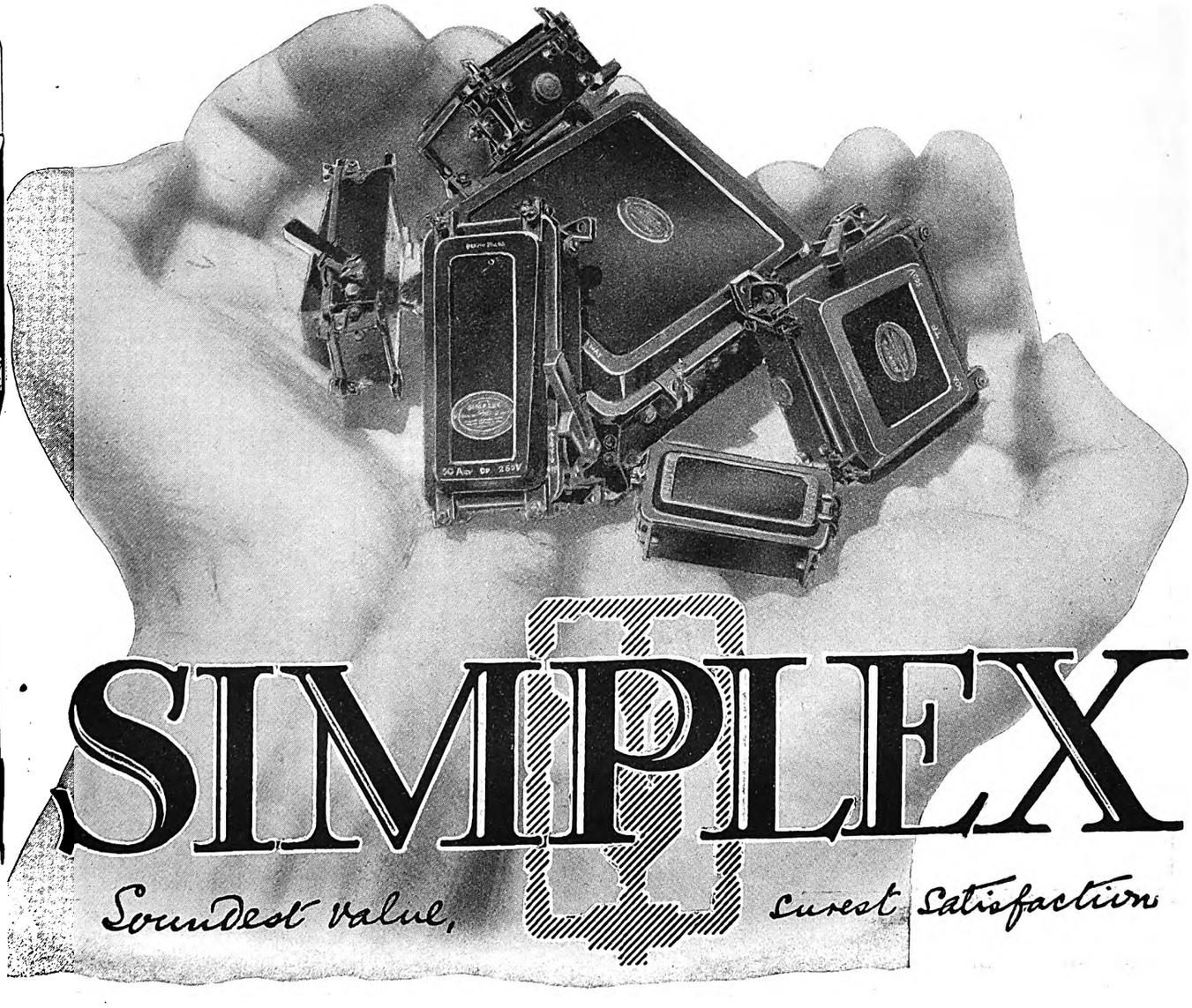

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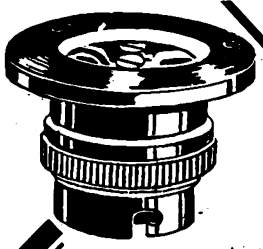

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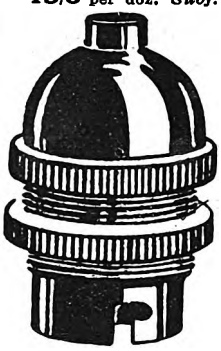

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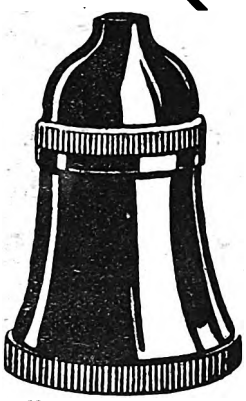

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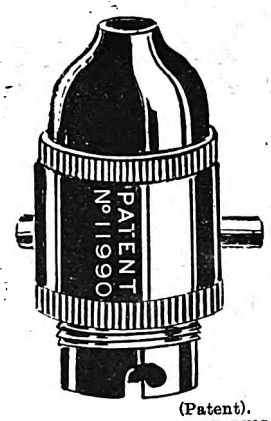

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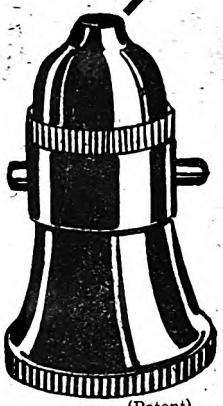

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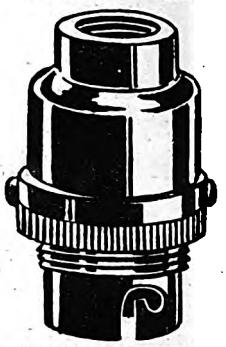

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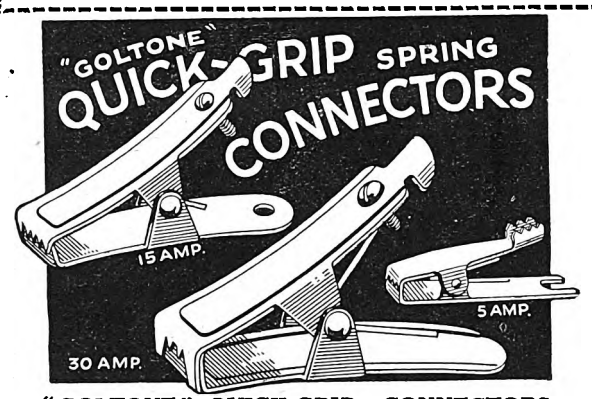

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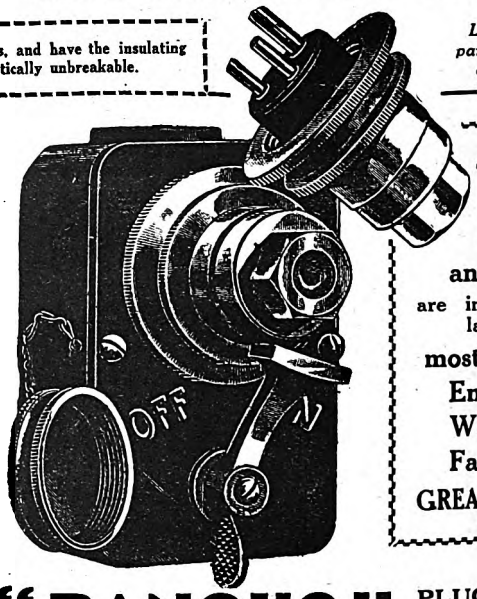

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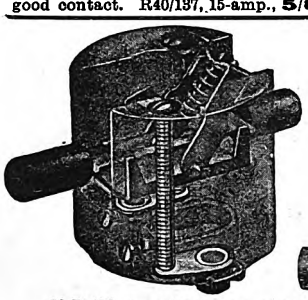

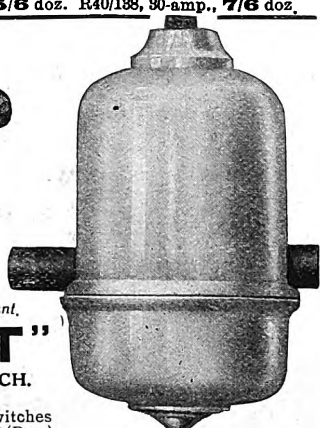

X-RAY view of switch movement.

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The containers for these Pear Switches are moulded from our IVORANT (Reg.) material which is HEAT-RESISTING, NON-SOFTENING, of HIGH INSULATION and attractive appearance. Supplied in the following colours:—Ivory-White, Black, Coral-Pink, Rose, Brown, Orange and Wedgwood Blue.

The switch movement, mounted on best English China, is of the quick make and break type. Reliable in action, it serves equally well as a 1-or 2-way Pear Switch. List No. S.F./80. Black or Brown **2/-** each, subject. Other colours 10% extra **2/3**.

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IRONCLAD SWITCH.

Robust Design. Neat Appearance.

Drilled and screwed for conduit.
Also made in multiple ways.

SINGLE POLE, 5 amps. cap. 1 way	5/6
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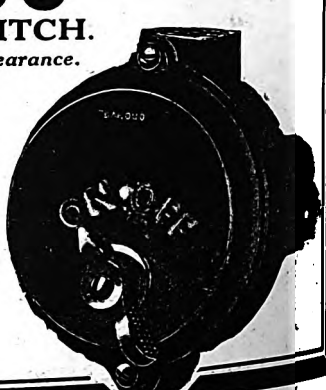

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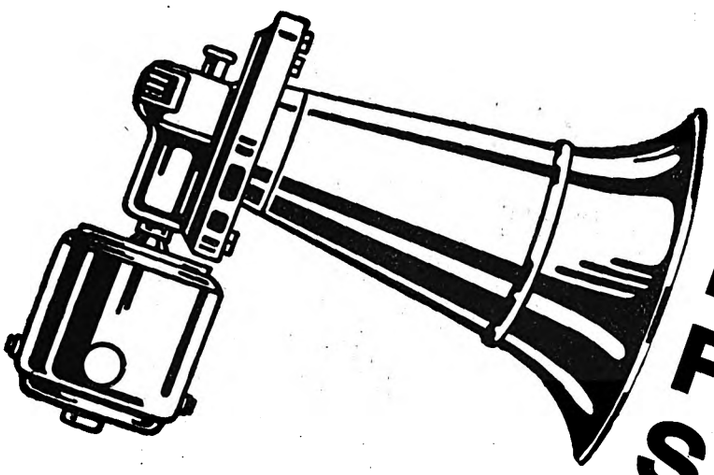

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Klaxon signals keep workers punctual. Klaxon signals are worked from the clock—on the very tick comes their message—saving time—saving money. In an emergency—fire—employees are warned—effectively—for the Klaxon sawtooth note commands attention—it stands out amidst a medley of bells, buzzers and sirens.

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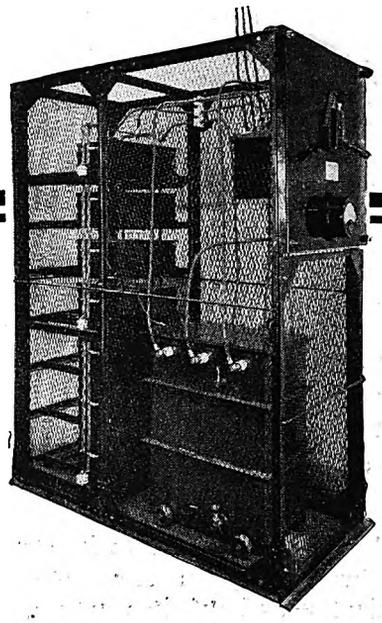

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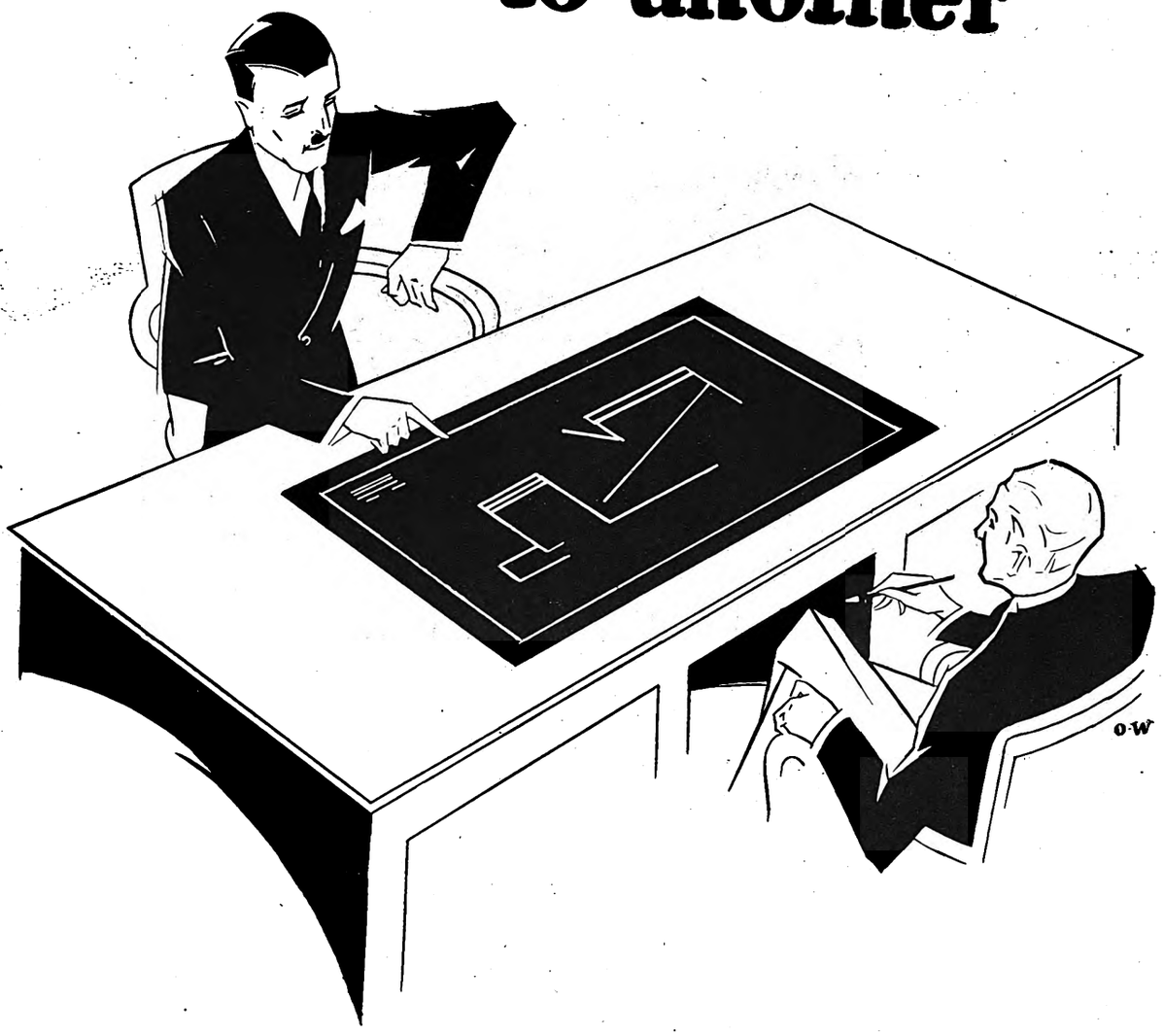

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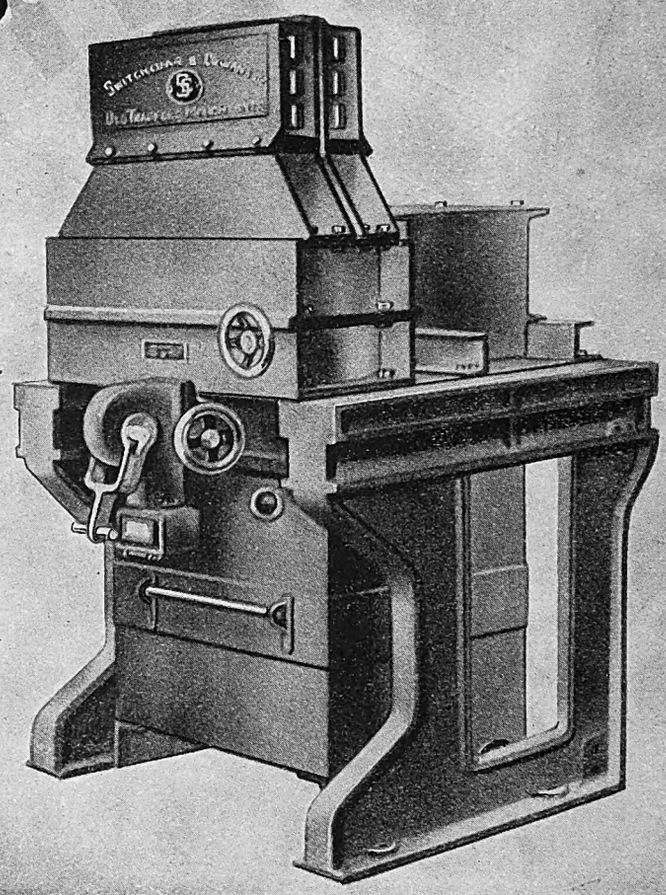

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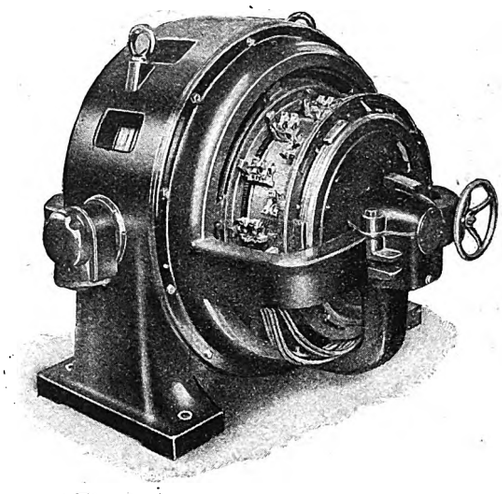

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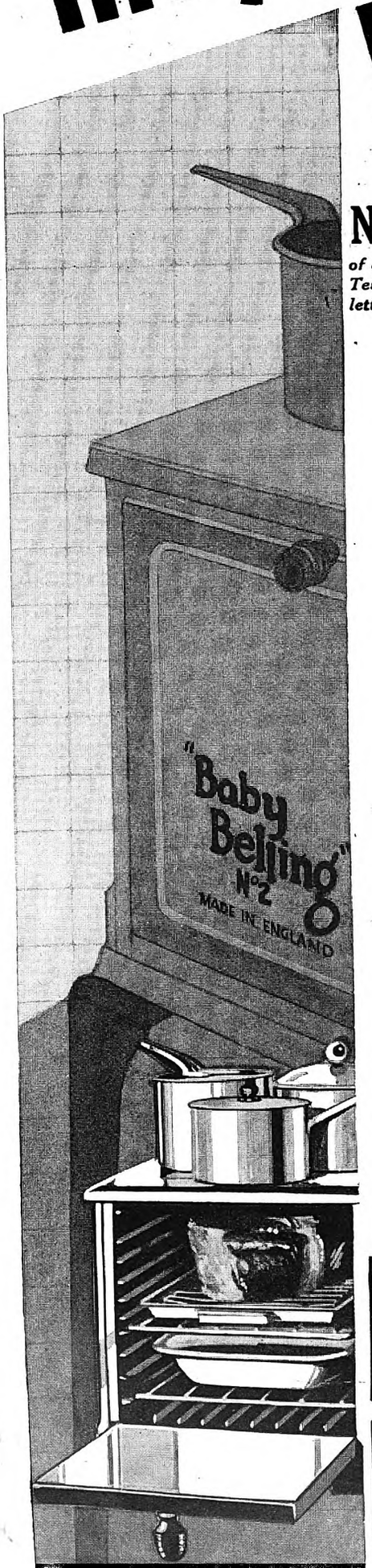

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Below is another of the many testimonial letters received from Electric Supply Authorities who have introduced the Baby Belling Cooker to householders in their district.

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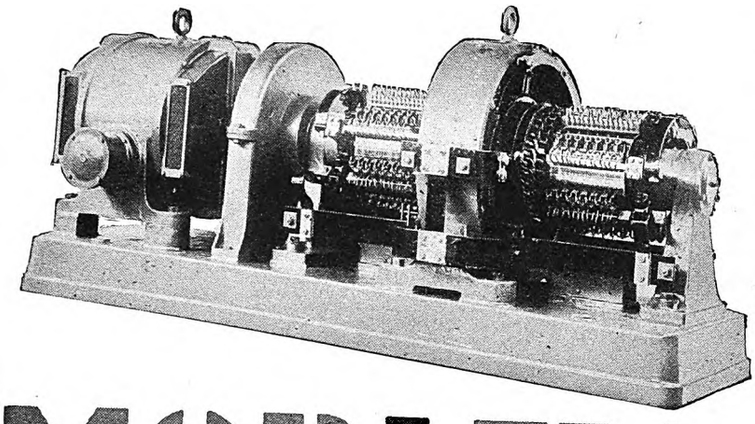

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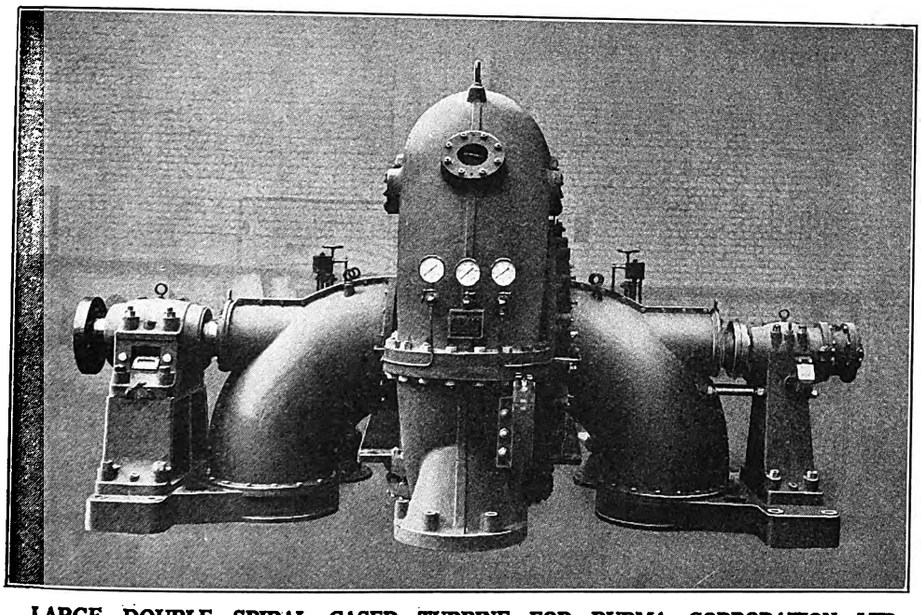

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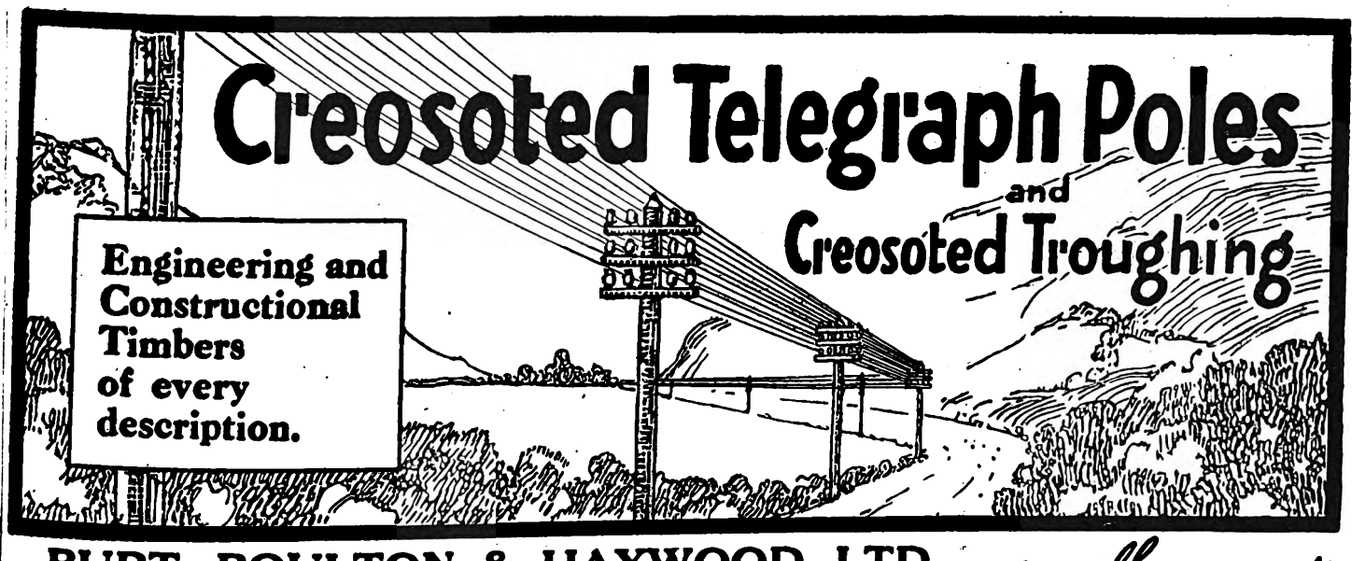

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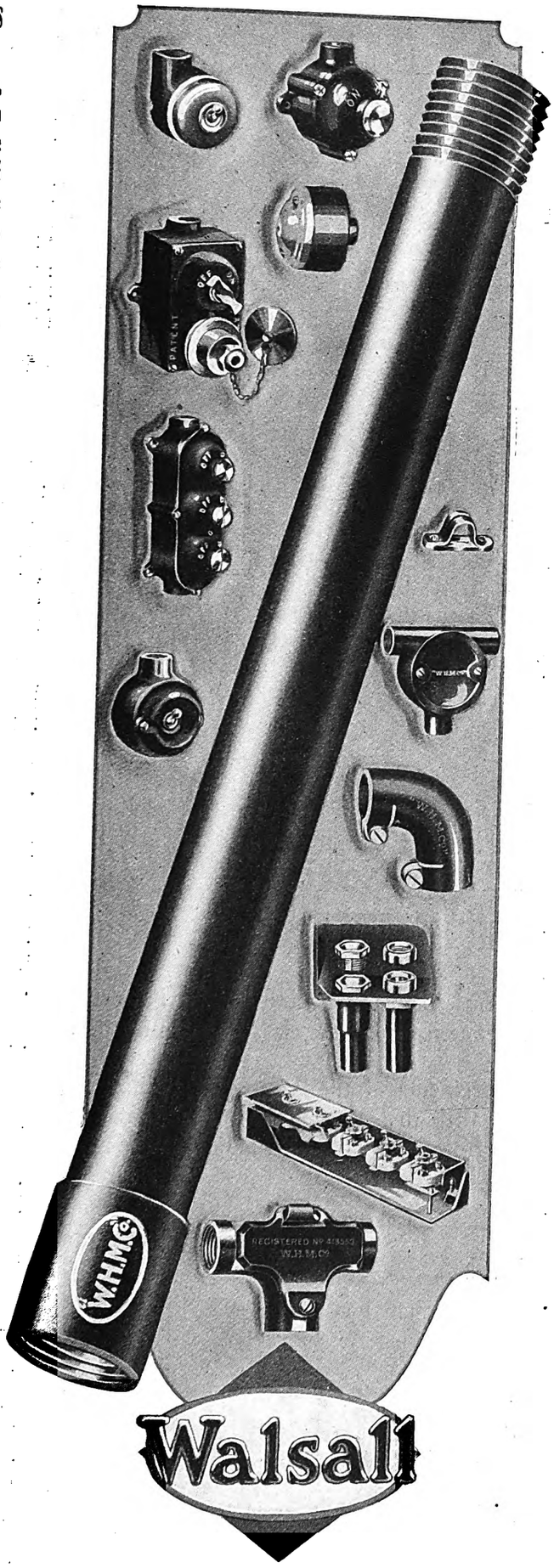

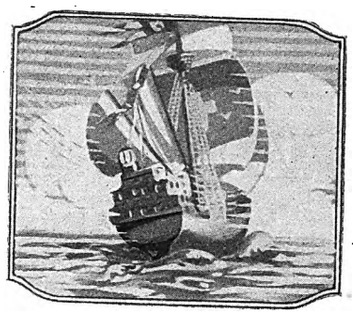

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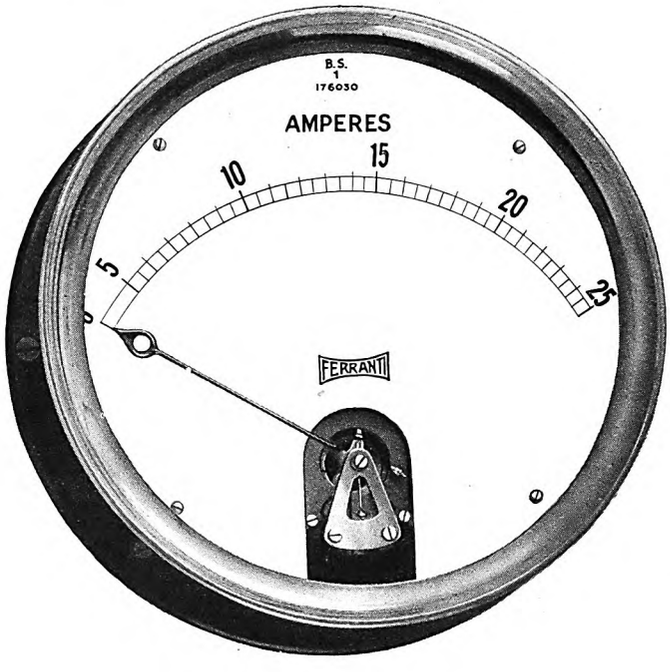

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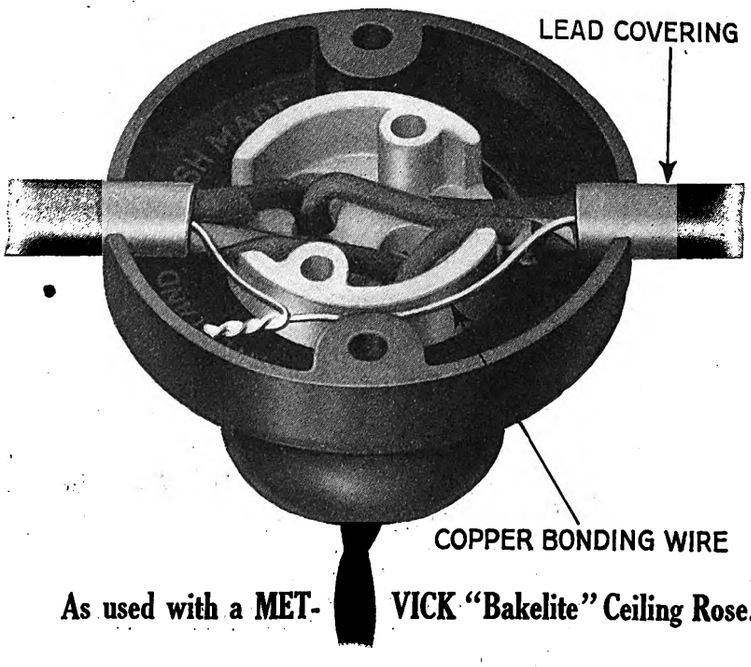

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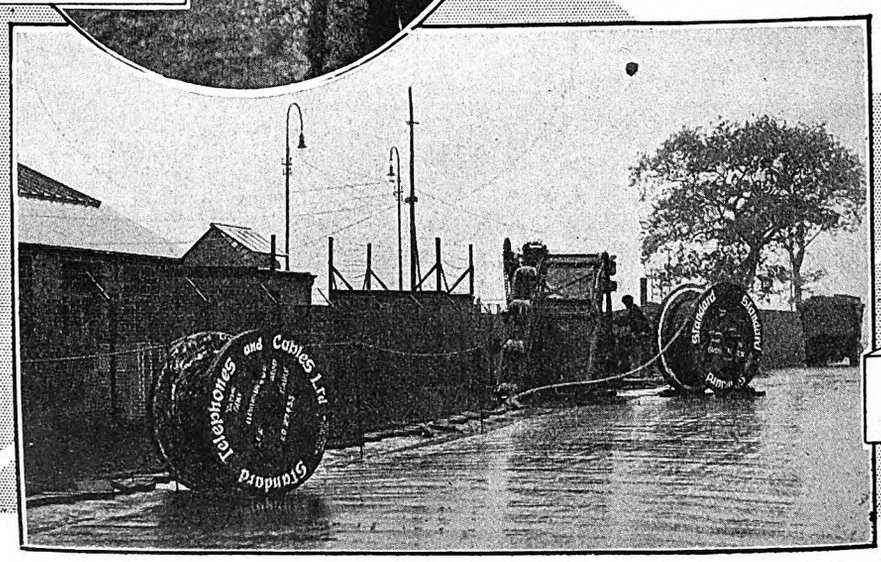

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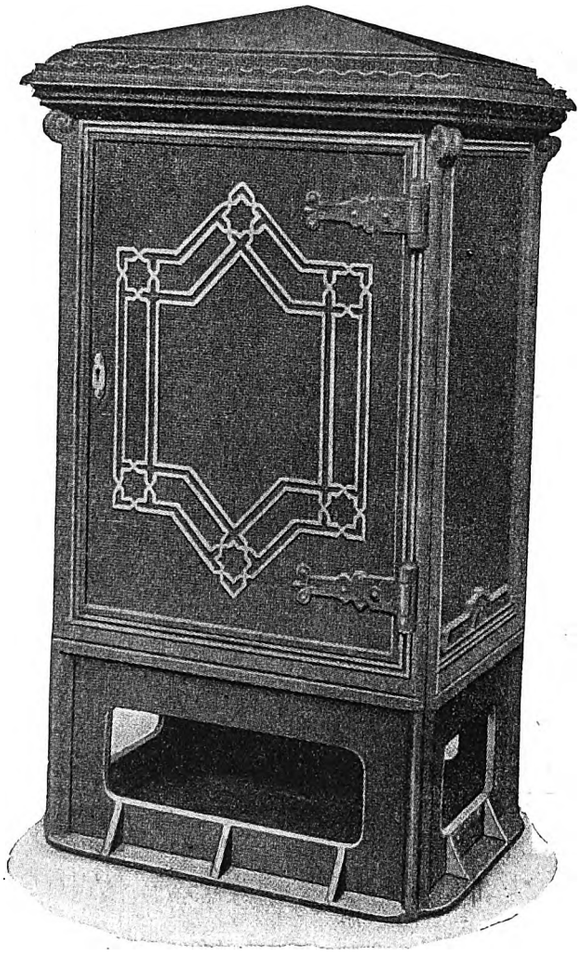
Please give us your enquiries for odd sizes whether taller or shorter or



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" 1a	19 × 14 ins.	33 × 15 ins.	
" 1b	21 × 12 ins.	33 × 17 ins.	
" 2	21 × 14 ins.	33 × 17 ins.	
" 2a	21 × 16 ins.	33 × 17 ins.	
" 2c	21 × 18 ins.	33 × 17 ins.	46½ ins.
" 2b	25 × 14 ins.	36 × 21 ins.	49 ins.
" 3	25 × 16 ins.	36 × 21 ins.	
" 3a	25 × 20 ins.	36 × 21 ins.	
" 3b	31 × 16 ins.	36 × 27 ins.	49½ ins.
" 4	31 × 20 ins.	36 × 27 ins.	
" 5	36 × 24 ins.	42 × 33 ins.	55½ ins.
" 6	42 × 24 ins.	61 × 38 ins.	74½ ins.
" 7	36 × 30 ins.	46 × 30 ins.	65½ ins.
" 8	42 × 30 ins.	46 × 36 ins.	
" 9	36 × 36 ins.	42 × 33 ins.	61½ ins.
" 10	36 × 30 ins.	42 × 33 ins.	

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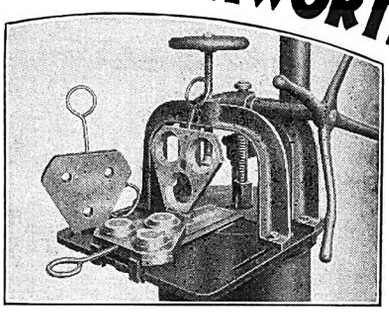

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Universal One-to-Four Way.

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Clamps removable, allowing Cable to be laid in flat.

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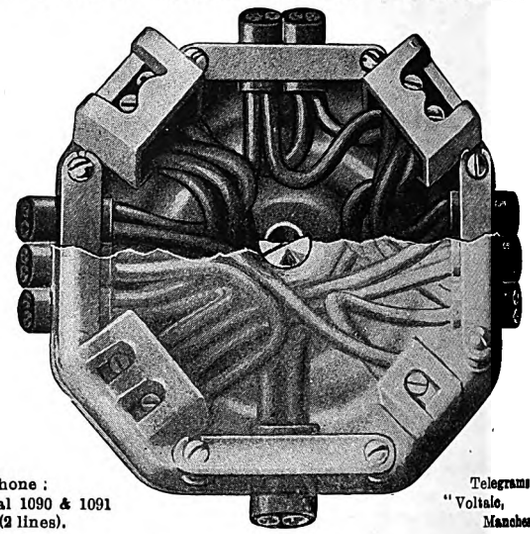

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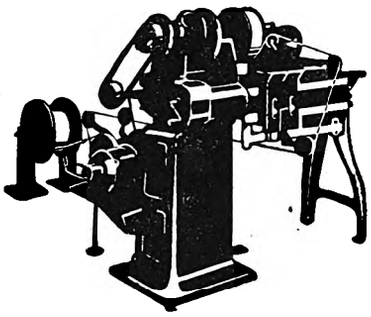

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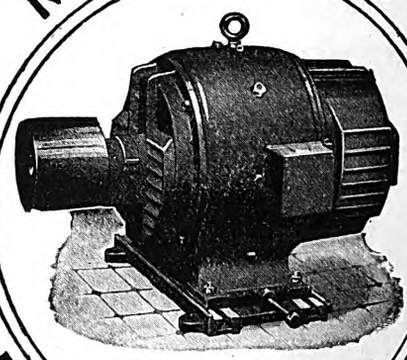

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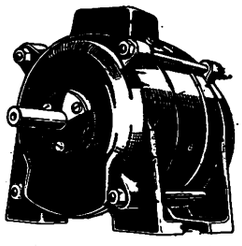

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Electrical Porcelains

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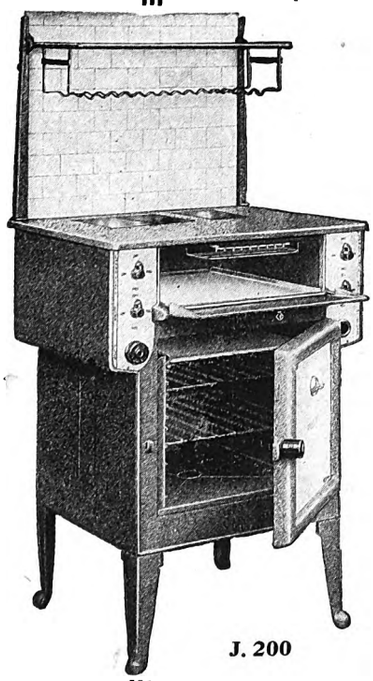

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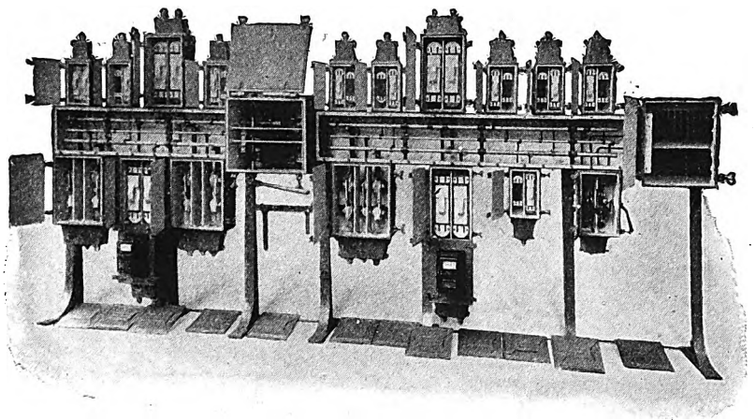
UNIT TYPE IRONCLAD SWITCHBOARDS



Originated by us 25 years ago there are now numerous flimsy imitations obtainable. **Specify Aeroflex Unit Boards** *if you want a robust and substantial job as distinct from a collection of odd switches strung together on an iron frame.*

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Temperature Switches
Pressure Regulators

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Made in four types. Coarse or Fine regulation, for regulating temperature of either air or liquids. Regulators consist of a brass tube enclosing a rod of special metal, which has a practically constant length at any temperature up to 700° F. When temperature reaches a predetermined maximum or falls to a similarly chosen minimum, the relay switch makes contact on diverse sides, the main switch thereby making or breaking the circuit.

The same skilled workmanship and efficient performance, which has made "Nathan & Allen" synonymous with first class "Time Switches," is equally evidenced in the Temperature Regulators, Temperature Switches, and Pressure Regulators supplied by Nathan & Allen, Ltd.

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Similar to temperature regulators, but the movement of a diaphragm under pressure operates the relay switch. It is more accurate, more easily adjustable than the contact making pressure gauge, and the Switch itself is more reliable and durable. Can be made for pressures from 7 lbs. to 145 lbs. per sq. in. The tube is screwed so that an air, gas or watertight joint may be made.

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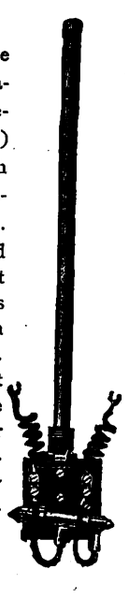
The temperature Switch is a temperature regulator (previously described) with an S.P. Switch consisting of a gas-filled mercury tube. The tube is sealed and is not subject to the usual troubles experienced with mercury contacts. The mercury cannot splash or waste away. Made for horizontal or vertical mounting. May be used for capacities up to 15 amps., 250 volts.



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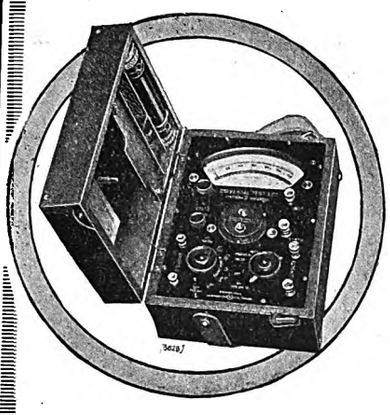

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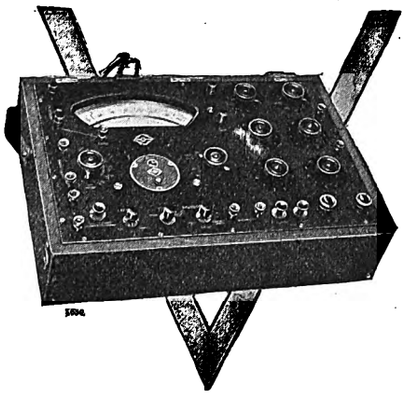

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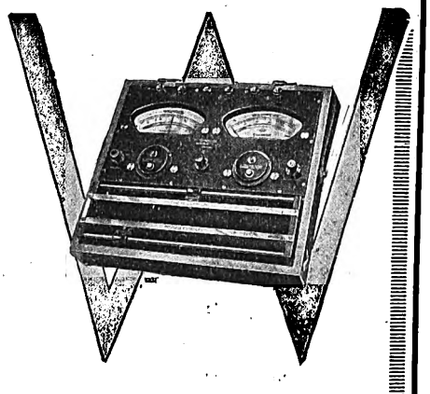

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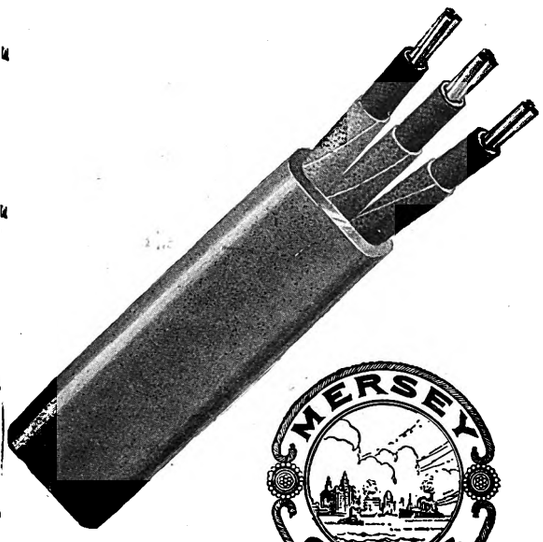

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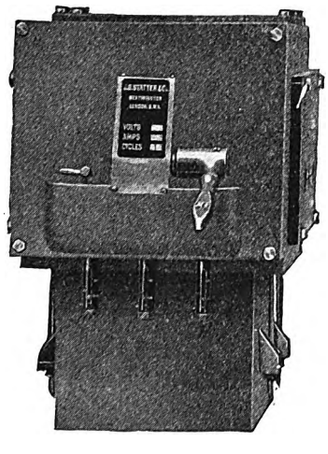

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Siemens Bros. & Co., Ltd.
St. Helens Cable & Rubber Co., Ltd.
Standard Telephones & Cables, Ltd.
Union Cable Co., Ltd.
Ward & Goldstone, Ltd.

Wire (Uncovered).
Bolton, T., & Sons, Ltd.
Richard, Johnson & Nephew, Ltd.
Smith, F., & Co., Ltd.

Wire Guards.
Carter, H. W., & James, Ltd.

Wire Ropes.
The London Electric Firm.

Wireless.
Cole, E. K., Ltd.
General Electric Co., Ltd.
Gent & Co.
Marconi Wireless Telegraph Co.
Ward & Goldstone, Ltd.

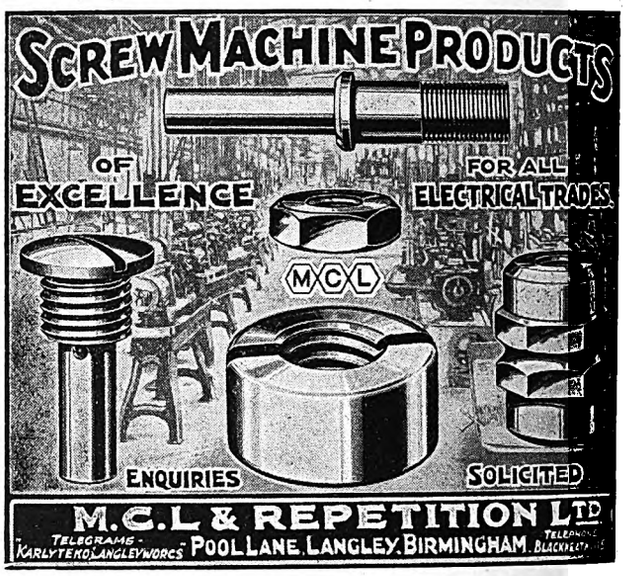
Wiring Systems.
Bowker, S. O.
Simplex Conduits, Ltd.

Woodwork (Electrical).
Wootton & Co., Ltd.

Yarns.
Christie & Co.

MISCELLANEOUS ANNOUNCEMENTS,

Relating to Situations, Articles for Sale and Wanted, &c., appear on Sup. 17, &c.



A LOW COST METHOD OF CONVERTING D.C. RADIO MAINS UNITS TO A.C.

ONE phase of compensation in the change-over from Direct Current to Alternating Current involves those people whose radio sets are powered by your electric energy.

There is a very low cost of converting such radio sets from D.C. to A.C., viz., by the addition of an **"EKCO"** Standardised Rectifying Unit.

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All **"EKCO"** Power Devices conform with I.E.E. Regulations.

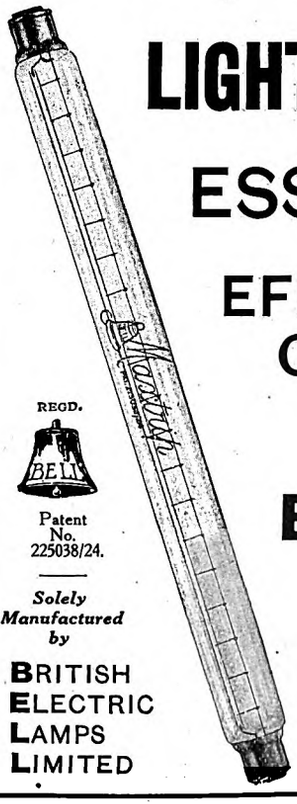
The **"EKCO"** Rectifier Unit will definitely solve a big radio compensation problem for you, efficiently and at the lowest possible cost.

"EKCO"

Announcement of E. K. Cole, Ltd., Dept. E.R., "Ekco" Works, Leigh-on-Sea.

B.E.L.L.

CONTINUITY OF LIGHT SOURCE IS ESSENTIAL FOR EFFICIENT CORNICE LIGHTING SO IS B.E.L.L. MAXTRIP



REGD.

Patent No. 225038/24.

Solely Manufactured by

BRITISH ELECTRIC LAMPS LIMITED

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'Phone: GERRARD 2779.

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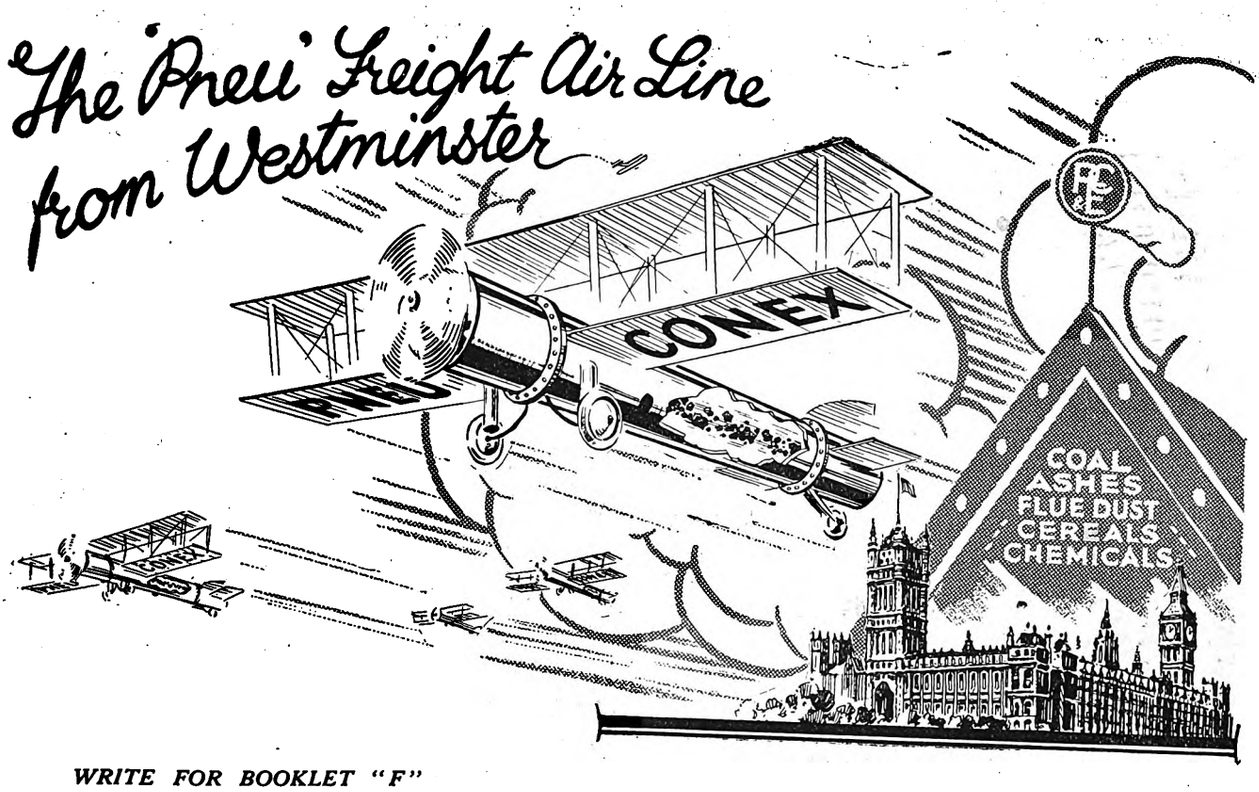

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PNEUMATIC CONVEYANCE & EXTRACTION

BROADWAY LIMITED **WESTMINSTER**

LONDON, S.W.1

Telephone—VICTORIA 6845 (5 lines). Telegrams—"PNEUCONEX," SOWEST.

ONE OF MANY WAYS—

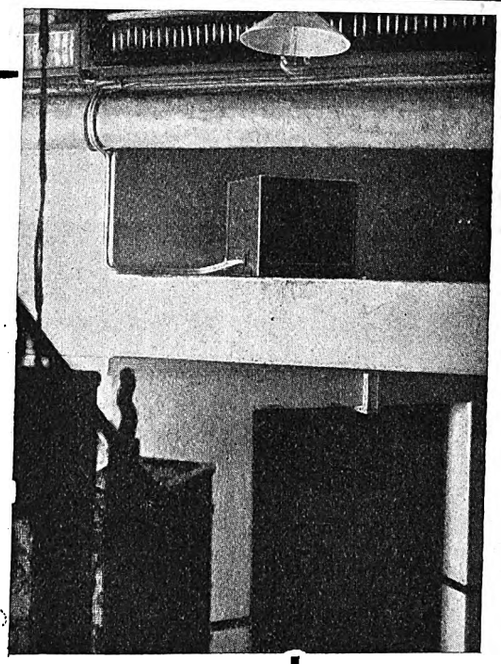
IN WHICH

WESTINGHOUSE

METAL RECTIFIERS

ARE SOLVING THE CHANGE-OVER PROBLEM—

The illustration shows a typical Westinghouse Rectifier operating lift gate controls.



These Rectifiers are constructed entirely of metal.

They have { **NO MOVING PARTS,** **NO VALVES,** **NO ELECTROLYTES.**

They require { **NO MAINTENANCE,** **NO ATTENTION.**

They make **NO NOISE.**

INSTALL THEM: THEN IGNORE THEM.

Illustrated booklet D.P. 11r giving full details will be sent, on request, to:

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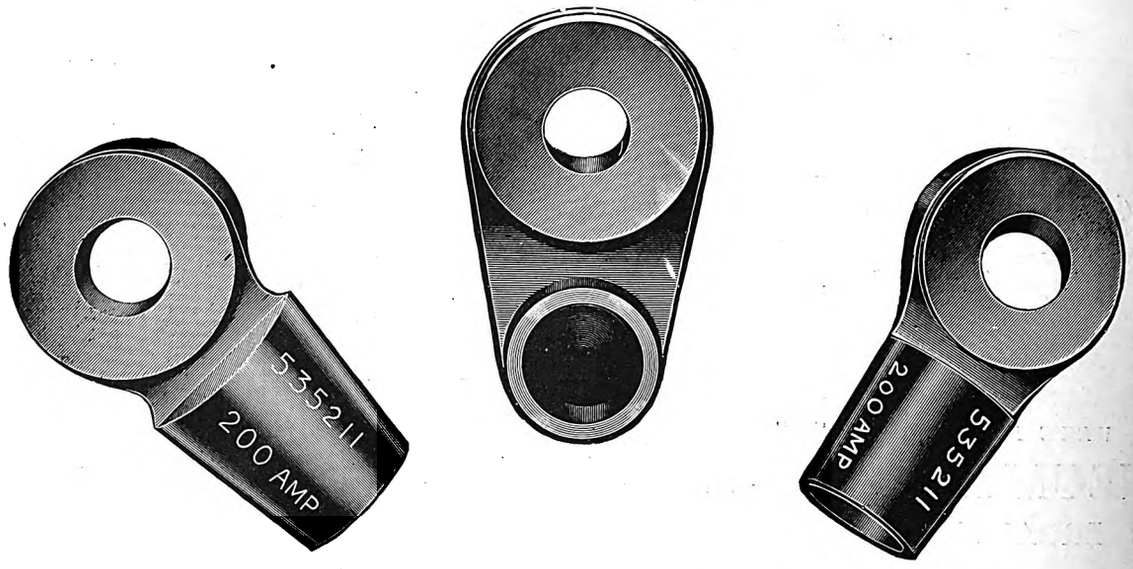
DAVIS & TIMMINS (LTD.),

Metal Thread Screws and Repetition Work.

YORK ROAD, KING'S CROSS, and WOOD GREEN, LONDON, N.

Telephone: NORTH 0580. Telegraphic Address: "CONDUCTIVITY, LONDON."

STANDARD CABLE ENDS.



Machined both sides of bolt hole, thereby ensuring good contact.

NOISE OVERCOME!

Orders easily understood despite roar of machinery

NOISE is an ever-present evil in factory and workshop. It is constantly taking its toll—in time and money. That is why the Brown Electro-Megaphone is to be found in so many industrial undertakings—because it overcomes noise, provides reliable communication and ensures the correct reception of orders despite the roar of machinery. It is for these reasons that the Brown Electro-Megaphone is used at the Belfast and Aberdeen Electricity Stations—because it is the modern and only reliable method of communication.

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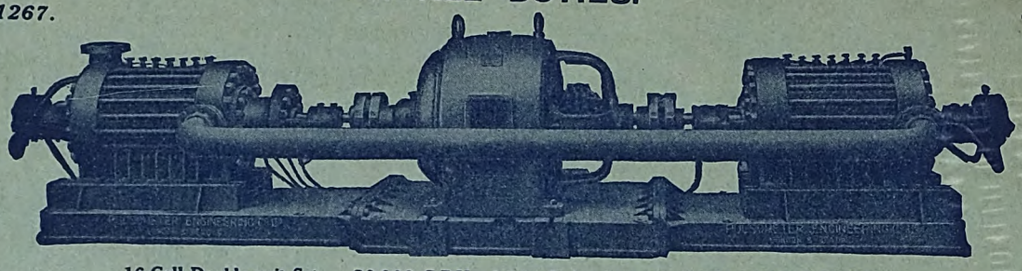
CENTRIFUGAL & TURBINE PUMPS

FOR ALL DUTIES.

WRITE FOR LIST No. 1267.

The 'Turbine' Symbol.



16-Cell Double-unit Set. 20,000 G.P.H.—1,545 ft. head—1,460 R.P.M.—300 B.H.P. Motor.

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are adopting

PULVERISED FUEL FIRING

because

(1) It gives greater flexibility both in operation and choice of fuel.

(2) The efficiency remains nearly constant at all loads.

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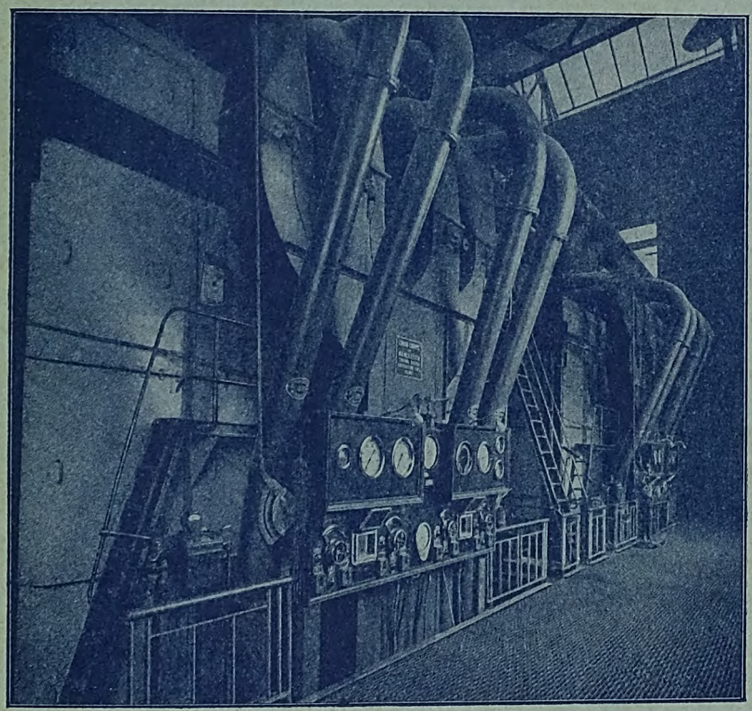
(4) Low grade fuels can be burnt without affecting the efficiency.

ALL BANKING LOSSES ARE ELIMINATED.



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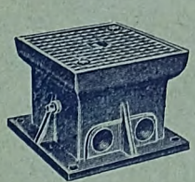
SIMON-CARVES, LTD.
20, MOUNT STREET, MANCHESTER

Telephone: Holborn 8637.

SIMMONDS & STOKES, LTD.,

Telegrams: "Niphon," Westcent, London.

WATERTIGHT PLUGS AND NIPHAN CABLE COUPLINGS



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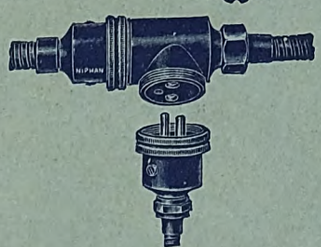

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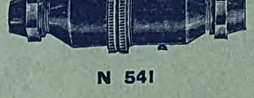

N 541

As used for Docks, Railways, Market Lighting etc.

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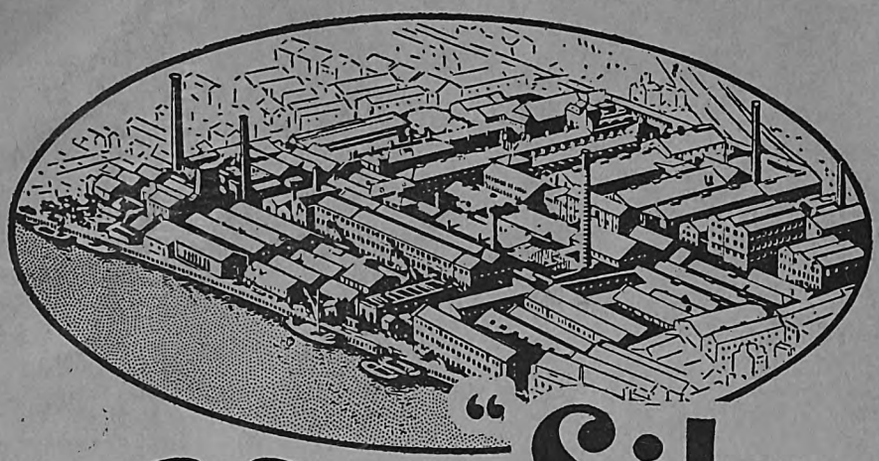

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stand large works—huge resources—and nearly threequarters of a century's EXPERIENCE!....

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PRIMARY BATTERIES Leclanché, Daniell, Bunsen, etc.

CARBONS.

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